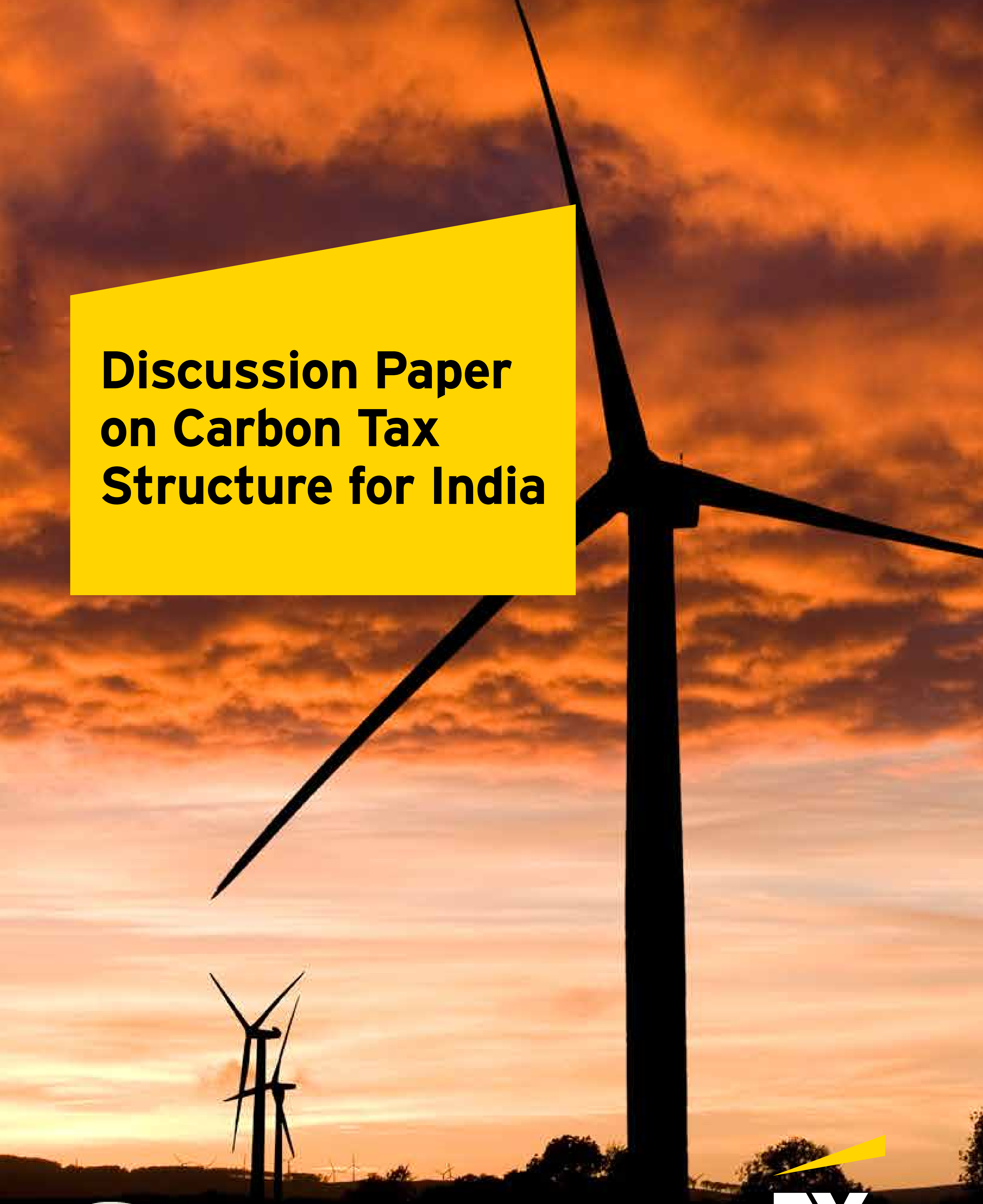
Discussion Paper on Carbon Tax Structure for India



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Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and sustainable transport solutions.

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Abbreviations

APM	Administrative pricing mechanism
ATF	Aviation Turbine Fuel
BS	Bharat Stage
CAFC	Corporate Average Fuel Consumption
CBA	Cost-benefit analysis
CBEC	Central Board of Excise and Customs
CBM	Certain Coal Bed Methane
CCA	Climate Change Authority
CCS	Carbon Capture and Storage
CCTA	Central Customs and Tax Administration
CDP	Carbon Disclosure Project
CEA	Central Electricity Authority
CENVAT	Central Value Added Tax
CH4	Methane
CHP	Combined Heat and Power Production
CIL	Coal India Limited
CO2	Carbon Dioxide
CPM	Carbon Pricing Mechanism
CSR	Corporate Social Responsibility
CST	Central Sales Tax
CVD	Additional Customs Duty
DICE	Dynamic Integrated Climate and Economy Model
DICE	Dynamic Integrated Climate-Economy Model
DST	Department of Science and Technology
ECS	Equilibrium climate sensitivity
ETS	Emissions Trading System
EU	European Union
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
FUND	Framework for Uncertainty, Negotiation and Development
GDP	Gross Domestic Product
GHG	Green House Gas
GRIHA	Green Rating for Integrated Habitat Assessment
GST	Goods and Services Tax
H2O	Water Vapour
HEP	Hydrocarbon Exploration Policy
HSD	Diesel
IAM's	Integrated Assessment Models
IAWG	Interagency Working Group
IEA	International Energy Agency
IGCC	Integrated Gasification Combined Cycle
INDC	Intended Nationally Determined Contribution
IPT	Initial pulse timescale
KKC	Krishi Kalyan Cess
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MDM	Mid-Day Meal
N2O	Nitrous Dioxide
NAPCC	National Action Plan on Climate Change
NCEEF	National Clean Energy and Environment Fund
NDCs	Nationally Determined Contributions
NELP	New Exploration and Licensing Policy
NHAI	National Highway Authority of India

OASI	Old-Age and Survivors Insurance
OECD	Organisation for Economic Co-operation and Development
OMCs	Oil and Marketing Companies
PAGE	Policy and Analysis of Greenhouse Effect
PAT	Perform Achieve and Trade
PDS	Public Distribution System
PFCs & HCFCs	Perfluorinated Carbons and hydro chlorofluorocarbons
PMGSY	Pradhan Mantri Gramin Sadak Yojana
PSC	Product Sharing Contract
REC	Renewable Energy Certificates
RPO	Renewable Purchase Obligation
SARS	South African Revenue Service
SAT	Tax Administration Service (SAT, as per the Spanish acronym)
SBC	Swachh Bharat Cess
SCC	Social Cost of Carbon
SF6	Sulphur Hexafluoride
SKO	Kerosene
SSA	Sarva Shiksha Abhiyan
SUV	Sport-Utility Vehicle
TCR	Transient climate response
TCRE	Transient climate response to emissions
TFEC	Total final energy consumption
TPES	Total primary energy supply
UNFCC	United Nations Framework on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax

Executive Summary

The increase in global temperatures and the resultant climate change is a matter of global concern. India is among the 175 nations who have ratified the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). India has agreed to further propagate a healthy and sustainable way of living and to adopt a climate friendly and a cleaner path. More specifically, it has committed in its Nationally Determined Contribution (NDC), to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level, achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 and create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent by 2030.

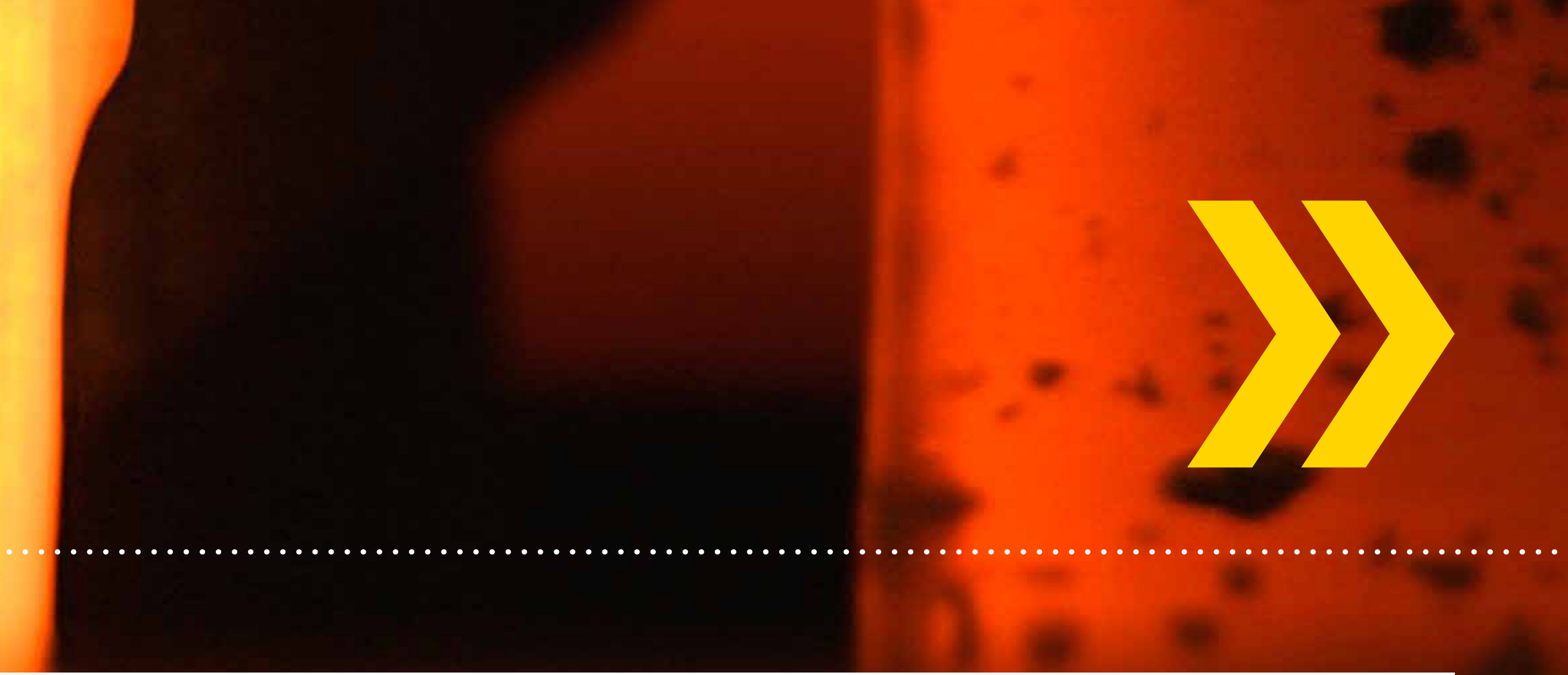
India has undertaken several measures, both regulatory and fiscal, to achieve its NDC goals. India aims to achieve more than five times increase in the installed capacity of renewable energy generation from 35 GW in March 2015 to 175 GW by 2022. The Perform, Achieve and Trade (PAT) scheme aims to decrease energy consumption in industry and thereby reduce emissions. Series of other measures, such as the flagship programmes on Smart Cities, Cleaning of rivers and Swachh Bharat Mission are in sync with India's climate change actions. The National Energy Policy brought out by the NITI Aayog reiterates the importance of de-carbonisation through the twin interventions of energy efficiency and renewable energy.

India has also adopted fiscal measures to reduce carbon emissions. A cess of INR 400 per tonne is applied to coal. Further, the decisions to make the diesel and petrol prices market determined, withdrawal of subsidies (the LPG subsidy withdrawn for consumers with taxable income of more than INR 10 lakh) and rationalisation of the quota of Kerosene under the Public Distribution System (PDS) over the years, are in line with the aim of reduction in carbon emissions.

These measures have had varied degrees of effectiveness and the carbon emitters do not actively monitor and limit their CO_2 output. It is in this context that a carbon tax structure in India is proposed to be examined in this Paper. A carbon tax is a tax that is levied to the greenhouse gas (GHG) emissions. First introduced by Finland in 1990, the carbon tax has seen a growing interest in the recent years around the world. It is considered by some countries to be an effective, transparent and low cost means of inducing carbon abatement. It can lead to economy-wide reductions in the CO_2 emissions and produce important co-benefits, for example reductions in air pollution or raising valuable public revenue.

India would need to take decisions about the timing and level of carbon tax, based on its own development priorities and needs. This Paper explores the following aspects:

- The level of GHG emissions in India and the sources that are contributing to the emissions.
- An assessment of the current tax and non-tax measures being taken by India towards reducing carbon emissions and the effectiveness of these measures
- International experience of the carbon tax structures and their effectiveness.
- Impact of Goods and Services Tax (GST) on the current tax instruments for mitigating GHG emissions and exploring if the carbon tax could be implemented within the framework of GST.
- The design and structure of carbon tax in India, rate(s) and exemption(s), the implementation framework, assessment of the impact of carbon tax on CO_2 emissions and utilisation of revenues.



Sources and levels of emissions

Greenhouse gas (GHG) emissions, attributed to be the most significant factor leading to climate change, primarily consist of six gases: water vapor (H_2O), carbon dioxide (CO_2), nitrous dioxide (N_2O), Methane (CH_4), Sulphur hexafluoride (SF_6) and Halocarbons (PFCs & HCFCs).

CO_2 originates mainly from the combustion of fossil fuels and biomass. Other activities that increase CO_2 in the atmosphere are deforestation, land clearing for agriculture and degradation of soils. The primary sources of methane are domesticated animals (e.g., dairy cows, pigs), and activities related to rice growing, gas flaring and mining. Nitrous oxide mainly originates from agricultural land management, animal manure management, combustion of fossil fuels, and the production of fertilizers and nitric acid.

CO_2 emissions constitute more than 70% of global GHG emissions, thus giving rise to the global concerns about reducing carbon emissions and devising ways and means by which carbon emissions can be restricted and cleaner forms of energy can be promoted. This Paper focuses on CO_2 emissions.

For the purposes of computing emissions, the Paper uses the methodology of applying emissions factor to the quantity of the fuel used in an activity across the following sectors:

- Domestic distribution sector: Households which cannot be categorized as commercial or industrial
- Transportation sector: Modes of transportation including aviation, shipping, road transport and railways. International aviation and marine bunkers have not been included
- Energy sector/ Power generation: Power generated as utility and captive power generation by private players
- Industrial sector: Mining and manufacturing. Manufacturing includes several categories such as chemicals, iron and steel, cement production, metallurgical, engineering goods, aluminium, textiles and ceramics.
- Agriculture: Total fuel consumed in production of fertilizers and other agricultural consumption of fuels.
- Miscellaneous sectors include resellers/retail consumption, private imports and other miscellaneous

No emission estimates have been made for biomass and biofuels owing to non-availability of data and the risk of double counting. We have not considered the emissions from Land Use, Land Use Change and Forestry (LULUCF) and emissions from domesticated animals like cows, buffalos, camels etc. Despite significant contribution to India's national emissions LULUCF and domestic animals are not accounted for, in national inventories, due to lack of reliable data.

Coal contributes more than 70% of the total emissions in India. Diesel (including both high speed diesel and low density oil) is the second highest carbon emitter with 10.9% of the total emissions. Natural gas and motor spirit/petrol contribute 5.83% and 3% respectively to the total emissions in India. Other notable sources of emissions are LPG (2.63%), naphtha (1.90%), kerosene (0.98%), ATF (0.91%), bitumen (0.86%) and lubes (0.51%).

1. www.unfccc.com
2. http://www.mospi.gov.in/sites/default/files/publication_reports/climateChangeStat2015.pdf

Basis for determining the carbon tax rate

The rate of carbon tax is a significant aspect that determines the impact that the tax will have on carbon emissions. The basis on which the rate will be determined becomes important in the context of the goals or policy objectives that the carbon tax plans to achieve. For the purposes of this Paper, two approaches have been considered for determining the carbon tax rate:

Social cost of carbon (SCC) approach - SCC is an estimate of the cost that the society bears from the emission of one tonne of CO_2 or carbon equivalent emissions at a given point of time. The social cost is associated with factors such as damage to human health, damages to property, adverse impact in the climate and the eco system, the shift in the tropical heat belts to name a few. Using the SCC approach, the carbon tax rate is equated to the social cost of carbon. The SCC approach is useful as it helps balancing the costs and benefits of the measures for reducing CO_2 emissions. The most prevalent models globally for estimating the SCC are the Integrated Assessment Models, such as Dynamic Integrated Model of Climate and Economy (DICE), Regional Integrated Model of Climate and Economy (RICE), Policy and Analysis of Greenhouse Effect (PAGE) and Framework for Uncertainty, Negotiation and Development (FUND). This Paper has considered DICE 2016 model which puts the global SCC at USD87, given India's regional SCC is assumed at 12% . This estimates India's social cost of carbon at USD 10.44 or, rounding off, at USD 10.

Abatement approach – This approach is useful in the cases where the carbon tax aims to meet a specific emissions reduction target, for example, the targets promised in the NDCs under the UNFCCC. This Paper uses the carbon tax rate estimates by Ian Parry and others (2017). Parry and others have brought out that even in a Business As Usual (BAU) scenario, the emissions intensity of India will fall, but only by 24% by 2030 compared to 2005 levels. The NDC target is to reduce the emissions intensity by 33-35% by 2030 as against the 2005 levels. A carbon tax of USD 10 per tonne of CO_2 emission could further reduce the emission intensity by 8% as against BAU levels. A higher carbon tax of USD 35 per tonne of CO_2 emission could reduce the emission intensity by 22% against BAU levels. That is, if the carbon tax is gradually increased in equal yearly increments such that it reaches USD 35 per tonne by 2030, it could lead to a reduction in the emission intensity by 22% against BAU level.

Fuels	Coverage under GST	GST Rate (%)	Emission factor (Kilograms CO2 per Million Btu) Kg CO_2/MBtu
LPG	Yes	5 (Domestic) 18(Non-domestic)	64.01
Kerosene	Yes	5(Fertilizer) 18 (Non-fertilizer)	72.30
Naphtha	Yes	18	72.80
Bitumen and Asphalt	Yes	18	75.61
Coal	Yes	5 (+GST compensation cess @ Rs. 400/ton)	95.35
Petroleum coke	Yes	5	102.10
Other Fuels	**Coverage under GST**	**Effective tax burden**	
Natural gas	No	0 - 25	53.07
ATF(Aviation turbine fuel)	No	14 - 62	70.90
Petrol	No	113	71.30
High Speed Diesel	No	78	73.16

3. Under the models used India's contribution to the global SCC is 12%, estimated on the basis of factors such as GDP (output), population, emissions, emissions and temperature sensitivity.

4. IMF Working paper on 'Reforming Energy Policy in India: Assessing the Options' Prepared by Ian Perry, Victor Mylonas and Nate Vernon

Assessment of measures undertaken by India to reduce carbon footprint

The government has introduced many measures, regulatory and fiscal, to reduce India's carbon footprint. An assessment of these measures brings out the following aspects that need attention:

- The current regulatory measures do not comprehensively cover all the emission sources. The main focus is on the transportation and electricity sector, which accounts for approximately 63% of the emissions. Manufacturing sector, which accounts for 26% of the emissions, is not fully covered by the government's regulatory measures.
- The number of measures taken require the government to make periodic changes in regulatory standards such as, energy efficiency standards for industries subject to PAT scheme and appliance efficiency standards. The success of these measures is dependent on the government's enforcement capability.
- India does not follow a uniform approach towards pricing of fuels. Prices can be subsidised, determined on a cost plus basis, based on an administered pricing mechanism or be market based. For example, price of domestically produced natural gas (based on formula prescribed by the government) is different from the price of imported gas (based on international price). Using different approaches to price fuels reduces the effectiveness of taxation in tackling the problem of carbon emissions.
- Imposition of clean environment cess is currently not linked to the quantum of carbon emissions. Further, availability of cleaner fuels such as natural gas, and actual usage of the power generation capacity of the renewable sources of power, need to be augmented to incentivize the switch from a polluting fuel like coal to a cleaner fuel, if the former is subject to higher tax.
- Petrol and diesel already suffer a high tax burden. Government's ability to impose additional taxes on these two fuels is limited.
- Under GST, the tax rates on fuel and the inclusion of fuels in the GST base are not guided by emission concerns, but by revenue considerations.
- A carbon tax could potentially cover all emissions other than biomass and biofuels and provide an incentive to users to consider using cleaner sources of energy.

International experience

Carbon taxes were first introduced in the early 1990s. Finland first adopted such a tax in 1990, followed by Norway and Sweden in 1991, and Denmark in 1992. The early 2010s saw, for the first time, carbon taxes being used in emerging economies. Countries such as South Africa, Mexico, and Chile are either employing carbon taxes or are contemplating implementing the imposition of a carbon tax. According to a World Bank report (March 2017), over 20 national and sub-national level jurisdictions (e.g., British Columbia in Canada) have adopted or are proposing to adopt carbon taxes.

The design and implementation of carbon taxes may vary from jurisdiction to jurisdiction. There are differences in rates, applicability, and point of taxation, coverage, administration and the usage of the revenues collected through carbon taxes. However, there are also similarities in the approach towards taxing carbon. Further, the level of success has varied across countries. On one hand carbon taxes in Nordic countries have been continuing for over two decades, and on the other hand, carbon tax (called the carbon pricing mechanism) in Australia was repealed within 2 years of introduction.

This Paper examines the experience of carbon tax design and structure in select jurisdictions and attempts to draw in learnings that could inform the design of a carbon tax mechanism for India. The countries selected include those where carbon tax led to reduction in carbon emissions (Denmark, Finland, Switzerland), those where carbon tax faced challenges (Australia), the BRICS countries (South Africa) and emerging economies (Mexico).

The following learning points emerge from the study of international experience:

Phased and incremental approach:

Countries with a successful history of carbon taxation, have followed a phased and incremental approach. Tax rates and the coverage have been gradually increased. Exemptions and rebates have been reduced over a period of time.

Tax base and point of incidence:

Indirect taxes on all fossil fuels imposed at the point of initial sale are the most common. The application of the tax to the carbon content of fossil fuels serves as an effective and simple proxy for CO_2 emissions as the price is passed down. Consumers' behaviour is thus directly targeted. These are comparatively easy to implement and administer. Tax Rates: Tax rates vary from a high of USD 132 in Sweden to a low of US$ 1 in Mexico. Carbon taxes that are applied only to fuels, emissions are measured based on the application of an agreed emissions factor (based on the carbon content of the fuel) to the amount of fuel sold.

Exemptions from carbon tax:

Exemptions vary across countries and are driven by the perceived economic objectives of the country. Further, the list of exemptions gets modified over a period of time and as a general principle, they reduce with time.

Administrating authorities:

The existing indirect tax authorities are most commonly used for administering a carbon tax.

Usage of revenues:

Countries use different policies for achieving revenue neutrality as well as using the money to fund specific programmes. Proceeds from imposition of carbon taxes have been used to reduce other taxes such as income taxes. They have also been used to fund contributions towards social security, thereby reducing the government expenditure towards such schemes. They have also been used for energy efficiency and environmental programmes.

Design of carbon tax

This Paper discusses five broad elements of the carbon tax design:

- Determination of the tax base,
- Estimation of the tax rate,
- The implementation mechanism,
- Utilisation of revenues from carbon tax and
- Addressing distributional impact

3. Under the models used India's contribution to the global SCC is 12%, estimated on the basis of factors such as GDP (output), population, emissions, emissions and temperature sensitivity.
4. IMF Working paper on 'Reforming Energy Policy in India: Assessing the Options' Prepared by Ian Perry, Victor Mylonas and Nate Vernon

Following recommendations are made:

Tax base

In most countries, carbon tax is usually imposed on the polluting inputs as opposed to directly taxing pollution on account of the measurement and implementation difficulties that the latter poses. Implementing a tax on inputs such as fuels can be considered the same as taxing emissions. A unit of fossil fuel will emit the same amount of carbon irrespective of when and where it is burned (assuming that they are fully burnt).

Carbon tax should be applied to all fuels that are sources of carbon emissions.

Point of levy of carbon tax

Taxation of fuels upstream (i.e. at the production/import level) would be the most appropriate point of levy as:

- Administratively, it will involve monitoring fewer producers as against a large number of consumers.
- Upstream fuel taxes can be easily implemented through the use of existing tax laws, systems and agencies for administering indirect taxes.
- They do not require the computation of emissions by the polluter and thus there will be no requirement of new institutional capacities to undertake the tasks.
- Upstream tax on fuels will not be perceived as a new tax on the consumers as the tax will be paid closer to the production point.

Legislative framework

There could be three options for introducing a carbon tax in India:

1. Amendment to the Constitution: The introduction of a carbon tax as a separate tax in India will require an amendment to the Constitution to empower the Centre and the States to legislate for the new tax.
2. Using Article 248: Carbon tax can be introduced as a new tax using the residuary powers of the Parliament under Article 248 of the Constitution.
3. Introduce carbon tax under the existing GST laws

The first option, i.e., amendment to the Constitution, can be a long drawn process:

- A Constitution (Amendment) Bill will be required to be passed in both the Houses of the Parliament separately, by absolute majority (more than 50% of the strength of the Parliament) and special majority (approval by 2/3 of the members present and voting}. The Bill must also be ratified by the legislatures of half of the states by a simple majority.
- After the Constitutional amendment, a new legislation for levying carbon tax will need to be drafted and passed by the Parliament and the State legislatures.
- Rules governing the administration of the new tax will need to be framed.

The second option of introducing carbon tax using Article 248 of the Constitution, will not require a Constitutional amendment. However, it would require a new legislation for levying carbon tax (to be passed by the Parliament), followed by the rules / regulations for its administration. The second option will have a limitation as, in this case, only the Centre will be able to impose the tax and the States will not have the power to impose a carbon tax.

Legislative framework

Given the above, the third option of applying a carbon tax within the existing legislative framework, i.e. within the GST would be most suitable. This option would involve amendment to the existing GST laws after a recommendation by the GST Council.

Applying a carbon tax within the existing legislative framework of GST would be most feasible. This option will involve a recommendation by the GST Council to this effect, followed by amendment to the existing GST laws.

Under this option it is suggested that all fuels should be brought under the GST, subject to GST plus an additional supplementary cess. The quantum of cess for each fuel should be determined on the basis of carbon emissions and calibrated to protect the government revenues.

Specific suggestions on tax base

Coal	Immediate term (0-2 years)	Medium to long term (3-12 years)
	In the short to medium term, India's dependence on coal as a source of energy would continue. Keeping these aspects in mind: ▸ Coal should continue to be subject to GST and a supplementary cess. ▸ The current cess on coal under GST should be linked to the quantum of carbon emissions from coal. The government should give a clear message to all stakeholders about its intent to link the cess to carbon emissions. ▸ The 'carbon cess' on coal should be applied only at the first point of supply. No set-off should be allowed for the cess paid. ▸ Ideally, since carbon tax is linked to the quantum of emissions, cleaner coal should be subject to a lesser tax burden compared to a more polluting variety of coal. However, in the interest of simplicity initially at the time of implementing carbon tax, same tax rate may be applied to all types of coal.	While coal continues under the purview of the GST: ▸ The supplementary cess should be increased gradually. ▸ The collections from the carbon cess on coal could be earmarked for environment objectives. This was also the objective of the clean environment cess when it was initially introduced.

