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Greenhouse Gases Emission Estimates for the Informal Manufacturing Industry of India

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About CEEW

The Council on Energy, Environment and Water (CEEW) is one of South Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with wider public.

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Tirtha is working closely with the GHG Platform India, developing an inventory of greenhouse gas emissions from the industrial sector and analysing the key underlying drivers for facilitating a policy dialogue on India's GHG emissions profile, sources, and related policies. He has completed a dual degree from the Indian Institute of Technology (Indian School of Mines), Dhanbad, and holds an undergraduate degree in Mineral Engineering and a Masters in Mineral Resource Management.

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1. Introduction

Industrial growth, largely through manufacturing[1], plays an important role in the economic growth of a country. Manufacturing contributed 17.8 per cent to the total Gross Value Added (GVA) (at basic prices) to the Indian economy in 2015-16 at constant prices with base year 2011-12 (RBI, 2017).

The manufacturing sector in turn, comprises organised and unorganised establishments, where the former refers to units employing 10 or more workers using power and 20 or more workers without power. All establishments that fall outside of this definition form the unorganised sector. Manufacturing units belonging to the organised sector are either registered under **Factories Act, 1948** or the **Bidi and Cigar Workers Act, 1966** (Manna, 2010). These include large factories, as well as medium, small, and micro enterprises (MSMEs). Of the total 1.92 lakh units in the organised sector, around 70per cent are MSMEs (MoSPI, 2016a). Data regarding the organised sector is obtained from the Annual Survey of Industries (ASI), whereas information about the unorganised sector is collected through periodic surveys called Follow-up Establishment Surveys, conducted by the National Sample Survey Organisation (NSSO).

The terms "informal sector" and "unorganised sector" are often used interchangeably. However, official statistics such as the Indian National Accounts Statistics (NAS) refers to them as "unorganised sector". The unorganised sector in India broadly corresponds to household enterprises, nearly 95 per cent of the total enterprises (NSSO 62nd and 73rd Round).

Of the unorganised sector, approximately 17 per cent are registered under either the shop act, various choir boards, Khadi Village Industrial Corporations (KVIC), self-help groups (SHGs), other local municipal corporations or under some local boards. The remaining 83 per cent are not registered at all. These are referred to as the unincorporated sector in the NSSO surveys.

In order to understand why it is important to study the unorganised sector, let us consider, i) share of the unorganised sector in the GVA of the total manufacturing sector, ii) share of the unorganised sector in the total number of enterprises in the manufacturing sector, iii) share of the unorganised sector in employment.

Table 1: Size of the unorganised vis-à-vis the organised sector

Category	ASI (2015-16)	NSSO (2015-16)	Manufacturing (economy-wide)*
GVA	12167 INR billion^	2270 INR billion #	20648 INR billion*
Employment	13.5 million	33 million	46.5 million
No. of enterprises	0.14 million	17 million	17.1 million

^: Estimate for 2015-16 based on 2013-14 data, and expected growth witnessed in the short-run
#: CEEW estimates from simplified metrics of value added per worker, from literature
*: GVA at basic prices for 2015-16 as reported by RBI/NAD, MoSPI

Source: CEEW Analysis

In Table 1, the organised sector value-add has been estimated for 2015-16 (based on 2014-15 data) and the unorganised sector is represented by the NSSO (73rd Round) for 2015-16. What is undeniable is the share of

1 Industry and manufacturing are sometimes used interchangeably. In the way statistics are gathered and represented in India. Manufacturing is a sub-set of industry with other elements including electricity generation and supply, utilities and

the informal sector in employment and just in the number of units they constitute. However, when it comes to GVA, Table 1 highlights that the official estimates of value-add from the informal manufacturing sector (the difference between column 4 and column 2) far exceeds the value-add estimated by us using NSSO data. It is worth noting that the National Accounts Division also uses the NSSO (2010-11) to estimate informal/ unorganised manufacturing sector value-add and then applies suitable assumptions to grow the estimates. The methodology (MoSPI, 2015) is clearly different from the one we have used (based on Manna (2010)), but the estimation of GVA by the NAD also suggests that the relationship between GVA and inputs is also not retained in the process. In the absence of alternate assessments of material input and GVA, we assess fuel input (and hence emissions) using a lower estimate of the GVA from the informal sector.

The characteristics of the unorganised sector have been defined based on the 4th MSME Census, carried out in 2008-09 (DC-MSME, 2011), which collected data on around 26.1 million units[2], and other service activities. More than half the enterprises (52 per cent) are involved in manufacturing. The major manufacturing activities in the unorganised sector include manufacturing of wearing apparel and textile, food and beverages, and tobacco, leather and leather products, furniture, chemicals and chemical products, fabricated metal products and computer, electronic and optical products (CII, 2014). The main energy input for these enterprises in the unorganised sector was electricity, which constituted 48 per cent of the fuel mix. Nearly 38 per cent of the enterprises did not use any electricity and used manually operated instruments like – handlooms, weaving machines, hand-operated oil and rice mills, etc. Among other conventional fuel sources, around 5 per cent of the enterprises used oil (furnace oil, diesel, etc.), only about 2 per cent used coal, and around 2 per cent used traditional fuels such as biomass. The use of non-conventional energy was reported to be insignificant.

