



Energy
Efficiency
Management
Office

FINAL REPORT

ENERGY USE AND ENERGY EFFICIENCY IN THE INDUSTRY AND SME SECTORS

SUBMITTED BY STRACONSULT LTD

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Abbreviations

CEB	Central Electricity Board
EDB	Economic Development Board
EEMO	Energy Efficiency Management Office
EUI	Energy Use Intensities
FMP	Fabricated Metal Products
HFO	Heavy Fuel Oil
ISG	Internal Steam Generation
LPG	Liquefied Petroleum Gas
MEPU	Ministry of Energy & Public Utilities
MEXA	Mauritius Export Association
PV	Photovoltaic
SMES	Small and Medium Enterprises
ToR	Terms of Reference

Executive Summary

The Energy Efficiency Management Office of the Ministry of Energy and Public Utilities launched its 2nd survey on energy use and energy efficiency in the Industry and SME Sectors in Mauritius. 241 enterprises were targeted for this survey in 11 sub-sectors.

Classification of enterprises in sectors

Enterprises with a turnover of less than 50 million rupees are grouped in the SME sector while enterprises with a turnover of above 50 million rupees have been classified in the industry sector.

Leading Sources of Energy in 2015, 2016 and 2017

The leading source of energy in 2015 for the two sectors was coal followed by electricity. However, in 2016 and 2017, electricity became the leading source of energy followed by coal. Other sources of energy during the three years were diesel, heavy fuel oil (HFO), liquefied petroleum gas (LPG), and in very minimal amounts, renewable energy.

The energy needs of the SME sector were mostly met by coal in 2015 and then electricity. In 2016 and 2017, electricity became the leading energy supplier while the contribution of coal went down substantially and became negligible in 2017. Diesel, HFO, LPG and renewable energy were other energy suppliers to the SME sector during the period.

The industry sector obtained most of its energy from coal in 2015 followed by electricity. In 2016 and 2017, electricity became the leading energy supplier to the sector with coal as the second most important source. Other energy sources were diesel, HFO, LPG and renewable energy.

Leading Energy End User

The leading end user of energy for the two sectors combined was internal steam generation (ISG) during the three years followed by electric motors. Other important end users were process heat, external steam generation, and compressed air/vacuum. When taken separately, the foremost end user of

energy in the SME sector in 2015 was ISG, followed by electric motors, process heat, and cooking/baking. Electric motors were the biggest end user in 2016 and 2017 with next in line being process heat and cooking/baking. The importance of ISG declined further in 2017 when it was the seventh largest end user. For the industry sector, the biggest end user of energy was ISG during the three years. In decreasing order of energy consumption, the next end users were electric motors, process heat, and external steam generation.

End Use of Energy

End use of energy was analyzed for ten different subsectors of the SME and industry sectors namely bakery, beverages, chemicals and chemical products, construction, fabricated metal products (FMP), food products, plastic products, paper and paper products, printing and textiles.

SME Sector

The findings on characteristics of each subsector within the SME sector are listed below:

- ***Bakery***: Cooking/baking was the biggest end energy user followed by electric motors.
- ***Beverages***: Water boiling was by far the largest consumer of energy with next largest being electric motors.
- ***Chemical and Chemical Products***: ISG was the most important energy user followed by electric motors and air conditioners.
- ***Construction and Fabricated Metal Products***: Process heat was the dominant end energy user with electric motors as the next biggest.
- ***Food products***: This subsector had many end energy users with the most important being negative cold room and electric motors.
- ***Paper and paper products***: The dominant end energy users were electric motors with next in line being air conditioners.
- ***Printing***: Electric motors consumed the biggest share of energy with air conditioners taking in next the biggest share.
- ***Textiles***: In 2015, ISG was the biggest energy user followed by electric motors. In 2015 and 2017, electric motors consumed the highest amount of energy followed by ISG.

Industry Sector

The findings on characteristics of each subsector within the industry sector are given below:

- **Beverages:** ISG was by far the biggest end energy user with electric motors as the next biggest user.
- **Chemicals and Chemical Products, Construction, and FMP:** For the three subsectors, the highest share of energy was consumed by process heat with the next biggest share taken in by electric motors.
- **Food Products:** Electric motors followed by adsorption chillers utilized the largest amount of energy.
- **Paper Products:** The biggest end energy user were electric motors with next in line being direct heating.
- **Printing:** Electric motors were the biggest energy consumer followed by air conditioners.
- **Textiles:** The highest share of energy was utilized for ISG with next in line being electric motors.

Energy Unit Intensity (EUI)

The energy unit intensity (EUI) is defined as energy consumed by a firm divided by product output or by floor area. The EUI by product output in kWh per production output was calculated separately for electricity, fossil fuels and total energy for all firms in the two sectors. The EUI per built up area in kWh/square meters was also calculated separately for electricity, fossil fuels and total energy for all firms in the two sectors. The different EUI values for all firms have been tabulated.

The EUIs for electricity, fossil fuels, and total energy within each subsector were analyzed to find patterns in consumption. When there were four or more firms within one subsector, regression analysis was undertaken to find relationships between EUIs and quantity of products.

1 Introduction

1.1 Background

One of the visions of the Ministry of Energy and Public Utilities (MEPU) is to ensure energy security, and one of its missions is to develop programs for the promotion of energy efficiency. The Energy Efficiency Management Office (EEMO), operating under the aegis of MEPU, has among its objectives the promotion of awareness for the efficient use of energy as a means to reduce carbon emissions and protect the environment. The functions of the EEMO are in particular to implement strategies and programmes for the efficient use of energy, establish links with regional and international institutions and participate in programmes pertaining to the efficient use of energy.

In line with the above, the EEMO retained the services of StraConsult, a Consulting firm, to undertake a survey on energy use and energy efficiency in the industry and SME sectors to address gaps in knowledge on energy consumption. The gaps include the lack of disaggregated data to enable the calculation of energy use intensities, and to determine whether energy is being used efficiently. Further, though total energy consumption in the industrial sector is available, it is not broken down in different subsectors such as food processing and textiles. There is also a lack of knowledge on the end use of energy in the sector e.g. electricity or thermal use.

The rise in the number of small and medium enterprises (SMEs), defined as those enterprises having a turnover of less fifty million rupees, is having an incidence on energy use in the country. However, due to unavailability of data, the impact of SMEs on energy consumption cannot be quantified, which, in turn results in a lack of data for planning purposes.

Initiatives taken by Government of Mauritius

For more than 15 years, the Government of Mauritius through its budgetary measures has been providing continuous supportive measures to enhance a well-structured Sustainability Plan for Energy Efficiency for the country.

The Budget Speech 2014 stated Electricity as '***an expensive commodity for both the state and for the consumer***' with a dependency on imported fossil fuels. To respond to the increasing demand for electricity, the Government has, through various budgetary measures, provided the following support:-

1. Grant on Solar water system for consumers
2. Installation of Photovoltaic
3. Construction of a new power plant of 30 megawatts
4. Assistance to small hotels and restaurants with turnover of less than Rs 10 million to hire consultancy services on renovation and energy efficiency
5. Development of energy standards and energy efficiency labeling for electrical appliances
6. Modulated taxation to promote the use of energy efficient appliances
7. Penalty of 25% on Energy inefficient appliances
8. The carrying-out of energy audits in public buildings
9. Investments in solar and wind projects
10. Implementation of a Solid Waste Management
11. Introduction of Biomass Development Scheme
12. Setting-up of Mauritius Renewable Energy Agency
13. SME Scheme provides support for investment in solar and other renewable energy
14. Increase grid absorption capacity from 148 to 160MW
15. No VAT on Photovoltaic Inverters and batteries
16. Wind Power generation at Bigara

1.2 Definition of SMEs & their contribution in the Mauritian economy

*SMEDA Act 2009*¹ classifies SMEs as:-

- a. Micro-enterprise is defined as an enterprise with an annual turnover not exceeding Rs 2M
- b. Small enterprise is an enterprise having an annual turnover of not more than Rs 10M and
- c. Medium enterprise is classified as an enterprise doing an annual turnover of more than Rs 10M but not exceeding Rs 50M

It is estimated that 108,000 SMEs are registered in Mauritius with a contribution of 40% in the GDP and 50% in employment rate.²