5. The GST Council is a joint forum of the Centre and the States. It is chaired by the Union Finance Minister, with the Revenue and Finance Ministers of all the States as members.

Specific suggestions on tax base

Petroleum fuels outside the GST base	Immediate term (0-2 years)	Medium to long term (3-12 years)
Petrol, diesel, natural gas, aviation turbine fuel (ATF)	▸ Maintain status quo for petrol, diesel and ATF i.e. no carbon taxes should be imposed until petrol and diesel are brought under the purview of GST. ▸ There is a strong case for including natural gas in GST as it is largely used as an intermediate product and in business to business transactions. In case the States continue to have reservations about the inclusion of the petroleum products in GST, at a minimum, natural gas should be included in the GST. ▸ For equality of tax treatment, natural gas should be subject to the same GST rate as coal (5% currently), with additional, non-creditable, supplementary levy linked to carbon emissions.	▸ All the currently excluded petroleum products should be brought into the GST base. ▸ The GST rate should be uniform, with an additional non-creditable, supplementary levy or cess. ▸ The quantum of cess for each fuel should be determined on the basis of the carbon emissions and calibrated to protect the government revenues. ▸ In case the States do not support the additional levy under the GST ▸ (Compensation to the States) Act, 2017 as this legislation empowers only the Centre to levy the tax, the GST Council may consider the alternative of a supplementary levy by the Centre and the States outside the GST, as is the current practice.
Others (LPG, kerosene, naphtha, furnace oil, low sulphur heavy stock / and other residues, bitumen and asphalt, lube oil/greases and petroleum coke)	▸ Measures to reduce subsidies on kerosene and LPG and switch to market based pricing should continue ▸ They should be subject to a GST plus an additional non-creditable cess, linked to the carbon emissions.	▸ Continue GST and supplementary cess. ▸ Increase cess gradually keeping in mind the overall acceptable burden

Rate of carbon tax

Social cost of Carbon (SCC) approach

Under the SCC approach to determine the quantum of carbon emissions by different fuels, using the emission factors, this Paper estimates the social cost of carbon for India at USD 10.44, or rounding off, at USD 10 per tonne of CO_2 emissions based on DCE estimates for the year 2015.

Abatement approach

This Paper uses the estimates in the Study by Ian Parry and others (2017) which brings out that compared to 2005 levels, the emission intensity of India will fall by 2030, but only by 24%, if it is a business as usual (BAU) scenario, with no further policy interventions. A carbon tax of USD 10 per tonne of CO_2 emission could further reduce the carbon intensity by 8% and a higher carbon tax of USD 35 per tonne of CO_2 emission could further reduce the carbon intensity by 22%.

The following need to be considered:

- The abatement approach brings out that for India to achieve its goal of 33-35% reduction in emission intensity by 2030, an additional carbon tax should be imposed across all fuels such that it reaches USD 35 (INR 2310) per tonne of CO2 emission by 2030. Since petrol and diesel are already heavily taxed, the additional burden will have to fall on coal and other fuels.
- The SCC approach reflects that while the other fuels are already heavily taxed, coal is under-taxed. At a minimum, the carbon tax on coal should be increased from the current level of INR 400 per tonne to INR 1,176 per tonne, based on a SCC of USD 10 per tonne of CO_2 emission.
- The current tax burden on petroleum products is already very high, leaving limited scope for increasing the burden any further.
- All petroleum products should be included under the GST at the earliest. All fuels should be subject to a uniform GST (5% currently) with an additional non-creditable supplementary cess linked to carbon emissions.
- India has rich reserves of coal and it is a cheap source of providing energy to the numerous Indian users. In short to medium term, India's dependence on coal as a source of energy would continue. Therefore, the quantum of the additional supplementary tax for coal and other fuels should be increased in a phased manner to the levels estimated under the SCC approach / abatement approach. The relative tax increase on coal and other fuels will have to be decided based on India's own economic priorities and circumstances.

It is expected that the high tax would encourage the consumers to shift to cleaner sources of energy, bring improvements in energy efficiency and reduce the use of energy-consuming products. The revenues from the additional taxes would also supplement the government's ongoing efforts to promote energy efficiency and encourage the renewable sources of energy.

The following table illustrates the level of carbon taxes when imposed at USD 10 per tonne of CO_2 and at USD 35 per tonne of CO_2.

Fuels	Carbon tax - USD 10/ Ton of CO_2		Carbon tax - USD 35/ Ton of CO_2	
	Using exchange rate, 1USD= INR 66			
	Carbon tax INR ton/ MBTU	Carbon tax (INR/ Ton)	Carbon tax INR ton/ MBTU	Carbon tax (INR/ Ton)
Natural Gas	35.03	1,853	122.59	6,486
LPG	42.25	1,940	147.86	6,791
Aviation Turbine Fuel	46.79	2,099	163.78	7,348
Petrol	47.06	2,049	164.70	7,173
SKO	47.72	2,089	167.01	7,311
Naphtha	48.05	2,074	168.17	7,260
Diesel	48.29	2,119	169.00	7,415
LSHS	48.84	2,290	170.94	8,016
Furnace Oil	48.84	2,130	170.94	7,454
Lubes and Greases	48.98	2,089	171.43	7,311
Bitumen	49.90	2,089	174.66	7,311
Coal	62.93	1,176	220.26	4,116
Petroleum coke	67.32	2,229	235.62	7,803

Exemptions

It is suggested that exemptions from carbon tax may be considered only for those industries where fuels are used as feedstock at the first point of supply.

The institutional mechanism

The options for taxation of coal, petroleum products and other fuels discussed above would not require a separate institutional mechanism to be put in place. The additional taxes suggested can be implemented within the existing tax law framework. For administration and enforcement too, the existing laws for implementation of GST, Central Excise and State VAT will provide a ready, simple and transparent mechanism.

Utilisation of revenues

Carbon tax can raise significant revenues, depending on how comprehensively it is implemented. Ian Parry and others (2017) estimate that a carbon tax of USD 35 per tonne of CO_2 emissions levied by India in phases from 2017 to 2030 can yield a revenue of more than 2% of GDP.

The GST Council, while deliberating on the application of cess on polluting fuels under the GST framework may also recommend the sharing of carbon tax revenues with the States.

As an illustration, the additional revenues mobilised from carbon tax may be utilised for the following purposes:

- Promoting research and deployment of clean coal technologies by setting up a Clean Coal Fund (CCF) and Clean Coal Technology Fund (CCTF).
- **Supporting renewable energy projects** – India envisages an increase in the overall renewable energy capacity to 175 GW by 2022, including 100 GW of solar, 60 GW of wind, 10 GW of biomass, and 5 GW of small hydro power capacity. The carbon tax revenues can be utilised for developing new technologies for renewable energy projects.
- **Augmenting natural gas production and distributi**on – Production of natural gas has experienced declining production from old and marginal fields and delay in completion of projects, shutdown of wells, processing platform/plants, pipelines. More investments in this direction could promote greater use of natural gas.
- Incentivising a shift from more polluting fuels to less polluting fuels by subsidising cleaner fuels – The government has been encouraging the substitution of biomass with LPG. A part of the carbon tax revenues could be utilised towards enhancing the direct transfer of LPG subsidies to the consumers' bank accounts. .
- **Mitigating the regressive impact of carbon tax** - A part of the carbon tax revenues could be utilised for mitigating the impacts on the vulnerable households and firms.

Distributional impact

The use of environmental taxes could be regressive in nature and may impact the vulnerable groups such as low income families or people in the disadvantaged regions. The additional tax burden on account of environmental taxes can also impact industry competiveness particularly in the international market. Even the taxes that are, on the face of it, levied on producers are often passed on to consumers in the form of higher prices. In other jurisdictions, the distributional impact is addressed through various measures such as:

- Support measures, such as output-based rebates, support programs, and other subsidies reduce taxpayers' overall financial burden on account of the carbon tax.
- Personal income tax reliefs or higher direct subsidy transfers to the poorer households can provide relief.
- Tax exemptions and reductions directly eliminate or reduce the amount of carbon tax paid by the entity liable to tax.
- Reducing carbon emissions may also affect workers in energy-intensive industries. Phasing-in the policies according to a clear timetable, and helping workers to retrain or move to other forms of employment, are examples of measures that can help to smooth the transition to a low-carbon economy.

A case in example is Denmark, which uses carbon tax revenue to reduce taxes on labour, subsidize energy efficiency investments, and subsidize the associated administrative costs of small companies. Approximately 40 percent of the tax revenue is used for environmental incentives, while the remaining 60 percent is returned to industry through reduced social insurance, reduced pension contributions, and compensation of administrative expenses for small businesses with limited payrolls. India could derive some lessons from these experiences.

Some concluding thoughts

Explicit carbon tax can be introduced: There is a case for introducing a proper carbon tax in India that comprehensively covers all fuels at a uniform rate, differentiated on the basis of the level of emissions. To make the concept more acceptable for the stakeholders, the level of carbon taxes should be increased gradually in a phased manner.

The carbon tax design proposed in this Paper can be implemented under the current regulatory and institutional mechanism in a relatively short period of time. No new institutional framework will be needed.

Social cost estimates may need a review: The criteria suggested in this Paper for arriving at a suitable carbon rate are the social cost of carbon and the emission factors. Estimation of social cost suffers from an inherent subjectivity and hence there would be a need for a better analysis of the social costs for India. If the social cost is considered as per the global estimates, it would be too high for India.

Other pollutants: This Paper has focused on estimating the CO_2 and accordingly suggesting a carbon tax for India. Once this concept is accepted, a similar tax could be introduced for other harmful emissions too such as nitrous dioxide (N_2O), Methane (CH_4), Sulphur hexafluoride (SF6) and Halocarbons (PFCs & HCFCs).

Impact would be visible only in medium to long term: Since it is important for the carbon taxes to be acceptable, it has been suggested that the carbon tax should initially not be any higher than the current tax burden and should be increased in phases. Further, the price elasticity estimates show that in the short term, the demand for consumption of fuels is unlikely to be impacted significantly by the change in prices of fuels. However, in the medium to long term, the price elasticities tend to be higher. It is therefore expected that the impact of carbon tax would be visible only in the medium to long term.

Stability and predictability of tax policy is important: It would be important that the carbon tax rates, once decided, are not changed frequently and should see only a gradual rise. This is important for the stakeholders to plan ahead.

1 Introduction

Background

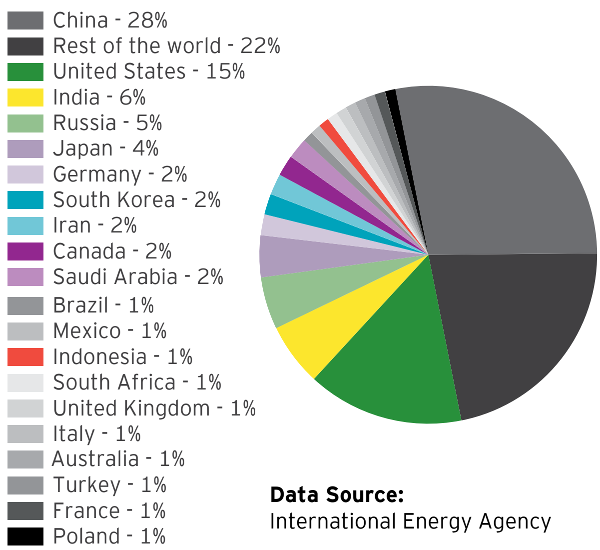
Climate Change has emerged as a global challenge, calling for an integrated global response to drive measures towards sustainability, in keeping with the national circumstances and priorities. India is a party to the United Nations Framework Convention on Climate Change (UNFCCC). It is also among the 175 nations who have ratified the Paris Agreement. India, while signing the pledge declared that it will keep in view its national laws and its development agenda, particularly the eradication of poverty and provision of basic needs for all its citizens. It committed to following the low carbon path to progress, on the assumption of unencumbered availability of cleaner sources of energy, technologies and financial resources from around the world.

The long-term goals of the Paris agreement include restricting the temperature rise to well below 2°C above preindustrial levels and to 1.5°C above pre-industrial levels. The agreement also calls for reaching a peak in greenhouse gas (GHG) emissions at the earliest and achieving carbon neutrality from 2050 onwards.

India is one of the fastest growing economies in the world, with a projected growth of 7.5% in 2018 as per World Bank's recent World Economic Outlook. India also supports about 17.5% of the world population and is the third largest emitter of carbon dioxide (CO_2) from fuel combustion after China and the United States. Therefore, it recognizes that its growth needs to be guided by environmental sensibilities so as to achieve a balance between holistic development and sustainability. In fact, India is one of the leading economies that the world looks up to, for driving the affirmative action on this front.

Figure 1: Contribution of emissions country wise

Share of Global Carbon Dioxide Emissions from Fuel Combustion (2015)



Data Source:
International Energy Agency

Risks to India

While climate change is impacted by the actions of countries across the globe, the impact can be different across countries. It is believed that tropical countries like India are more vulnerable to the threat posed by climate change. A study undertaken on behalf of the World Bank has identified the following possible risks to the Indian economy :

- A 2°C rise in the world's average temperatures can make India's summer monsoon highly unpredictable. An abrupt change in the monsoon could precipitate a major crisis, triggering more frequent droughts as well as greater flooding in large parts of India.
- A 2.5°C rise in warming, melting glaciers and the loss of snow cover over the Himalayas are expected to threaten the stability and reliability of northern India's primarily glacier-fed rivers, particularly the Indus and the Brahmaputra. The Ganges could be less dependent on melt water due to high annual rainfall downstream during the monsoon season. Alterations in the flows of the Indus, Ganges, and Brahmaputra rivers could significantly impact irrigation, affecting the amount of food that can be produced in their basins as well as the livelihoods of millions of people (209 million in the Indus basin, 478 million in the Ganges basin, and 62 million in the Brahmaputra basin in the year 2005).
- A 4°C rise in warming, would cause:
    - An extremely wet monsoon that currently has a chance of occurring only once in 100 years is projected to occur every 10 years by the end of the century.
    - The west coast and southern India are projected to shift to new, high-temperature climatic regimes with significant impacts on agriculture.
    - Droughts are expected to be more frequent in some areas, especially in north-western India; Jharkhand, Orissa and Chhattisgarh.
    - Crop yields could fall significantly because of extreme heat by the 2040s.

India's response

India has taken several initiatives to address the issue of climate change challenges. Its National Action Plan on Climate Change (NAPCC) enshrines eight national missions that provide the framework for multipronged, long term and integrated strategies. The missions cover the areas of (a) Solar Energy (b) Enhanced Energy Efficiency (c) Sustainable Habitat (d) Water (e) Green India (f) Sustainable Agriculture and (g) Strategic Knowledge for Climate Change. Two dedicated funds have been set up – National Clean Energy Fund (later renamed as National Clean Energy and Environment Fund (NCEEF)) and National Adaptation Fund on Climate Change (NAFCC) to address the cost of cleaner technologies in certain identified sectors.

In order to lower carbon emissions, comprehensive Nationally Determined Contribution (NDC), have been prepared. Under the NDC, it is proposed to create a carbon sink of 2.5 to 3 billion tonnes of CO2 by 2030 through additional forest and tree cover. India aims to reduce the emissions intensity (carbon emissions as percentage of GDP) by 33-35% by 2030 as against 2005 levels. India aims to achieve more than five times increase in the installed capacity of renewable energy generation from 35 GW (March 2015) to 175 GW by 2022. This is a key measure of the Government of India to reduce the emissions intensity. In addition, government has introduced a Perform, Achieve and Trade (PAT) scheme to decrease energy consumption in industry and thereby reduce emissions. Series of other measures, such as the flagship programmes on Smart Cities, Cleaning of rivers and Swachh Bharat Mission are in sync with India's climate change actions. The National Energy Policy brought out by the NITI Aayog reiterates the importance of decarbonisation through the twin interventions of energy efficiency and renewable energy. While these measures have been playing a useful role in mitigating the carbon emissions, one of the issues worth debating is whether these measures cover all the sources of emissions in India, or fall short of a comprehensive coverage.

India has also adopted fiscal measures to reduce carbon emissions. A cess of INR 400 per tonne of coal is applied to coal. Further, the decisions to make the diesel and petrol prices market determined, withdrawal of subsidies (the LPG subsidy withdrawn for consumers with taxable income of more than INR 10 lakh) and rationalisation of the quota of Public Distribution System (PDS) Kerosene over the years, are in line with the aim of reduction in carbon emissions.

3. www.unfccc.com
4. Ibid
5. http://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts

Petrol and diesel in particular are subject to high level of taxes in the form of excise duties and value added taxes. Indirect taxes account for as much as 100% of the retail prices in certain states in India. These are not "carbon taxes" in true sense, however, they are like implicit carbon taxes. India has been gradually increasing the taxes on fossil fuels while at the same time incentivising, through subsidies the use of renewable sources of energy. Again, while the fiscal measures have been useful in curbing the consumption of carbon emitting fuels, there is still a question, whether the pricing and taxation policies followed in India are in sync with the carbon footprint. There are instances where fuels with a higher carbon footprint are subject to lower levels of taxation or subsidised prices or non-market driven prices.

The reach of all these measures has varied degrees of effectiveness. It is in this context that a carbon tax structure in India is proposed to be examined in this Discussion Paper.

Policy options for mitigating carbon emissions

The issue of reducing carbon emissions can be addressed through two broad policy alternatives i.e., regulatory and market based instruments. The regulatory instruments prescribe standards or limits for emissions. However, some of these standards could involve considerable costs in terms of their implementation and monitoring for compliance and effectiveness. For instance, implementation of renewable sources of energy requires the government to take a number of measures spread across all the states of India such as persuading the state governments to buy renewable power, even though the cost of generation may be higher than other sources. Similarly, prescribing efficiency standards for each of the appliances and the periodic revision and implementation of these standards can be challenging. Thus, the regulatory policies may give rise to a situation where the cost of adopting measures for abating emissions is far more than the actual environment benefits. Moreover, the command and control type of measures may not be comprehensive and may not cover all sources of emissions.

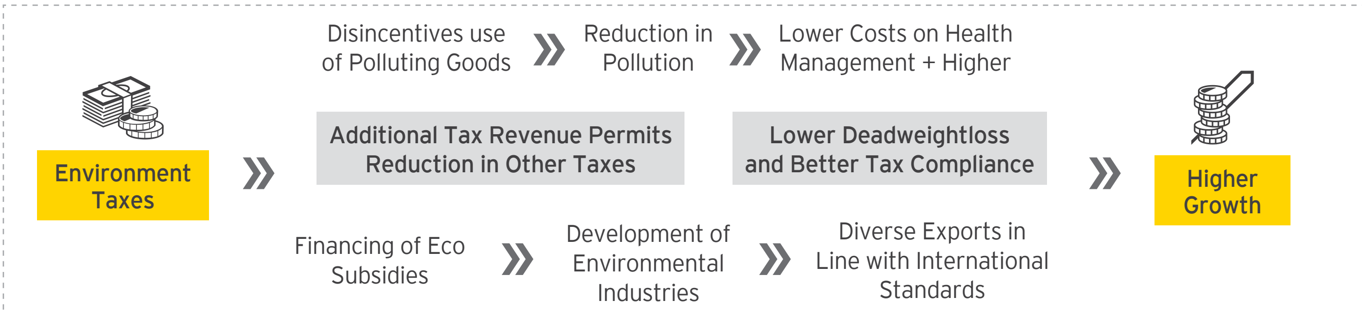
On the other hand, the market based instruments in the form of taxes, levies, subsidies and trading instruments can be more cost effective. They essentially work on the principle that they can induce appropriate environmentally friendly decisions by raising the relative cost of polluting inputs and outputs. The intent of introducing these instruments is not to put an additional burden of taxation on the citizens, but to change the structure of taxation. The market based instruments such as taxes provide the opportunity for reallocating the emission reduction/ abatement among different polluters such that each polluter can reduce emissions at the least cost to it.

Two principle MBI's to mitigate emissions are Carbon Tax and Emissions Trading Systems. Carbon taxes have a wider coverage as compared to Emissions Trading Systems, which are sector or industry specific. Further,carbon taxes are administratively more transparent and convenient to implement, especially economy wide.

The environment taxes also provide a continuous incentive to encourage innovation to develop newer technologies that aim at reducing emissions in a cost effective manner. Further, depending on how these instruments are designed, they can have a more widespread impact.

The environment taxes can also raise additional revenues which can then be utilised towards environment protection objectives. Environment taxes can have a positive impact on growth7. The figure below depicts three channels that may lead to better growth, i.e., (a) lower health management costs, (b) lower deadweight losses and (c) promotion of environmental industries through financing of eco-subsidies.

Figure 2: Environmental Tax Reforms and Growth



6. MBIs are also called economic incentives (EI) for pollution control and include pollution charges or levies, taxes, subsidies, and tradable permits, as per World Bank report. http://siteresources.worldbank.org/INTRANETENVIRONMENT/Resources/GuidanceNoteonMarketBasedInstruments.pdf

7. D K Srivastava and K S Kavi Kumar

Rationale of a carbon tax

A carbon tax is a tax that is explicitly / directly applied to the GHG emissions, including carbon emissions. Under this tax system, the taxpayer entities report their emissions on an annual basis and pay a tax for each ton of GHG emission. First introduced by Finland in 1990, the carbon tax has seen a growing interest in the recent years. Carbon tax is considered by some countries to be an effective, transparent and low cost means of inducing carbon abatement. It can lead to economy-wide reductions in the CO_2 emissions. It is believed that putting a price on CO_2 or taxing carbon can produce important co-benefits, for example reductions in air pollution or other negative side-effects of energy use or raising valuable public revenue.

Across countries, carbon taxes may take different forms. They may be general taxes applicable to all goods or activities (e.g. higher value-added taxes on polluting goods), or those that apply specifically to carbon-intensive goods, such as excise taxes/ duties on fossil fuels. As against these levies, carbon taxes directly put a price on GHG emissions, thus incentivising the taxpayers to reduce emissions, whether by opting for more efficient or cleaner fuels or changing their lifestyle.

Carbon tax in India

As mentioned earlier, India has taken a number of policies that contribute to climate mitigation by reducing or avoiding CO_2 emissions. However, those responsible for carbon emissions do not actively monitor and limit their CO_2 output.

According to the World Bank, a carbon tax sends a price signal that gradually causes a market response across an entire economy, creating incentives for emitters to shift to less greenhouse-gas intensive ways of production and ultimately resulting in reduced emissions.

There are several policy considerations that need to be examined for a carbon tax in India. It would be important to identify the key sources of carbon emissions as, to the extent possible, carbon tax should directly be levied on the pollutant or action causing the environmental damage. Another important aspect would be how the carbon tax would interact vis-à-vis other current taxes on the sources of carbon emissions (primarily fossil fuels) such that the 'effective carbon tax burden' on the energy sector does not become excessive. The interaction of carbon tax with the non-fiscal measures such as subsidies for cleaner energy sources, prescribing efficiency standards, earmarking funds for research and development of cleaner technologies and so on, becomes important so as to ensure there are no counteracting measures.

Besides providing economic incentives for making changes in usage of fuels, revenues collected from carbon tax can also be used by the society through the government to fund extensive research and development on novel green technologies that cannot be undertaken by individual businesses. India has a history of imposing specific cesses to fund different programmes, e.g., cess to fund highway development, cess for funding education etc. The outcome has been mixed. Therefore, utilisation of revenues from carbon taxes is an important aspect to be considered.

The design of carbon tax will involve an interplay of several dimensions:

- The fuels or sectors to be taxed (tax base), exemptions if any and the point of incidence
- The level at which the carbon tax can be levied after taking into consideration the social cost of carbon emissions and the existing taxes – explicit or implicit (tax rate)
- The revenues from carbon tax and their application, i.e., whether for lowering other taxes or reducing subsidies or channelising into clean energy resources
- The cost of administration and compliance and whether the existing administration mechanisms could be utilised for implementing carbon tax
- Public acceptance of carbon tax
- The possibility of carbon tax leading to any carbon leakage or a negative impact
- The possibility of combining tax with other fiscal and non-fiscal policy instruments to provide for an effective measure to address the problem of rising carbon emissions.

The measures undertaken are influenced by the perceptions and national needs of the different countries.