While the numbers may seem small, when represented as a share of the total unorganised sector, the actual number of enterprises using oil and coal is nearly 14 lakh units. However, there are no official estimates on the quantity of energy consumed in the unorganised sector. Estimated quantities of fuel and energy consumption can be arrived at, based on reported fuel expenditure (in the NSS 62nd and 73rd round).

Table 2: Energy balance for the Indian manufacturing sector (in MTOE)

Year	Coal & Lignite			Natural gas			Petroleum fuels			Electricity		
	CCO*	CEEW estimate*	NITI AAYOG*	MoPNG^	CEEW estimate*	NITI AAYOG^	MoPNG^	CEEW estimate*	NITI AAYOG^	CEA^^	CEEW estimate**	NITI AAYOG^^
2006-07	52	46	58	3	2	3	10	13	12	21	15	21
2007-08	56	62	62	4	2	3	9	15	13	23	16	23
2008-09	60	56	70	3	8	3	11	15	16	24	17	24
2009-10	66	65	75	7	8	1	12	27	14	26	18	26
2010-11	69	76	72	8	8	2	11	19	12	28	20	28
2011-12	93	80	79	11	9	3	11	21	13	30	21	30
2012-13	124	95	90	10	8	3	14	18	16	31	23	32
2013-14	135	93	101	10	18	3	13	22	16	33	21	33

*: Excludes the captive fuel consumption within the industrial sector
^: No clarity on captive fuel consumption within the industrial sector
**: Includes both grid and captive electricity consumption within the industrial sector
^^: Includes both grid and captive. However, captive consumption by the commercial sector is also included

Source: CEEW Analysis

A comparison of the energy consumption by the formal sector manufacturing industries (CEEW estimates) and the manufacturing sector as a whole - including unorganised sector (NITI Aayog) is shown in Table 2. The former is based on a bottom up aggregation of ASI data, and the latter is compiled from sector level data provided by the respective ministries. While NITI Aayog does not explicitly suggest that this includes all manufacturing, the top down assessment indicates it must be. In order to be consistent with what these

2 this also includes service sector units and the result is higher than the 17 million

sources represent, the energy supplied to the entire manufacturing sector must be greater than the energy consumed the units in the formal manufacturing. This is evident in the case of electricity. However, it is not true for the remaining fuels. This mismatch between the supply and consumption side energy further compounds the challenges in estimating energy consumption by the informal sector.

Even in the national statistics, that provide a supply side account of fuel used in various sectors, the unorganised sector is not separately estimated. A significant amount of energy sold through the open market or other private distributing agencies are reported under a category typically referred to as "Others" and this could cater to both formal and the unorganised sector.

For instance, in 2015-16, ~85 per cent of High Speed Diesel Oil (HSDO) and 45 per cent of Light Diesel Oil (LDO) supplied was through the retail channel (MoPNG, 2016-17). A survey of diesel sales at retail outlets in 2012-13, suggests that less 2 per cent of this finds its way to industry (for use in activities other than electricity generation) (Nielsen, 2013). Retail outlets are an important source of diesel for the unorganised sector. However, of the industrial diesel consumption, the share consumed by unorganised industries has not been quantified.

Similarly, it can be seen from the Coal Directory (2015-16), that 14 per cent of the total coal dispatched (around 86 million tonnes of coal) is assigned to the nebulous "Others" category (CCO, 2016). This category includes retail sales in the open market, allocation to State Nominated Agencies (SNAs) for distribution to industries without official Fuel Supply Agreements (FSAs), and other consumers (Ministry of Coal, 2017-18) (OECD, 2002). Part of the coal despatched under the "others" category is purchased by registered industrial units and some by the unorganised sector. The challenges, of apportioning fuel to the organised and unorganised categories, are immense, as there is no mechanism to track these allocations.

It is thus extremely important to estimate the energy consumed by the unorganised enterprises, if any useful policy recommendations are to be made regarding the overall energy footprint of the sectors, and the opportunities that it affords for efficiency gains and a switch to a lower carbon trajectory.