A research carried out by the World Bank in September 2015 stated that formal SMEs have a contribution of 33% in emerging countries' economy and contribute up to 45% in the employment rate.³

The 6th Census on Economic Activities in Small establishments for Mauritius and Rodrigues conducted in 2013 estimated that the number of small production units operating in Mauritius and Rodrigues were 125,500 compared to 92,400 in 2007. It is noted that there has been an increase of 36% of small production units between 2007 and 2013. The positive impact of this increase has resulted in the creation of 71,400 jobs and to an annual value added per unit increased by 40% compared to 2007.⁴

¹ *SMEDA Act 2009*

² *SME Master Plan & National Export Strategy 2017-2021*

³<http://www.worldbank.org/en/topic/financialsector/brief/smes-finance>

⁴ <http://statsmauritius.govmu.org/English/Publications/Pages/2013-CEA-Small.aspx>

Table 1-1 provides a detailed value added contribution per sector of activity in Small establishments for Mauritius and Rodrigues

Table 1-1: Value added Contribution per sector of activity in Small establishments for Mauritius and Rodrigues

Sector of Activity	Gross output per unit (Rs 000)	Value added per unit (Rs 000)	Intermediate consumption as a % of Gross output	Value added as a % of Gross output
Manufacturing	1,148.2	595.9	48.1	51.9
Construction	1,986.7	804.7	59.5	40.5
Wholesale and retail trade; repair of motor vehicles, motorcycles	736.9	555.2	24.7	75.3
Transportation and storage	751.4	474.6	36.8	63.2
Accommodation and food service activities	1,091.7	645.4	40.9	59.1
Information and communication	1,925.5	1,058.1	45.0	55.0
Financial and insurance activities	3,132.5	2,690.5	14.1	85.9
Real estate activities	733.3	608.8	17.0	83.0
Professional, technical and support service activities	2,338.1	1,838.9	21.3	78.7
Education	761.0	587.2	22.8	77.2
Human health and social work activities	1,045.9	782.4	25.2	74.8
Arts, entertainment and recreation	2,373.5	1,832.5	22.8	77.2
Other services	535.6	341.8	36.2	63.8

Source: Statistics Mauritius

Table 1-2: Value added contribution per sector of activity in the large industry

Industry Group	Value added as a % of Gross Output
Mining and quarrying	41.3
Manufacturing	38.6
<i>EOE</i>	37.7
<i>Non-EOE</i>	39.5
Electricity, gas, steam and air conditioning supply	25.3
Water supply: sewerage, waste management and remediation activities	59.1
Construction	34.9
Wholesale and retail trade; repair of motor vehicles and motorcycles	59.8
Wholesale trade, except for motor vehicles and motorcycles	57.7
Transportation and storage	31.7
Accommodation and food service activities	56.6
Information and communication	62.7
Financial and insurance activities	76.6
<i>Financial intermediation, except insurance</i>	82.2
<i>Insurance, reinsurance and pension funding</i>	65.0
Real estate activities	77.4
Professional, scientific and technical activities	78.9
Administrative and support service activities	59.9
Education	89.4
Human health and social work activities	72.2
Arts, entertainment and recreation	45.7
Service activities not elsewhere classified	60.7

Source: Statistics Mauritius

1.3 General Objective of the Assignment

The general objective of the assignment is to assist the EEMO in achieving the following functions, necessary to attain its objectives, with respect to the transport, industrial and SME sectors:

- (i) Collect and maintain data on energy efficiency and energy consumption;
- (ii) Issue guidelines for energy efficiency and energy conservation, and;;
- (iii) Establish energy consumption standards/energy baseline.

1.4 Specific Objectives of the Assignment

The specific objectives of the assignment are:-

- (i) To obtain a breakdown of energy use in the industries and the SME sectors. It should cover electricity, fossil fuels, gas and renewable energy sources, as may be applied and according to different end use;
- (ii) To obtain details on the renewable energy technology installations (photovoltaic and solar water systems) and on stand-by generators installed in the sectors;
- (iii) To determine the level of energy efficiency of the industry facilities and SMEs, through Energy Use Intensity (EUI) calculations;

1.5 Terms of Reference of the Assignment

The Terms of Reference of the assignment are as follows: -

Task 1: gathering and compiling the following data of the establishments for the past three years for the industry sector and SMEs: -

- (i) the CEB Tariff, gross surface area (in m²) and the total built area (in m²) of the establishment being surveyed;
- (ii) the total annual energy use (in kWh and kVAh) of the building, including where necessary instrumented measurements (service provider to make necessary arrangements for the supply and installation of the instruments), with breakdown showing electricity consumption, fossil fuel use and renewable energy use;

- (iii) the surface area (in m²) and peak capacity of solar photovoltaic (PV) installations and the surface area (in m²) and capacity of solar water collectors present at the site;
- (iv) the average annual electricity generation (in kWh) from solar PV system and consumption of such generated electricity (in kWh);
- (v) the total capacity of the standby generator(s) installed on site, the average number of hours run per month and per year and total electricity generated monthly and yearly;
- (vi) the total annual electricity use (in kWh) for specific uses, including equipment, lighting, air conditioning and motive power;
- (vii) the total annual electricity use (in kWh) for thermal purposes, including water heating, steam generation and direct heating;
- (viii) the type and quantity of fuel use for thermal purposes, including water heating, steam generation and direct heating;
- (ix) the annual cost of fuel used; and
- (x) the annual production of the establishment.

Task 2 Provide a breakdown of the energy consumption in each establishment for equipment, lighting, air conditioning, motive power, direct heating, water heating and steam generation (internal and external separately) and other uses as required.

Task 3 Determine the Energy Use Intensities (EUI) of the establishments listed under the Industry and SME sector in terms of kWh per production output and kWh per m². The EUI is defined as the site energy consumption per total built area and per production output. EUI shall be provided according to each source of energy namely: electricity, fossil fuel and hot water as well as the total EUI for the building. EUI shall be provided in kWh/m² year or MJ/m² year or kWh/output for the past three years.

Task 4: Investigate and display through appropriate charts the relationship of EUI and fuel economy for the different subsectors and categories.

2 Methodology

2.1 Design of Questionnaire

A comprehensive questionnaire designed by StraConsult and approved by EEMO was used to carry out the survey for the Industry and SME Sectors. A copy of the questionnaire is at Annex 1. A digital version of the questionnaire was made available on the website of EEMO at emmo.govmu.org.

2.2 Targeted enterprises

The collaboration of the following institutions was sought in having the list of enterprises registered with them:-

- a. SME Mauritius;
- b. Economic Development Board (EDB formerly known as Enterprise Mauritius), and
- c. Mauritius Export Association (MEXA).

Other sources of information were yellow pages of Mauritius Telecom Directory, Top 100 Companies Directory and Export directory of Enterprise Mauritius.

2.3 Dissemination of information on the carrying-out of the survey

In January 2018, EEMO organized an explanatory meeting with various stakeholders on the carrying-out of the survey. Stakeholders invited for the meeting:-

1. Association of Mauritian Manufacturers
2. Economic Development Board (previously known as Enterprise Mauritius)
3. MEXA
4. President of Private Bus Owners Association
5. MCCI

Table 2-1 indicates the number of targeted establishments for the survey in the respective sub-sectors along with the number of enterprises contacted and the participation received. On a total of 297 letters sent to enterprises, some 67 letters returned back as the companies have closed down or gone away. Most of these companies were in the Textile and Food sectors. During site visits, it was noted that the remaining companies were either dormant or have shifted to trading, distribution or other activities not related to the initial registration. 2 companies were under Insolvency proceedings.