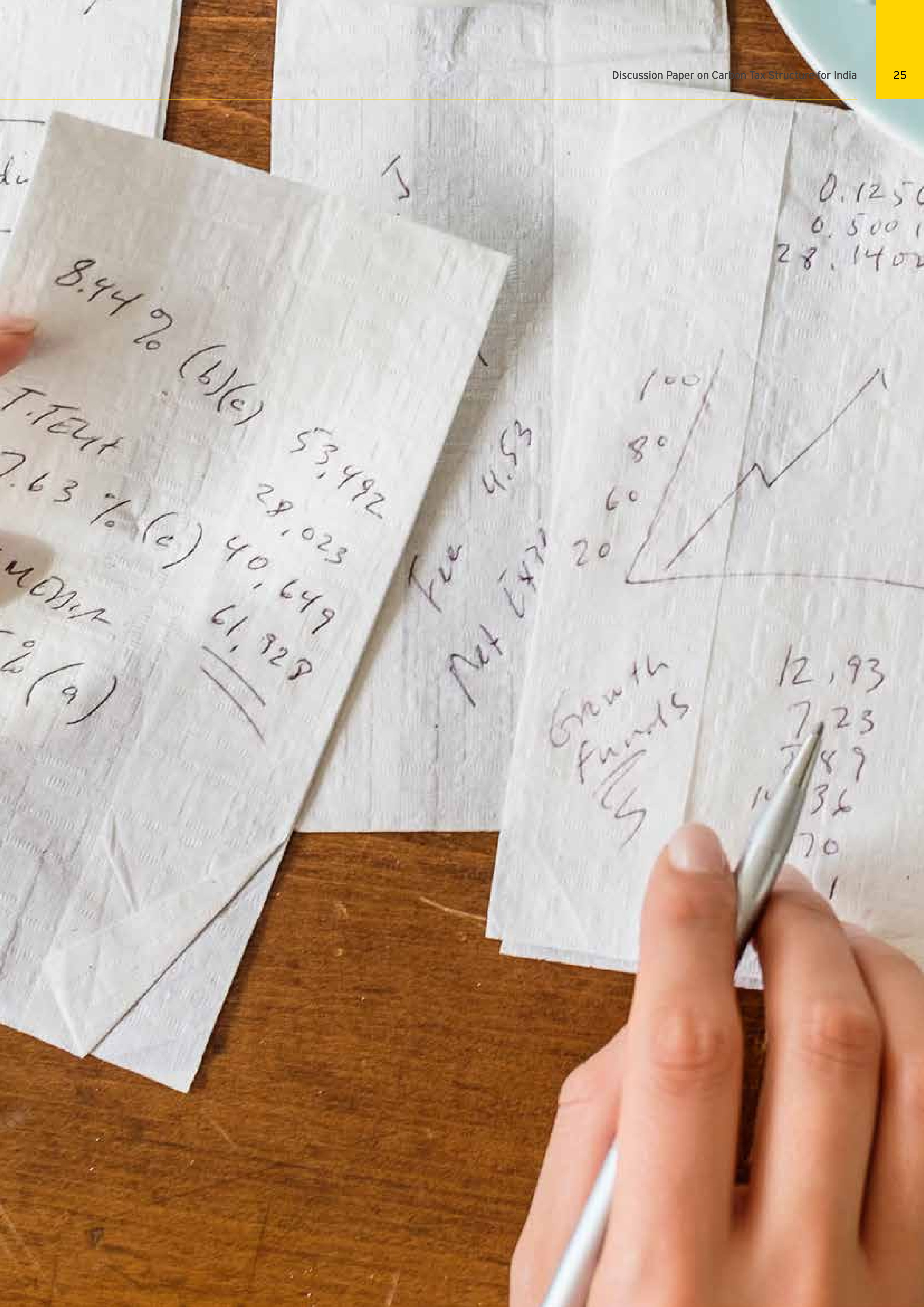
8. Environment and Fiscal reforms in India; DK Srivastava & K.S. Kavi Kumar

Outline of the paper

The Shakti Sustainable Energy Foundation intends to facilitate a domestic dialogue on carbon taxation in India. Accordingly, the key focus of this engagement is to prepare and disseminate a Discussion Paper that proposes a carbon tax structure for India and assesses its merits and challenges. The paper will form the basis of initiating a fresh dialogue on the subject, among the identified stakeholders.

This Discussion paper explores the following:

- The level of emissions in India and the sources that are contributing to the emissions.
- An assessment of the current tax and non-tax measures being taken by India towards reducing carbon emissions, the effectiveness of these measures and the utilisation of revenues collected through the current tax instruments.
- International experience of the carbon tax structures and their effectiveness.
- Impact of GST on the current tax instruments for mitigating GHG emissions and exploring if the carbon tax could be implemented within the framework of GST.
- The design and structure of carbon tax in India, rate(s) and exemption(s), the implementation framework and assessment of the impact of carbon tax on CO_2 emissions.
- Merits and challenges of introducing a carbon tax in India.


8.44 %
53,492
28,023
40,649
61,928
Growth Funds
12,93

2 Carbon emissions: Sources and levels

Countries around the world are implementing a variety of tax and regulatory measures to reduce the level of CO_2 emissions. As mentioned in the previous chapter, while evaluating the tax and non-tax measures adopted to address the issue of emissions, the following aspects merit attention:

- Whether all the sources of emissions are being addressed by the regulatory measures taken by the government.
- Is the approach for imposing taxes on fuels in line with the level of emissions from the usage of that particular fuel? A lower incidence of tax on fuels which cause higher level of emissions vis-à-vis other fuels encourage the usage of highly polluting fuels. Ideally, from an emission perspective, incidence of tax should be higher on fuels emitting higher levels of CO_2 on a per unit basis.
- It is also important to understand which economic activities are the largest contributors of CO_2 emissions in India. This becomes relevant particularly in the context of evaluating the utilisation of revenues raised from carbon taxes. The revenue could be used to check/influence those economic activities that are responsible for higher emissions.

This chapter discusses the sources of emissions, contribution of the various sectors and computation of the level of emissions.

Greenhouse gas emissions

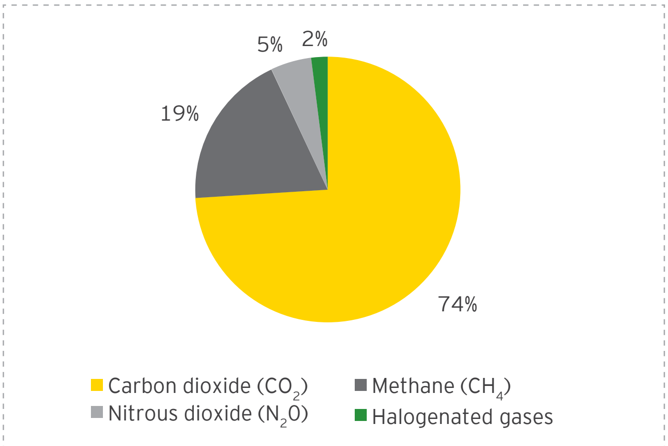
Greenhouse gas (GHG) emissions from anthropogenic factors/economic activities are attributed to be the most significant factor leading to climate change. GHGs primarily comprise of six gases i.e., water vapour (H_2O), carbon dioxide (CO_2), nitrous dioxide (N_2O), Methane (CH_4), Sulphur hexafluoride (SF_6) and Halocarbons (PFCs & HCFCs).

- CO_2 originates mainly from the combustion of fossil fuels and biomass. Other sources of CO_2 emissions are the result of direct human-induced impacts on forestry and other land use, such as deforestation, land clearing for agriculture and degradation of soils. The primary sources of methane are domesticated animals (e.g., dairy cows, pigs), and activities related to rice growing, gas flaring and mining. N_2O mainly originates from agricultural land management, animal manure management, combustion of fossil fuels, and the production of fertilizers and nitric acid.
- CO_2 emissions constitute more than 70% of global GHG emissions, thus giving rise to the global concerns about reducing carbon emissions and devising ways and means by which carbon emissions can be restricted and cleaner forms of energy can be promoted.

This chapter focuses on CO_2 emissions.

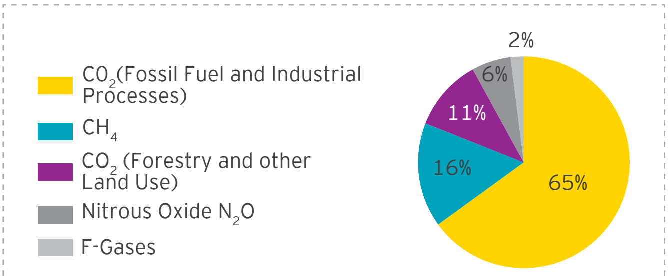
9. http://www.mospi.gov.in/sites/default/files/publication_reports/climateChangeStat2015.pdf

Figure 3: India's GHG Emissions by Gas



India's Biennial Update Report to UNFCCC, 2010

Figure 4: Global GHG Emissions by Gas



IPCC 2014, based on global emissions in 2010

Approaches for measurement of emissions:

Broadly, two methods or approaches are used for quantification of emissions, i.e., direct measurement approach and indirect measurement approach. Indirect measurement approach is also called as calculation based approach. In the direct measurement approach, emissions are recorded real time on the premises of the emitter using a measuring device that records emissions for auditing purposes. The calculation based approach, on the other hand, computes emissions by applying emissions factor to the quantity of the fuel used in an activity.

Emissions factor are important for arriving at reliable emission estimates. Emissions are calculated by multiplying the amount of consumption of the fuels with emissions factor. The product of the two gives the total emissions produced by a specific fuel in an economy for the period of consumption. Emissions factor are expressed in $KgCO_2$/ton of fuel, i.e., kilograms of CO_2 equivalent released by burning a unit ton of a specific fuel.

Direct emission computations are very difficult to undertake for an economy as a whole. Data for applying this method for estimating CO_2 emissions is not available. This paper adopts the calculation based approach /indirect approach to estimate the quantum of emissions.

Indirect measurement approach to estimate emissions

There are three broad ways to compute emissions under the indirect measurement method :

Scope/ Tier I formula is employed when detailed information on the break-up of fuel's heat or carbon content by volume is not available. This is the most basic calculation and due to the data used in calculation of scope I emissions, it is technology independent and represents averaged values of emissions.

Tier I

Emissions = Fuel (tonnes) * EF (tonnes CO_2/tonne of fuel)

Where, Emissions = Mass of CO_2, CH_4, or N_2O emitted

Fuel = Mass or volume of fuel combusted

EF = CO_2, CH_4, or N_2O emissions factor per unit mass or volume

Emissions = Activity Data * Emissions factor

(Fuel) (Volume of fuel) (Carbon Emitted per unit of fuel by Combustion)

The details of the formulae and other method used for the calculations are provided in Annexure I

For the purpose of calculation in this chapter, Tier I formula has been considered for estimating carbon emissions. The choice has been driven by the following factors:

- Availability of reliable data and ease of computations.
- This formula is used for national carbon accounting by USA, UK, Australia and India as recommended by UNFCCC for calculation of national inventories of CO_2.

10. Carbon tax Policy Guide: A Handbook for Policymakers, World Bank Group, March 2017
11. UK Emission Inventory

Sources of carbon dioxide emissions

For the purpose of analysing the level of CO_2 emissions in India, all the key fuels have been taken into consideration. In all, fifteen fossil fuels, biofuel and biomass were considered. Table 1 provides the list of the fuels and their consumption by different sectors; domestic sector, transport, energy, industry and agriculture.

We have not considered the emissions from Land Use, Land Use Change and Forestry (LULUCF) and emissions from domesticated animals like cows, buffalos, camels etc. Despite significant contribution to India's national emissions LULUCF and domestic animals are not accounted for, in national inventories, due to lack of reliable data.

Given below is the break-up and description of the sector that have been considered for estimating emissions in India, based on consumption figures for selected fuels in the year 2015:

Domestic distribution sector: Quantity of fuel consumed by households, which cannot be categorized as commercial or industrial.

Transportation sector: Cumulative number for various modes of transportation including aviation, shipping, road transport and railways. International aviation and marine bunkers have not been included in this category.

Energy sector/ Power generation: Cumulative of power generated as utility and captive power generation by private players.

Industrial sector: It includes mining and manufacturing. Manufacturing includes several categories such as chemicals, iron and steel, cement production, metallurgical, engineering goods, aluminium, textiles and ceramics.

Agriculture: Total fuel consumed in production of fertilizers and other agricultural consumption of fuels.

Miscellaneous sector include resellers/retail consumption, private imports and other miscellaneous

Table 1: Sector-wise consumption of fuels

Fuels (In '000 Tonnes)	Domestic Distriution	Transport	Energy	Industrial	Agriculture	Misc.	Total Fuel	Emissions factors
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LPG	17,182	172.0	2.70	1,666	7.0	594	19,623	2,940
Naphtha	0	0.0	50.0	13,221	0.0	0.0	13,271	3,143
SKO (Kerosene)	6,649	0.0	0.0	64.00	0.0	113	6,826	3,165
High Speed Diesel Oil	0.0	71,514	224.0	2,279	630	0.0	74,647	3,210
Light Diesel Oil	0.0	3.70	154.0	63.00	1.30	185	407	3,210
Furnace Oil	0.0	380.00	430.0	5,616.00	57.00	0.0	6,482	3,227
Low Sulphur Heavy Stock/ Hot Heavy Stock	0.0	0.0	51.0	71.0	0.0	29	150	3,470
Motor Spirit (Petrol)	0.0	21,847	0.0	0.0	0.0	0.0	21,847	3,105
Aviation Turbine Fuel	0.0	6,262	0.0	0.0	0.0	0.0	6,262	3,181
Bitumen	0.0	0.0	0.0	5,938.00	0.0	0.0	5,938	3,16,541
Lubes and Grease	0.0	0.0	0.0	3,571.00	0.0	0.0	3,571	3,165.41
Natural gas	0.0	0.0	27,340	18,200.00	0.0	0.0	45,540	2,808.57
Coking Coal	0.0	0.0	0.0	2,03,949	0.0	0.0	20,39,49,000	1,782
Thermal Coal	0.0	0.0	5,55,324	37,902	0.0	81,763	67,49,89,000	1,782
Biofuels	0.0	0.0	505	0.0	0.0	0.0	505	0.0
Biomass	0.0	0.0	0.0	0.0	0.0	0.0	3,600	0.0

Source: Ministry of Petroleum and Natural Gas, Ministry of Coal and Ministry of Natural and Renewable sources for the year for 2015-16; BP Statistical Review, 2016

Emissions Factor

The emissions factor considered are based on the following assumptions:

1. In the case of coal, diesel and motor spirit (petrol), emissions factor as provided in India's Economic survey 2015 have been considered.
2. For other fuels, UK emissions factor calculation has been employed due to the availability and reliability of standard international values for different fuels. (Annexure II provides further details on this aspect). Given that the standard composition of fuel is similar across geographies, we have considered average values for emission factors.

Estimates of Emissions for India

The following table details out the emission estimates for India.

Table 2: Emissions produced by different sectors/ fuel wise; contribution to total national emissions

Fuels (In '000 Tonnes)	Domestic Distriution	Transport	Energy	Industrial	Agriculture	Misc.	Total emissions (fuel wise) Million tonnes CO2 equivalent	Total CO_2 emissions (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LPG	50.51	0.51	2.7	1,666	7	594	19,623	2,940
Naphtha	0.0	0.0	50	13,221	0.0	0.0	13,271	3,143
SKO (Kerosene)	21.05	0.0	0.0	64	0.0	113	6,826	3,165
HSD(Diesel)	0.0	229.56	224	2,279	630	0.0	74,647	3,210
LDO	0.0	0.01	154	63	1.3	185	407	3,210
Furnace Oil	0.0	1.22	430	5,616	57	0.0	6,482	3,227
LSHS	0.0	0.0	51	71	0.0	29	150	3,470
Motor Spirit	0.0	67.83	0.0	0.0	0.0	0.0	21,847	3,105
ATF	0.0	19.92	0.0	0.0	0.0	0.0	6,262	3,181
Bitumen	0.0	0.0	0.0	5,938	0.0	0.0	5,938	3,16,541
Lubes	0.0	0.0	0.0	3,571	0.0	0.0	3,571	3,165.41
Natural gas	0.0	0.0	27,340	18,200	0.0	0.0	45,540	2,808.57
Coking Coal	0.0	0.0	0.0	2,03,949	0.0	0.0	20,39,49,000	1,782
Thermal Coal	0.0	0.0	5,55,324	37,902	0.0	81763	67,49,89,000	1,782
Biomass	0.0	0.0	505	0.0	0.0	0.0	505	0.0
Biofuels	0.0	0.0	0.0	0.0	0.0	0.0	3,600	0.0
Total Emissions (sector wise) million tonnes CO_2	71.56	319.06	1,069.32	584.73	2.23	148.50	2,195.40	100%
	3.26%	**14.53%**	**48.71%**	**26.63%**	**0.10%**	**6.76%**	**100%**	

No emission estimates have been made for biomass and biofuels owing to two factors:

- Non availability of reliable data for biomass since no breakup is available for the usage of fuels like cow dung, wood, crop residues, and other farm residues which are burnt as biomass, calculating emissions based on such vague information is difficult. Though the data for biofuels is available, but accounting only for biofuels and not for biomass would lead to double counting of emissions.
- Double counting: CO_2 is emitted and absorbed at various stages in a single process.

Other estimates of CO_2 Emissions

- A number of other international and national agencies have estimated the quantum of CO_2 emissions for India. The following table summarizes the results of estimates made by various agencies. As may be noted, the estimates in table 2, 2195.40 Mt CO_2, fall broadly within the reference range of estimates as calculated by international agencies as given in table 3.

Table 3: Estimates of India's Emissions

Agency	Emissions estimates ($MtCO_2$)			Formula Employed
IEA (International Energy Agency)	1990	2005	2014	(5)
	530	1080	2020	Tier I CO_2 Emissions= Fuel Consumption* Emission Factor
BP Statistical Review 2016	2014	2015	2016	13221
	2085.9	2157.4	2271.1	Tier I CO_2 Emissions= Fuel Consumption* Emission Factor
Global Carbon Atlas (BNP Paribas Foundation)[12]	2016			
			2431	Individual National calculation#
Global Carbon Budget, 2016[13]	2015			
			2270	
European Commission[14]	2014			
			2340	Tier I CO_2 Emissions= Fuel Consumption* Emission Factor
National Greenhouse Inventory (India's Reporting to UNFCCC)	2010			
	1884			Tier I CO_2 Emissions= Fuel Consumption* Emission Factor
EY Estimate of Total emissions = 2195.40 million tonnes CO_2				

Note: # Global carbon atlas is reporting numbers as reported to UNFCCC by different countries. Hence, the methodology for reaching those numbers is different as employed by different countries.

12. http://www.globalcarbonatlas.org/en/CO_2-emissions
13. Global Carbon Project, Budget 2016
14. http://edgar.jrc.ec.europa.eu/news_docs/jrc-2015-trends-in-global-co2-emissions-2015-report-98184.pdf

Evaluating the estimates

Table 2 gives the sources of emissions across sectors and the estimates of total CO_2 emissions from each fuel in a specified sector. India's energy mix is highly inclined in the direction of fossil fuels, particularly coal. The values calculated in the table above present the data for biggest contributors to India's emissions, fuel wise and sector wise, in the year 2015-16 based on consumption of fuels.

Coal contributes more than 70% of the CO_2 emissions in India. It also makes up for 77% of the total power generation capacity in India. Coal is also extensively used in manufacturing industries in India. Diesel (including both high speed diesel and low density oil) is the second highest carbon emitter with 10.9% of the total emissions. Natural gas and motor spirit/petrol contribute 5.83% and 3% respectively to the total emissions in India. Other notable sources of emissions are LPG (2.63%), naphtha (1.90%), kerosene (0.98%), ATF (0.91%), bitumen (0.86%) and lubes (0.51%).

At an overall sectoral level, the energy sector is the highest contributor with 48.71% of CO2 emissions, followed by the industrial sector with 26.63% and transport with 14.53% contribution to the total emissions.

According to the global and Indian estimates, agriculture plays a larger part in contribution to total GHG emissions. However, the emission estimates given in Table 2 for agriculture are much lower than the international and national estimates. This discrepancy is because some elements such as land use changes, forestry and other land use under the category of agriculture have not been included in the overall estimates for calculation in table 2. Estimates of emissions are solely based on the consumption of selected fuels in the sector. Agriculture uses naphtha and furnace oil for production of fertilizer and diesel as transport fuel which have been accounted here. For instance, the diesel used in agriculture is considered under transportation rather than agricultural consumption due to lack of a reliable break-up of diesel consumption.

15. UNFCCC based on 2010 emissions
16. Biennial Update Report to UNFCCC, 2010

3 Basis for determining the carbon tax rate

Introduction

The rate of carbon tax is a significant aspect that determines the impact that the tax will have on carbon emissions. The basis on which the rate will be determined becomes important in the context of the goals or policy objectives that the carbon tax plans to achieve. There could be different approaches to determine the carbon tax rate. The tax rate could be based on the amount of revenues the government may want to generate through carbon tax (revenue approach), or on the level of reduction in the quantum of emissions that the country wants to achieve (abatement approach), or the rate could be linked to the social costs of the emissions (social cost of carbon approach). Some jurisdictions also use the benchmarking approach for determining the rate of carbon tax wherein they link the rate to that being charged in other jurisdictions who may be neighbouring countries or trading partners or competitors .

For the purposes of this Paper, two approaches have been explore for determining the carbon tax rate:

Social cost of carbon (SCC) approach

SCC is an estimate of the cost that the society bears from the emission of one tonne of CO_2 or carbon equivalent emissions at a given point of time. Some of the costs associated with high levels of carbon emissions are costs to human health, damages to property from natural disasters such as more frequent floods and droughts, impact of changed pattern of climate on agricultural productivity, loss of ecosystem by extinction of species, shifting of tropical heat belts resulting in increased cost for air conditioning as against lower cost of heating, etc. Social Cost of Carbon (SCC) estimates the monetary value of the above mentioned costs.

SCC also represents the value of damages that can be avoided through a reduction in emissions. Its estimation is therefore important not only for evaluating the net impact of GHGs on environment, both positive and negative, but also considering the level of emissions related taxation that can be considered. Using the SCC approach, the carbon tax rate is equated to the social cost of carbon. The SCC approach is useful as it helps balancing the costs and benefits of the measures for reducing CO_2 emissions. The carbon tax is determined at the level where the costs of reducing the CO_2 emissions equals the benefits from the reduction in the emissions.

The SCC approach, however, is dependent on a number of factors and assumptions such as level of emissions, the GHG concentration in the atmosphere, the valuation of the social damages, the discount rate and so on. As a result, different policy makers have used varied estimates of SCC, which may vary from US$ 10 to US$ 130. The calculations of the SCC for India are explained separately in this Chapter.

Abatement approach

The abatement approach is useful in the cases where the carbon tax aims to meet a specific emissions reduction target, for example, the targets promised in the NDCs under the UNFCCC. As opposed to balancing the cost and benefit of the carbon abatement measures, this approach determines the carbon tax for achieving a given level of reduction in the emissions.

India's NDC targets for 2030 include, among others, lowering of the emissions intensity of GDP by about 33–35% below 2005 levels. The details of the abatement approach to determine the carbon tax rate are discussed in the following paragraphs.

SCC Approach

Models for estimating SCC

The most accepted model globally for estimating the social cost of carbon is the Integrated Assessment Model (IAM). These estimates are widely used by global agencies like UNFCCC, and countries such as the United States.

Interagency Working Group (IAWG) on Social Cost of Carbon (SC-CO_2) in United States has been publishing SCC estimates under federal executive order 12866, since 2010.

While these models do not include all the damages caused by higher level of GHGs, they represent an accepted standard for approximation. It is important to point out that these models make a number of assumptions which make up for their inherent subjective nature with regard to parameters such as future levels of emissions of greenhouse gases, i.e.,

- the effects of past and future emissions on the climate system
- the impact of changes in climate on the physical and biological environment
- the translation of these environmental impacts into economic damages

Three models used in IAM's are Dynamic Integrated model for Climate and Economy (DICE), Policy Analysis of Greenhouse Effect (PAGE) and Climate Framework for Uncertainty, Negotiation and Distribution (FUND). Further details of Integrated Assessment Models, are provided in Annexure III.

SCC estimates

Some of the estimates of SCC from different agencies and private organizations are provided in table 4 on the next page. The difference between the values for SCC highlights the different key assumptions which influence the value of SCC. The assumptions may be with respect to, discount rate, equilibrium climate sensitivity (ECS) , transient climate response (TCR), transient climate response to emissions (TCRE) and initial pulse adjustment timescale (IPT).

18. https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html
19. Equilibrium climate sensitivity (ECS) measures the long-term response of global mean temperature to a fixed forcing, conventionally taken as an instantaneous doubling of CO_2 concentrations from their preindustrial levels.
20. Transient climate response (TCR) measures the transient response of global mean temperature to a gradually increasing forcing. It is measured on a shorter time frame
21. Transient climate response to emissions (TCRE) measures (on a similar time-scale as TCR) the ratio of warming to cumulative CO_2 emissions. Although TCRE has become a widely used metric over the past decade, it has a shorter history
22. Initial pulse-adjustment timescale (IPT) has only recently been a focus of research and does not have a standard name or definition, but it may be of considerable importance for estimates of the SC-CO_2, which are driven by the injection of a pulse emission of CO_2. It measures the initial adjustment timescale of the temperature response to a pulse emission of CO_2

Table 4: 2020 Global SC-CO_2 average estimates according for the three models at different discount rates (2007$/metric ton CO_2). The values are computed at 2007 USD value

Models	PAGE			DICE			FUND		
Discount rates/ Scenario	2.5%	3%	5%	2.5%	3%	5%	2.5%	3%	5%
BAU	123	87	27	72	48	15	39	23	3
Optimistic	75	54	17	40	28	10	35	21	4
Average	81	55	17	52	34	11	21	11	0

Source: Technical Support Document: Technical Update of Social cost of carbon for Regulatory Impact Analysis, Interagency Working Group, United States Government; August 2016.

Social Cost of Carbon Used by Different Countries

In a recent paper by Smith S and Braathen (2015) it was found that at least 13 countries account for carbon externalities while undertaking cost-benefit analysis (CBA) of investment projects in the transportation or energy sectors. Several countries including the United States report taking account of the SCC more generally in ex-ante cost benefit analysis of public policies.

Countries use either the SCC or marginal abatement costs while reflecting the cost of carbon externalities. As shown in Table 5, the SCC estimates differ across countries. The important observation is that these countries take into account an estimate of the global benefits of reducing CO_2 emissions (i.e., avoided damages worldwide) while undertaking cost benefit analysis of domestic regulations. Paper by Smith and Braathen is a comparative study, between existing values used for carbon and projected values based on present trends for 2020.

There is, however, a growing debate about whether the global SCC is appropriate forcost benefit analysis of domestic policy. The practice is justified on the basis that climate change is a unique problem because of its scale as a global externality. Application of the global SCC among all countries would lead to globally efficient emissions. Climate policy takes place in the international relations arena. One country's actions are used to leverage those of others, and no one country can solve the problem of climate change alone.

The other side of the argument is that national policy should account for national damages, or might end up excessively burdening local societal resources for climate mitigation measures.

Table 5: Carbon values used in Cost benefit analysis of public policies for 2014 and 2020

S. No.	Countries	2014 (2014 USD values)	2020 (2014 USD values)
1	Canada	39.4	46.3
2	Chile	4.5	-
3	France	53.1	-
4	Germany	132.8	159.4
5	Ireland	23.8	51.8
6	United Kingdom	95.3	104.7
7	United States	40.6	47.7

Source: Smith S. and N Braathen (2015), "Monetary Carbon Values in Policy Appraisal: An Overview of Current Practice and Key Issues". OECD Working Environmental Papers. Annex Page 45.

23. Smith S. and N Braathen (2015), "Monetary Carbon Values in Policy Appraisal: An Overview of Current Practice and Key Issues". OECD Working Environmental Papers. Annex Page 45.
24. Kotchen, Matthew J., Which Social Cost of Carbon? A Theoretical Perspective, Yale University, 2016.

Carbon Pricing Estimates by Corporations Carbon Disclosure Project (CDP)

Carbon Disclosure Project 2016, is an annual disclosure of corporates approaching climate change and managing their carbon risk by pricing carbon internally. CDP is a non-profit organization running disclosure system for corporates and sub-national governments. Corporates across the globe anticipate that policies in the future can place a price on carbon. Companies are using an internal price of carbon to act as an incentive for allocating capital and resources towards low carbon activities. A number of companies have disclosed that through the usage of a carbon price, investments have shifted towards energy efficiency measures, low-carbon initiatives and development of low carbon product offerings.