2. Methodology

Some of the approaches for measuring the informal sector are documented in the book "Measuring the Non-Observed Economy – A Handbook by OECD". This book classifies them into direct and indirect approaches. The direct approach involves measurement and recording of data on output, intermediate consumption, and changes in inventories from these informal sector establishment census or surveys. In India, the NSSO carries out periodic surveys to measure the informal economy. We have considered the two most recent surveys - NSSO 62nd Round Non-Agriculture unorganised enterprise survey for the year 2005-06 and NSSO 73rd Round Non-Agriculture un-incorporated enterprise survey for the year 2015-16. However, it is generally observed that these establishment surveys under-report data on financial transactions for various reasons. The responses from many units are based on recall rather than recorded figures and there is no verification mechanism to check and validate their responses. There is also no incentive for units to report accurate figures on account in order to retain the current opacity that exists in their tax liability.

The indirect approach, however, attempts to correct this information by using certain benchmarked proxies and estimates the activity levels of unorganised establishments. One of the most commonly used methods in the indirect approach is known as the Labour Input Method (LIM). The core assumption of this method revolves around the condition that the labour productivity for a similar industrial activity and firm size does not vary with the registration status of the enterprise. Using this method involves three steps: (i) understanding and sourcing benchmark labour productivity indices (GVA per employee) for various industrial activities and firm size from existing studies, which are in turn based on surveys; (ii) computing the employment across various industrial activities from the informal sector establishment surveys; and (iii) multiplying the values arrived at in the first two steps - i.e. employment figure with the corresponding benchmarked labour productivity indices.

The estimation of labour productivity in the informal sector relies on the follow-up surveys (FS) of the Economic Census that are carried out. The NSS 62rd Round in 2005-06 was one such FS and has been used (Manna, 2010) to estimate labour productivity in the form of Value Added per Worker (VAPW). These benchmark values are also periodically revised and subsequently interpolated for the intermediate years and could be used to extrapolate growth in VAPW overtime, with suitable factors. The labour productivity indices or Value Added per Worker (VAPW) are provided in Annexure 1.

We use the labour input method to estimate the GVA from industrial activity in the unorganised sector. For 2005-06, it is done by multiplying the benchmark VAPW values to the total employment in the establishments across the various industrial activities as recorded by these surveys (refer to Equation 1). For 2015-16, new VAPW estimates were not available in literature and the direct estimation of VAPW from the 73rd Round of the NSSO yielded extremely low estimates. We decided to apply the a historically observed growth rate in VAPW (between 2000/01 and 2005/06) to estimate the VAPW in 2015-16 (refer to Annexure 1).

Equation 1: Estimation of GVA for the informal establishments

$$GVA_{Informal,i} = VAPW_{Bench,i} * Employment_{Informal,i}$$

Where,

$GVA_{informal}$ = Estimated GVA of the informal establishment performing a certain activity i

$VAPW_{Bench}$ = Benchmarked labour productivity indices for that activity i

$Employment_{informal,i}$ = Total employment by the informal establishment for that activity i

Source: CEEW Analysis

With a GVA estimate for each sector at hand, we now attempt to estimate expenditure incurred on fuels. A majority of the informal sector establishments belong to the small and micro categories and operate at a much smaller scale of manufacturing output when compared to their bigger industrial counterparts. Our recent interactions with these units (both registered and unregistered) among various clusters in Faridabad, Agra, Firozabad, Ludhiana, Ankleswar, Tarapur, and Kolkata suggest that these units typically operate with very little or no technology and input variations for a given manufacturing activity. A limiting but useful extension of this assumption is that the ratio of fuel expenditure to GVA ratio of these units that produce similar products (or intermediates) does not vary based on the registration status of these enterprises. **In effect, we are assuming that each firm (within an industry group) has the same level of energy efficiency, since the assumption is that each firm expends the same amount of energy for every unit of value add.** The ASI survey records data from the audited balance sheets provided by the companies and can provide reliable estimates of fuel expenditure to GVA ratios of the MSMEs across the industry spectrum. By virtue of the invariance assumption made above, the same ratios of fuel expenditure to GVA can be extended to the unorganised sector as well (refer to Annexure 2).

Estimating the total fuel consumption from the informal sector involves correcting the under-reported expenditures on fuel consumption (Equation 2).

Equation 2 : Estimation of fuel expenditures by the informal establishments

$$Fuel\ Exp_{Informal,i} = \frac{\sum_i Fuel\ Exp_{ASI,MSME}}{\sum_i GVA_{ASI,MSME}} \times GVA_{Informal,i}$$

Where,

$Fuel\ Exp_{Informal,i}$ = Estimated fuel expenditure of the informal enterprise performing a certain activity i

$\sum_i Fuel\ Exp_{ASI,MSME}$ = Fuel expenditure of MSMEs in ASI performing a certain activity i

$\sum_i GVA_{ASI,MSME}$ = GVA of MSMEs in ASI performing a certain activity i

$GVA_{Informal,i}$ = New revised GVA of the informal establishments estimated through labour input method