Table 2-1 : Breakdown on targeted number of enterprises & number of participation received for the survey per sub-sector of activity

Sub-sector	Minimum number of establishments to be surveyed			Number of enterprises contacted
	Industry	SME	Total number of enterprises per sub sector	
Bakery		20	20	21
Beverages	5		5	16
Chemical and chemical products	5		5	10
Construction	10		10	10
Fabricated metal products, except machinery and equipment	10	10	20	25
Food Products	10	20	30	36
Paper and Paper products	10		10	12
Plastic Products		5	5	18
Printing	20	10	30	32
Textiles	26		106	118
Wearing Apparel	50	30		
Total	146	95	241	297

Sub-sector	Minimum number of enterprises which participated in the survey		
	Industry	SME	Total number of enterprises per sub sector
Bakery	1	9	10
Beverages	7	5	12
Chemical and chemical products	6	3	9
Construction	5	3	8
Fabricated metal products, except machinery and equipment	4	9	13
Food Products	9	14	23
Paper and Paper products	3	4	7
Plastic Products	1	7	8
Printing	10	11	21
Textiles & Wearing Apparel	19	31	50
Other (distribution, Real Estate, Retailer/Wholesaler, etc)	1	6	7
Total	66	102	168

2.4 Team Composition

A. Technical

The Engineering Team of the project comprises:-

- Dr. Krishna Heeramun who holds a Ph.D in Management as well as a Diplome d'Etudes Approfondies (DEA) in Industrial Engineering and a Master's Degree in Electrical Engineering.
- Mr Hemchand Rai HEEROO who holds a Bachelor of Science in Electrical Engineering, a Master of Engineering, and a Master of Business Administration.
- Mr. Judex Soulange who holds a CEng and a Master of Business Administration

B. Administrative Support

The Technical team was assisted by Mrs Pamelah Gungaram who is a graduate of the Institute of Chartered Secretaries and Administrators and Ms Sadhiska Bhoojedhur who holds a BSc (Hons) in Economics and Management and an MBA.

2.5 Assistance to enterprises

Visits were scheduled by the support engineers to the enterprises to explain and assist them to fill-in the questionnaire. All enterprises who participated were provided technical support. The engineers also assisted to the collection of data.

The data collected in the paper questionnaires were then transferred on an excel sheet and basic screening was carried out to detect and correct inconsistent figures and data capture errors.

An excel tool was developed with calculations based on the raw data to respond to the 4 tasks in the ToR.

2.6 Implementation Issues

The technical team witnessed some shortcomings on field to obtain the required data. It was found that most companies did not record the data in its technical form. Most data were recorded in its financial form. It was also observed that the person designated to assist the team in filling-in the questionnaire has no or limited technical knowledge in the field which made the compilation and cleaning of data to be a lengthy process.

In cases where the technical team found a mismatch on the CEB data, the enterprises were requested to submit copies of the CEB bills. Other readily available data are fossil fuel consumptions obtainable from purchase records of the firm. Where these were not available, the firms were asked to give reasonable estimates.

Among the data which were more difficult to obtain are the ratings and loadings of various electrical appliances as well as their daily and weekly usage in terms of hours. In these cases also, the firms were requested to provide reasonable estimates.

3 Findings – Results of Task 1 – Overview of Collected Data

3.1 Summary of Energy Sources

The main energy sources for the industry and SME sectors are electricity from the public utility, the Central Electricity Board (CEB), diesel, heavy fuel oil (HFO), coal, and liquefied petroleum gas (LPG). Fifteen firms reported using solar water heaters which supply very limited amounts of energy. Two firms have solar photovoltaic installations that supply them with electricity for internal use. Three firms reported on the use of green energy for their heating process. One firm stated that it burnt dry ravenala leaves, a form of biomass, for cooking its product, biscuits. During all further analysis, energy from solar water heaters, photovoltaic installations, and ravenala leaves have been grouped as renewable energy.

3.1.1 Conversion to kWh

The firms were requested to state the quantities of diesel and HFO they used in litres (lts), coal in tons, and LPG in kilograms (kg). These quantities were converted into kilowatt-hours based on calorific values given in table 3-1.

Table 3-1: Calorific Values of Fossil Fuels

Fossil Fuel	Calorific Value
Diesel	9.98 kWh/l
HFO	10.71 kWh/l
Coal	7,203 kWh/tonne
LPG	12.55 kWh/kg

Source : Statistics Mauritius and CEB

The firms were asked to specify the capacity of their solar water heaters in litres, while the quantity of ravenala leaves was given in tons by the firms utilizing that fuel. According to the Ministry of New and Renewable Energy of the Government of India, a 100 litre solar water heater can supply 1500 kWh of energy annually. One ton of ravenala leaves was assumed to produce 5556 kWh based on figures for calorific values of biomass published in Natural Resources 2016, 7, 57- 68 (www.scirp.org/journal/nr/).

3.2 Standby Generators

Forty-four firms reported having a standby generator installed in their premises. For each of these firms, the quantity of electricity produced by the standby generators was added to the amount of electricity that they purchased from the CEB.

3.3 Annual Breakdowns of Energy Sources for the Industry and SME Sectors

Table 3-2 shows the annual breakdown of energy sources for the industry and SME sectors from 2015 to 2017 while Figure 3-1 displays the breakdown graphically. The total quantity of energy utilized by the two sectors decreased from around 613 million kWh to 585 million kWh in 2016, and then increased to 615 million kWh in 2017.

The leading source of energy for the industry and SME sectors was coal in 2015 and electricity in 2016 and 2017. The second source of energy was electricity in 2015 and coal in 2016 and 2017. During the three years in review, the next significant sources of energy in decreasing order were HFO, diesel, LPG, and renewable energy. For each of the three years, electricity represented around 33/34% of the total energy consumed by the electricity and SME sectors whereas the corresponding figure for renewable energy, the least significant contributor, was 0.20/0.21%. The quantity of energy contributed by coal decreased over the three years with the deficit being met by consistently increasing amounts from diesel and HFO.

Table 3-2: Annual Breakdown of Energy Sources for the Industry and SME Sectors

Source	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity	201,306,426	32.83	198,497,647	33.94	206,796,015	33.63
Diesel	25,345,497	4.13	26,134,776	4.47	39,730,949	6.46
HFO	152,152,857	24.81	155,432,570	26.58	167,342,240	27.21
Coal	209,808,984	34.22	181,378,743	31.01	178,454,325	29.02
LPG	23,379,257	3.81	22,219,762	3.80	21,383,531	3.48
Renewable Energy	1,196,089	0.20	1,199,726	0.21	1,210,445	0.20
Total	613,189,111	100.00	584,863,224	100.00	614,917,504	100.00

Figure 3-1: Charts Showing Annual Breakdown of Energy Sources for the Industry and SME Sectors

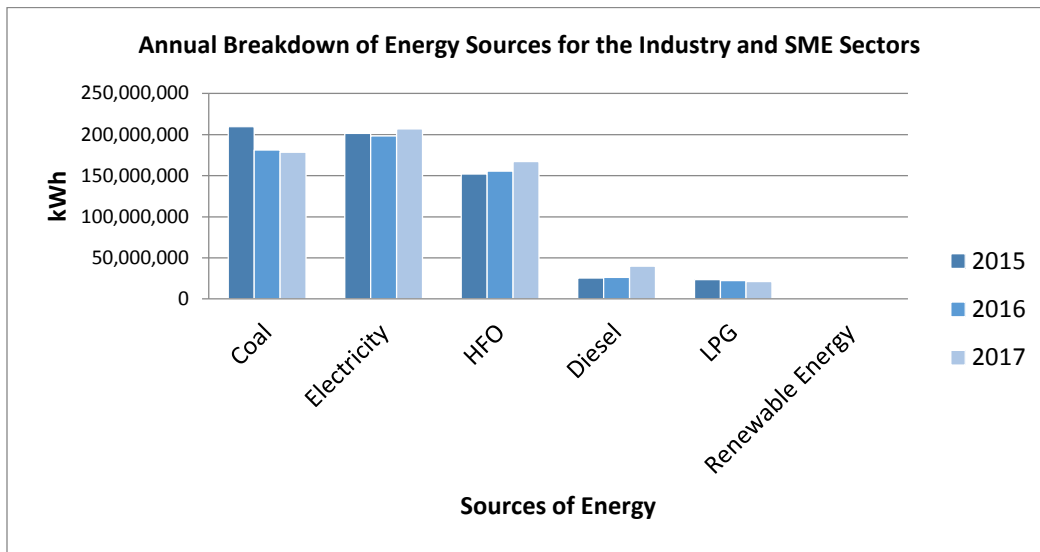
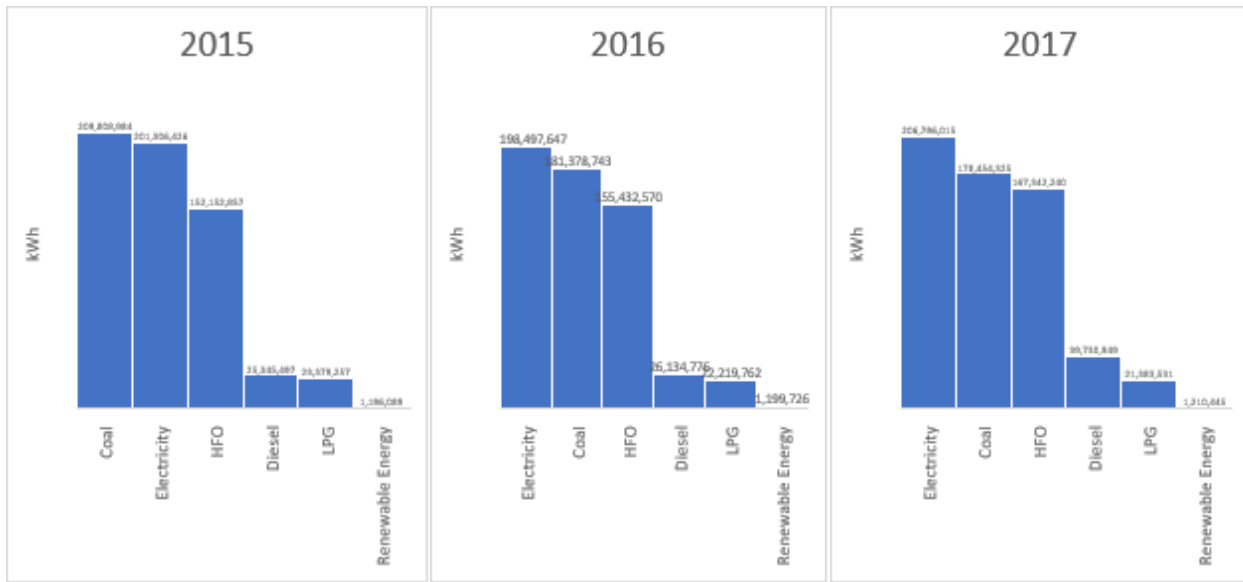