The following table provides data on the level of internal carbon price as priced by corporates across regions

Table 6: Range of Internal Carbon price used by Corporates across Regions

Regions	Number of companies reporting	Lowest carbon price reported (US$)	Highest carbon price reported
North America (USA & Canada)	136	1	150
Europe	255	1.19	160.41
China	13	0*	6.17*
Japan	50	8.93*	893.29*
Australia and New Zealand	21	1.30*	36.75*
India	12	2.12*	29.41
Brazil	16	1.13	93
South Africa	22	0.47	9.26

Source: Carbon Disclosure Project, 2017. *Carbon Disclosure Project, 2016

Analysis of the above table suggests that there is a wide variation in estimates of the price of carbon.

25. https://b8f65cb373b1b7b15febc70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/001/13 2/original/CDP_Carbon_Price_2016_Report.pdf?1474269757

SCC for India

The estimates for SCC for India are as follows:

Table 7: India's SCC according to different models for standard given variables. Values of Global SCC are Estimates for 2020

Index	Global SCC (US$)	India's SCC (%)	India's SCC(US$)
DICE 2010	40	12	4.8
PAGE	74	22	16.28
FUND	22	5	1.1
DICE2013R#	50	12@	6
DICE2016R#	87	12@	10.44

Source: William D. Nordhaus, Revisiting the Social Cost of Carbon, Yale University. November 21, 2016.

#: DICE 2013R and DICE2016R are the updated and revised versions of DICE2010.

@: Assuming that the Regional Social Cost of Carbon has not changed for DICE model. We use the most recent updated values of SCC and employ India's regional Social cost of carbon 12 % to calculate latest estimates for India's Regional SCC with DICE2013R &DICE2016R values

SCC for various regions

The DICE model is a globally aggregated model. Whereas, the RICE model takes into account regional differences. The output and abatement for the RICE model have structures for 12 regions. Due to this the final output for the models is not the same.

The estimates for regional SCC are as follows:

Table 8: Regional SCC according to RICE 2010

Regions	RICE 2010, % global
United States	10
EU	12
Japan	2
Russia	1
Eurasia	1
China	16
India	12
Middle East	10
Africa	11
Latin America	7
Other High income	4
Other	12
Global (Total)	**100**

Note: The Global estimates are not equal but proportional to the regional values total, the difference is due to calibrations in model between global to regional values.

Global social cost of carbon at 2010 prices for the year 2015 was US$ 31.2 per t CO_2. This is estimated to rise to US$ 51.6 per tCO_2 by 2030. GSCC is an acceptable standard employed in most of the estimates and national accounting as well as by UNFCCC (United Nations Framework Convention on Climate Change). The IAWG estimates that the global social cost of carbon for 2017 is US$40 (at 2014 prices).

26. Nordhaus, William D. (2017), Revisiting the social cost of carbon, Proceedings of the National Academy of Sciences, Volume 114, no. 7: 1518-1523, as quoted in Economic Survey Vol II, page 126.

In table 7, India's regional SCC is calculated based on the DICE model. We refer DICE because it has been revised an updated in 2013 and again in 2016, which gives us the leverage to use updated data for calculating regional SCC of India. Assuming that India's contribution in global SCC estimates is equal to DICE2010 @ 12%, multiplying this percentage with DICE2016R latest values of global SCC yields (US$ 87), gives the value for India's regional SCC based on latest values of 2016 and updated/revised model of DICE.

Using the above methodology, India's social cost of carbon is taken at US$ 10.44 or, rounding off, at US$ 10. This estimate has been used in this paper in the discussions on the possible rate of carbon tax for India.

Abatement approach

Estimating the carbon tax

For determining the carbon tax rate using the abatement approach, this Paper uses the estimations given in a study by Ian Parry, Victor Mylonas and Nate Vernon .

In their study, Parry and others (2017) use a model that uses recent data on fuel use across different energy sectors in India, project the data to 2030, and compute the environmental, fiscal, and economic impacts of alternative policies, including a carbon tax. The model uses certain assumptions about fuel price elasticities and emissions for different fuels. Seven fossil fuels are distinguished, namely coal, natural gas, gasoline, road diesel, kerosene, LPG, and an aggregate of other oil products (used in power generation, domestic aviation and maritime, petrochemicals, home heating, etc.).

The model first develops a business as usual (BAU) scenario for fuel use and then goes till 2030, projecting energy prices and GDP. The impacts of policy reforms, including carbon tax, are then assessed by computing induced changes in fuel and electricity prices, the resulting changes in energy efficiency, use of energy products, and hence fuel demand. The resulting change in carbon emissions are calculated from the changes in fuel use.

The study analyses that between the years 2015 to 2030, India's real GDP is expected to expand rapidly (by over 7% a year), implying that it would be about three times as large in 2030 compared with 2015. During the same period, the total energy consumption would also expand, but at a much slower rate. The energy consumption would be about 85% higher in 2030 compared with 2015. As a result, the energy intensity of GDP would fall by 37% from 2005 levels.cThe decline in energy intensity is due to a combination of improving energy efficiency, rising fuel prices which dampen the growth in energy demand, and an assumption that income elasticities for energy products are slightly below unity.

The study further notes that the share of coal as an energy source is expected to rise between 2015 and 2030, while that of biomass declines, as thermal based electricity reaches more number of low income households that currently rely on biomass. As a result, the CO_2 emissions are expected to rise by 112% between 2015 and 2030. Thus, in a BAU scenario, even as the overall energy intensity of GDP falls by 37%, the emissions intensity of India will fall only by 24% by 2030 compared to 2005 levels. The NDC target is to reduce the carbon intensity by 33-35% by 2030 as against the 2005 levels.

The study estimates that a carbon tax of US$ 10 per tonne of CO_2 emission could further reduce the carbon intensity by 8% as against BAU levels. A higher carbon tax of US$ 35 per tonne of CO_2 emission could reduce the emissions intensity by 22% against BAU levels. To avoid a sudden increase in tax burden and make it more acceptable for the stakeholders, the carbon tax could be increased in phases such that it reaches US$ 35 (INR 2,310) per tonne of CO_2 emission by the year 2030.

This aspect is discussed in the Chapter on Design of Carbon tax.

27. The central estimate of the GSCC, based on a 3% discount rate, is US$40 (in 2014$s) per metric ton of CO_2 emitted in 2015, Which Social Cost of Carbon, page 5.
28. http://www.commerce.wa.gov/wp-content/uploads/2015/11/Energy-EV-Planning-Social-Cost-of-Carbon-Sept-2014.pdf
29. IMF Working Paper, Reforming Energy Policy in India: Assessing the Options, by Ian Parry, Victor Mylonas, and Nate Vernon May 2017
30. BAU refers to no fiscal or regulatory policy changes to reduce fossil fuel use beyond those already implicit in recently observed fuel use and price data, as per IMF working paper, Reforming Energy Policy in India: Assessing the Options, by Ian Parry, Victor Mylonas, and Nate Vernon May 2017

4

Assessment of non-tax measures to check carbon emissions

Introduction

India has taken several initiatives to address the issue of climate change challenges. Its National Action Plan on Climate Change enshrines eight national missions as mentioned earlier. These missions provide a framework for long term policies for addressing climate change. Two dedicated funds have been set up – National Clean Energy and Environment Fund National Clean Energy and Environment Fund (NCEEF) and National Action Plan on Climate Change National Action Plan on Climate Change (NAPCC) to address the cost of cleaner technologies in certain identified sectors.

To lower carbon emissions, through its NDC commitments, India proposes to:

- Install 175 GW of renewable power capacity by 2022 to increase the country's share of non-fossil-based installed electric capacity to 40% by 2030
- Reduce India's GHG emissions intensity per unit GDP by 33 to 35% below 2005 levels by 2030
- Create an additional carbon sink of 2.5 billion to 3 billion tonnes of carbon dioxide through additional tree cover

To promote energy efficiency, the Energy Conservation Act is aimed at reducing carbon intensity and promoting efficient use of power by different industries. The act specifies norms and standards of energy efficiencies to be followed be different sectors/industries in use of their power, provides standards for labelling of equipment and appliances and sets energy conservation building codes for commercial buildings. Along with this, the National Electricity Policy was implemented to focus on providing uniform access to electricity and promoting renewable sources of energy, just as the Integrated Energy Policy. The Government has also introduced market mechanisms such as Perform Achieve and Trade (PAT), Renewable Energy Certificates (REC) and a regulatory regime of Renewable Purchase Obligation (RPO)[31].

For simplicity, the government's initiatives can be summarized as follows:

- Promotion of renewable forms of energy
- Introduction of auto fuel standards
- Promotion of clean coal technologies
- Promotion of bio-fuels
- Promoting energy efficiency

31. India's Intended Nationally Determined Contributions to the UNFCCC

Promotion of renewable forms of energy

The government's key initiative to reduce emissions has been to promote renewable forms of energy and thereby reduce the share of fuels emitting CO_2 from its overall energy mix. During the period 2002 to 2015, share of renewable grid capacity increased from 3,900 MW in 2002 to 42,850 MW in 2016. The following table provides the year wise capacity and average emissions:

Table 9: Installed capacity

Year	Overall installed capacity (in GW)	Renewable capacity (in GW)	Growth rate of renewable capacity (%)	Average level of emissions generated by electricity sector (tCO_2 / MWH)
2010 -11	173.62	16.27	-	0.79
2011 -12	NA	22.74	40%	0.78
2012 -13	223.34	26.93	18%	0.83
2013 -14	NA	31.55	17%	0.82
2014 -15	271.72	33.75	7%	0.82
2015 - 16	NA	38.8	15%	NA
2016 - 17	329.22	49.89	29%	NA

Source: Annual Reports, Ministry of New and Renewable Energy and Central Electricity Authority

The current contribution of renewable in the total power generation is as follows:

Table 10: Installed capacity and electricity generation from renewables

Source of power	Installed capacity*	Renewable capacity (in GW)	Electricity generation**	Average level of emissions generated by electricity sector (tCO_2 / MWH)
	in GW	**% of total**	**in GW**	**% of total**
Solar	13.95	4.23%	7.14	1.31%
Wind	32.63	9.89%	25.66	4.71%
Hydro	49.04	14.86%	70.02	12.86%
Conventional sources of energy	234.45	71.03%	441.69	81.12%
Total	**330.07**	**38.8**	**544.51**	**NA**

Source: Government of India, Ministry of Power, Central Electricity Authority, Executive summary of Power Sector for August 2017

*Numbers as on 31 August, 2017

**From April 2017 to August 2017

Note: MU – Million units of energy, a term used for gigawatt-hour

Solar and wind power account for 14% of the installed capacity. However, they contributed only 6% of the total energy production during April to August 2017. Hydro power contributed approximately 13% of the total power generation. India's energy needs are still dominantly dependent on coal, with thermal energy contributing 77% to total energy production[32].

In the past, there has been a significant increase in both the thermal power generation capacity and the renewable power capacity. Despite the capacity of the renewable power being doubled between 2010-11 and 2014-15, the average level of emissions have not reduced. In fact they have increased marginally.

The government has set targets for renewable power capacity in India in its NDCs. The National Energy Policy calls for renewable energy installations to average at 21-22 GW annually going forward. The installed capacity of renewable forms of power has an average growth rate of 18% since 2010-2011. To reach the government's target, higher investments are required in the renewable energy sector.

India is taking a number of initiatives to develop both grid based and off grid renewable power capacity.

Distributed/decentralized renewable power projects using wind energy, biomass energy, hydro-power and hybrid systems are being promoted to meet the energy requirements of isolated communities and areas which are not likely to be electrified in near future.

India has set the following targets to further increase the capacity of renewable energy in India.

Table 11: India's renewable capacity targets

S. No.	Energy source	Targeted installed capacity by 2022
1	Solar	100 GW
2	Wind	60 GW
3	Biomass	10 GW
4	Small hydro	5 GW
	Total	**175 GW**

Source: India's Intended Nationally Determined Contributions

Of the 100 GW of Solar power generation, 40 GW is proposed to be harnessed from rooftop solar energy.

If the government's target of 175 GW of renewable capacity is implemented, the Central Electricity Authority (CEA) estimates that 327 billion units of power/electricity would be generated and 268 million tonnes of CO_2 would be avoided annually by the end of 2021-22. Central Electricity Authority in the National Electricity Plan has projected that the per capita emissions from the electricity sector could reduce, should the plan be implemented. However, the report also states that the level of emissions may not reduce fully, as:

"The net reduction of CO_2 emissions will be less as emissions from thermal power stations will increase due to frequent cycling and ramping of the plants than during steady state operation." [33]

In the past, tariffs from renewable power generation were higher than from other sources such as coal based power. The government promoted the renewable power capacity through a mix of Renewable Purchase Obligations and Renewable Energy Certificates.

The tariffs for solar energy and wind energy have been reducing. In the recent auctions concluded in May 2017 for

Bhadla Phase-IV Power for Rajasthan, a tariff of INR 2.44 per unit has been fixed for solar power. This tariff is fixed for

25 years with no escalation and the bidders have sought no viability gap funding from the government[34]. Similarly, in a recent wind auction conducted by the Solar Energy Corporation of India on behalf of the Ministry of New and Renewable

Energy, the tariff decided was INR 2.64 per unit for wind power[35].While the tariffs quoted could vary with geographical location and cost of equipment, some of the industry players feel that renewable power may not require financial support from the government.

32. Own calculations
33. Draft National Electricity Plan, Volume I, Central Electricity Authority, Ministry of Power, Government of India, December 2016
34. http://pib.nic.in/newsite/PrintRelease.aspx?relid=161755
35. http://pib.nic.in/newsite/PrintRelease.aspx?relid=171394

The implementation of the government targets face the following challenges:

- Changes need to be made to grid design, technology and its operations for such a large renewable capacity to be absorbed by the electric grid[36]
- Power systems in the states, especially those with a high share of renewable energy, would require access to sufficient flexible resources, e.g., gas turbines, flexible thermal energy, hydroelectricity to ensure continued stability of the grid. It is unclear, whether such a detailed plan has actually been developed to address above challenges
- Implementation of rooftop power scaling up presents a number of challenges such as poor grid availability in semi urban and rural areas and customer acquisition issues[37]

Introduction of auto fuel standards

Bharat Stage emission standards have been mandated since 1991. Bharat Stage (BS) IV emission standards were imposed all over the country in April 2017. In 2016, the government decided to skip BS-V emission standards and adopt BS-VI norms by 2020. Two sets of corporate average fuel consumption standards for cars have been notified[38]. The first set came into force in April 2017 and the second set is expected to come into force in 2022. Passenger fuel vehicle fuel efficiency standards were finalized in 2014 and also came into effect in April 2017. Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) India has been introduced to promote faster adoption and manufacturing of hybrid and electric vehicles.

Under the National Urban Renewal Mission, the development of Mass Rapid Transport Systems were initiated. The introduction of metros in cities, as present in Delhi NCR, has been done with the intent to reduce CO_2 emissions. The government has also developed dedicated freight corridors that are expected to reduce emissions by 457 million tons of CO_2[39].

Effectiveness in reducing carbon emissions

The transportation sector accounts for 14.53% of the total CO_2 emissions . Introduction of emission standards helps to reduce emissions from this sector. However, the current measures suffer from the following inadequacies:

- The Bharat Stage Emission Standards do not provide regulations for CO_2 emissions[40]. They cover emissions from carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides and particulate matters[41]
- The Corporate Average Fuel Consumption (CAFC) Standards aim to keep 50 million tons of CO_2 out of the atmosphere[42]. The CAFC Standards have also been criticized by environmentalists. The fuel efficiency norms do not pertain to the efficiency of each car model, but for the average of all models and gives manufacturers the ability to circumvent the regulations. Mild diesel hybrid technologies are also given benefits under the standards, which have a limited impact on emissions. Manufacturers face no penalization in case of non-compliance[43]

Promotion of clean coal technologies

According to our estimates, coal has the highest contribution to CO_2 emissions (approximately 71%) in India. The high dependency of industries and power plants on coal makes it the most important source of fuel in India. Recognizing the impact of coal on the Indian environment, the government has pushed for the use of clean coal technologies in coal-based power generating systems. It is now mandatory for large generation stations to use efficient supercritical technology. Moreover, renovation, modernization and life extension of existing old power stations is proposed to be undertaken. Additionally, coal beneficiation has been made mandatory.

36. National Energy Policy, Niti Aayog
37. USAID and the Ministry of New and Renewable Energy
38. Ministry of Power, Government of India
39. India's Intended Nationally Determined Contributions to the UNFCCC
40. Own calculations, emissions table
41. Countries such as the EU provide CO_2 emission norms for the transportation sector (source: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2018)615640)
42. India's Intended Nationally Determined Contribution
43. http://www.thehindubusinessline.com/companies/fuelefficiency-norms-give-big-wiggle-room-for-carmakers/article9535262.ece; http://www.hindustantimes.com/india-news/proposed-rules-to-implement-india-s-fuel-efficiency-norms-weak-experts/storyu2h3H9fpZNrQcrWPRn6ZDM.html

The government has also come up with some future policies which include the introduction of ultra-supercritical technology as and when it is made commercially available and the implementation of stringent emission norms for thermal plants[44].

Implementation of this initiative has the following challenges:

- According to Pande (2015)[45] , India faces many challenges in implementing clean coal policies due to a lack of administrative and financial resources. The inspection of plants, though mandated to install pollution monitoring systems, happens at most once or twice a year
- Carbon Capture and Storage (CCS) would be required to reduce India's CO_2 emissions from coal based power generating stations in the next few decades. According to Dr. LL Sloss at the International Energy Agency (2015), the most effective way to reduce CO_2 emissions from coal based generation stations is a 25 year plant retirement, introduction of ultra-supercritical upgrades after 2025 and CCS installation
- However, it is unclear if plants will be retired after 25 years. Further, the high ash content in coal used for power generation in India could be an impediment to adopt ultra-supercritical technologies

Promoting energy efficiency

The Government of India is focusing on reducing the energy intensity of the Indian economy. While the focus has been on reducing the energy usage, with a reduction in energy intensity, it is expected that the emissions would reduce indirectly. These measures are being implemented through the Bureau of Energy Efficiency, under the Ministry of Power.

The key measures undertaken are as follows:

- India has launched a major program to replace all incandescent bulbs with LED bulbs. Government expects this measure to lead up to savings of 100 billion kWh annually. This effort has been successful, with the sales of CFLs increasing over the years
- The standards and labelling program launched by the government aims to enable consumers to make informed decisions by providing information about the energy consumption of an appliance. This was also accompanied by the launch of the super-efficient fan program, launched to promote the usage of fans that use half as much energy as the average fan. While the labelling is mandatory, there is no obligation on the consumers to buy energy efficient appliances. The purchase decisions would be driven by both the upfront costs as well as the recurring operating costs
- The Energy Conservation Building Code sets a minimum energy standard for new commercial buildings. A building energy rating system called Green Rating for Integrated Habitat Assessment (GRIHA) has also been developed to recognize energy efficient buildings and stimulate their large scale replication. While some commercial buildings have adopted the code, however, it is unclear as to what has been the impact of this measure on reducing emissions and energy usage. Additionally, Design Guidelines for Multi-Storey Residential Buildings was launched
- The government has also tried to launch several market mechanisms to promote energy efficiency. The value of energy saved is determined by trading of certificates on the market. The Partial Risk Guarantee Fund is a risk sharing mechanism to provide financial institutions with partial coverage of risk involved in extending loans for energy efficient projects. In addition to the above, The Venture Capital Fund for Energy Efficiency was established, which is a trust fund to provide equity capital to energy efficiency companies.
- The PAT scheme is a market based energy efficiency trading mechanism that has been launched to decrease energy consumption in industries. The first phase of the scheme was implemented between 2014 and 2016 and covered 478 plants. The second cycle is applicable from 2016 to 2019. The scheme doesn't spread across all sectors and is restricted to a few sectors, viz.:
- Thermal power generation
- Iron and steel
- Fertilizer
- Cement
- Aluminum
- Paper and pulp
- Textile
- Chlor-alkali
- Railways (included in PAT Cycle II)
- Refinery (included in PAT Cycle II)
- DISCOMS (included in PAT Cycle II)

44. India's Nationally Determined Contributions to the UNFCCC
45. Coal in Indian energy future – emissions and policy considerations, Dr. LL Sloss, IEA Clean Coal Centre, November 2015

- According to a study supported by Shakti Sustainable Energy Foundation, more energy intensive sectors such as sugar, glass, ceramics and petro-chemicals, should also be included in the scheme. Moreover, the paper also highlights that the implementing agency (the Bureau of Energy Efficiency) faces shortage of resources and there exists a need for extensive training of personnel to ensure that the scheme is implemented effectively[46]
- While the PAT scheme promotes energy efficiency, it does not incentivize industries to use cleaner forms of energy. Further, while the scheme covers large players, it does not cover all industrial users of energy. There are also concerns about measuring baseline energy usage and setting of realistic reduction targets
- India's measures to reduce the energy usage is driven primarily through regulations, which may or may not get implemented effectively

Promotion of biofuels

Biofuels are being promoted as an alternative to traditional fossil fuels, as proved by the launch of the National Biodiesel Mission. The policy aims to encourage the production, cultivation and use of biofuels to substitute petroleum and diesel for transport and other applications to control emissions from traditional fossil fuels. The government is trying to promote biofuels based on non-food feedstock to be grown on lands not suitable for agriculture. The mission was launched in two phases in 2003 and 2007. The government decided to give special emphasis to the Jatropha curcas plant as the source of biofuel, as it contains 35% non-edible oil and can be directly used in diesel engines as an extender and trans-esterifies to a biodiesel fuel[47].

The effectiveness of the National Biodiesel Mission is limited in reducing CO_2 emissions. The use of Jatropha biofuel is facing many challenges, with respect to the lack of domestic knowledge on the crop itself as well as the knowledge on the technology required has not been standardized or localized. The lack of awareness and outreach programs to farmers has been another hurdle in the success of the mission. There is a preference to grow crops that can either yield fuel along with food annually or can be cultivated in rotation with food crops. Further, the Government should fix a minimum selling cost of biodiesel so that it can compete with the cost of fossil fuels. 39 Thus, the promotion of biofuels has resulted in limited impact on CO_2 emissions in India.

46. The PAT Scheme: Analysis, insights and Way forward, Shakti Sustainable Foundation, November 2014
47. http://www.tandfonline.com/doi/full/10.1080/23317000.2014.930723 39 http://www.tandfonline.com/doi/full/10.1080/23317000.2014.930723

An overview of the progress on various measures initiated by India are given in the below table.

Table 12: Overview of policy implementation status

Policy	Policy status	Overview	Progress and way forward
PAT	Implemented	▸ Cap-and-trade scheme to incentivize energy intensive sectors to undertake energy efficiency initiatives ▸ The Scheme sets consumption targets and provides Energy Saving Certificates that can be traded over a market exchange	▸ First three year cycle (till March 2015) set a target of 478 plants across 8 energy sectors ▸ In the first phase, among the assessed plants, all sectors with the exception of thermal power generation have met their target with an overachievement of the target by about 30 percent (Government of India, Ministry of Power 2016) ▸ Second three year cycle to target 621 plants in 11 sectors leading to a reduction in energy consumption of ~4%
Fuel Efficiency Standards	Partially implemented	▸ The scheme sets average fuel consumption standards for all manufactured and imported fossil fuel based vehicles in a fiscal year with an aim to reduce current consumption of 16km/ liter to 22km/liter by 2022-2023 ▸ The standards are expected to significantly impact the GHG emissions given the expected CAGR of 12% in the vehicle market by 2020	▸ Standards for passenger cars are implemented with delays due to inter-ministerial conflicts. However, standards for heavy-duty vehicles are under development and expected to be effective by 2020 ▸ The BEE is also proposing to introduce a fuel economy star rating for passenger vehicles that will inform consumers about vehicle mileageManufacturers are gearing up for these standards and are likely to start venturing into electric and hybrid vehicles as well
Renewable Energy Certificate (REC) Mechanism	Implemented but facing policy challenges	▸ Mechanism put in place to address the gap between the requirements for renewable energy production from distributers and its availability ▸ RECs can be sold to any RPO entity enabling the generators of renewable energy to comply with RPO regulations	▸ Due to inadequate implementation of RPOs and inefficient penalty systems, there is lower demand for RECs ▸ The REC mechanism has significant potential to scale up its installation at competitive costs. This would require regulatory authorities to intervene with more stringent enforcement of RPOs and penalties for noncompliance

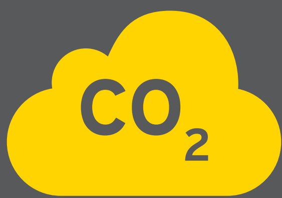
Policy	Policy status	Overview	Progress and way forward
National Electric Mobility Mission Plan (NEMMP)	Partially implemented	▸ Set up to ensure national fuel security through promotion of electric and hybrid vehicles and plans to increase sales from 15 million to 16 million by 2020 ▸ The plan covers four focus areas including increasing demand by providing cash subsidies, tax rebates on domestic manufacturing, R&D initiatives and pilot tests and infrastructure creation by leveraging private-public partnerships for power and charging facility creation	▸ Phase 1 of FAME to be implemented by 2017 with funds allocated to demand creation, pilot tests and infrastructure development ▸ Limited domestic manufacturing capabilities and a non-existent supply chain are substantial barriers that need to be addressed if the uptake of electric vehicles in the country is to be improved ▸ To reduce the high cost of electric vehicles, the government needs to spur localized manufacturing and increase investments in R&D and technology acquisition from other countries
Energy Conservation Building Code (ECBC)	Implemented but facing policy challenges	▸ Provides voluntary guidelines for minimum energy standards for new commercial buildings with a connected load or contract demand above 100 KW and 120 Kilovolt-ampere respectively	▸ Five year plan (2012-2017) focused on making 75% of the commercial buildings compliant to this code and reducing energy consumption by 20% by 2017 ▸ Code is not implemented to full potential due to policy and institutional barriers, lack of technical and managing capacity, insufficient availability of energy efficient equipment and materials and shortage of finances ▸ For an effective take-off of the ECBC across the nation, mandatory ECBC notification in remaining states within the building bylaws, accompanied by their effective enforcement by urban local bodies, is important
Unnat Jyoti Affordable LEDs for All (UJALA) Scheme	Implemented	▸ Scheme launched in 2016 to promote energy-efficient lighting in India with an aim to substitute 77 crore inefficient lamps with LED lamps with an expected GHG emissions savings of 80 million tCO_2 by 2019	▸ By March 2016, eight crore LED bulbs have been distributed in various states and the scheme is also being extended to include other appliances such as fans and air conditioners ▸ With the current rate of market transformation for the UJALA scheme, the market can be ready in the space of a few months and support from EESL may no longer be required

Policy	Policy status	Overview	Progress and way forward
Clean Environment Cess (NCEEF)	Implemented but facing policy challenges	▸ Launched in 2010-2011 for domestically produced and imported coal, ignite and peat	▸ Current cess of INR400 per tonne used towards R&D and other projects developing clean energy technologies ▸ The total funds expected to be generated by the cess through March 2017 amount to INR54,336.17 crores (US$9 billion) (Government of India, Ministry of Finance 2017) ▸ Currently under scrutiny as allocated funds used for projects such as curbing environmental pollution and not on R&D activities ▸ Future initiatives include developing a better communication strategy and allocating funds to environment and R&D initiatives

Source: Pathways for Meeting India's Climate Goals. (2017). New Delhi: World Resource Institute.

