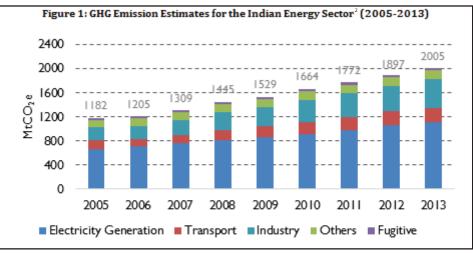**P O L I C Y   N O T E**

Background

Through India's Intended Nationally Determined Contributions (INDC) commitment, the government of India envisaged a target to reduce the emissions intensity of Gross Domestic Product (GDP) by 33 to 35 per cent by 2030, from 2005 levels, using low carbon emission strategies. In this context, it is important to create a Green House Gas (GHG) emission inventory every year, which will assist policy makers to develop plans and strategies by monitoring sectoral progress towards emissions reduction.

According to official estimates published by Ministry of Environment, Forest and Climate Change (MoEFCC), in 2010, energy sector contributed more than 80% of the total emissions (including Land Use Land Use Change and Forestry)[1]. As per the structure formulated by Inter-governmental Panel on Climate Change (IPCC), energy sector emissions take into account emissions from electricity generation, industrial energy use, transport, fugitive (fuel production) and other sectors (residential, commercial, agriculture/fisheries). Each sub-sector is further divided into multiple divisions based on the activities within the sector. Typically, these activities are classified based on fuel consumption and other metrics that are dependent on the sub-sector; i.e., transport mode (road, railways, aviation and water navigation), service based fuel usage (lighting and cooking,). Owing to paucity of data, in this exercise,h CSTEP estimates are based on the fuel combusted in each sub-sector. The methodology employs a combination of Tier I and Tier II approach to estimate the amount of fuel utilised in each activity/fuel, which is further multiplied with emission factors (fuel/activity

based) to derive emissions estimates (refer Figure 1). The GHG inventory period is noted to be 2005 to 2013.

Data gaps and observations towards building a robust dataset

The data used in estimating GHG emissions for the energy sector were obtained from reports and documents published by government ministries/agencies, secondary literature (journals and reports) and expert solicitation. The government agencies started publishing detailed sector wise activity data in the desired format only recently (2013-14). Typically, the household level activities are published either on a decadal basis using Census survey or through a sample survey by the Ministry of Statistics and Programme Implementation (MoSPI). However, it is important to note that the periodicities of these surveys are inconsistent and lacks uniformity in time interval. Therefore, these factors may lead to gaps in availability of data required to calculate emissions from fuel combustion. Depending on the nature of identified gaps, CSTEP calculations employed a range of statistical methods to bridge the gap. These methods include linear interpolation and extrapolation, fuel elasticity to sectoral growth and proxy variables that mimics consumption trends.

The accuracy of emission estimates will be low depending on the number of instances where aforementioned methods are applied over a large example, the latest household fuel consumption data published by National Sample Survey Office (NSSO) covers the consumptive pattern for 2011-12, but

Figure 1: GHG Emission Estimates for the Indian Energy Sector[2] (2005-2013)

1. Energy – 1510 MtCO$_2$e; Total (including LULUCF) – 1884 MtCO$_2$e (http://unfccc.int/resource/docs/natc/indbur1.pdf)
2. Industrial energy emissions estimated by CEEW are derived using data extraction application

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POLICY NOTE

there is no information of this data for the past 5 years. The cumulative annual growth rate (CAGR) of the fuel consumption data was calculated from the previous two survey rounds to bridge this gap. Similarly, the population data considered in the Census and survey data do not match with each other- thereby increasing the chances for errors in final estimation.

Typically, CSTEP estimates rely heavily on statistical reports published by Ministry of Coal (Provisional Coal Statistics) and Ministry of Petroleum and Natural Gas (MoPNG). Fossil fuel consumption is generally provided in aggregate national or sectoral values. For instance, sector wise diesel consumption through retail sales are not segregated in any reports, making it difficult to allocate the retail sales to road transport, tractors, agricultural pump sets, fishing boats, and Diesel Generator (DG) sets used in residential and commercial sectors. Based on the survey conducted by Nielsen, for Petroleum Planning Analysis Cell (PPAC)[3] , the share of diesel consumed in road and agricultural sector in 2011-12 was obtained, to reflect emissions due to diesel consumption in residential and commercial sector. In addition, using other secondary literature, the share of diesel in the various sectors was calculated and the emissions were estimated. It is important to note that activity data generated is validated using other publications to ensure that the resultant values are within the acceptable norms.

Though fisheries sector is a minor contributor in the overall emissions from energy sector, it is imperative to accurately estimate its contribution. This will assist policy makers to devise strategies accordingly. Nonetheless, there is no account of the total quantity of diesel and kerosene utilised by fishing fleets in India. Discussions with experts revealed that the quantity of the subsidised kerosene supplied to the fisheries sector varies in each state, as it is usually allocated only after fulfilling the needs from households in the jurisdiction. And, there is no accounting or monitoring practices implemented to compute the quantity of non-subsidised kerosene and diesel consumed by these boats or any other sub-sector.