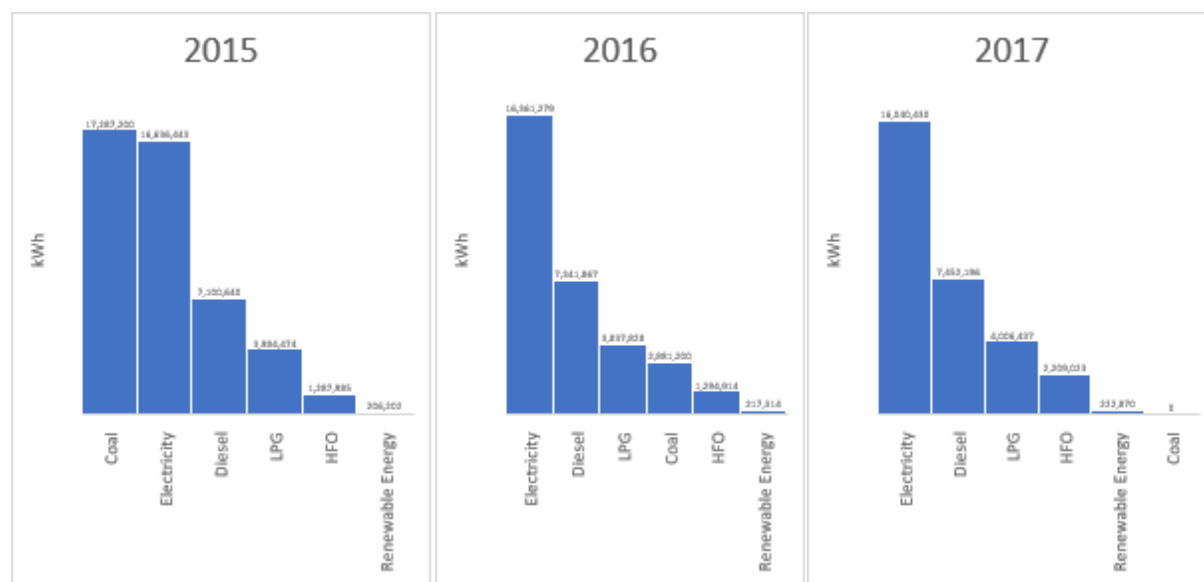
Table 3.3 provides the annual breakdown of energy sources for the SME sector from 2015 to 2017. Figure 3.2 illustrates the same information graphically. The total quantity of energy consumed by the sector decreased from 47 million kWh in 2015 to 32 million kWh in 2016 and 30 million kWh in 2017. The primary energy source was coal in 2015, and electricity in 2016 and 2017. The second most important energy source was electricity in 2015 and diesel in the next 2 years. The contribution of coal to the total energy mix of the sector decreased significantly from 17 million kWh in 2015 to 3 million kWh in 2016 and to zero kWh in 2017. The contribution of

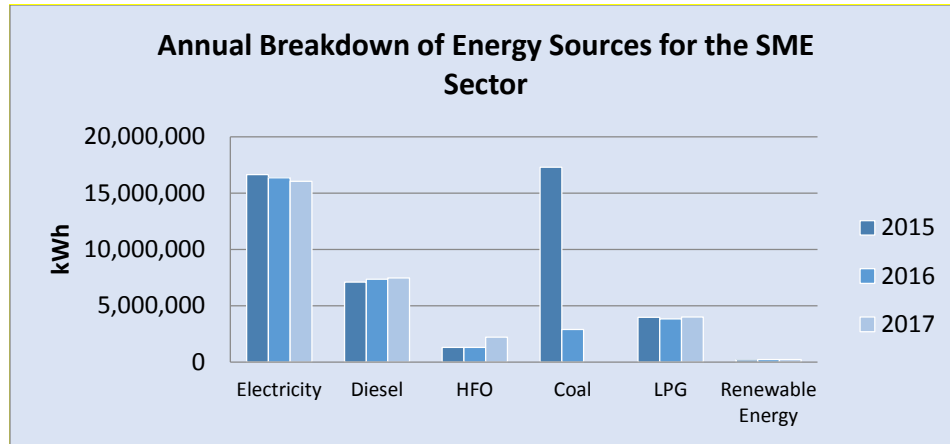
electricity also decreased but in less significant amounts. The quantity of energy sourced from diesel, the third most significant source in 2015 and second most significant source in 2016 and 2017, increased consistently over the period. Renewable energy increased its share of the total energy to the sector from 0.44% in 2015 to 0.68% in 2016 and 0.74% in 2017. It was the least significant source of energy in 2015 and 2016 and just ahead of coal in 2017.

Table 3-3: Annual Breakdowns of Energy Sources for the SME Sector

Source	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity	16,636,443	35.78	16,361,279	51.23	16,040,430	53.59
Diesel	7,100,640	15.27	7,341,867	22.99	7,452,196	24.90
HFO	1,287,985	2.77	1,294,914	4.05	2,209,023	7.38
Coal	17,287,200	37.17	2,881,200	9.02	0	0.00
LPG	3,984,474	8.57	3,837,828	12.02	4,006,437	13.39
Renewable Energy	206,202	0.44	217,314	0.68	222,870	0.74
Total	46,502,945	100.00	31,934,402	100.00	29,930,956	100.00