How effective are the current measures to mitigate emissions ?

- *The government has introduced and continues to introduce new measures to reduce India's carbon footprint.*
- *However, the current regulatory measures do not comprehensively cover all the emission sources. The bulk of the focus is on the transportation and electricity sector, which accounts for approximately 63% of the emissions. Whereas, the manufacturing sector accounts for a significant share in emissions and is not fully covered by the government's regulatory measures.*
- *The number of measures taken require the government to make periodic changes in regulatory standards such as efficiency standards for industries subject to PAT scheme and appliance efficiency standards. The success of these measures is dependent on the government's enforcement capability.*
- *A carbon tax could potentially cover over 90% of the emissions and provide an incentive to users to consider using cleaner sources of energy.*



5 Pricing and taxation of fuels in India

Introduction

Tax instruments have been found to have certain benefits over using regulatory approaches in addressing the environmental problems. They are a more cost effective way of reducing emissions and also have the advantage of revenue generation which can then be used for cleaner technologies. In addition to the regulatory measures, the Government of India has also undertaken tax measures to reduce the level of emissions. The key measures have been the imposition of a cess on the consumption of coal and subjecting petrol and diesel to high level of excise and value added taxes. Although, these cesses and taxes have not been referred to as carbon taxes, they are considered as implicit carbon taxes.

High energy prices can be effective in reducing emissions by decreasing the demand for fuels. Higher prices for fuels with greater emissions can encourage substitution towards less carbon intensive forms of energy. In this context, it is important to evaluate the following:

- Does India follow a consistent approach towards pricing of fuels? Is their pricing, market based for some fuels while subsidized or administered for others? Further, is the approach to pricing consistent with the carbon footprint of the fuels?
- What has been the impact of tax measures taken by the government? Have they resulted in substitution of fuel choices, or their impact has been limited to suppressing the overall demand? What lessons can be drawn while considering the design of a carbon tax?
- Is the overall approach towards taxation, i.e., the level and incidence of taxation, designed to minimize emissions? Or is there a case where fuels with a higher carbon footprint are subject to lower rates of taxation?

Pricing of fuels in India

India has used a variety of approaches for pricing of fuels such as subsidies, administered pricing and market pricing. The price formulae have changed with time and never co-related with the carbon footprint of the fuels. As a result, the price signals to the users of fuels do not incentivize them to reduce their consumption and substitute them with low carbon emitting sources of energy.

The following paragraphs bring out the experience with pricing of fuels in India:

Petroleum products

Historically, the pricing of liquid fuels was determined by the Government of India, under an Administrative Pricing Mechanism ("APM"). Under the APM, product prices were directly administered by India's Central Government based on a complex cost plus formula. In 2002, the APM was discontinued and oil marketing companies were free to set prices based on an import parity pricing mechanism.

With the sustained rise in crude oil prices beginning in 2004, the Indian Government increasingly looked to restricting the ability of oil marketing companies to increase prices, in order to protect Indian consumers. By mid-2004, the post APM model of product pricing was effectively abandoned, with the government once again centrally sanctioning upward price revisions. The oil and marketing companies (OMCs) are public sector companies under the control of central government. The government policies impact the pricing of fuels in addition to providing fuel subsidies. While retail prices for petrol and diesel were revised upward many times by the government, LPG and kerosene prices remained effectively fixed. The rise in petrol and diesel prices was not commensurate with the increase in international crude oil prices, thereby resulting in government providing subsidies on the sale of these fuels. As a result, instead of a carbon tax, India had a carbon subsidy.

In 2014, the prices of crude oil started coming down. India took advantage of the fall in global crude oil prices and removed the subsidies on petroleum products. By the end of 2014, the prices of diesel and petrol were determined by the market. Currently, subsidies are provided to only a few consumers of LPG and kerosene. The level of subsidies provided on LPG and kerosene is decided by the central government, while the other fuel products are sold at market prices.

Natural gas

A multitude of formulae and mechanisms are used to price natural gas in India.

- Gas produced from nominated fields (ONGC and Oil India, blocks under New Exploration and Licensing Policy (NELP) and certain Coal Bed Methane (CBM) blocks are sold on the basis of a price formula prescribed by the Government of India. Production of oil and gas in India can be undertaken only with the approval of the central government after signing a production sharing or a revenue sharing agreement with the Government of India. These contracts provide the basis for determining the pricing of natural gas produced in India. The government has used its rights under these contracts to prescribe a formulae. The current formula uses the price of natural gas prevailing in other countries such as US, UK, Canada and Russia to compute the prices applicable for the gas produced for the above mentioned blocks. This formula became effective from November 2014, prior to which a different basis was used to price gas.
- In certain blocks, the price is provided for the PSC is used to price gas
- LNG imported into India is priced based on both long term and prevailing spot market prices. These are based on the global forces of demand and supply for LNG
- Under the Hydrocarbon Exploration Policy (HEP)[48] enacted by the Indian Government in 2016, the contractors, i.e., players who would be producing gas in the future under new contracts, would have the freedom to determine the price of natural gas

The Government of India proposes[49] to set up a natural gas exchange in India where natural gas could be traded and could be supplied in India through a market based mechanism. At this point of time, it is unclear as to whether the government would replace the pricing formulae referred above with the price determined through such an exchange. However, the setting up of an exchange is expected to help discover a price based on the local demand and supply.

Coal

In India, coal is sold under a number of different pricing mechanism:

- Coal produced by Coal India and its subsidiaries are priced based on price notifications of Coal India Limited (CIL). The notified price is determined by the management of CIL. CIL also sells part of its production through E-auctions Prices realized through e-auctions are different from the notified price. More than 70%[50] of the coal consumed in India is produced by CIL and its subsidiaries

48. http://pib.nic.in/newsite/PrintRelease.aspx?relid=137638
49. PIB Press Release, Ministry of Oil and Natural Gas. Dated November 2, 2017.
50. Coal India Limited Directories, Own calculations
51. Coal India Limited Directories, Own calculations

- Imported coal is priced based on prevailing international prices. These prices vary constantly and are impacted by the forces of international demand and supply. In 2015-16, approximately 23%[51] of the demand for coal in India was met through imports
- Coal produced by captive mines is sourced at cost plus royalties paid to the state government
- The Government of India has recently announced its intent to allow commercial mining of coal by private parties. It is expected that the players undertaking commercial coal mining would have the freedom to set coal prices

As can be seen, multitude of formulae are used for pricing fuels in India. Ideally, the prices of all fuels should be market determined.

Tax measures to control emissions

Clean Environment Cess

The Finance Bill 2010 provided for creation of the NCEEFNCEF. The fund was set-up for the purpose of financing and promoting clean energy or any other purpose relating thereto. The cess was imposed on both imported as well as domestically produced coal. It was based on the "Polluter Pays" Principle[52]. Initially set at INR50 per tonne, the coal cess has been revised several times and is currently set at INR400 per tonne. In the budget of 2016-17, this was renamed as Clean Environment Cess.

Upon the introduction of the GST, the usage of money collected under coal cess has undergone a change. It will be utilized for compensating states for potential losses in revenues on account of GST implementation.

What is taxed?

The cess applies to the gross quantity of raw coal, lignite or peat, raised or dispatched from a coal mine. At the same time, the cess is applicable on washed coal or any other form, provided the appropriate cess has not been paid at the raw stage. The cess is also applicable on imports of coal in any form.

Who enforces the tax collection?

The coal cess was levied by the Central Board of Excise and Customs (CBEC). Post the implementation of GST, it is imposed by the CBEC under the supervision of the GST Council.

Revenue generation and usage

The following table provides information on the funds collected and the usage of the Coal Cess

Table 13: Collections from the coal cess

Year	Coal Cess collected (INR crore)	Amount transferred to National Clean Energy Fund (NCEF) (INR crore)	Projects financed from NCEF (INR crore)
2010-11	1,066	0	0
2011-12	2,580	1,066	221
2012-13	3,053	1,500	246
2013-14	3,472	1,650	1,219
2014-15	5,393	4,700	2,088
2015-16	12,676	5,123	5,235
2016-17	28,500	6,903	6,903
2017-18 (BE)	29,700	8,703	-
Total	**86,440**	**29,645**	**15,911**

Source: Government of India

As can be noted from the table, approximately, 30% of the cess collected has been transferred towards the NCEEF. Further, 50% of the money transferred to the fund has been used to finance projects.

52. Polluter Pays Principle: Those who pollutes should bear costs of preventive and curative measures taken, to minimize the damage on human health and environment.

The Government had set-up an Inter-Ministerial Committee that made recommendations on the projects to be funded from the proceeds of NCEEF. A ministry wise allocation of funds is provided in the following table.

Table 14: Fund allocation from the NCEEF (All figures in INR Crores)

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

Source: Ministry of New and Renewable Energy, Government of India

Tax measures to control emissions

Based on the table above, less than 30% of the money collected from the imposition of the cess has been used for funding environment projects.

Further, only some of these projects are related to abatement of emissions, e.g., funding of renewable energy projects. While information is available about the utilization of the funds for various projects, there is no analysis about the impact of projects funded through the NCEEF on curbing emissions in India. The operation of NCEEF has also been questioned due to lack of a dedicated team and inadequate administration.

As stated earlier, under GST, the money collected through the cess will no longer be used to fund clean energy projects. In fact, it would be used to compensate states for any revenue losses under GST.

Year	Rate of cess (INR)	Weighted average emission factor tCO_2/ MWH	Average emission rate from coal based power plants $kgCO_2$/ KWH net
2010-11	50/ tonne	0.79	1.06
2011-12	50/ tonne	0.78	1.05
2012-13	50/ tonne	0.83	1.04
2013-14	50/ tonne	0.82	1.03
2014-15	100/ tonne	0.82	1.01

Source: National Electricity Plan, Central Electricity Authority, Ministry of Power, Government of India

The following can be concluded from the above table:

- Due to increase in coal based generation of power and reduction in hydro and gas based power, the weighted average emission factor shows an increase over the years
- Per capita emissions from coal based power plants have reduced. This could be influenced by the commissioning of super critical technology based power plants. Central Electricity Authority has also attributed the reduction to the increase in efficiency of the power plants that are utilizing less coal
- Imposition of coal cess should ideally be linked to the quantum of carbon emissions such that it is a carbon tax in true sense. Availability and actual usage of cleaner fuels such as natural gas, for power generation, would be a critical factor in the effectiveness of the cess on coal. The details of this aspect have been discussed in the chapter on tax design

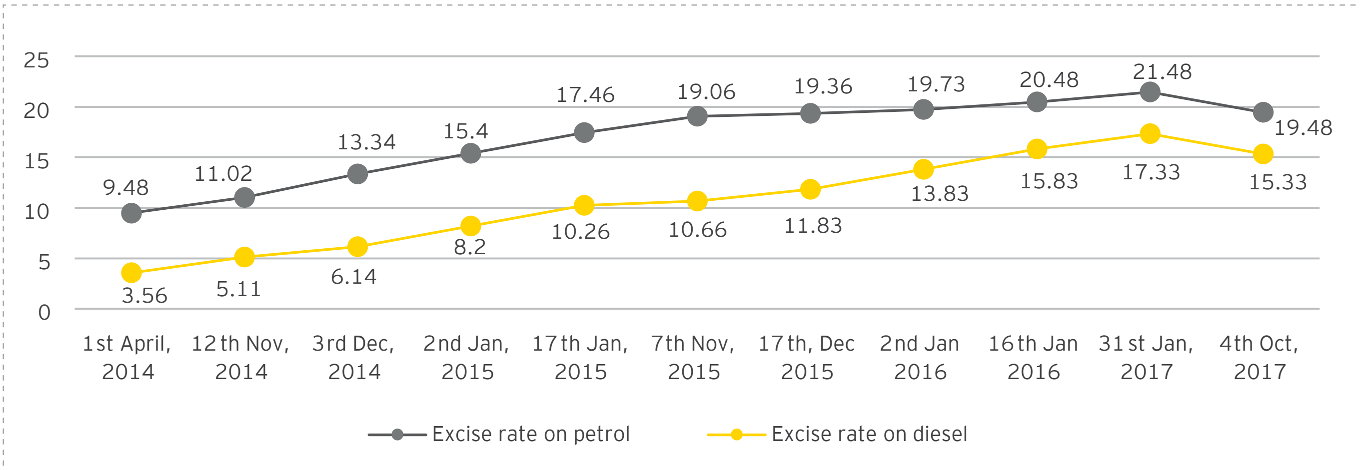
Taxation of diesel and petrol

The excise rates for petrol and diesel have been constantly revised by the government, as illustrated in Figure 1.

The government has since changed the taxation rates on both petrol and diesel.

Figure 5: Excise duty on petrol and diesel

Excise duty on petrol and diesel (INR/liter)



Source: Petroleum Planning and Analysis Cell

Petrol and diesel are subject to high levels of taxation, as illustrated in the table below.

Table 16: Effective tax burden on petrol and diesel

Particulars	Petrol*	Diesel*
Prices before taxes and dealer commission	30.76	31.34
Central taxes	20.1	15.95
State taxes	14.7	8.63
Dealer commission	3.57	2.52
Price	69.13	58.44
Effective tax burden	**113%**	**78%**
* Delhi as at Dec 16, 2017 ** Delhi, Dec 1, 2017 *** Mumbai, Dec 1, 2017		

Source: Petroleum Planning and Analysis Cell

It may be noted that excise duties and VAT are the part of the government's general revenue. While the government has justified the high taxes on petrol and diesel as implicit carbon tax, the high tax level is on account of government's revenue needs as opposed to environmental considerations. Based on estimates in chapter 2, it may also be noted that petrol and diesel account for only 14% of India's emissions but have a heavy tax burden. Given the already high level of taxes and the impact of fuel prices on inflation and economy, the government's ability to increase taxes on these fuels is limited.

Tax treatment of fuels: Comparison: Pre- and post-GST

Prior to the introduction of GST, the goods/services were subject to multiple taxes:

- Production of goods was subject to excise duties levied by the Government of India. India had introduced a CENVAT scheme such that taxes paid on inputs could be set off from the final excise duty payable on the manufacture of goods
- Provision of services was subject to the Service tax levied by the central government
- State governments imposed a "Value Added Tax" on the sale of goods
- A Central Sales Tax (CST) was imposed on inter-state sales

There were a number of anomalies:

- CENVAT load on the goods was included in the value of goods to be taxed under the state VAT. This was causing a burden of multiple taxation, i.e., tax on tax, which had a cascading impact
- While the Government of India had introduced CENVAT, a number of central taxes such as additional customs duty, surcharges, etc. were not included in the overall framework of the CENVAT
- The state level VAT structure also had shortcomings. Several taxes that were in nature of an indirect taxes on goods and services, such as luxury tax, entertainment tax, etc. were not subsumed under the VAT
- Inter-state sales tax effectively resulted in Indian market getting fragmented by state boundaries

Introduction of GST has reduced the multiplicity of indirect taxes for goods and services that fall under the purview of the GST. Under the GST, tax is levied on the final point of sale of good or provision of services, with the seller of good or provider of service claiming tax credit for GST paid on inputs.

As a result, a continuous chain of set-off from the original producer's or service provider's point up to the retail level is established reducing the cascading tax burden.

Current tax treatment of fuels

While the GST has been introduced on most goods and services, five petroleum products, i.e., petrol, diesel, natural gas, ATF and crude oil have been kept outside the purview of the GST. These products are subject to excise duties and VAT.

However, other products that are emitters of CO_2 like coal, kerosene, naphtha, lubes and LPG have been included in GST.

Ideally, bringing petroleum and petroleum products within the ambit of the GST will make them more competitive as their rate will be fixed at a rate lower than the existing tariffs imposed on them. This will also provide certainty to the industry since rates will not be fluctuating as they currently do.

The current taxation for various petroleum products is as follows:

Table 17: Taxes applicable on fuels outside the purview of the GST as on March 1, 2018 (except VAT)

S.No	Particulars	Petrol*	Customs			Central excise			VAT*
			Basic Customs Duty (BCD)	Additional Customs Duty (CVD)	Additional Customs Duty	Basic Excise Duty	Special Additional Excise Duty	Additional Excise Duty	
1	Crude petroleum		Nil + INR 50/MT as NCCD	Nil	-	Nil+ Cess @ 20% +INR 50/ MT as NCCD	-	-	Nil to 5%
2	Petrol	Non-branded	2.5%	INR 4.48 /ltr. + INR.7.00/ ltr SAD	INR8.00/ ltr.	INR 4.48/ ltr	INR7.00/ltr	INR.8.00/ltr.	Nil - 42.71%
		Branded	2.5%	INR5.66/ ltr. + INR7.00/ ltr SAD	INR8.00/ ltr.	INR5.66/ltr	INR7.00/ltr	INR.8.00/ltr.	
3	High Speed Diesel	Non-branded	2.5%	INR6.33/ ltr+ INR.1.00/ ltr	INR8.00/ ltr.	INR.6.33/ ltr	INR1.00/ltr	INR.8.00/ltr.	Nil to 30.71%
		Branded	2.5%	INR8.69/ ltr+ INR1.00/ ltr	INR8.00/ ltr.	INR8.69/ Ltr	INR1.00/ltr	INR.8.00/ltr.	
4	Aviation Turbine Fuel		Nil	14%[3]	-	14%	-	-	Nil to 38%
5	Liquefied Natural Gas		2.5%	Nil	-	Nil	-	-	Nil to 25%
6	Natural gas	Gaseous	5.0%	Nil	-	Nil	-	-	Nil to 25%
		Compressed	5.0%	5.0%	14%	-	14%	-	

Source: Petroleum Planning and Analysis Cell; Customs Tariff of India 2018 Note:

1. The BCD on LNG is either Nil or 2.5% depending on the exemptions provided by the Government of India.

2. In addition to the above, 10% Social Welfare Surcharge (3% in case of petrol and diesel) is also applicable on the total duties of Customs (excluding CVD in lieu of IGST).

3. In case of ATF, Basic Excise Duty /Additional Customs Duty (CVD) is 2% in place of 14%, for supply to schedule commuter airlines (SCA) from the regional connectivity scheme (RCS) airports.

* As of December 2017.

The GST rates for most other products such as Kerosene, Naphtha, Furnace Oil, LPG, Kerosene, etc. are at 18%. However, GST rates for Kerosene under PDS and domestic LPG are at 5%. The applicable GST rates are provided in the table below:

Table 18: GST rates applicable on fuels as on 1 March 2018

S.No	Particulars		Customs			GST		Any Applicable cesses
			Basic Customs Duty (BCD)	Additional Customs Duty (CVD)	Additional Customs Duty	CGST	SGST	
1	LPG	Domestic	Nil	5%	-	2.5%	2.5%	
		Non-domestic	5%	18%	-	9%	9%	
2	Kerosene	PDS	Nil	5%	-	2.5%	2.5%	
		Non-PDS	5%	18%	-	9%	9%	
3	Naphtha*	Fertilizer	Nil	18%	-	9%	9%	
		Non-fertilizer	5%	18%	-	9%	9%	
4	Furnace oil*	Fertilizer	Nil	18%	-	9%	9%	
		Non-fertilizer	5%	18%	-	9%	9%	
5	Low sulphur heavy stock/ and other residues*	Non-fertilizer	5%	18%	-	9%	9%	
		Fertilizer	Nil	18%	-	9%	9%	
6	Bitumen and asphalt		5%	18%	-	9%	9%	
7	Lube oil/Greases		5%	18%	-			
8	Petroleum coke		10%	18%	-	2.5%	2.5%	
9	Coal		10%		-	2.5%	2.5%	GST Compensation Cess @ INR 400/ tonne

Source: Customs Tariff Manual, 2018; GST rate notifications, CBEC, Ministry of Finance, Government of India; Petroleum Planning and Analysis Cell
*Note: There is no bifurcation of GST rates for these sources of fuel.

Impact of Introduction of GST on emissions

The design of GST raises a number of issues with regard to emissions:

1. **Taxation rates are not related to the incidence of pollution.** If a polluting good is taxed at a lower rate, then the resulting consumption of the polluting good is likely to be higher, especially in the long run. As mentioned earlier, long term price elasticities are higher than short term price elasticities. Further, in a destination based taxation system, tax revenues will accrue to the consuming states rather than the producing states that experience the impact of the emissions. For the purposes of minimizing emissions, it is important that the rates be set keeping in view the sources of emissions (producing states). The producing states also cause emissions and therefore, should be accounted into the distribution of tax revenues.

2. **Decision on whether to include a product under GST is not related to level of emissions.** All products causing emissions are under the purview of the GST, with the exception of the five petroleum products. The products under GST have the advantage of a set-off for the input taxes against the GST paid on output. However, for products outside the GST, the input tax credits cannot be set-off against the output tax and there is a cascading effect on the input duties. As a result, the effective rate of taxation tends to be higher for products outside the purview of the GST making them less competitive. This is also evidenced by the wide demand of natural gas producers to bring natural gas within the purview of the GST. As an example, even though the carbon footprint of natural gas is lower than that of other products, like coal and other liquid fuels (such as LPG, Naphtha, furnace oil, etc.), it has been kept outside the purview of the GST. As a result, it can be inferred that the government, while taking decisions on treatment of fuels under GST, did not take carbon footprint of fuel into consideration.

Fuel	Coverage under GST	GST rate(%)	Emission factor (Kilograms CO2 per Million Btu) Kg CO2/MBtu
LPG	Yes	5 (Domestic) 18 (Non-domestic)	64.01
Kerosene	Yes	5 (Fertilizer) 18 (Non-fertilizer)	72.30
Naphtha	Yes	18	72.80
Bitumen and asphalt	Yes	18	75.61
Coal	Yes	5 (+GST compensation cess @ Rs. 400/ton)	95.35
Petroleum coke	Yes	5	102.10
Other Fuels	Coverage under GST	Effective tax burden	
Natural gas	No	0-25	53.07
ATF	No	14-62	70.90
Petrol	No	113	71.30
High speed diesel	No	78	73.16

Conclusions

- *India does not follow a uniform approach towards pricing of fuels. As discussed, prices can be subsidized, determined on a cost plus basis, based on an administered pricing mechanism or be market based. For example, the price of domestically produced natural gas (based on formulae prescribed by the government) is different from the price of imported gas (based on international market prices). Inconsistency in pricing of fuels reduces the effectiveness of taxation in tackling the problem of carbon emissions.*
- *Imposition of coal cess should ideally be linked to the quantum of carbon emissions such that it is a carbon tax in true sense. Availability of cleaner fuels such as natural gas and actual usage of the power generation capacity of the renewable sources of power, would be a critical factor in the effectiveness of the cess on coal.*
- *Petrol and diesel already suffer a high tax burden. Government's ability to impose additional taxes on these two fuels is limited.*
- *Under GST, the tax rates on fuel and the inclusion of fuels in the GST base are not guided by emission concerns, but by revenue considerations.*

6 International experience

Introduction

With a number of countries developing Nationally Determined Contributions (NDCs) under the Paris Agreement, there is an interest in policy instruments that put a price on carbon emissions through the imposition of a carbon tax. As mentioned in an earlier chapter, companies around the world are also using a carbon price in their internal decision making process, anticipating that in the future, carbon could be priced in different jurisdictions.

Carbon taxes were first introduced in the early 1990s. Finland first adopted such a tax in 1990, followed by Norway and Sweden in 1991 and Denmark in 1992. These early taxes were concentrated on the energy sector and were linked to the excise duties. The tax rate was linked to the amount of CO_2 emitted and varied by fuel under consideration. Until the early 2010s, only a handful of European countries had adopted carbon taxes.

The early 2010s saw, for the first time, carbon taxes being used in emerging economies. Countries such as South Africa, Mexico and Chile are either employing carbon taxes or are contemplating implementing the imposition of a carbon tax.

According to a World Bank report published in March 2017, over 20 national and at sub-national level jurisdictions (e.g., British Columbia in Canada) have adopted or proposing to adopt carbon taxes. In addition, a number of other countries are pricing carbon through emission trading schemes. On average, carbon pricing initiatives implemented and scheduled for implementation cover about half of the total emissions from these jurisdictions[55].

There is however, a lot of diversity in the development and implementation of carbon taxes in each jurisdiction. There are differences in rates, applicability and point of taxation, coverage, administration and the usage of the revenues collected through carbon taxes. However, there are also similarities in the approach towards taxing carbon. Further, the level of success has varied across countries. On one hand carbon taxes in Nordic countries have been continuing for over 2 decades. On the other hand, carbon pricing mechanism in Australia was repealed within two years of introduction.