Source: CEEW Analysis

What we now have is an estimate of total expenditure on fuels for each industry group. This still does not provide any insights on the kinds of fuels used and the emissions arising from each. However, given the variation in emission factors (for e.g., varying between 63.1 tonnes CO_2 /TJ to 107 Tonnes CO_2/TJ for various petroleum products), it is equally important to understand what fuels were potentially used in the informal sector. In order to arrive at a reasonable estimate of the quantum of different fuels consumed, and their corresponding emissions, we again turn to the MSMEs represented in the ASI. The rationale for this is the same as that used in the earlier case when estimating fuel expenditure to GVA shares – units in the informal sector are not that different when it comes to operation of the units themselves. We investigated the fuel consumption mix of MSMEs in the ASI dataset, which reported expenditure on various energy inputs in each manufacturing segment over a period of time. We used a similar (from the appropriate year) breakdown of fuel expenditure for units in the unorganised sector and thereby apportioned the overall fuel expenditure (estimated in the previous step), to various fuels. For each specific fuel type, representative price, based on

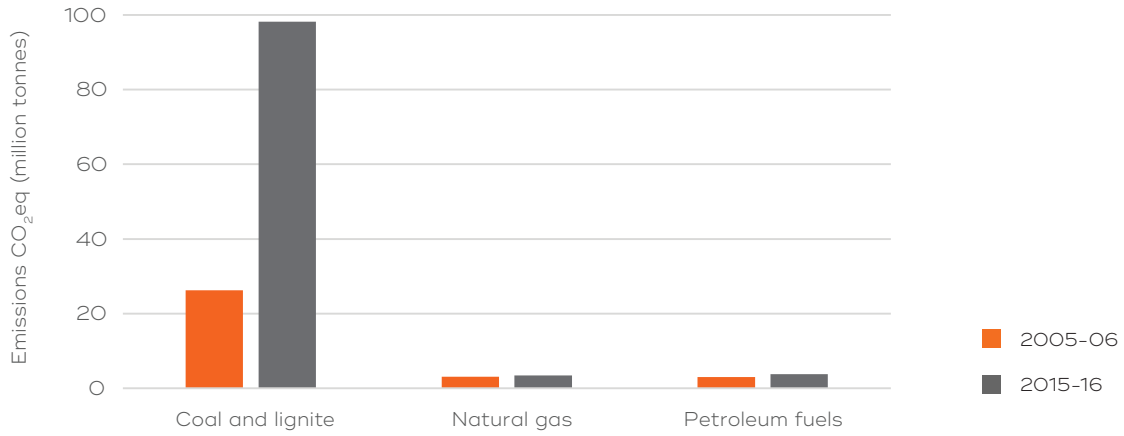
the location and industry type were used to compute the quantity of fuel consumed. In the final step, we apply appropriate (India-specific or globally-accepted) calorific values and emissions factors for each fuel type, in each industry type and arrive at an emissions estimate. It is worth noting that all emissions estimated for the informal sector comprise of fuel emissions and do not include any process emissions that may arise.

3. Results

The NSSO 62nd Round survey on Non-Agricultural unorganised enterprises and NSSO 73rd survey on Non-Agricultural unincorporated enterprises, indicate that between 2005-06 and 2015-16, the number of manufacturing establishments in the informal sector grew from ~ 11 million to ~18 million. The corresponding estimates of GHG emissions from consumption of primary energy (excluding electricity) have risen from 32 million tonnes of CO_2eq in 2005-06 to 105 million tonnes of CO_2eq in 2015-16.

Figure 1 shows that for both the years, combustion of coal was the single largest source of emissions from the informal sector - contributing more than 80 per cent of the emissions in 2004-05 and more than 90 per cent of that in 2015-16. During the period, emissions from natural gas consumption remained static. Emissions from the consumption of petroleum fuels (primarily diesel oil) showed a marginal increase from 3 $MtCO_2$eq in 2005-06 to 4 $MtCO_2$eq in 2015-16.

Figure 1: Emissions from the informal sector from combustion of various fuel types



Source: CEEW Analysis

A detailed breakdown of fuel consumption and resultant emissions for the year 2005-06 and 2015-16 is provided in Annexure 3 and Annexure 4. In 2005-06, total coal and lignite consumption in the informal sector is estimated to be ~ 14 million tonnes. The top three sectors consuming coal are manufacturing of non-metallic minerals (dominated by the brick industry) (22 per cent); finishing/dyeing of textiles (18 per cent); and manufacturing of food products (16 per cent).