Figure 3-2: Charts Showing Annual Breakdown of Energy Sources for the SME Sector



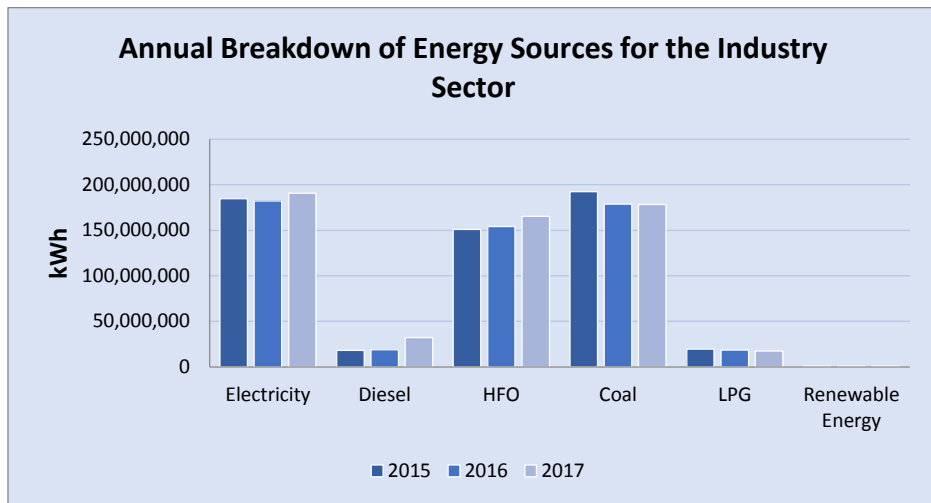
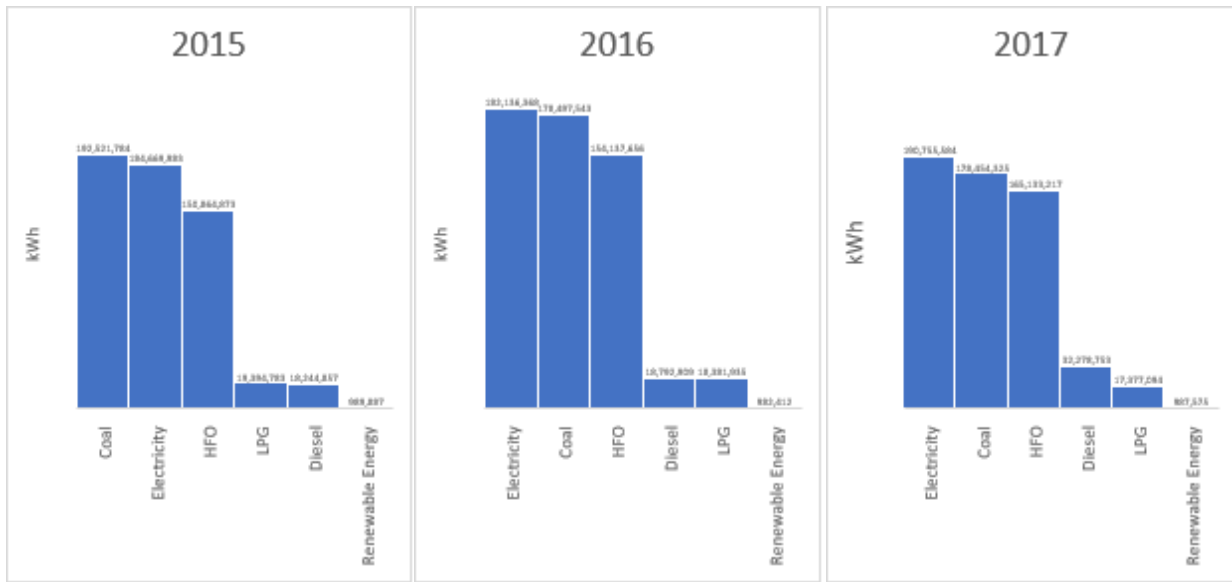


The annual breakdown of energy source for the industry sector from 2015 to 2017 is given in table 3-4 and indicated graphically in figure 3-3. The total energy consumption of the sector decreased from 567 million kWh in 2015 to 553 million kWh in 2016, and increased to 584 million kWh in 2017. The foremost energy source was electricity during the three years followed by coal and HFO. LPG and diesel were the fourth and fifth most important energy source in 2015. The two fuels interchanged their rankings in 2016, and kept the same relative positions in 2017. Renewable energy contributed a nearly constant amount of energy to the sector over the 3 years and was the least important energy supplier over the period.

Table 3-4: Annual Breakdown of Energy Sources for the Industry Sector

Source	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity	184,669,983	32.59	182,136,368	32.94	190,755,584	32.61
Diesel	18,244,857	3.22	18,792,909	3.40	32,278,753	5.52
HFO	150,864,873	26.62	154,137,656	27.88	165,133,217	28.23
Coal	192,521,784	33.97	178,497,543	32.28	178,454,325	30.51
LPG	19,394,783	3.42	18,381,935	3.32	17,377,094	2.97
Renewable Energy	989,887	0.17	982,412	0.18	987,575	0.17
Total	566,686,166	100.00	552,928,822	100.00	584,986,548	100.00

Figure 3-3: Charts Showing Annual Breakdown of Energy Sources for the Industry Sector



4 Findings – Results of Task 2 – Breakdown of Energy Consumption by End Use

4.1 Overview

All firms depended on electricity as an energy source with some also relying on one or more other fossil fuels as additional sources for nearly all their energy needs. Firms had several end uses for electricity e.g. lighting, air conditioning, electric motors etc. Allocation of annual electricity consumption to each end use was calculated using the rating of the end use equipment and the number of hours of its weekly operation together with the assumption that firms operated for fifty weeks in one year. For heating fuel applications such as steam generation, process heat, etc, firms gave the annual amount of fuel used for such purposes from which the annual amount of energy was calculated.

Basis of analysis of energy consumption by end use

A further step in analyzing the breakdown of energy consumption by end use was finding the consistency between annual measured electricity consumption and the summation of annual consumption for different end uses. Measured electricity consumption for a firm is the summation of its CEB bills, the electrical output of its standby generator, and the electricity drawn from photovoltaic panels. Only firms whose ratio of annual measured electricity consumption to calculated annual consumption were between 0.25 and 1.2 were retained for further analysis. A ratio below 0.25 for a firm implied that the data it has supplied on electrical ratings and number of hours of operation have been grossly overestimated. A ratio above 1.2 for a firm was due to it having omitted to mention many of its electrical equipment in the survey and/or severely underestimating the number of hours of operation of its electrical equipment.

As a result of filtering on the above criteria, 151 out of the 167 firms that responded to the survey were found to be satisfactory for further analysis. Seventy five of the firms were SMEs while the remaining seventy-six were from the industry sector. The annual electricity consumption of each end use was adjusted to make their summation equal to the measured annual electricity consumption.