This chapter examines the experience of carbon tax design and structure in select jurisdictions and attempts to draw in learnings that could be used for designing a similar tax for India. While undertaking an analysis, the following aspects have been evaluated:

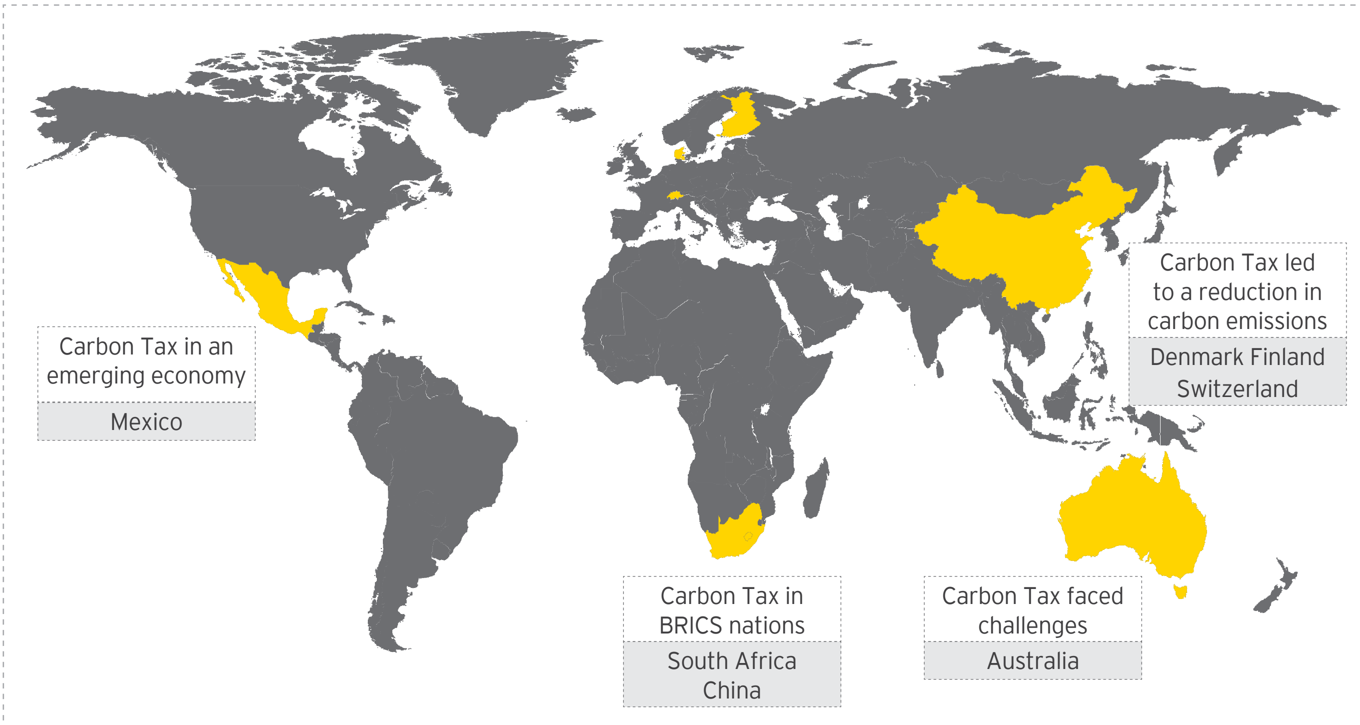
55. http://www.worldbank.org/en/news/press-release/2017/05/23/number-of-carbon-pricing-initiatives-nearly-doubled-over-past-fiveyears-says-new-report

- What is the tax base and the point of incidence?
- What are the tax rates and how have they changed over time ?
- Have the carbon taxes leveraged upon the existing taxation structure in those countries ?
- Whether new agencies have been set-up to implement a carbon tax or existing institutions have been used ?
- How is the money raised through imposition of a carbon tax utilized by the host government, i.e., whether they are used to meet the general budgets of the countries or are used to set-up specific funds ?

Countries whose carbon tax structures have been evaluated

The sample covered comprises of the countries where:

- Carbon Tax led to reduction in carbon emissions
- Carbon Tax faced challenges
- Carbon Tax in BRICS nations
- Carbon Tax in an emerging economy



Pictorial-World map with selected countries (Color coding for criteria)

Summary

The following table summarizes the design elements and context of the carbon tax adopted for each selected jurisdiction.

Table 19: Carbon Taxes around the world

Country	Fuel coverage	Sectors	Tax rate (Price in 2015 (US$/ tCO2e)	Revenue Revenue use use	Point of application	Implementation and administrative agencies
Denmark	All	Purchase and sale of fossil fuels	14	Reduced income taxes and employer's pension and social insurance contributions, energy efficiency and environmental programs	Tax is payable downstream but collected upstream	Central Customs and Tax Administration (CCTA)
Finland	All	Heating fuels, electricity, transportation	48-83	Reduced income taxes and employer's social insurance contributions, general budget	Downstream, tax is administered as excise (indirect) tax.	Finnish customs on behalf of the Ministry of Finance
Switzerland	All	Electricity and heat production	87	Reduced health insurance and social security contributions, energy efficiency in buildings, technology fund	Upstream on producers and importers and midstream on distributors	Federal Customs Administration
Mexico	Coal, oil (oil products)	Sales and imports of: Propane, butane, gasoline, kerosene and other jet fuels, fuel oil, petroleum coke, carbon coke and coal	1 to 4	General budget	Upstream. The tax applies to producers and importers	Tax Administration Service
Australia	All	Electricity generation, industry, waste, fugitive emissions	20	Assistance for low-income households, including income tax reform, jobs and competitiveness package, compensation to coal-fired electricity, use of offsets, Clean Energy Finance Corporation	Midstream and downstream	Clean Energy Regulator
South Africa	All	All sectors involving fossil fuel combustion, industrial processes, product use and fugitive emissions	8.50*	Electricity levy reduction, support for energy efficiency and renewable energy, support for public transport and rail freight transport, use of offsets	Upstream (fuel refiners), midstream (electricity generators) and downstream (industrial facilities)	-South African Revenue Service (SARS) -Department Environmental Affairs-for monitoring and verification system

a. This rate is the "headline" rate for the South African carbon tax. In the first phase of the tax, liable entities are allocated tax-free allowances of 60–95%, meaning that the effective tax rate paid by liable entities will be significantly lower than the headline rate. The rationale behind it is to allow businesses to adapt and transition to low carbon alternatives in the first phase.

Denmark

In 1990, Denmark adopted "Energy 2000" (the Plan) plan. The Plan set a target of 20% reduction in CO_2 emissions by 2005, over the 1988 levels. In 1992, Denmark introduced a carbon tax on fossil fuels used for heat production as a part of its emission reduction plan. While the CO_2 tax was levied on all energy consumers, businesses through a voluntary energy efficiency agreement with the Danish Energy Agency, could limit their tax liability. A more comprehensive Green Energy Package was adopted in 1996. Under this package coverage was increased to cover other emissions like SO_2 emissions also. Further, the tax rate on CO_2 emissions was increased. The Carbon Tax was modified again in 2005.

Tax rate and coverage: The Danish carbon tax rate for industry is Euro12 (~90 DKK/14USD)[26] per ton of CO_2 emissions for all fuels. Prior to 2005, the carbon tax rate was set at Euro13/ton.

The tax is applicable on gas, oil, coal and electricity usage. However, the sectors covered under EU ETS scheme are not covered under Carbon Tax. As a result, Carbon Tax covers about 45% of the country's emissions. It may be noted that district heating plants, which are also covered by the EU ETS, are required to pay the Carbon Tax as well. Since 2013, waste incineration plants have likewise been regulated by the Denmark Carbon Tax and the EU ETS, as per a World Bank Report of 2014.

Exemptions: In the second phase, implemented in 1996 there were significant reductions in the exemption allowances from the energy and carbon taxes faced by most firms, particularly the energy-intensive sector. ETS industries are generally exempt from the tax on fuel use for industrial processes and electricity production. The energy-intensive companies which are not covered by the EU ETS are exempted from Carbon Tax.

Point of incidence: The tax is applied upstream on producers and importers and midstream on distributors. The tax is collected by the distributors, although it is ultimately paid by the downstream end users.

Revenue use: Denmark has taken a mixed approach to revenue use. Revenue from the carbon tax has been used to reduce taxes on labor, subsidize energy efficiency investments and subsidize the associated administrative costs of small companies. Approximately 40% of the tax revenue is used for environmental incentives, while the remaining 60% is returned to industry through reduced social insurance, reduced pension contributions and compensation of administrative expenses for small businesses with limited payrolls. A particular aspect of Denmark's program of carbon-energy taxation, believed to have been significant for the marked impacts on energy productivity, was the earmarking of 20% of the revenues to co-finance energy efficiency measures and upgrade production technology. These funds were made available in a Danish Energy Agency supervised program[27].

Implementation and administrative agencies: The early taxes piggybacked on the excise taxes on fuels, using the existing administrative system but the tax rate was linked to the carbon content of fuels. The Central Customs and Tax Administration (CCTA) collects taxes and issues refunds associated with voluntary agreements. The CCTA issues rebate to businesses participating in a voluntary agreement on being notified by the Danish Energy Agency. In the case of Denmark, advantage of existing capacities was taken and other programs were also aligned.

Evaluation: The data on the specific environmental impacts of the CO_2 tax separate from the impacts of the comprehensive Green Tax Package are unavailable. However, as per the early evaluations made by Danish Energy Agency for the Green Energy Package, a 5% reduction in carbon emissions between 1996 and 2005 were a result of the policy. Between 1990 and 2012 there was a reduction of 14% in carbon emissions and by 2035 they are further expected to fall to levels which are 23% below the 1990 levels. A study conducted in 2000 suggested that the reductions in labor taxes and the subsidies for energy efficiency programs off set the impacts on energy costs.

56. http://www.cfe-eutax.org/taxation/environmental-taxes/denmark
57. https://pure.au.dk/ws/files/56715114/819_sapiens_andersen_2_.pdf

Finland

In January 1990, Finland became the first country in Europe to introduce a carbon tax based on the carbon content of fossil fuels. The tax originally covered fuel oil, natural gas and coal. In the initial years, carbon dioxide emitting resources such as peat and wood were excluded. The initial tax rate was €1.12/tCO2 (US$1.34/t$CO_2$). The taxation system has undergone several changes since then. The tax rate has been increased many times. Its structure has been changed and currently there are taxes related to carbon content, CO_2 emissions and strategic storage levy. Since 2008, a carbon tax has also been applied to automobile registration.

Tax rate and coverage: The CO_2 tax covers fossil fuels. The carbon tax covers a part of businesses and households use of fossil fuels and is estimated to account for approximately 15% of the country's total GHG emissions. Fuels used for electricity production, commercial aviation and commercial yachting are not covered by the tax (World Bank 2014, 79). Combined heat and power production (CHP) plants and biofuels that meet certain sustainability criteria face reduced carbon tax rates.

Point of incidence: The tax is administered as an indirect tax and is applied on the end consumers.

Revenue use: All energy tax and environmental tax revenues are collected into the general state budget. A shift in labor taxes to other taxes which includes environmental taxes has been a general commitment of the Finish government. According to government bills, this shift in taxation from labor taxes to energy taxes has been an explicit goal of the 1997 and 2011 energy tax reforms (Finlex Data Bank 1995; Finlex Data Bank 2010).

Implementation and administrative agencies: The taxes have been collected by Finnish customs on behalf of the Ministry of Finance.

Evaluation: Since the Carbon Tax is combined with energy taxation (e.g., on electricity) it is difficult to say how much of the emission reductions achieved have been derived from the CO_2 tax or energy taxation (Ludovino Lopes Advogados et al. 2014, 59). An early study estimated that between 1990 and 1998, carbon and energy taxes reduced CO_2 emissions by approximately 7% and fuel use by 4.8% (IEEE 2013, 44). Furthermore, Finland's GHG emissions decreased by 13.3% between 1990 and 2012 (UNFCCC 2016).

Switzerland

In 2008, Switzerland introduced a CO_2 levy covering heating and fuels (oil, natural gas and coal) as part of a comprehensive climate policy package. The objective of the package was to decrease the use of fossil fuels and consequently carbon emissions. The CO_2 tax was introduced at a rate of CHF 12 per ton of CO_2 emitted, since then the Carbon Tax has been increased several times. The tax rate is derived on the basis of emission reduction targets and price and cross-price elasticities.

Tax rate and coverage: The Carbon Tax applies to oil, gas and coal used for heating, lighting, operation of combined heat and power (CHP) plants and electricity production (approximately covering 35% of the total GHG emissions). The following businesses can be exempted from the carbon levy:

- Large, energy-intensive companies from industries exposed to international competition can apply for exemption from carbon levy and the ETS if they agree to emission reduction targets
- Large, energy-intensive companies that are covered by the ETS (usually companies with a total rate of thermal input of at least 20 MW)
- Small and medium enterprises that voluntarily make emission reduction commitments (World Bank 2014, 56, 82; Federal Office of the Environment 2016a)

The tax rate has increased gradually over a period of time, it was CHF 12/tCO_2e (US$10.68/t$CO_2$e) in 2008 and CHF 84/tCO2e (US$87/t$CO_2$e) in 2016. It is further expected to rise in 2018, with maximum tax rate being CHF 120/tCO_2e (US$125/t$CO_2$e) in case the pre-set targets for carbon emissions reduction are not achieved (Kossoy et al. 2015).

Point of incidence: In Switzerland, the carbon levy is applied on importers and distributors; however, the portion of the final price paid by consumers is clearly indicated on the invoice for the energy delivered, making the signal visible. Requiring or encouraging electricity and fuel distributors to highlight the carbon price portion on invoices or through other means can therefore help to increase the visibility of the tax.

Revenue use: Roughly two-thirds of the revenue is redistributed to the public on a per capita basis through the health insurance system (only administrative channel) and

58. The collection duty will be transferred from Finnish customs to the tax administration in 2017.

reduced OASI social insurance contributions for businesses (Federal Office for the Environment, 2016c). Roughly one-third of the revenue, up to CHF 300 million (US$301 million), is used to finance carbon dioxide emission reductions from buildings. A part of the revenue is also directed into a technology fund, which offers loan guarantees for the development of technological innovations in renewable energy, energy efficiency and improved use of natural resources (Environmental Defense Fund, CDC Climate Research, Caisse des Dépôts Group and IETA 2015, 6).

Implementation and administrative agencies: The Federal Customs Administration collects the CO_2 levy (Federal Office for the Environment, 2016b) and refunds.

Evaluation: The Federal Office of the Environment recently conducted two studies to estimate the impact of the carbon levy. Two separate models and business surveys were used in the estimation.

The results suggested that:

- The CO_2 levy was highly efficient in reducing emissions. Between 2008 and 2013, the total cumulative reduction effect was estimated to be between 2.5 and 5.4 million tCO_2
- Approximately three-fourths of these reductions came from households, while only one-fourth of reductions came from industry
- Less CO_2-intensive fuels (natural gas and renewables) acted as important substitutes for fossil fuels, especially in households
- Larger, energy-intensive firms were more likely to make an effort to reduce emissions (Ramer 2016)

Australia

In 2011, the Australian Government introduced the carbon tax or the Australian Carbon Pricing Mechanism (CPM). It was implemented with effect from July 2012. The intent was to have a fixed-price for carbon for a period for three years and then switch to an emissions trading scheme in which the carbon price would be determined by the market. The Australian emissions trading scheme was set to be linked to the European Union Emissions Trading System (EU ETS) by 2015. However, the CPM was repealed in July 2014 (Ludovino Lopes Advogados et al. 2014; Environmental Defense Fund, CDC Climat Research, Caisse des Dépôts Group and IETA 2015, 2).

Rate and coverage: The CPM covered all direct emissions of GHGs, that is, carbon dioxide, methane, nitrous oxide, sulphur hexafluoride and hydro fluorocarbons. It was applicable for large emitters, i.e., players with emissions in excess of 25,000 ECO2 tonnes. This accounted for approximately 60% of the nation's total GHG emissions (World Bank 2014, 78). An equivalent carbon price was applied to some business transport emissions and non-transport uses of fuels through changes in fuel tax credits or fuel excise, as well as to the import of synthetic GHGs.

The covered sectors included: Power stations using non-renewable energy sources, other stationary electricity generation sources, fugitive emissions, industrial processes, transportation and landfills (Department of Climate Change and Energy Efficiency, Australian government 2012). The exempted sectors comprised agriculture, forestry, fishing, on-road and light transport, land use, legacy landfills, legacy industrial processes and fugitive emissions from closed underground mines (Department of Climate Change and Energy Efficiency, Australian government 2012).

Point of regulation: Distributors of electricity and gas were taxed at midstream level. For other emissions (e.g., industrial facilities) end users/consumers were taxed.

Revenue use: Australia introduced its carbon pricing mechanism with the objective of being fiscally neutral and placed special emphasis on dedicating carbon revenues to families and businesses. At least 50% of the revenues generated were earmarked for a Household Assistance Package—financial assistance for pensioners and low-income households to compensate for the increase in cost of living caused by the carbon price. Around 40% of the revenues generated from the carbon tax were to be allocated toward a Jobs and Competitiveness Package, under which a number of measures were formulated to assist business community to make the transition to a clean energy future.

Implementation and administrative agencies: Three main agencies involved in policy making and administration of the CPM were the Productivity Commission, the Climate Change Authority and the Clean Energy Regulator (Department of Climate Change and Energy Efficiency, Australian Government 2012).

The Clean Energy Regulator was the regulatory body responsible for administering the CPM. The Clean Energy Regulator's responsibilities included allocating carbon units (under the flexible ETS phase), determining entities' liability, operating the Australian National Registry of Emission Units and ensuring compliance and enforcement of the CPM (Peel 2014, 444).

The Climate Change Authority (CCA) was an expert advisory body charged with conducting a wide range of reviews of the carbon tax policy. The CCA was responsible for reviewing the policy and offering advice on the annual emissions caps, which were to be established on a 5-year rolling basis. This agency was also responsible for reviewing the Renewable Energy Target and CFI (Peel 2014, 444). The Productivity Commission was responsible for reviewing international pollution reduction actions, the Jobs and Competitiveness Program and the fuel excise and taxation regime.

Evaluation:

- Australia's emissions in 2012 were broadly at the same level as in 1990. While broad economic forces accounted for some of the reduction in emissions intensity, the Australian government believes the CPM also played an important role in reducing emissions (Climate Change Authority, Australian government 2014, 76)
- Between 2012 and 2014, estimates suggest the CPM led to a modest increase in electricity prices, fuel switching from coal to less polluting energy sources and a reduction in energy intensity of the country's power supply
- Despite the initial emission reductions from the CPM, evidence suggests that emissions have increased again since the repeal of the CPM (Christoff 2015)

Why CPM was repealed

Press reports suggest that CPM was not politically accepted as it was seen to be leading to an increase in energy prices and cost of living. There were also concerns around the competitiveness of the economy being impacted.

It is also important to keep in view that the CPM was different from the carbon tax applied in Nordic countries in the following ways:

- In Nordic countries, carbon taxes have been enacted as a part of indirect taxes on fuels that emit CO_2. In Australia, it was enacted as a separate tax over and above the indirect taxes applicable on fuels. Consequently, it was seen as an additional tax burden on businesses and households
- In Australia the focus was downstream i.e., at end users, while in Nordic countries the focus was upstream i.e., at the point of purchase of fuel
- In Nordic countries implementation has been undertaken by the government agencies collecting indirect taxes. In contrast in Australia, CMP was enforced by environmental agencies

Carbon tax in emerging economies

The implementation of a carbon tax is gaining wider acceptance. This paper examines the carbon pricing mechanisms which have been either adopted or are planned to be adopted by emerging economies. In particular, this section covers Mexico, South Africa and China.

Mexico

The Mexican government introduced a Carbon Tax on fossil fuels under its 2013 amendments to the Special tax on production and services, which took effect in 2014 (World Bank 2014, 81). The economy is heavily reliant on oil to meet its energy needs.

Tax rate and coverage: The Carbon Tax covers sales and imports of propane, butane, gasoline, kerosene and other jet fuels, fuel oil, petroleum coke, carbon coke and coal by upstream producers and importers. Natural gas is excluded from the Carbon Tax and is used as a benchmark for calculating the tax incidence. The emission factor is set at the approximate difference between the carbon dioxide emissions from natural gas and the fuel used (World Bank 2014, 81).

In July 2016, the tax rate was a maximum of Mex$18.77 (between US$0.31 and US$2.50). This covers roughly 40% of Mexico's total GHG emissions (IETA 2014, 77). The energy sector is the primary focus of the tax since the tax is applied upstream, to producers and importers (Climate Focus 2013, 68). Since natural gas is not taxed, natural gas producers and importers are not subject to the tax.

Point of incidence: The tax applies to producers and importers (i.e., upstream), but not to resellers (i.e., midstream) (Ludovino Lopes Advogados et al. 2014, 68).

Use of tax revenues: The tax was expected to raise roughly US$1 billion annually (Environmental Defense Fund, CDC Climat Research, Caisse Dépôts Group and IETA 2015, 3). However, public records indicate revenues have been significantly less than expected: US$492,975,296 (Mex$9,670,350,000) in 2014; US$389,905,895 (Mex$7,648,509,994) in 2015 and an estimated US$355,247,469 (Mex$6,968,640,000) in 2016 (Servicio de Adminstración Tributaria 2016). At present, all revenues from carbon tax, are a part of the overall national budget. Earmarking of tax revenues is not a practice followed in Mexico on account of legal aspects of the national tax structure (Muñoz 2016).

Implementation and administrative agencies: The Tax Administration Service (SAT, as per the Spanish acronym), the agency of the Ministry of Finance charged with tax collection, is responsible for the day-to-day administration of the carbon tax.

Evaluation: The Mexican government claims that the carbon tax has already led to GHG emission reductions of 1.5 million tCO_2e (Muñoz 2016).

South Africa

Recognizing the importance of lowering carbon emissions, the government has undertaken the commitment to reduce emissions by 34% by 2020 and 42% by 2025. South Africa is under the process of developing its carbon tax regulation. Adoption of a carbon tax is expected to lead to an increase in the tax base of the government. It is also expected that the carbon tax would send the necessary price signals which can stimulate a change in user behavior and business decisions to switch towards low carbon options[59]. The structure described below is as proposed in the draft bill of 2015.

South Africa has a structural issue when it comes to electricity production, with the country being totally dependent on a single producer of electricity, state-owned Eskom, which derives 90% of its electricity from coal[60].

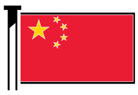
Tax rate and coverage: The tax is proposed to cover approximately 75% of the GHG emissions from fossil fuel combustion, industrial processes and fugitive emissions. Due to the challenges with emissions measurement in the waste and land-use sectors, these sectors will be exempt from the tax through Phase 1. Fuels used for international flights and ships will initially also be excluded from the tax. Emissions from gasoline and diesel will be covered under the existing fuel tax regime (National Treasury 2015). Further, there would be no tax on the amount of carbon dioxide being captured and stored by the businesses. The headline tax rate has been proposed at Rand 120/tCO_2e (US$8.50/$tCO_2e$). All businesses subject to the tax will be given a tax exemption on the initial 60% of their emissions. Some industries will receive additional limits, capped at a total threshold of 95% of emissions.

Point of incidence: The tax will be applied upstream for fuel refiners, midstream for electricity generators and downstream in case of industrial facilities. South Africa also intends to apply an upstream fuel tax to cover transport emissions.

Revenue use: The revenues from the Carbon Tax would go to the National Revenue Fund[61]. When the tax was first proposed, the government had stated that the revenues arising from the Carbon Tax would be recycled and would include measures like funding for the energy efficiency tax incentive already being implemented, a reduction in the electricity levy, additional tax relief for roof top (embedded) solar photovoltaic (PV), additional support for free basic electricity to low income households and additional allocations for public transport amongst others[62].

Implementation and administrative agencies: The South African Revenue Service (SARS) will administer the carbon tax. The Department Environmental Affairs approves the methodology for reporting of emissions factors.

Evaluation: Since the tax is yet to be enforced, it is difficult to comment on its impact. An early study by the National Treasury suggested a broad-based carbon tax that is implemented gradually and recycles tax revenues will decrease GHG emissions with minor short-term negative impacts on the economy. In the medium to long term, such a policy would help South Africa transition to a low-carbon economy and create green jobs (National Treasury 2015).



China

In 2009, China committed to lower its carbon dioxide emissions by 40 to 45% (per unit of GDP) of 2005 levels by 2020 and has been revised 60 to 65% by 2030. In 2011, the Government of China announced a plan to gradually establish a national carbon market as one instrument to reduce emission levels. In 2015, pilot projects for five cities and two provinces were launched. It is expected that shortly a nationwide emissions scheme would be launched.

Given that the program would be an emissions trading scheme, the carbon price would be market determined. Price information is not yet available. China's ETS is expected to apply to all companies which consumed at least 10,000 metric tons of coal equivalent between 2013 and 2015 in the major

59. http://www.thecarbonreport.co.za/the-proposed-south-african-carbon-tax/
60. http://theconversation.com/a-carbon-tax-for-south-africa-why-a-pragmatic-approach-makes-sense-45721
61. http://www.treasury.gov.za/public%20comments/CarbonTaxBill2015/Carbon%20Tax%20Bill%20final%20for%20release%20for%20co mment.pdf
62. http://www.treasury.gov.za/comm_media/press/2015/2015110201%20-%20Media%20Statement%20Carbon%20Tax%20Bill.pdf

industries like petrochemicals, chemicals, building production and materials, iron and steel, nonferrous metals, pulp and paper, power and aviation.

China's ETS is expected to become the world's biggest carbon pricing mechanism, overtaking the EU ETS. The country also aims to raise the share of non-fossil fuels to 20% of its total energy mix by 2020 and bring carbon emissions to a peak by around 2030. Like India, China relies heavily on coal for its energy needs (60% of country's primary energy). In spite of Beijing's efforts to boost up the renewable energy consumption, coal generated power remains the main source of electricity in the country, which accounted for 65.2% of total power generation in 2016. In October 2017, the thermal power generation in China fell 2.8% from a year earlier, while power generated from hydro and solar rose 16.9% and 35.7% respectively. This is indicative of the fuel switching behavior in the country. According to the National Energy Administration the coal generated power capacity across the country is expected to be capped at 1,100 gigawatts by 2020.

Conclusions

The following learnings can be taken while considering the design of a carbon tax for India:

Phased and incremental approach

Countries with a successful history of carbon taxation, have followed a phased and incremental approach.

- *Tax rates and the coverage have been gradually increased*
- *Exemptions and rebates have been reduced over a period of time*

As an example, Finland introduced a carbon tax in 1990 at the rate of US$1.4/ton$CO_2$. The tax was later increased to US$22/ton$CO_2$ in 1998. The tax was initially applicable for heating applications and electricity production. Thereafter, it was expanded to cover transportation. Another example of this is Denmark. Denmark implemented a system of high initial refunds. The rebate was decreased over a period, from 50% in 1993 to 10% in 2000.

The adoption of a phased-in, gradual approach to the implementation of carbon taxes is important for the following reasons.

- *Introduction of a tax at a low rate with increase in rates over time strengthens the acceptability of the tax. Rates can be increased over time and likely to find a lower level of challenge*
- *This approach provides guidance to the industry and sectors and allows emitters the time to make adjustments in their businesses. Such structured and gradual adjustments send a clear price signal for long-term investment decisions and encourage behavioral responses even at low tax rates*

Tax base and point of incidence

Indirect taxes on all fossil fuels imposed at the point of initial sale are the most common. These are also most straight forward, easiest to implement and administer[63]. Principle for a downstream tax is that the polluter pays and also the linkage between emissions and consumption of products. However there are other considerations like administrative ease of implementation and others.

The emissions occur upon use by the consumer either as an intermediate good or as a final consumption good. The amount of carbon contained in the fuel is roughly equivalent to the amount of emissions that

63. https://openknowledge.worldbank.org/bitstream/handle/10986/26300/Carbon%20Tax%20Guide%20%20Main%20Report%20web%20FINAL.pdf?sequence=1&isAllowed=y

would be eventually released. The application of the tax to the carbon content of fossil fuels serves as an effective and simple proxy for CO_2 emissions as the price is passed down. Consumers' behavior is thus directly targeted. Indirect taxes on fuel applicable at an early stage of sale have the following advantages.