A summary of all the sector level data sources employed to create a robust dataset is tabulated in Table 1. It represents key data sources, collection mechanisms and periodicity at which the data is published.

As indicated, a bottom-up approach across several sub-sectors is needed to prepare a robust dataset for estimating reliable emissions inventory. Based on CSTEP's experience in building a robust activity dataset, key recommendations are provided that can help designated agencies prepare a time-series activity data.

Recommendations

- The emission factors for all fuels and gases (mainly CO_2, CH_4 and N_2O) must be updated

Sub-sector	Data source	Collection mechanism	Periodicity
Electricity Generation	Central Electricity Authority (CEA) General Review	Published data from CEA website (Hard Copies)	Once in a year (except for 2011-12)
Transport	Reports and studies published by Petroleum Planning and Analysis Cell (PPAC)	Online reports	Published only once (2013)
	Indian Petroleum and Natural Gas Statistics published by MoPNG	Online reports	Once in a year
Others – Residential, Commercial, Agriculture/Fisheries	NSSO Consumer Expenditure (Type 2) Reports and Raw Data for rounds (61, 62, 63, 64, 66 and 68)	Report (Hard Copies) for 62, 63, 64; Soft copies of raw data in CD for 61, 66 and 68th round	Thick rounds[4] published for survey conducted in 2004-05, 2009-10, 2011-12 Thin rounds published in 2005-06, 2006-07, 2007-08
	Indian Petroleum and Natural Gas Statistics published by MoPNG	Online reports	Once in a year
Fugitive – Solid Fuels	Provisional Coal Statistics report published by Ministry of Coal (MoC)	Online reports from MoC	Once in a year
Fugitive – Oil and Natural Gas	Petroleum Planning and Analysis Cell (PPAC) published by MoPNG	Online reports	Once in a year

3. http://ppac.org.in/WriteReadData/Reports/20141110329450069740AllIndiaStudyonSectoralDemandofDiesel.pdf
4. Thick rounds consider a larger number of sample data as compared to thin rounds

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periodically based on the nature of mining and extraction, in addition to the geographical conditions – given the importance of the climate change programmes in India.

• Central Electricity Authority (CEA) should publish the General Review books every year and an electronic copy shall be maintained for ease of access and use.

• Mode wise (two-wheelers, cars, buses) fuel consumption data in the transport sector should be recorded by government agencies each year, as transport is recognised as a significant consumer of hydrocarbons.

• NSSO shall maintain uniform time gap between the survey rounds of the same theme and the survey frequency should be increased, as it provides data that showcases the progress of households towards inclusivity and energy transition pathways.

• Survey programmes should be converted to electronic formats from the traditional manual data entry. This will help organisations to process and publish the data in a shorter time period.

• State agencies shall maintain a monthly record on the capacity and quantity of fuel consumed by the generator sets used in household and commercial space. As India aspires to be the leader in fossil-free energy generation, it is important to elucidate the progress on decarbonisation in every sub-sector.

• Sale of Piped Natural Gas (PNG) in domestic and commercial sector can be published on an annual basis to illustrate the transparency of government bodies working towards provision of 100% energy access across the country.

• Activity wise diesel consumption in agricultural sector (tractors, agricultural pump sets) should be recorded and published every year. This can project the developmental accomplishments in the sector, which is still considered to be the backbone of the economy, and identify further opportunities. Fisheries department should mandatorily record the quantity of fuel consumed by fishing boats, on a monthly basis. Government agencies should publish the activity data in calendar year apart from the financial year format. This is important as the climate targets (NDC) communicated adhere to calendar year format.

The Government of India has proposed to develop a National Inventory Management System (NIMS) to develop high quality emission inventory that sets the foundation for determining Nationally Appropriate Mitigation Actions (NAMA) and robust Measurement, Reporting and Verification (MRV) mechanisms for a country. It will include historic emissions, datasets and methodology used for estimating emissions, uncertainties and improvements associated with emissions inventory. A robust NIMS includes 3 major committees:

a. A technical committee covering all sectors formulated by IPCC, in charge of preparing reports towards UNFCCC submission showcasing the status

b. A coordination committee that acts as an interface between the technical and review committee, towards seamless coordination and compilation of reports in desired format

c. A review committee which reviews and approves the final reports. The technical team will be responsible in updating the data and the time series inventory based on the availability of data.

Since the industrial and commercial facilities provide realisable GHG abatement opportunities, a mandatory reporting structure should be introduced for businesses that produce emissions above a defined threshold. These data should be made available in public domain annually at the national, state and industry level, in accordance with the Tier III data suggested by IPCC. It is important to note that a similar mechanism has already been introduced countries like Australia (2007) to increase the reliability and accuracy of emissions inventory using plant-level data[5].

Conclusion

The accuracy and transparency in data used to estimate GHG emissions are very critical factors while creating a country-wide time series emissions inventory. To ensure the same, the sub-sectoral activity data should be published in public domain help designated agencies prepare a time-series activity data.

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5. http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/how-inventory-works

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