A quick comparison of the coal consumption estimates arrived at by CEEW and other available national estimates for 2005-06 is presented in Table 3. Our estimate of coal consumption is a demand-side approach, which is a summation of coal consumed by formal enterprises covered in the ASI database and the remaining informal sector enterprises covered in the NSSO 62nd Round Non-Agriculture enterprise surveys. The estimates by Coal Controllers Organisation (CCO, 2016) and NITI Aayog (NITI Aayog, 2017) employ supply-side approach. On comparing these two approaches we observed that the difference between the coal consumed as reported by the entire manufacturing sector and the coal supplied to the sector ranges from 10 per cent to 15 per cent.

Table 3: Comparison of coal consumption by manufacturing sector across various approaches for 2005-06

Coal consumption – million tonnes of oil equivalent (MTOE)			
CEEW estimate		Coal Directory estimate	NITI estimate
Formal enterprises – ASI	Informal enterprises – NSSO	Formal + Informal enterprises	Economy-wide
36	7	48	51

Source: CEEW Analysis

Due to the non-availability of these data sources for the year 2015-16, we were unable to carry out a similar comparison across the different estimates.

Between 2005-06 and 2015-16 it is observed that unlike the brick industry, sectors like finishing of textiles (dyeing) and manufacturing of food products which were heavily dependent on coal have gradually shifted away from coal to other fuels which offer higher energy density or are more cost effective (refer to the tables on sector-wise fuel consumption within the informal sector in Annexures 3 and 4). Multiple interactions with the textile dyeing industries in and around the Faridabad MSME clusters also confirmed the fact that many of these units that were using coal have gradually shifted to petroleum coke due to its cheaper price and a reliable supply of consistent quality.

In 2015-16, out of the total estimated coal consumption by the unorganised sector, the contribution of brick kilns is the most significant (~ 49 per cent) at 26 million tonnes (refer to fuel consumption table for the brick industry with NIC 2008 2-digit code 23, in Annexure 4). Further, this one of the few sectors for which comparative estimates of coal consumption figures exist, given its relative importance to the energy footprint of the unorganised sector. It makes for an ideal case study to test the robustness/comprehensiveness of the methodology. Also, the variations in the estimates of fuel consumption for brick kilns highlight the data gaps and the need for a detailed assessment of the fuel consumption in the unorganised sector.

The following studies have been used for the comparison of the brick industry:

i. "Towards cleaner brick kilns" – Shakti study (Greentech Knowledge Solutions Pvt. Ltd, 2013)
ii. "Use of biomass in brick kilns" – Ministry of New and Renewable Energy (MNRE) study (Verma & Uppal, Use of Biomass in Brick Kilns, 2013)
iii. "Brick kilns in India" – Central Pollution Control Board (CPCB) study (Kamyotra, 2015)

The three studies indicated above, estimate coal consumption by the overall brick industry - both organised and unorganised. We compare these against the estimates we arrive at, for both the organised and unorganised sector. Most of the brick units in India operate in the unorganised sector, which is corroborated by the fact that only a handful (~ 6 per cent of the total number of brick units)[3] are covered in the ASI. In 2013-14, these industries reported a total coal consumption of 0.47 million tonnes. Supply statistics indicate that the quantity of coal allocated to the entire brick industry was only to the tune 0. 077 million tonnes (Provisional Coal Statistics 2015-16). Even in the other years for which data on formal coal linkages is available, the quantum of consumption is of the same order as in 2015-16. One reason for this is likely on account of the FSAs (formal agreements to supply coal) being signed with a few players in the industry, while the bulk of the sector/ units purchase coal from the open market or through SNA distribution.

3 Assuming total number of brick industries to be around 100000 (based on the Shakti study)

Figure 2: Comparison between different studies on coal consumption in the brick industry

*: Estimates of organised sector (ASI) for 2013-14, and unorganised sector (NSSO 73rd) for 2015-16
^: Estimates are for the year 2012
**: Estimates are for the year 2015
^^: Average estimates from a range, for the year 2013

Source: CEEW Analysis

The MNRE study (2013) assumes an average coal consumption of 17.4 tonnes per one lakh bricks and using two different growth rates for brick production (6 per cent p.a. and 9 per cent p.a.), estimates the coal consumption to be in the range of 46 million tonnes and 69.1 million tonnes.

The CPCB (2015) and Greentech (2012) estimates are consistent with each other; reporting annual coal consumption by brick kilns to be around 35-40 million tonnes and 35 million tonnes respectively, albeit for different years. The CPCB study also includes biomass (in tonnes of coal equivalent) consumption by brick kilns along with coal itself. However, as per the MNRE estimates, consumption of biomass is restricted to four major northern states, and these totally consume only around 8.2 million tonnes of biomass (6.3 million tonnes of coal equivalent).