- They do not require the computation of emissions by the polluter. Further, for implementing such a system, no institution with the right legal competences and the required institutional capacities to undertake the tasks required may be available. Therefore new structures may need to be established. This may take several years to develop and implement such as system. They are not seen as a new tax on the consumers

Tax rates

There is a wide variation in the tax rates. They vary from a high of US$132in Sweden to a low of US$1 in Mexico. Carbon taxes that are applied only to fuels and emissions are measured based on the application of an agreed emissions factor (based on the carbon content of the fuel) to the amount of fuel sold.

Exemptions

Exemptions vary by country and are driven by the perceived economic objectives of the country. Further, the list of exemptions gets modified over a period of time and as a general principle, they reduce with time. One of the principles used are exempting those industries that agree to a voluntary emission reduction or are already covered under an ETS scheme. This has been followed in the case of Denmark and Switzerland.

Administrating authorities

The existing indirect tax authorities are most commonly used for administering a carbon tax. This is the case with Denmark (Central Customs and Tax Administration), Mexico (Tax Administration Service, Ministry of Finance), etc. Existing indirect tax authorities can leverage the existing laws, systems and manpower, etc. for administering and collecting carbon taxes.

Usage of revenues

Countries use a combination of the principles for achieving revenue neutrality as well as using the money to fund specific programs. Proceeds from imposition of carbon taxes have been used to reduce other taxes such as income taxes. They have also been used to fund contributions towards social security, thereby reducing the Government expenditure towards such schemes. They have also been used for energy efficiency and environmental programs.

Revenue recycling facilitates tax cuts elsewhere in the economy. It is widely considered as the most economically efficient means of using carbon tax revenue. It has been used by governments seeking to improve the efficiency of their tax system. The principle of revenue neutrality can be accomplished through reductions in other distortionary taxes. This tax shifting exercise by imposing taxes on emissions and reducing other taxes not only provides for a more efficient tax system, but also facilitates environmental protection.

7 Design and structure of carbon tax in India

Introduction of carbon tax is an important policy decision. It can serve dual purposes:

- **First**, it can stem the additional carbon emissions by discouraging the use of emission intensive inputs and outputs (disincentive effect)
- **Second**, it can generate additional revenue which can be used, partially or fully, for betterment of the environment (revenue effect)

In the case of developing countries in particular, the additional revenues help improve the tax-GDP ratio and a higher amount of funds can be allocated towards environmental objectives. Careful planning and designing of the carbon tax is important to ensure that the tax is successful in achieving its goals. Consultation with stakeholders would also be important to understand their concerns and priorities.

India has taken several fiscal and non-fiscal measures for environment protection. In the earlier sections of this paper, it has been brought out that these measures to check carbon emissions have been useful, but not fully effective. There are several anomalies that make these measures only partially effective:

- The decisions to use tax and non-tax measures have been guided by reasons such as self-dependence (favoring the domestically available resources), social and economic needs (soft pricing the products of mass consumption) and administrative ease
- Basis of fuel pricing varies widely. Principles such as international prices or administered pricing including subsidized pricing, thereby sending inconsistent messages to the consumers
- There are variations in the taxation of fuels. Some are within the GST base (e.g., coal) while others remain outside the GST ambit (i.e., crude, petrol, diesel, natural gas, ATF). The tax rates also vary and are linked not to carbon emissions but to other considerations such as self-sufficiency, revenue considerations and social considerations. The rates provide little incentive for industries to switch to cleaner sources of fuels. As mentioned, tax rates are lower on fuels with a larger carbon footprint (coal) vis-à-vis fuels with a lower carbon footprint (natural gas)
- The non-tax measures do not fully cover all emissions

The purpose of this chapter is to derive lessons for India from international experience and keeping in perspective the needs of the Indian economy, examine the design for implementation of carbon tax in India. The following dimensions need to be examined in this context:

1. Should carbon tax complement the existing fiscal and non-fiscal measures for achieving environment objectives?
2. Which fuels should be subject to carbon tax and what should be the point of its regulation?

3. Given India's federal set up, what would be the roles of the central and the state governments?
4. Can carbon tax be a part of the GST?
5. How should the rate for carbon tax be determined? Should carbon tax be revenue neutral or revenue augmenting?
6. What would be a suitable strategy to utilize the revenue from carbon tax?

Carbon tax should complement the existing measures

International experience suggests that while developing the instruments for environment management, countries start with the regulatory/command and control instruments, move to user charges and then complement these policy options with environment taxes / carbon taxes.

India already has an extensive regulatory regime in place. In view of India's commitments under the

NDC targets, it is the appropriate time to consider bringing in a carbon tax that imposes a burden based on the carbon emissions by the polluters. The carbon tax would complement the existing fiscal and non-fiscal measures.

Carbon tax base and point of levy

In most countries, a carbon tax is usually imposed on the polluting inputs as opposed to directly taxing pollution on account of the measurement and implementation difficulties that the latter poses. Experts argue that implementing a tax on inputs such as fuels can be considered the same as taxing emissions. Fossil fuels of a particular kind will emit the same amount of carbon irrespective of when and where they are burned (assuming that they are fully burnt). Therefore, carbon tax should be applied to all the carbon emitting fuels.

The point of tax levy should be such that it minimizes collection and monitoring costs and maximizes coverage. Thus, taxation of fuels upstream would be the most appropriate point of levy as:

- Administratively, it will involve monitoring fewer producers as against a large number of consumers
- Upstream fuel taxes can be easily implemented through the use of existing tax laws, systems and agencies for administering indirect taxes. The same has been the case with Denmark (Central Customs and Tax Administration) and Mexico (Tax Administration Service, Ministry of Finance)
- Further, they do not require the computation of emissions by the polluter and thus there will be no requirement of new institutional capacities to undertake the tasks
- Another important aspect is that upstream tax on fuels will not be perceived as a new tax on the consumers as the tax will be paid closer to the production point

Carbon tax: The legislative framework

Article 246 of the Constitution of India provides for the distribution of legislative powers between the Parliament and the legislatures of states. The Seventh Schedule to the Constitution enumerates the matters in respect of which the Union or the States are empowered to legislate exclusively and concurrently.

Article 246A of the Constitution empowers the center and the states to make laws with respect to GST imposed by the Union or by that State respectively.

Article 248 of the Constitution grants an exclusive power to the Parliament to make any law with respect to any matter not enumerated in the Concurrent List or State List. This power includes the power of making any law imposing a tax not mentioned in either of those Lists.

At present, none of the Lists in the Seventh Schedule to the Constitution of India (Union List, State List and Concurrent List) has an entry for carbon tax. There could be three options for introducing a carbon tax in India:

1. Amendment to the Constitution: The introduction of a carbon tax as a separate tax in India will require an amendment to the Constitution to empower the Centre and the States to legislate for the new tax
2. Using Article 248: Carbon tax can be introduced as a new tax using the residuary powers of the Parliament under Article 248 of the Constitution
3. Introduce carbon tax under the existing GST laws

The first option, i.e., amendment to the Constitution, can be a long drawn process:

- A Constitution (Amendment) Bill will be required to be passed in both the Houses of the Parliament separately, by absolute majority (more than 50% of the strength of the Parliament) and special majority (approval by 2/3 of the members present and voting}. The Bill must also be ratified by the legislatures of half of the states by a simple majority

- After the Constitutional amendment, a new legislation for levying carbon tax will need to be drafted and passed by the Parliament and the State legislatures
- Rules governing the administration of the new tax will need to be framed

The second option of introducing carbon tax using Article 248 of the Constitution, will not require a Constitutional amendment. However, it would require a new legislation for levying carbon tax (to be passed by the Parliament), followed by the rules / regulations for its administration. The second option may have a limitation as, in this case, only the Centre will be able to impose the tax and the States will not have the power to impose a carbon tax.

Given the above, the third option of applying a carbon tax within the existing legislative framework, i.e., within the GST, might be most suitable. This option would involve amendment to the existing GST laws after a recommendation by the Goods and Services Council (GST Council)[64].

Current carbon taxes on fuels

Currently, the highest carbon emitting fossil fuels are subject to the following taxes, which act as implicit carbon tax:

- In addition to GST, a cess of INR400 per tonne applies to coal, briquettes, ovoids and similar solid fuels manufactured from coal, lignite, whether or not agglomerated. The cess is also applicable on imports of coal in any form
- Petroleum crude, high speed diesel, motor spirit (petrol), natural gas and aviation turbine fuel (ATF) are currently out of the GST base. However, the Constitution empowers the GST Council to recommend the date on which GST can be levied on these products. At present, these products continue to be subject to Union Excise duty and State VAT under Entry 84 of the Union List and Entry 54 of the State List respectively in the Seventh Schedule to the Constitution. The rates of duty / VAT vary across States and are not linked to carbon emissions

More details about the current tax burden on fuels, both under GST and outside GST, are tabled as Annexure IV.

The GST is the most significant indirect tax reform in India. It provides the right opportunity to address the distortions and anomalies in the Indian indirect tax system and replace them with an efficient tax system. Ideally, the five petroleum products (crude, petrol, diesel, natural gas and ATF) should have been included in the GST base right from inception. At all stages in the supply chain of the petroleum sector, whether it is oil exploration and production, refining, transportation and pipelines or distribution and marketing, substantial inputs of goods and services are acquired such as survey and exploration of mineral oil or gas service, cargo handling service, transportation of goods by road service etc. All such inputs are taxable under the GST, but the tax paid is non-creditable since the petroleum products are excluded from GST. The impact of the credit blockage is huge[65].

The exclusion of the five petroleum products from the GST is an outcome of the GST Council's decision, guided by the states' concern to protect their revenue base. States are of the view that the inclusion of petroleum products in GST would compromise on their fiscal autonomy and lead to revenue losses for them.

The international practice is to include all petroleum products in the GST base and then apply a supplementary levy. The quantum of supplementary levy varies, depending on the carbon / sulphur content of the fuels. A credit is allowed for the GST portion of the tax to commercial or industrial use of the fuels, but not for the supplementary levy. The supplementary levy serves the purpose of restricting consumption or encouraging a switch to low emission fuels. It also serves the purpose of revenue augmentation in some jurisdictions. India too could follow the same practice.

64. The GST Council is a joint forum of the Centre and the States. It is chaired by the Union Finance Minister, with the Revenue and Finance Ministers of all the States as members.
65. Due to non-availability of input tax credits to businesses outside GST have to bear the burden of higher tax rates compared to those within the GST

Carbon tax under GST

1 Tax on coal under GST

The Finance Act, 2010 introduced a clean energy cess of INR100 per tonne, as duty of excise, on production of coal. The amount was later reduced to INR50 per tonne vide notification dated 22 June 2010. The stated objective of the cess was financing and promoting clean energy initiatives, funding research in the area of clean energy or for any other related purpose. The proceeds of the cess were credited to the Consolidated Fund of India. At the time of introduction of the cess, it was provided that its proceeds shall not be distributed among the states. The cess was later re-christened as clean environment cess. This cess has been referred to as an implicit carbon tax by the government. With the introduction of GST, most central surcharges and cesses relating to supply of goods and services, including the clean environment cess, have been subsumed under the GST.

Under the GST, supply of coal is subject to 5% GST. In addition, under the Goods and Services Tax (Compensation to States) Act, 2017, a cess of INR400 per tonne is levied by the center on supply of coal. No credit is provided for cess paid against payment of GST. However, the input tax credit in respect of cess on supply of coal can be utilized towards payment of the cess on supply of goods and services. The stated purpose of the levy of cess under GST is providing compensation to the states for loss of revenue arising on account of implementation of the goods and services tax, for a period of five years or for such period as may be prescribed on the recommendations of the GST Council.

All the proceeds received from the GST compensation cess are required to be credited to a non-lapsable Goods and Services Tax Compensation Fund. The funds would then be used for compensating tax revenue loss to states on account of GST implementation. Any unutilized funds at the end of the transition period would be shared equally by the central government and all state governments. The state governments' share would be determined in the ratio of their total revenues from the state tax or the Union Territory GST, in the last year of the transition period.

Clearly, under the GST, neither is the amount decided for cess linked to the pollution caused by coal, nor is the revenue utilization earmarked for the environmental cause. At the same time, the government's revenue constraints for compensation to the states are understandable.

Given the above situation, the following is suggested for taxation of coal under GST:

Immediate term (0-2 years)

India has rich reserves of coal and it is a cheap source of providing energy to the numerous Indian users. In the short to medium term, India's dependence on coal as a source of energy would continue. Keeping these aspects in mind, the following is suggested:

1. Coal should continue to be subject to GST and a supplementary cess
2. The current cess on coal under GST should be linked to the quantum of carbon emissions from coal. It should therefore become a "carbon cess" in true sense. Any increase in tax would have to come in a phased manner. The details of the suggested amount of carbon cess are discussed under the section on carbon tax rates
3. The government should give a clear message to all stakeholders about its intent to link the supplementary cess to carbon emissions
4. At present, the cess on coal is applicable at every point of supply in the supply chain, with credit for cess paid at the previous point against cess paid on the next point. It is suggested that the 'carbon cess' on coal should be applied only at the first point of supply and should be non-creditable.
5. Since the government is committed to using the proceeds of the current coal cess for compensating the States for revenue loss under GST, for the initial period of five years, in the short term, the "carbon cess" on coal would continue to be utilized for the same purpose

Medium to long term (2-12 years)

While coal continues under the purview of the GST, the supplementary cess should be increased gradually

1. The collections from the carbon cess on coal could be earmarked for environment objectives. This was also the objective of the cess on coal when it was initially introduced
2. The increase in cess under GST could be notified by the central government and would not require any legislative amendment. However, the decision about the utilization of revenues for environment purposes would require an amendment to the GST (Compensation to States) Act, 2017.

2 Petroleum products outside the purview of GST

As discussed in the previous paragraphs, ideally, India should include all the currently excluded petroleum products, i.e., crude, motor spirit (petrol), high speed diesel, natural gas and aviation turbine fuel (ATF) in the GST base. Once all fuels are brought into the GST base, they should be subject to GST (uniform for all fuels) and a supplementary levy, which could vary according to the carbon emissions.

However, some aspects need to be considered in the context of applying a carbon tax on petroleum goods:

- The effective tax burden on petrol and diesel (center and state taxes combined) is very high. For instance, for Delhi, the effective tax on petrol is as high as 113% and on diesel it is 78%[66]. As against this, the effective carbon tax rate estimated at a carbon tax of US$10 per tonne is merely INR1.4 per litre[67] for petrol and INR1.7 per litre for diesel. Even at a US$30 per tonne[68], it is merely INR4.2 for petrol and INR5.1 for diesel. Clearly, the current high taxes on petrol and diesel more than adequately meet the need of a tax burden on these fuels that disincentivizes their consumption
- Secondly, while the government considers the high tax burden on petrol and diesel as an implicit carbon tax, it is driven more by revenue considerations as opposed to the environmental cause. The collection from excise duties is a part of the government's general revenue and not clearly earmarked for environment improvement
- At the time of preparing this paper, the states continue to be resistant to the proposal of including petroleum products in GST for the fear of loss of revenues

In view of the above, the following is suggested in respect of carbon tax on petroleum products currently out of the GST ambit:

Immediate term (0-2 years)

- Maintain status quo for crude, petrol, diesel and ATF, i.e., these fuels will remain outside the GST at the current juncture
- There is a strong case for including natural gas in GST as it is a cleaner fuel and is largely used as an intermediate product and in business to business transactions. In case the states continue to have reservations about the inclusion of the petroleum products in GST, at a minimum, natural gas should be included in the GST. The inclusion of natural gas under GST will require a recommendation by the GST Council. The CGST, SGST and IGST laws provide that GST on the supply of petroleum crude, diesel, petrol, natural gas and ATF shall be levied with effect from such date as may be notified by the government on the recommendations of the Council. Subsequent to the recommendation by the GST Council, relevant notifications can be issued by the central and the state governments for applying GST to natural gas
- For equality of tax treatment, natural gas should be subject to the same GST rate as coal (5% currently), with additional supplementary levy linked to carbon emissions. While GST will be creditable, the supplementary levy will be a non-creditable cess. The imposition of cess will require an amendment to the GST (Compensation to the States) Act, 2017

Medium to long term (3-12 years)

- All the currently excluded petroleum products should be brought into the GST base. The GST rate should be uniform, with an additional non-creditable, supplementary levy or cess
- The quantum of cess for each fuel should be determined on the basis of the carbon emissions and calibrated to protect the government revenues
- Inclusion of petroleum products in GST would require a recommendation by the GST Council to this effect. The central and the state governments can then, by notification, apply GST to these products
- Ideally, in the interest of uniformity of tax treatment and administration, the supplementary levy should be levied by way of amendment to the GST (Compensation to the States) Act, 2017 just as in the case of coal. However, the states' main resistance against the inclusion of petroleum products in GST has been that their fiscal autonomy would be compromised for those goods which are among the highest revenue earners for the governments. The states may, therefore,

66. Ready Reckoner Snapshot of India's Oil & Gas data, Petroleum Planning & Analysis Cell (Ministry of Petroleum & Natural Gas), November, 2017
67. Tax rate (INR/litre)=Tax Rate (INR)/Conversion Factor(converted tonnes into litres using standard conversion factors)
68. According to IMF report

have concerns about the additional levy under the GST (Compensation to the States) Act, 2017 as this legislation empowers only the center to levy the tax. To address this concern, the GST Council may consider the alternative of a supplementary levy by the center and the states outside the GST, as is the current practice

- The Constitution (One Hundred and First Amendment) Act, 2016 has amended the Seventh Schedule to the Constitution such that the Centre and the States continue to have the powers to levy excise duty and State VAT on the specified petroleum products. Thus, making use of these powers, the additional levy could be imposed in the form of an excise duty or State VAT as is currently levied by the center and the states. The additional tax should be non-creditable.
- The center and the states should consciously earmark a part of the revenues from the supplementary levy on petroleum products to a dedicated environment fund. This aspect has been further discussed under the section on utilization of revenues.

3 Other petroleum products

Other fuels, besides coal and petroleum products discussed above, are currently included in the GST base and attract a GST of 5% or 18%. These are LPG, kerosene, naphtha, furnace oil, low Sulphur heavy stock / and other residues, bitumen and asphalt, lube oil/greases and petroleum coke.

For the above fuels, the following is suggested:

- Kerosene and LPG (cooking gas) are currently subsidized by the government in the interest of the low income sections of the population. Measures are being taken to reduce the subsidies and switch to market based pricing, particularly in the case of kerosene. These measures should continue to be pursued
- The tax burden for these fuels too should be on the lines of that suggested for coal and natural gas. They should be subject to a GST plus an additional non-creditable cess, linked to the carbon emissions

Rate of carbon tax

International experience shows that there could be a multiplicity of factors that drive the rate of carbon tax, depending on the policy goals and the socio-economic and political set up of each jurisdiction. The considerations could be reduction in emissions, revenue augmentation, the current tax burden and the social cost of carbon. Determination of the right rate is important both from the perspective of acceptability by the taxpayers and the desired outcome of emissions abatement. The rate should not be so low that it becomes non-effective for the objective it is imposed. It should also not be so high as to make the burden excessive, resulting in a negative impact.

Most jurisdictions have started with a relatively low rate and increased it over time. For example, Iceland used benchmarking to set its initial tax rate, indexing the carbon tax to the carbon price reflected in the EU Emissions Trading System (ETS). However, it phased in that rate, setting its rate to 50% of the EU ETS price in 2012, raising it to 75% of the EU ETS price in 2013 and the full EU ETS price in 2014. Following that period, the country stipulated that its carbon tax would rise by the rate of inflation or 3% per year, whichever was the highest . Similarly, Finland introduced a carbon tax in 1990 at of the rate of US$1.4/ton$CO_2$, which was later increased to US$22/ton$CO_2$ in 1998. The tax was initially applicable for heating applications and electricity production. Thereafter, it was expanded to cover transportation. Another case in point is the example of Denmark which implemented a system of high initial refunds. The rebate was decreased over a period, from 50% in 1993 to 10% in 2000.

The important aspects in the context of carbon tax rate will be identifying the basis for setting the tax rate and determining if the tax rate will vary over time after its initial implementation. Another important aspect will be certainty of tax policy for businesses. The government may want to have the flexibility to adjust the tax rates in future if needed. However, for businesses, an indication about the likely prices will lend stability to their planning process and in making investment decisions. It is for this reason that a gradual increase in tax rate is considered better.

Tax rates for carbon emitters in India

For suggesting carbon tax rates in India, this paper considers two approaches – the social cost of carbon (SCC) approach and the abatement approach. The SCC approach estimates the cost that the society bears from the emission of one tonne of carbon dioxide or carbon equivalent emissions at a given point of time. The abatement approach determines the carbon tax for achieving a given level of reduction in the emissions. Chapter 3 of this paper details the estimates of carbon tax rate based on both the SCC approach as well as the abatement approach.

SCC approach

Depending on the models used and assumptions taken into account, the SCC estimates by different policymakers could vary. For instance, as per the international standard estimates, the SCC for India could be as high as US$40 per tonne of carbon emissions.

This paper uses the SCC approach to determine the quantum of carbon emissions by different fuels, using the emission factors. It estimates the social cost of carbon for India at US$10.44, or rounding off, at US$10 per tonne of CO_2 emissions.

Abatement approach

Under the Paris Agreement on climate change, India's submission of the nationally determined contribution (NDC) has pledged to reduce the carbon emissions intensity of GDP by 33-35% by 2030 compared to the 2005 levels.

In a study on "Reforming Energy Policy in India: Assessing the Options", Ian Parry, Victor Mylonas and Nate Vernon estimate that even as the overall energy intensity of GDP falls by 37%, the carbon intensity of India will fall only by 24% by 2030 compared to 2005 levels if no further policy interventions are made. However, a carbon tax of US$10 per tonne of CO_2 emission could further reduce the carbon intensity by 8% and a higher carbon tax of US$35 per tonne of CO_2 emission could further reduce the carbon intensity by 22%. To avoid a sudden increase in tax burden and make it more acceptable for the stakeholders, the carbon tax should be increased in phases such that it reaches US$35 per tonne of CO_2 emission by the year 2030.

The following table estimates the effective tax rate for each of the carbon emitting fuels based on the SCC approach and the abatement approach at three different rates of US$10, 35 and 40 as calculated in chapter 3. The rate of US$40 is standard rate of carbon tax, as it is the value of the central estimate of GSCC based on 3% discount rate. Further the US$10 and US$35 are estimates in accordance with SCC approach and Abatement Target Approach respectively as calculated in chapter 3 above. The tables below give estimates in US Dollars (US$) and Indian Rupees (INR) according to the increasing emission factors expressed in two different units, US$/MBTU and US$/Ton of fuel for each rate.

69. Carbon Tax Guide, A Handbook for Policymakers, World Bank Group

70. IMF Working Paper, May 2017

Table 20 (a): Tax rate on fuels (USD)

Estimated tax rate (USD)						
Fuels	Carbon tax - US$10/ Ton of CO_2 Sectors		Carbon tax - US$ 35/ Ton of CO_2		Carbon tax- US$ 40/ Ton of CO_2	
	Carbon Tax USD$Ton/ MBTU	Carbon Tax (US$/ Ton)	Carbon Tax USD$Ton/ MBTU	Carbon Tax (US$/ Ton)	Carbon Tax USD$Ton/ MBTU	Carbon Tax (US$/ Ton)
Natural gas	0.53	28.08	1.86	98.27	2.12	112.32
LPG	0.64	29.39	2.24	102.88	2.56	117.61
Aviation Turbine Fuel	0.71	31.80	2.48	111.31	2.84	127.24
Petrol	0.71	31.05	2.50	108.66	2.85	124.20
SKO	0.72	31.65	2.53	110.78	2.89	126.61
Naphtha	0.73	31.42	2.55	109.98	2.91	125.73
Diesel	0.73	32.11	2.56	112.37	2.93	128.39
LSHS	0.74	34.70	2.59	121.44	2.96	138.80
Furnace oil	0.74	32.27	2.59	112.95	2.96	129.08
Lubes and greases	0.74	31.65	2.60	110.78	2.97	126.61
Bitumen	0.76	31.65	2.65	110.78	3.02	126.61
Coal	0.95	17.82	3.34	62.36	3.81	71.27
Petroleum coke	1.021	33.78	3.57	118.23	4.08	135.12

EY Estimates

Table 20 (b): Tax rate on fuels (INR)

Estimated tax rate (INR)						
Fuels	Carbon tax - US$10/ Ton of CO_2		Carbon tax - US$ / Ton of CO_2		Carbon tax - US$40/ Ton of CO_2	
Using exchange rate, 1 US$= INR 66						
	Carbon tax INR ton/ MBTU	Carbon tax (INR/ Ton	Carbon tax INR ton/ MBTU	Carbon tax (INR/ Ton)	Carbon tax INR Ton/ MBTU	Carbon tax (INR/ Ton)
Natural gas	35.03	1,853	122.59	6,486	140.10	7,413
LPG	42.25	1,940	147.86	6,791	168.99	7,762
Aviation Turbine Fuel	46.79	2,099	163.78	7,348	187.18	8,398
Petrol	47.06	2,049	164.70	7,173	188.23	8,197
SKO	47.72	2,089	167.01	7,311	190.87	8,356
Naphtha	48.05	2,074	168.17	7,260	192.19	8,298
Diesel	48.29	2,119	169.00	7,415	193.14	8,474
LSHS	48.84	2,290	170.94	8,016	195.36	9,161
Furnace oil	48.84	2,130	170.94	7,454	195.36	8,519
Lubes and greases	48.98	2,089	171.43	7,311	195.91	8,356
Bitumen	49.90	2,089	174.66	7,311	199.61	8,356
Coal	62.93	1,176	220.26	4,116	251.72	4,704
Petroleum coke	67.32	2,229	235.62	7,803	269.28	8,918

EY Estimates

Naphtha = Natural gasoline

ATF = Jet fuel

Lubes and greases = Lubricating oil

Furnace Oil = Fuel oil

LSHS = Residual fuel oil

Petrol = Motor spirit

Diesel = Distillate fuel oil

Note: According to MoPNG Statistics 2015-16, the conversion factors are taken to be as provided in the report.