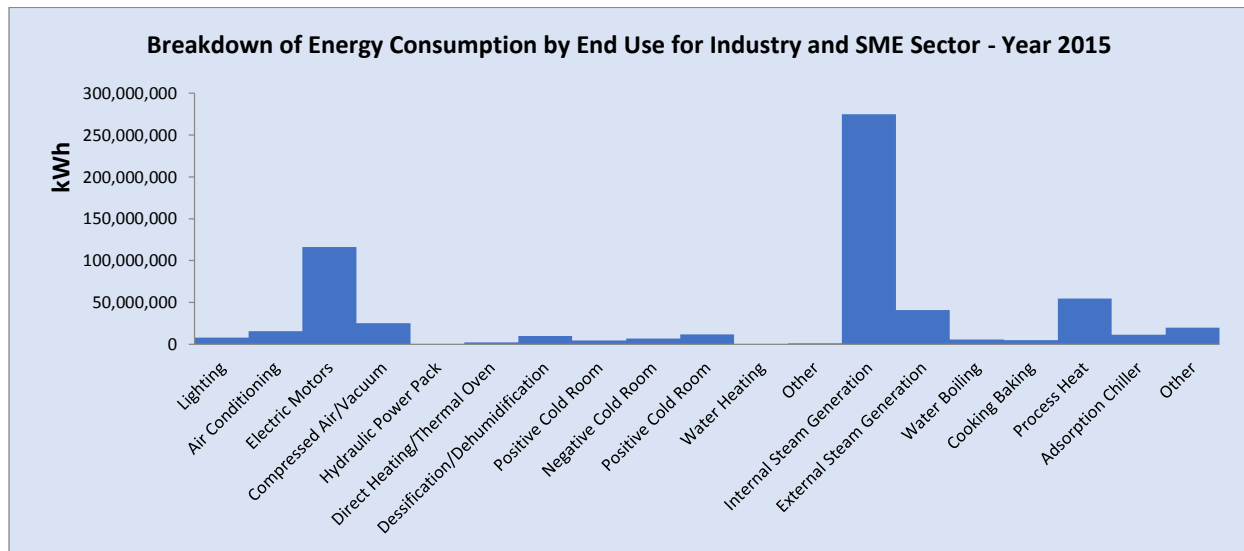
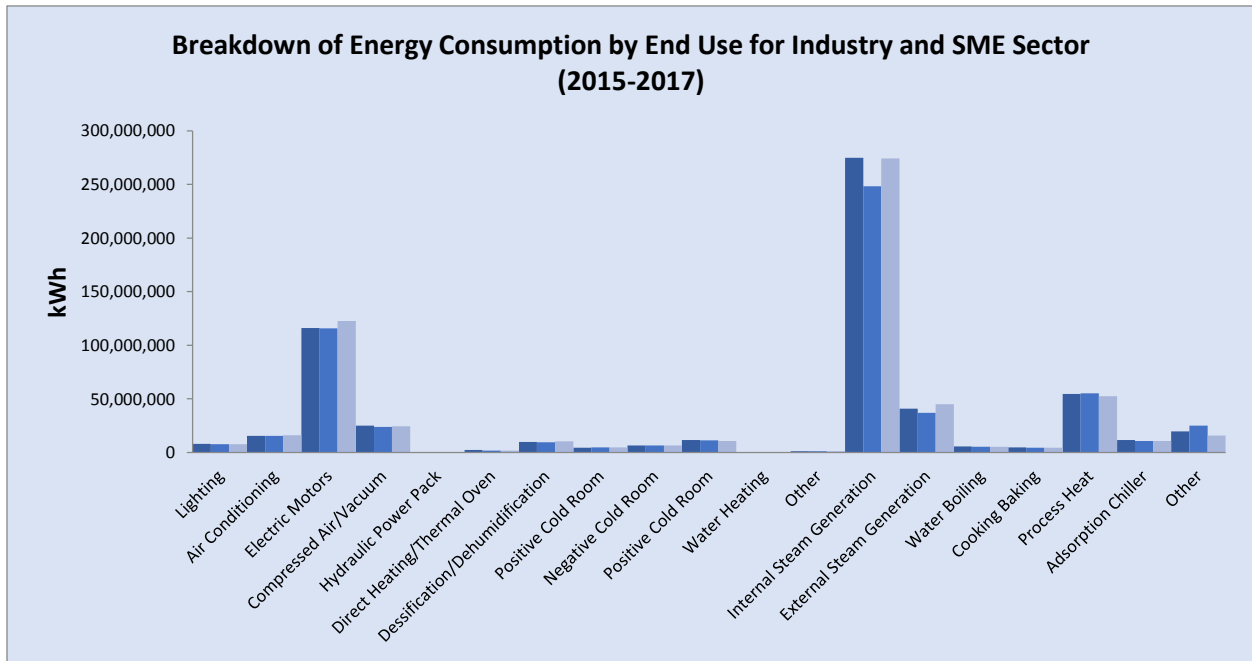
4.2 Breakdown of Energy Consumption by End Use for Industry and SME Sector

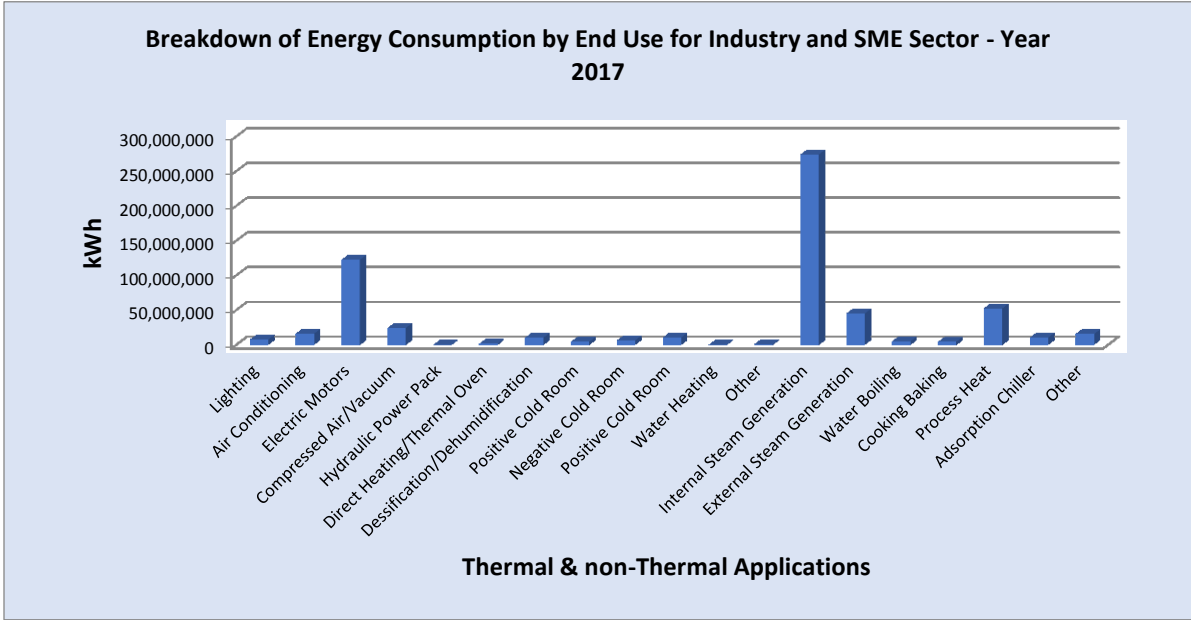
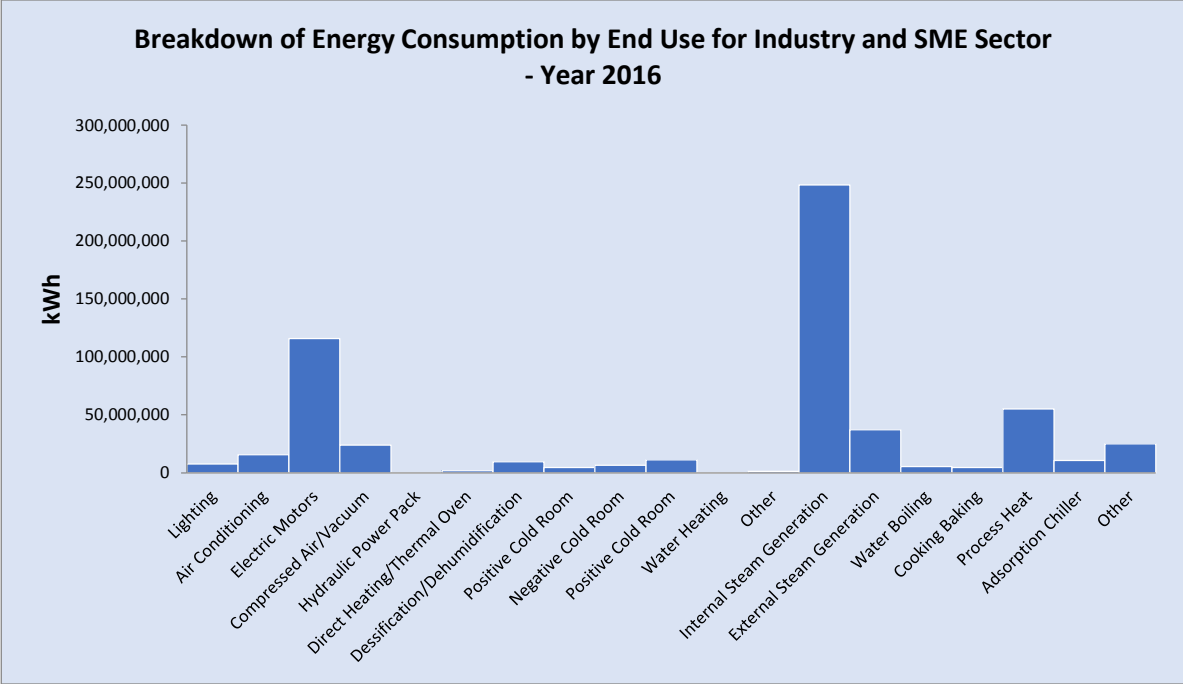
The breakdown of energy consumption by end use for the industry and SME sectors is shown in Table 4-1 and graphically in Figure 4-1. The total energy consumed by the two sectors decreased from 613 million kWh in 2015 to 585 million kWh in 2016 and increased to 615 million kWh in 2017. The largest part of energy supplied to the industry and SME sectors was utilized for internal steam generation, around 45% of total energy in 2015, 42% in 2016 and 45% in 2017. Electric motors were the next most important energy consumer representing around 19% of the total energy in 2015 and around 20% in 2016 and 2017. Process heat, the third most energy consumer over the 3 years, lagged far behind at around 9% of total energy supplied to the 2 sectors.