The lower estimates in our analysis (Figure 2) can be attributed to the under-reporting of employment numbers (informal employment) in the NSS 73rd Round survey. The labour-input method used by this study uses estimates for productivity of employees in the sector, along with number of people employed to estimate the total GVA from the sector. Consequently, any under-reporting in the employment numbers would lead to under-reporting of the fuel consumption values. The CPCB study estimates employment numbers by the brick industry to be between 9-10 million, whereas the employment numbers by the NSS 73rd Round are around 1.8 million. Thus, an under-estimation of over 10 million tonnes of coal consumption could be attributed to the lower reported values of employment (which reflect inputs and output). However, it is difficult to estimate what the relationship between this under-reporting and fuel consumption is likely to be.

4. Conclusion

The informal or unorganised sector contributes approximately 40 per cent of the GVA and accounts 71 per cent of the employment in the manufacturing sector. It accounts for a staggering 97 per cent of the number of industrial enterprises, and yet there are no reliable estimates of the operational parameters for these enterprises. This study has attempted to quantify the energy consumption and associated emissions of the sector, bearing in the mind the dispersed nature of the sector. The methodology used in this study is widely used in national accounts, such as for measurement of the contribution to GDP from the informal sector. The important caveat to remember in consuming these estimates, is the reliability or uncertainty associated with the reporting on employment and GVA from the various informal manufacturing units. No attempt to correct for this under-reporting has been made in this study.

There are various periodic surveys carried out by MoSPI such as the establishment surveys, employment surveys and follow up surveys of the economic census (among others), which attempt to measure different aspects of the informal sector. However, these surveys are limited in their scope; in that, they do not exhaustively cover (proportionally) all industrial sub-sectors. They are limited in their focus, and none of them record data on energy consumption comprehensively. More importantly, they lack adequate data validation processes. This calls for either an annual exercise similar to ASI to record data on the informal sector, or the integration of the multitude of existing efforts to measure the sector more accurately and frequently, which in turn will make the current national statistics more representative and reliable.

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Annexures

Annexure 1: VAPW (INR/no of employees) across different industrial activity

NIC04 at 2 digit	VAPW (2005-06)	NIC08 at 2 digit	VAPW (2015-16)	Sectoral CAGR
1	47300	1	563822	49%
15	24300	10	59725	11%
16	6800	12	6417	-1%
17	19300	13	36679	8%
18	18900	14	24208	3%
19	28700	15	42087	4%
20	13500	16	21897	5%
21	20000	17	18491	-1%
22	50000	18	108770	9%
23	37300	19	88613	11%
24	18900	20	25410	3%
25	50900	22	86701	6%
26	28300	23	87439	15%
27	103500	24	519442	25%
28	54300	25	275655	25%
29	68400	28	231250	17%
30	76200	26	185791	11%
31	49500	27	72861	4%
32	92900	26	493670	26%
33	64900	33	127518	8%
34	59500	29	111833	7%
35	46600	30	45616	0%
36	38700	31	117605	15%
37	40100	32	129665	16%

Source: (Manna, 2010)

Annexure 2: GVA to fuel expenditure ratio of MSMEs across various industrial activity as recorded by ASI 2013-14

NIC - 08 2 digit	Fuel expenditure (INR)	GVA (INR)	GVA/Fuel expenditure
5	40300000	125000000	3
7	1982681	4392387	2
8	402000000	4150000000	10
10	109000000000	526000000000	5
11	17600000000	1111000000000	6
12	2430000000	56200000000	23
13	1540000000000	377000000000	2
14	12800000000	2070000000000	16
15	6130000000	78800000000	13
16	3780000000	26400000000	7
17	39300000000	78600000000	2
18	4820000000	57000000000	12
19	24500000000	58600000000	2
20	1740000000000	4830000000000	3
21	30800000000	4450000000000	14
22	39000000000	2640000000000	7
23	1970000000000	2850000000000	1
24	3640000000000	3980000000000	1
25	25700000000	2720000000000	11
26	9860000000	1400000000000	14
27	19900000000	2600000000000	13
28	19000000000	3520000000000	19
29	33200000000	2540000000000	8
30	13800000000	1490000000000	11
31	1360000000	20600000000	15
32	6030000000	1100000000000	18
42	104000000	806000000	8
43	6067480	137000000	23

Annexure 3: Fuel consumption and corresponding emissions across various industrial activity within the informal sector for 2005-06