Considering the effective carbon tax estimated on the basis of social cost and abatement cost methods, the following aspects may be noted:

- The abatement approach brings out that for India to achieve its goal of 33-35% reduction in emissions intensity by 2030, an additional carbon tax should be imposed such that it reaches USD$35 (INR2,310) per tonne of CO2 emission by 2030. Since petrol and diesel are already heavily taxed, the additional burden will have to fall on coal and other fuels
- The SCC approach reflects that while the other fuels are already heavily taxed, coal is under-taxed. At a minimum, the carbon tax on coal should be increased from the current level of INR400 per tonne to INR1,176 per tonne, based on a SCC of USD$10 per tonne of carbon emission
- The current tax burden on petroleum products is already very high, leaving limited scope for increasing the burden any further. It is suggested that all petroleum products should be included under the GST at the earliest. All fuels should be subject to a uniform GST (5% currently) with an additional non-creditable supplementary cess linked to carbon emissions
- It is recognized that India has rich reserves of coal and it is a cheap source of providing energy to the numerous Indian users. In the short to medium term, India's dependence on coal as a source of energy would continue. Therefore, the quantum of the tax and additional supplementary levy for coal and other fuels should be increased in a phased manner to the levels estimated above under the SCC approach / abatement approach. The relative tax increase on coal and other fuels will have to be decided based on India's own economic priorities and circumstances
- It is expected that the high tax would encourage the consumers to shift to cleaner sources of energy, bring improvements in energy efficiency and reduce the use of energy-consuming products. The revenues from the additional taxes would also supplement the government's ongoing efforts to promote energy efficiency and encourage the renewable sources of energy

Exemptions from carbon tax

From an environmental point of view any exemptions and particularly when they are given for emission-intensive sectors, reduce the effectiveness of the tax. Even then, exemptions are generally considered for the following reasons:

- They may help address the challenges associated with leakage of carbon tax or adverse distributional impacts. For instance, fuels used in the farm / agriculture sector are usually given exemption from carbon tax in many jurisdictions
- Any negative effects of carbon tax on competitiveness of companies or a sector could be reduced through sectoral exemptions and tax reduction
- Initial / short term exemptions help the companies / taxpayers to adjust to policy shifts
- Where a carbon emitting fuel is used for purposes other than combustion and is used as a feedstock for manufacturing. Examples of such a sector in India is fertilizers
- Internationally, exemptions are also given to industries that agree to a voluntary emission reduction program with the government. This principle has been followed in countries like UK and Denmark. However, in India, some industries are subject to PAT schemes but are not exempted from payment of coal cess. In a country as vast as India with numerous small businesses, this may not be easy to implement. Further, implementation of such a system would require the development of an entirely new administrative set-up and can lead to subjectivity
- Other legal / technical reasons. For instance, in India, in the state of Meghalaya, coal is mined under traditional and customary rights vested on the local tribes. The mines operated by these tribes are not subjected to the provisions of laws that regulate the operation of coal mines. Hence, full exemption from Clean Energy Cess has been provided to coal produced in the State of Meghalaya under such rights

In the Indian context, it is suggested that exemptions may be considered for those industries where fuels are used as feedstock at the first point of supply.

The institutional mechanism

The options for taxation of coal, petroleum products and other fuels discussed above would not require a separate institutional mechanism to be put in place. The additional taxes suggested can be implemented within the existing tax law framework. For administration and enforcement too, the existing laws for implementation of GST, Central Excise and state VAT will provide a ready, simple and transparent mechanism.

The table below outlines the various processes involved in a general revenue administration:

Key process	Functions
Registration	▸ Registration of taxpayers ▸ Registration of importers, exporters, brokers, clearing agents etc. ▸ Assignment of unique taxpayer identification numbers (TIN) ▸ Periodic updating of taxpayers' registers ▸ Detection of unregistered potential taxpayers ▸ Registration for allied taxes, licensee base
Taxpayer services	▸ Taxpayer education: Seminars, workshops, advertisements, brochures, TV ads, interviews, competitions, dissemination through the internet etc. ▸ Taxpayer assistance: Telephone helplines, assistants ▸ Assistance in understanding legal and procedural issues and filling forms ▸ Facilitation of voluntary compliance ▸ Setting up of one stop offices and counters ▸ Providing electronic filing and payment facilities ▸ Refurbishing waiting areas
Trade facilitation	▸ Enabling electronic filing of periodic declarations, payment of taxes and electronic downloading of statutory forms ▸ Creating fast track processes for established, compliant clients
Processing of return and payments	▸ Receipt and checking of periodic declarations and online scrutiny thereof ▸ Processing of payments of taxes and duties ▸ Detection of non-filers, stop-filers and payment defaulters ▸ Remedial actions to secure compliance with filing and payment obligations ▸ Issue of tax refunds
Monitoring of periodic declarations, tax withholders and collection agents	▸ Monitoring of persons required to deduct tax on payments made to other taxpayers to verify: ▸ Whether the correct amount of tax is deducted ▸ The amount of tax deducted is paid to the tax authority in time ▸ Monitoring of Banks and other organizations receiving payments to verify: ▸ Timely payment of taxes into government account ▸ Quality of transcribed information forwarded to the Revenue administration

Key process	Functions
Collection of information about taxable transactions	▸ Collection of information from third parties: ▸ Financial institutions ▸ Government agencies ▸ Traders ▸ Other state governments ▸ Stock brokers ▸ Intelligence operations ▸ Purchase (processing)of information from informants ▸ Processing of complaints of tax evasion ▸ Surveillance of suspect taxpayers ▸ Research and analysis ▸ Search and seizure and survey operations to obtain incriminating evidence
Risk analysis and selection of cases for physical inspection, audit and investigation	▸ Physical inspection to detect undeclared imports and exports ▸ Analysis of returns and declarations, in the light of risk factors, to select cases where the possibility for tax fraud is high
Audit and investigation	▸ Audit planning ▸ Examination of returns and books of accounts ▸ Inquiries from third parties ▸ Collection of documentary and oral evidence ▸ Examination of legal issues ▸ Assessment of additional liabilities for tax, interest and penalties ▸ Evaluation of audits
Recovery of tax arrears	▸ Persuasive recovery ▸ Coercive recovery ▸ Bankruptcy proceedings ▸ Recovery through courts
Control on use of VAT invoices	▸ Spot checks of customers to verify if sales are being recorded ▸ Imposition of penalties on defaulting businesses
Legal and judicial matters	▸ Legislation ▸ Amendment of existing legislation ▸ Preparation of new legislation ▸ Preparation of regulations ▸ Issue of rulings and clarifications on legal matters ▸ Appeals ▸ Administrative hearing of objections and appeals ▸ Defending the department's actions before higher appellate authorities ▸ Scrutiny of appellate decisions and filing further appeals
Fiscal studies	▸ Analysis of revenue collection and compliance patterns, tax burden on different sectors, effect of exemptions and deductions, revenue effects of proposed tax policy changes, etc.

In the context of carbon tax, all the above functions can be carried out by the existing administrative framework under the Central and State Finance Ministries. The diagram given below outlines the administrative structure of the Finance Ministries at the Centre and the Sate levels.

1. Member GST and Principal Secretaries of states coordinate for operational requirements
2. Administers Central Excise Duty for products outside the purview of GST. The administrative structure of these Commissionerates is the same as that of the existing formation
3. Assists the Council in policy formulation in CGST and IGST matters
4. There are other Members also, for customs, IT policy & infrastructure, post, vigilance & training and legal Judicial and Audit
5. P&V functions like transfer, posting, appointment and vigilance
6. Handles economic & offences related to taxation

Utilization of revenues

In most jurisdictions, carbon taxes are not meant to be revenue augmenting taxes. Instead, they seek to change the structure of taxation without putting additional burden on the taxpayers. They make polluting resources more expensive and thus reduce their use. At the same time, they can also be helpful in lowering other taxes such as on labor and capital, resulting in enhanced output. In countries with low tax to GDP ratio, however, carbon taxes can be used to improve the tax-GDP ratio that will allow a greater allocation for both environmental objectives as well as other welfare objectives of the government.

Some countries such as Japan[71], use the carbon tax revenues to promote low carbon technologies, improve energy efficiency and encourage the use of renewable energy. Others like Ireland use the tax revenues for the general budget so as to have the flexibility to use the revenues and prevent any additional increase in labor taxes. Denmark uses a mixed approach to revenue use in which the carbon tax revenues have been used both to reduce taxes on labor and subsidize energy efficiency investments.

Carbon tax can raise significant revenues, depending on how comprehensively it is implemented. Ian Parry and others (2017) estimate that a carbon tax of USD$35 per tonne of CO2 emissions levied by India in phases from 2017 to 2030 can yield a revenue of more than 2% of GDP[72]. Effective and properly targeted utilization of revenues is crucial for achieving the goal of reducing carbon emissions.

At present, the Government of India is committed to utilizing the revenues from cess on coal for compensating the states for any revenue losses under GST until the year 2022. Gradual increase in the tax burden in line with the suggestions given under the "Rate of carbon tax" section in the paper will help augment revenues that can be utilized for mitigating the carbon emissions. The GST Council, while deliberating on the application of cess on polluting fuels under the GST framework may also recommend sharing of carbon tax revenues with the states.

The revenues from carbon tax could be utilized for environment purposes such as:

- Promoting research and deployment of clean coal technologies
- Supporting renewable energy projects
- Augmenting natural gas production and distribution
- Incentivizing a shift from more polluting fuels to less polluting fuels by subsidizing cleaner fuels
- Mitigating the regressive impact of carbon tax

This paper focuses on the design of carbon tax in India and does not dwell on the details of utilization of revenues

Carbon tax: Distributional impact

The use of environmental taxes is often controversial because of their regressive nature and the concern that they may disproportionately fall on the vulnerable groups such as low income families or people in the disadvantaged regions. Even the taxes that are, on the face of it, levied on producers are often passed on to consumers in the form of higher prices.

In other jurisdictions, the distributional impact is addressed through various measures such as:

- Tax exemptions and reductions directly eliminate or reduce the amount of carbon tax paid by the entity liable to tax
- Support measures, such as output-based rebates, support programs and other subsidies reduce taxpayers' overall financial burden on account of the carbon tax
- Personal income tax reliefs or higher direct subsidy transfers to the poorer households can provide relief
- Reducing carbon emissions may also affect workers in energy-intensive industries. Phasing-in the policies according to a clear timetable and helping workers to retrain or move to other forms of employment, are examples of measures that can help to smooth the transition to a low-carbon economy

71. Partnership for Market Readiness (PMR) 2017. Carbon Tax Guide: A Handbook for Policy Makers. World Bank, Washington, DC.
72. However, while considering these estimates, one would have to provide for reduced use of polluting fuels and the greater use of cleaner fuels over the years, particularly after the implementation of carbon tax.

The following table provides an overview of the measures taken by select jurisdictions to address the distributional impact of carbon taxes. India could derive some lessons from these experiences.

Overview of measures to address leakage and distributional risks					
		Measure	Pros	Cons	Examples
Measures addressing leakage and distributional risks	Reducing carbon tax payments	Exemptions	Relatively straightforward to implement Can be directly targeted at affected industries Unlikely to present legal challenges Can be made contingent upon emission reduction agreements	Negate price signal of tax Difficult to determine appropriate level and extent ex ante Risk of domestic legal challenge from nonexempt industries Loss of tax revenue Contrary to polluter pays principle	British Columbia, Japan, South Africa, Switzerland
		Reduced rates			Sweden, France
		Rebates on carbon tax payments			Denmark, Ireland, Finland
		Offsets	Incentive for emission reductions in uncovered sectors Incentivize private investment in emission reductions	Administratively complex Reduced tax revenues Environmental integrity challenges	Mexico, South Africa
	Support measures	Output-based rebates	Retain price signal Strong leakage protection	High and uncertain costs to public budget Significant data requirements reduce incentive to shift to other products	Sweden NOx tax
		Support programs	Retain price signal and offer additional emission reduction incentive Popular with industry groups Flexible in design, as can take the form of grants of tax credits, loans, guarantees etc.	Costly to public budget (though often less than exemptions) May present challenges as far as complying with state aid rules is concerned	South Africa, Australia, Ireland, Switzerland, Japan
		(Non-carbon) tax reductions	Retain price signal Potential for net positive effect on business and economy	Cost to public budget Difficult to target directly at affected entities	British Columbia, France
		Flat payments	Retain price signal Simple for citizens to claim Popular with general public Potential for net positive social and economic benefits	Cost to public budget	

Overview of measures to address leakage and distributional risks

		Measure	Pros	Cons	Examples
Measures addressing leakage only	Border adjustments and consumption based taxation	Border carbon tax adjustments	Maintain price signal for domestic industry Prevent free-riding by companies from nontaxed jurisdictions Do not put pressure on public budgets	Politically unpopular internationally and risk damaging international relations Administratively challenging Potential negative economic impacts on importers May be challenged as trade barrier under WTO or other trade law, though well designed measures can likely be defended	California ETS
	Tax coordinating measures	Tax- coordinating measures	Retains domestic price signal Leverages domestic carbon price to encourage carbon pricing in partner jurisdictions No domestic administration needs	Difficult to negotiate across many countries, so may be unworkable for sectors with large numbers of international competitors	None

Annexures

Annexure I: Methods of calculating emissions

Scope/ Tier I formula is employed when detailed information on the break-up of fuel's heat or carbon content by volume is not available. This is the most basic calculation and due to the data used in calculation of scope I emissions, it is technology independent and represent averaged values of emissions.

Tier I

Emissions = Fuel * EF

Where, Emissions = Mass of CO_2, CH_4, or N_2O emitted

Fuel = Mass or volume of fuel combusted

EF = CO_2, CH_4, or N_2O emission factor per unit mass or volume

Emissions = Activity Data * Emissions Factor

(Fuel) (Volume of fuel) (Carbon Emitted per unit of fuel by Combustion)

Tier II formula requires refined or high level data, i.e., volume of fuel used by actual heat content of the individual fuel as against default values used in Scope I. For instance, to estimate the emissions from coal, national/domestic values of emissions factor would be required for all the fuels used in a country. For this method to be applied the data on volume of coal used by calorific values would be required.

Tier II

Emissions= Fuel * Higher Heating Value * Emission factor

Where, Emissions= Mass of CO_2, N_2O or CH_4 emitted by a fuel;

Fuel= Mass or volume of fuel combusted;

HHV= Higher Heating Value, fuel heat content in units of energy per mass or volume of fuel

EF= Emission factor, CO_2, N_2O or CH_4 emission factor energy per unit

For **Tier III,** formula can be further refined as follows:

Tier III

Emissions= Fuel * CC * 44/12

Where Emissions= Mass of CO_2 emitted;

CC= Fuel carbon content in units of mass of carbon per mass or volume of fuel;

44/12= Ratio of molecular weights of Carbon Dioxide (CO_2) and Carbon

For the purposes of calculation in this chapter, Tier1 formula has been considered for estimating carbon emissions. The choice has been driven by the following factors:

- Availability of reliable data and ease of computations

This formula is used for national carbon accounting by USA, UK and Australia and recommended by UNFCCC for calculation of national inventories of CO_2.

Annexure II: Emissions Factors

S.No.	Fuel	Emission factors (KgCO_2/tonne)	Source
1	Motor spirit	3,105	Economic Survey 2014-15
2	Diesel (HSD, LDO)	3,210	Economic Survey 2014-15
3	Coal (Lignite, Coking Coal, Domestic Coal)	1,782	Economic Survey 2014-15
4	LPG	2,940	UK GHG[73] emission calculator
5	Naphtha	3,143	UK GHG emission calculator
6	SKO	3,165	UK GHG emission calculator
7	Furnace oil	3,227	UK GHG emission calculator
8	LSHS	3,470	UK GHG emission calculator
9	ATF	3,181	UK GHG emission calculator
10	Natural gas	2,808.8	UK GHG emission calculator
11	Bitumen	3,165	UK GHG emission calculator
12	Lubes and greases	3,165	UK GHG emission calculator

73. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2017

Annexure III: Methodology of calculating Social Cost of Carbon by Interagency Working Group, US

Integrated Assessment Models (IAM)

IAWG employs three IAMs to arrive at an average value of SCC. Three models are:

- DICE (Dynamic Integrated Climate and Economy Model)
- PAGE (Policy and Analysis of Greenhouse Effect)
- FUND (Climate Framework for Uncertainty, Negotiation and Development)

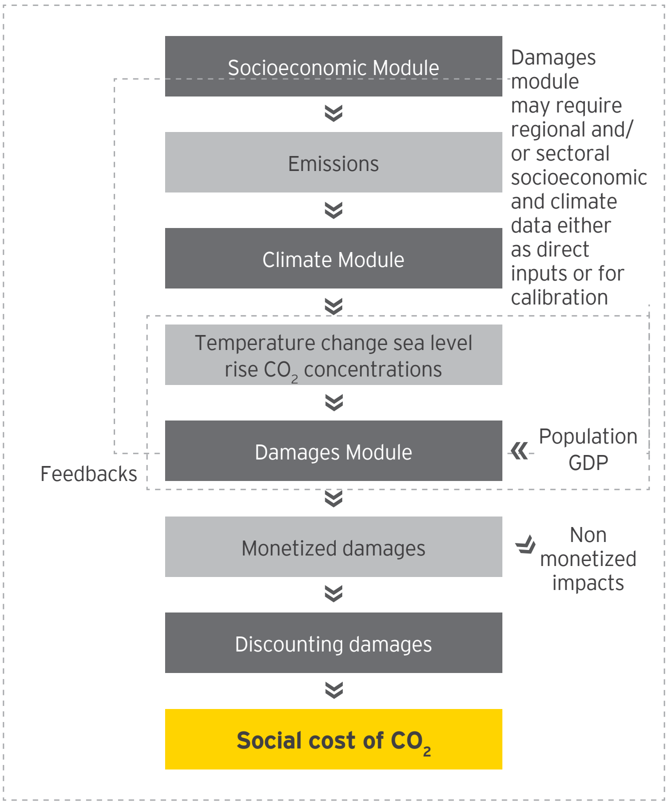
The models differ in their initial assumptions, data used, mathematical models and approaches applied to translate temperature changes into economic damages. The key similarity of the three models is that they are relatively simpler compared to the myriad other climate damage models available and are relatively easier to comprehend. These models[74], translate changes in atmospheric greenhouse gas concentrations into temperature changes. Thereafter, the models estimate the impact of temperature changes on economic damages in terms of global and regional GDPs.

IAMs[75] use four modules or steps for estimation

- Socio economic module
- Climate module
- Damages module
- Discounting

Figure illustrates how each of the modules are used for computing the Social Cost of Carbon.

Socio economic module: This module estimates the population growth and economic parameters such as the GDP growth. Based on these estimates, future emissions are calculated. The estimates for emissions are used to compute the baseline climate trajectory. The baseline trajectory of emissions influences the response of the climate to a pulse of CO_2 emissions. Population and GDP estimates are also used as direct inputs for the subsequent modules.



74. Nordhaus, William, Boyer, Joseph. Roll the DICE Again: Economic Models of Global Warming. Chapter 4. Yale University. 25 October 1999.
75. National Academies of Sciences, Engineering and Medicine. 2017. Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press. doi: https://doi.org/ 10.17226/24651.

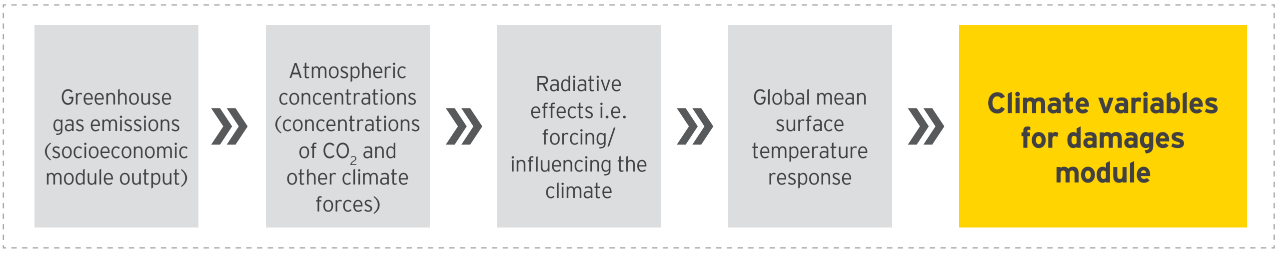


Figure: Climate module translates the following into the successive stages

Climate module: The climate module uses the outputs of the socioeconomic module such as the CO_2 emissions and other climate influencing/forcing agents and estimates their effect on physical climate variables such as temperature, precipitation, humidity, etc., over a period of time.

It is therefore important that the climate module accurately represents within a probabilistic context the current understanding of the climate and carbon cycle systems and the associated uncertainties. As mentioned earlier there is subjectivity involved in translating the impacts of climate change. Simple earth system models are used to translate the emissions and other variables into physical responses. Some of the key metrics used in the process are ECS[76] (Equilibrium climate sensitivity), TCR[77](Transient climate response), TCRE[78](Transient climate response to emissions) and IPT[79](Initial pulse timescale)

Damages module: The damages module estimates the physical impacts and, if possible, monetized damages based on the socio-economic variables (e.g., income and population) and physical climatic variables (e.g., changes in temperature and sea level) as estimated in previous modules. The Integrated assessment models for calculating social cost of carbon (SCIAMs) include damage representations that are either simple and global (e.g., global damages as a function of global mean temperature and gross world product), or are regionally disaggregated for a particular sector (e.g., agricultural damages as a function of regional temperature, precipitation change, CO_2 concentrations and the economic value added or GDP of relevant sectors or regions).

Discounting module: The discounting module estimates the present value of the future stream of monetized damage estimates through the use of a suitable discount rate. Since the impact of CO_2 emissions in any particular year would persists for years to come, the value of avoiding those impacts depends on how much society discounts those future impacts. Due to the power of compounding, small differences in the discount rate can have large impacts on the estimated value of SC-CO_2.

76. Equilibrium climate sensitivity (ECS) measures the long-term response of global mean temperature to a fixed forcing, conventionally taken as an instantaneous doubling of CO_2 concentrations from their preindustrial levels.

77. Transient climate response (TCR) measures the transient response of global mean temperature to a gradually increasing forcing. It is measured on a shorter time frame

78. Transient climate response to emissions (TCRE) measures (on a similar time-scale as TCR) the ratio of warming to cumulative CO2 emissions. Although TCRE has become a widely used metric over the past decade, it has a shorter history

79. Initial pulse-adjustment timescale (IPT) has only recently been a focus of research and does not have a standard name or definition, but it may be of considerable importance for estimates of the SC-CO_2, which are driven by the injection of a pulse emission of CO2. It measures the initial adjustment timescale of the temperature response to a pulse emission of CO_2

Annexure IV: Current taxes on fuels

Taxes on Fuels within the GST ambit

S.No.	Particulars		Customs			GST		Any applicable cesses
			Basic Customs Duty	Additional Customs Duty (CVD)	Additional Customs Duty	CGST	SGST	Nil
1	LPG	Domestic	Nil	5%	-	2.5%	2.5%	Nil
		Non-Domestic	5%	18%	-	9%	9%	Nil
2	Kerosene	PDS	Nil	5%	-	2.5%	2.5%	Nil
		Non-PDS	5%	18%	-	9%	9%	Nil
3	Naphtha	Fertilizer	Nil	18%	-	9%	9%	Nil
		Non-fertilizer	5%	18%	-	9%	9%	Nil
4	Furnace oil	Fertilizer	Nil	18%	-	9%	9%	Nil
		Non-fertilizer	5%	18%	-	9%	9%	Nil
5	Low sulphur heavy stock/ and other residues	Non-fertilizer	5%	18%	-	9%	9%	Nil
		Fertilizer	5%	18%	-	9%	9%	Nil
6	Bitumen and asphalt		5%	18%	-	9%	9%	Nil
7	Lube oil/ Greases		5%	18%	-	9%	9%	Nil
8	Petroleum coke		2.5%	18%	-	2.5%	2.5%	Nil
9	Coal		10%	18%	-	2.5%	2.5%	GST Compensation Cess @ INR 400/ tonne

Note: In addition to the above; 2% education cess and 1% secondary and higher education cess is applicable on the customs duty.

74. Nordhaus, William, Boyer, Joseph. Roll the DICE Again: Economic Models of Global Warming. Chapter 4. Yale University. 25 October 1999.

75. National Academies of Sciences, Engineering and Medicine. 2017. Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press. doi: https://doi.org/ 10.17226/24651.

Note: Cess rates:

1. Motor vehicles that are electrical operated and hydrogen based and of capacity not exceeding 1200cc and length less than 4000mm: Nil
2. Motor vehicles of capacity not exceeding 1200cc and length not exceeding 4000mm
   - Driven on petrol : 1%
   - Driven on diesel : 3%
3. Motor vehicles of capacity exceeding 1200cc and length exceeding 4000mm
   - Driven in combination or driven in diesel: 15%
4. Motor vehicles of capacity between 1200cc and 1500cc: 17%
   - All vehicles attract 17% rate
5. Motor vehicles of capacity greater than 1500cc: 20%
   - SUVs: 22%
   - Motorcycles having capacity greater than 350cc: 3%
   - Aircrafts for personal use: 3%
   - Yachts and other vehicles for pleasure or sport: 3%

S.No.	Particulars		Customs			Central Excise			VAT*
			BCD	Additional Customs Duty (CVD)	Additional Customs Duty	Basic CENVAT Duty	Special Additional Excise Duty	Additional Excise Duty	
1	Crude Petroleum		Nil + INR 50/MT as NCCD	Nil	-	Nil + Cess @20% +INR 50/MT as NCCD	-	-	Nil to 5%
2	Petrol	Non-branded	2.5%	INR 6.48/ltr + Rs 7/ltr SAD	INR 6/ltr	INR 6.48/ ltr	INR 7/ltr	INR 6/ltr	Nil - 42.71%
		Branded	2.5%	INR 7.66/ltr + INR 7/ltr SAD	INR 6/ltr	INR 7.66/ ltr	INR 7/ltr	INR 6/ltr	
3	High Speed Diesel	Non-branded	2.5%	INR 8.33/ltr +INR 1.00 /ltr	INR 6/ltr	INR 8.33/ ltr	INR 1/ltr	INR 6/ltr	Nil to 30.71%
		Branded	2.5%	INR 10.69/ltr +INR 1/ ltr	INR 6/ltr	INR 10.69/ ltr	INR 1/ltr	INR 6/ltr	
4	Aviation Turbine Fuel		Nil	14%[1]					Nil to 38%
5	Liquefied Natural Gas		2.5%	Nil					Nil to 25%
6	Natural gas	Gaseous	5%	Nil					Nil to 25%
		Compressed	5%	14%					

Notes: 1: BCD is 8% for the supply to scheduled commuter airlines (SCA) from Regional Connectivity Scheme (RCS) . In addition to the above; cess @ 2% Education cess and 1% Secondary and Higher education cess is applicable on the customs duty *VAT rates pertain to December 2017

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