Table 4-1: Breakdown of Energy Consumption by End Use for Industry and SME Sector

End Use	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity Users						
Lighting	8,051,047	1.31	7,615,773	1.30	7,720,111	1.26
Air Conditioning	15,513,383	2.53	15,636,195	2.67	16,214,040	2.64
Electric Motors	116,143,929	18.94	115,833,359	19.81	122,635,906	19.94
Compressed Air/Vacuum	24,980,105	4.07	23,969,554	4.10	24,379,489	3.96
Hydraulic Power Pack	209,315	0.03	238,297	0.04	203,087	0.03
Direct Heating/Thermal Oven	2,320,951	0.38	1,863,046	0.32	1,805,594	0.29
Dessification/Dehumidification	9,935,735	1.62	9,612,393	1.64	10,551,928	1.72
Positive Cold Room	4,596,350	0.75	4,662,287	0.80	4,688,969	0.76
Negative Cold Room	6,594,164	1.08	6,498,561	1.11	6,578,964	1.07
Positive Cold Room	11,599,761	1.89	11,204,899	1.92	10,633,144	1.73
Water Heating	256,974	0.04	270,773	0.05	247,725	0.04
Other	1,194,599	0.19	1,174,923	0.20	1,224,632	0.20
Heating Fuel Users						
Internal Steam Generation	274,924,623	44.84	248,348,270	42.46	274,088,073	44.57
External Steam Generation	40,803,646	6.65	37,134,059	6.35	45,115,523	7.34
Water Boiling	5,697,439	0.93	5,483,619	0.94	5,251,443	0.85
Cooking Baking	4,805,950	0.78	4,546,305	0.78	4,591,561	0.75
Process Heat	54,456,064	8.88	55,062,024	9.41	52,647,074	8.56
Adsorption Chiller	11,488,785	1.87	10,711,713	1.83	10,621,794	1.73
Other	19,616,291	3.20	24,997,175	4.27	15,718,446	2.56
Total	613,189,111	100.00	584,863,224	100.00	614,917,504	100.00

Figure 4-1: Charts Showing Breakdown of Energy Consumption by End Use for Industry and SME Sector





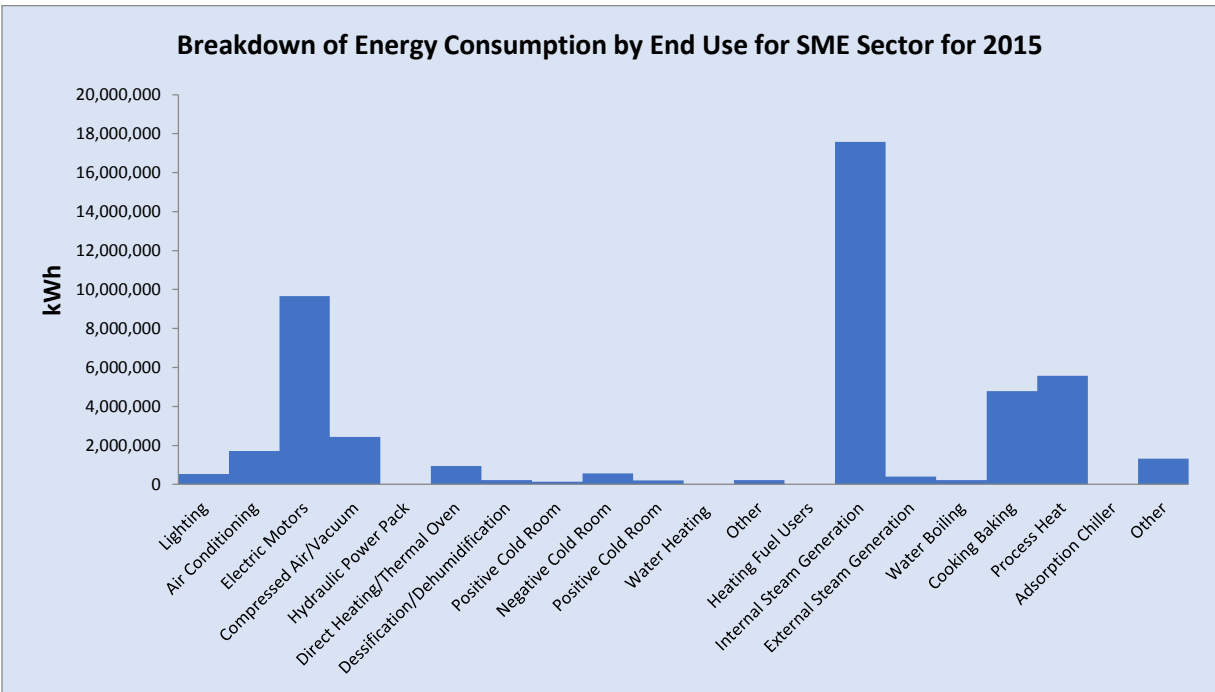
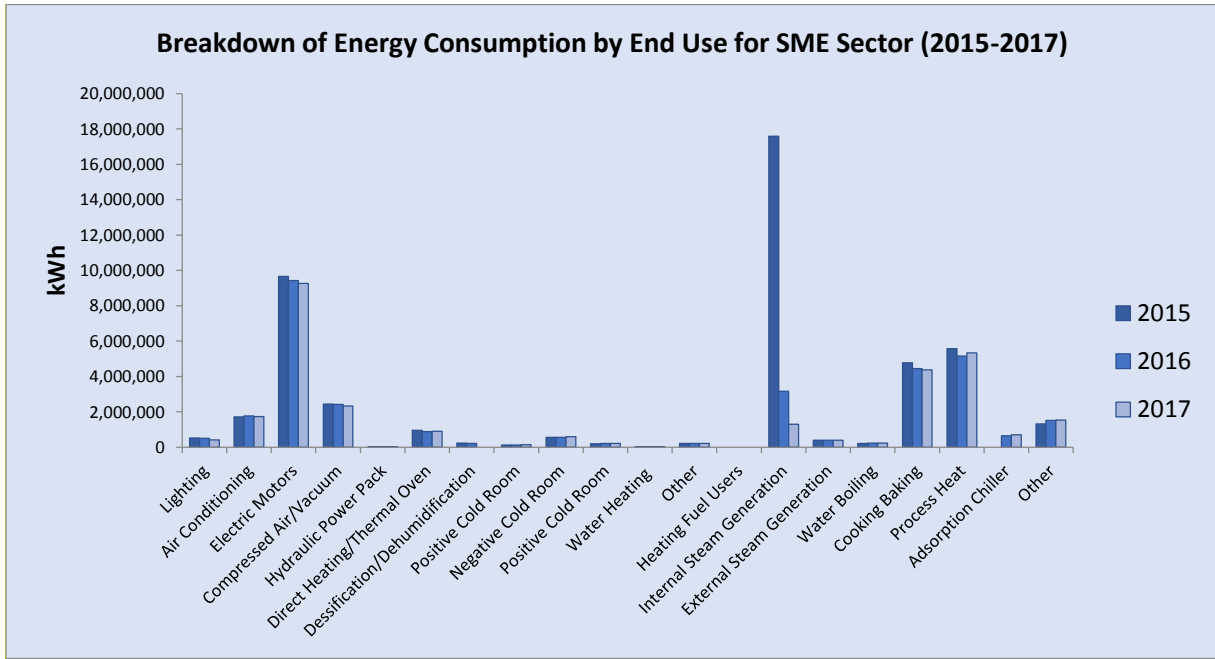
4.3 Breakdown of Energy Consumption by End Use for SME Sector

Table 4-2 gives the breakdown of energy use by the SME sector from 2015 to 2017 while the same breakdown is illustrated graphically in Figure 4-2. The energy consumption of the sector decreased from 47 million kWh in 2015 to 32 million kWh in 2016 and 30 million kWh in 2017. Thirty eight percent of the total energy supplied to the sector in 2015, the biggest share, was used for internal steam generation, but this share decreased to 10% in 2016 and 4% in 2017. Electric motors were the second largest energy user consuming 21% of total energy in 2015, but this equipment climbed to be the largest energy user in 2016 (29% of total energy) and 2017 (31% of total energy). Process heat consumed the third largest share, 12%, in 2015 and the second largest share, 16% and 18%, in 2016 and 2017 respectively.