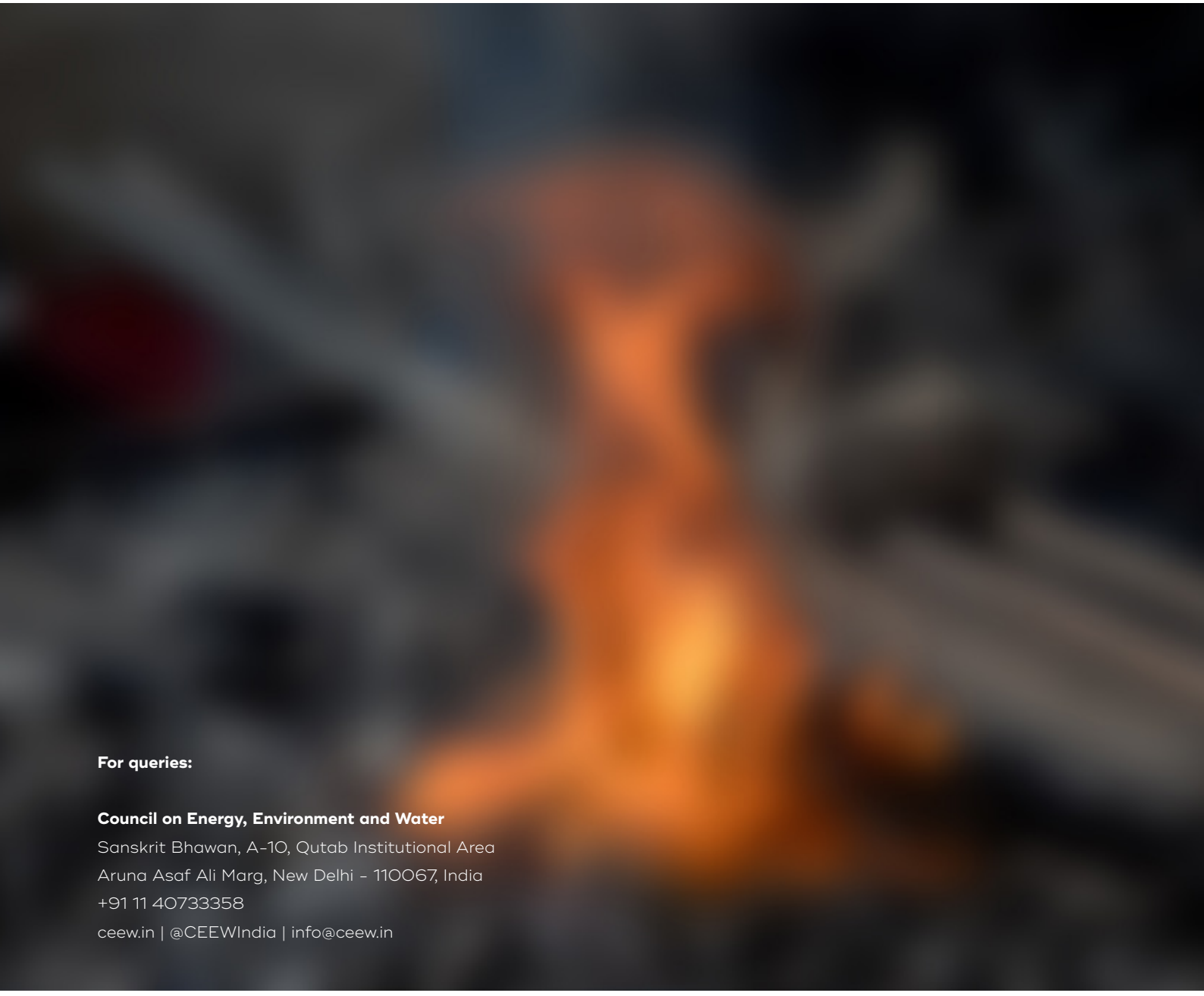
Fuel Quantity								
NIC-04 2 Digit	Coal and lignite (tonnes)	Natural gas (kg)	Diesel (kilo litres)	Furnace oil (tonnes)	LPG (kg)	Kerosene (kilo litres)	Other fuels/ Biomass (kg)	Other petroleum fuels (tonnes)
1	0	0	0	0	0	0	0	0
15	2229219	0	0	941698	0	0	0	0
16	431363	0	0	75981	0	0	0	0
17	2503597	0	0	445857	2643	26428	453816	152
18	103235	0	0	550604	0	0	0	0
19	46262	469477	0	62110	0	0	548385	0
20	603183	0	0	212085	0	0	0	0
21	492412	0	0	24982	0	13601	0	0
22	0	0	0	324568	0	0	0	0
23	130	14780	0	258	40500	0	26	103777
24	362370	514104	151	90566	228837	1115505	588546	6866
25	100965	2546	0	126579	0	0	0	0
26	3096823	1342	33	156089	0	11671	12315	0
27	1178618	0	0	28985	0	0	13683	57
28	740806	1183644	0	655577	0	0	242290	0
29	1137811	151824231	0	371420	0	0	0	0
30	0	0	0	29571	0	0	0	0
31	8048	159295	0	40167	24283	0	0	0
32	628	2376743	0	35648	0	0	0	0
33	6328	9848	0	26402	0	0	241142	0
34	13520	0	0	111685	0	0	0	0
35	13966	5668	0	26423	0	0	0	0
36	1086256	0	0	1471776	0	0	193584	0
37	0	0	0	0	0	0	0	0

Fuel Emissions (tonnes)								
NIC-04 2 Digit	Coal and lignite	Natural gas	Diesel	Furnace oil	LPG	Kerosene	Other fuels/ Biomass	Other petroleum fuels
1	0	0	0	0	0	0	0	0
15	4214020	0	0	2885	0	0	0	0
16	815401	0	0	233	0	0	0	0
17	4732526	0	0	1366	8	66706	1	0
18	181138	0	0	1687	0	0	0	0
19	87448	1402	0	190	0	0	1	0
20	1140187	0	0	650	0	0	0	0
21	930802	0	0	77	0	34331	0	0
22	0	0	0	994	0	0	0	0
23	151	311	1	1	121	0	0	500
24	683753	4538	398	277	684	2815604	1	15873
25	190853	8	0	388	0	0	0	0
26	5846979	28	87	478	0	29458	0	0
27	2263381	0	0	89	0	0	0	181
28	1403516	3190	0	2008	0	0	0	0
29	1632218	3063997	0	1138	0	0	0	0
30	0	0	0	91	0	0	0	0
31	13786	435	0	123	73	0	0	0
32	1187	49969	0	109	0	0	0	0
33	11961	27	0	81	0	0	0	0
34	25556	0	0	342	0	0	0	0
35	26401	119	0	81	0	0	0	0
36	2053340	0	0	4509	0	0	0	0
37	0	0	0	0	0	0	0	0

Annexure 4: Fuel consumption and corresponding emissions across various industrial activity within the informal sector for the year 2015-16

Fuel Quantity								
NIC-08 2 digit	Coal and lignite (tonnes)	Natural gas (kg)	Diesel (kilo litres)	Furnace oil (litres)	LPG (kg)	Kerosene (kilo litres)	Other fuel/ Biomass (kg)	Other petroleum fuels (tonnes)
10	2844156	121730914	899582	10570400	0	124	2127376080	309298
11	178442	4906873	38472	0	0	0	116607316	0
12	57071	899064	18664	0	0	0	15888294	0
13	6855498	153203540	803558	0	0	0	1204696042	785
14	137115	4141288	301257	1323309	0	0	125548153	0
15	32080	545595	42079	0	0	0	8409190	426
16	196993	278453	66868	14957	0	0	177069027	0
17	361446	687303	16636	0	919	0	77390223	0
18	55	5056036	147289	0	0	0	11850206	168
19	22836	153886391	1221	16199	6722096	0	1810221	22198
20	77357	46436219	11570	471843	227569	2439	91522825	182
21	0	306	0	0	0	0	20	0
22	199858	13283795	117650	258761	314605	0	62102557	83334
23	25780238	457304991	657164	3679859	0	70	1096530490	114388
24	14204909	112072017	322930	11868525	0	0	324738795	89958
25	498736	302926155	1099257	17340827	98591	0	582517096	1142
26	68	111479241	16762	0	0	0	262418	442542
27	6522	21917721	11946	3409058	372623	0	4652362	39330
28	152674	23413958	307730	0	0	0	63106938	513
29	3848	4033584	38193	9494	0	0	8230505	115557
30	20	314878	2050	0	19	0	1283338	18
31	88739	15620236	307799	0	0	0	197432322	0
32	283217	19296124	245410	0	17389965	0	119589631	0

Fuel Emissions (tonnes)								
NIC 2 Digit	Coal and lignite	Natural gas	Diesel	Furnace oil	LPG	Kerosene	Other fuel/ Biomass	Other petroleum fuels
10	5388491	328101	2376848	32382	0	313	3311	866720
11	343214	12675	101650	0	0	0	181	0
12	108123	2423	49312	0	0	0	25	0
13	12958883	412929	2123125	0	0	0	1875	2481
14	259186	11162	795967	4054	0	0	195	0
15	60641	1471	111180	0	0	0	13	407
16	372307	751	176675	46	0	0	276	0
17	683333	1852	43954	0	3	0	120	0
18	104	13628	389160	0	0	0	18	432
19	43593	2495	3226	50	20080	0	3	65260
20	147602	65538	30571	1445	680	6156	142	556
21	0	0	0	0	0	0	0	0
22	367894	35804	310851	793	940	0	97	233009
23	47817672	1232644	1736337	11273	0	176	1706	363110
24	27748453	302067	853233	36359	0	0	505	253039
25	952148	816744	2904408	53124	295	0	906	3499
26	128	8283	44289	0	0	0	0	1240100
27	12154	8865	31564	10444	1113	0	7	110223
28	248890	63108	813076	0	0	0	98	741
29	8311	10872	100911	29	0	0	13	310210
30	38	849	5417	0	0	0	2	56
31	167743	42101	813254	0	0	0	307	0
32	535244	52009	648411	0	51945	0	186	0



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