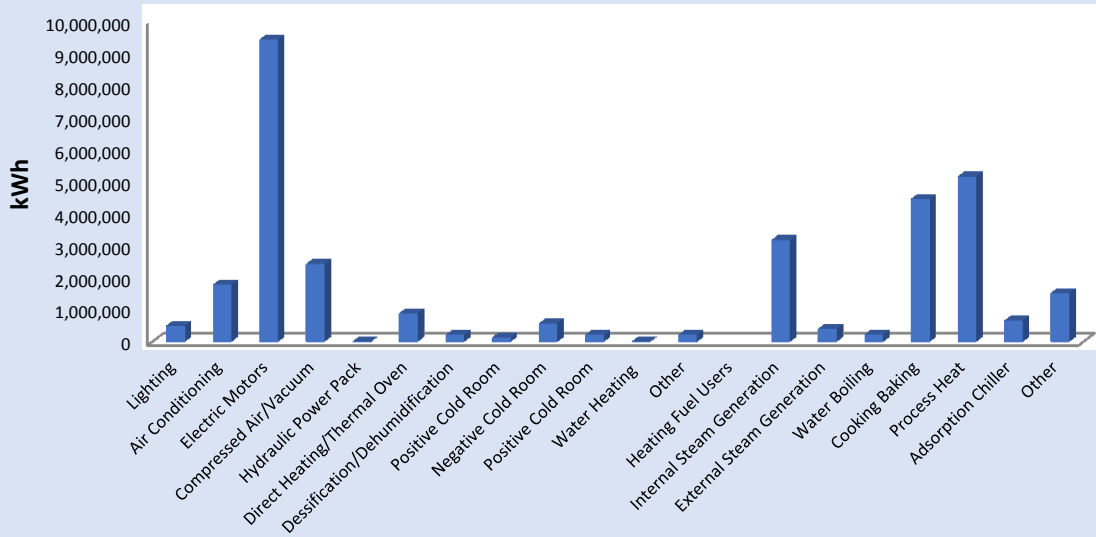
Table 4-2: Breakdown of Energy Consumption by End Use for SME Sector

End Use	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity Users						
Lighting	527,065	1.13	497,342	1.56	421,249	1.41
Air Conditioning	1,708,525	3.67	1,776,056	5.56	1,726,594	5.77
Electric Motors	9,664,991	20.78	9,419,032	29.49	9,266,187	30.96
Compressed Air/Vacuum	2,439,252	5.25	2,423,285	7.59	2,329,377	7.78
Hydraulic Power Pack	5,020	0.01	5,497	0.02	5,381	0.02
Direct Heating/Thermal Oven	949,167	2.04	887,849	2.78	901,417	3.01
Dessification/Dehumidification	227,075	0.49	215,686	0.68	219,311W	0.73
Positive Cold Room	133,225	0.29	133,664	0.42	136,026	0.45
Negative Cold Room	563,919	1.21	566,615	1.77	594,895	1.99
Positive Cold Room	197,432	0.42	215,212	0.67	218,530	0.73
Water Heating	5,630	0.01	8,270	0.03	8,865	0.03
Other	215,143	0.46	212,770	0.67	212,598	0.71
Heating Fuel Users						
Internal Steam Generation	17,577,409	37.80	3,170,354	9.93	1,307,055	4.37
External Steam Generation	398,580	0.86	398,490	1.25	398,021	1.33
Water Boiling	214,570	0.46	225,259	0.71	234,530	0.78
Cooking Baking	4,783,994	10.29	4,456,205	13.95	4,367,959	14.59
Process Heat	5,578,009	11.99	5,148,424	16.12	5,336,570	17.83
Adsorption Chiller	-	0.00	656,325	2.06	710,466	2.37
Other	1,313,940	2.83	1,518,065	4.75	1,535,924	5.13
Total	46,502,945	100.00	31,934,402	100.00	29,930,956	100.00

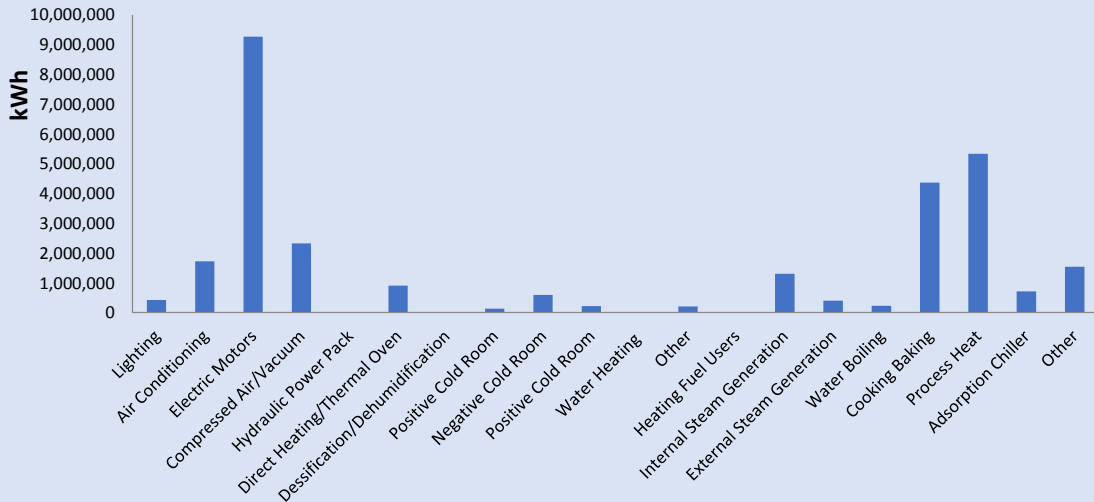
Figure 4-2 Breakdown of Energy Consumption by End Use for SME Sector



Breakdown of Energy Consumption by End Use for SME Sector for 2016



Breakdown of Energy Consumption by End Use for SME Sector for 2017



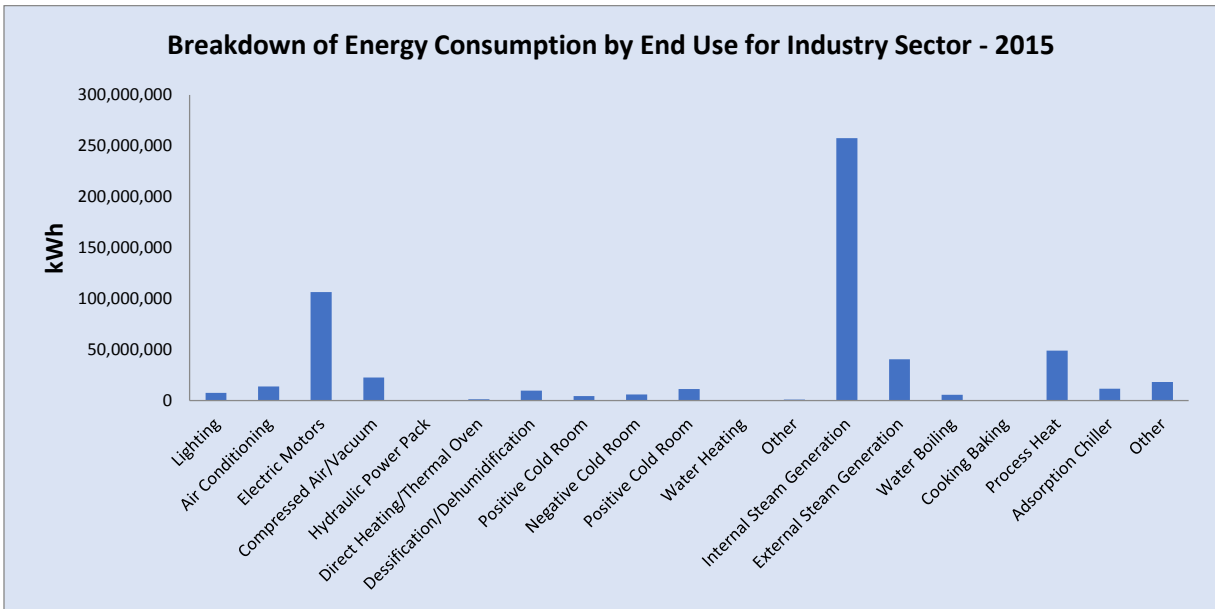
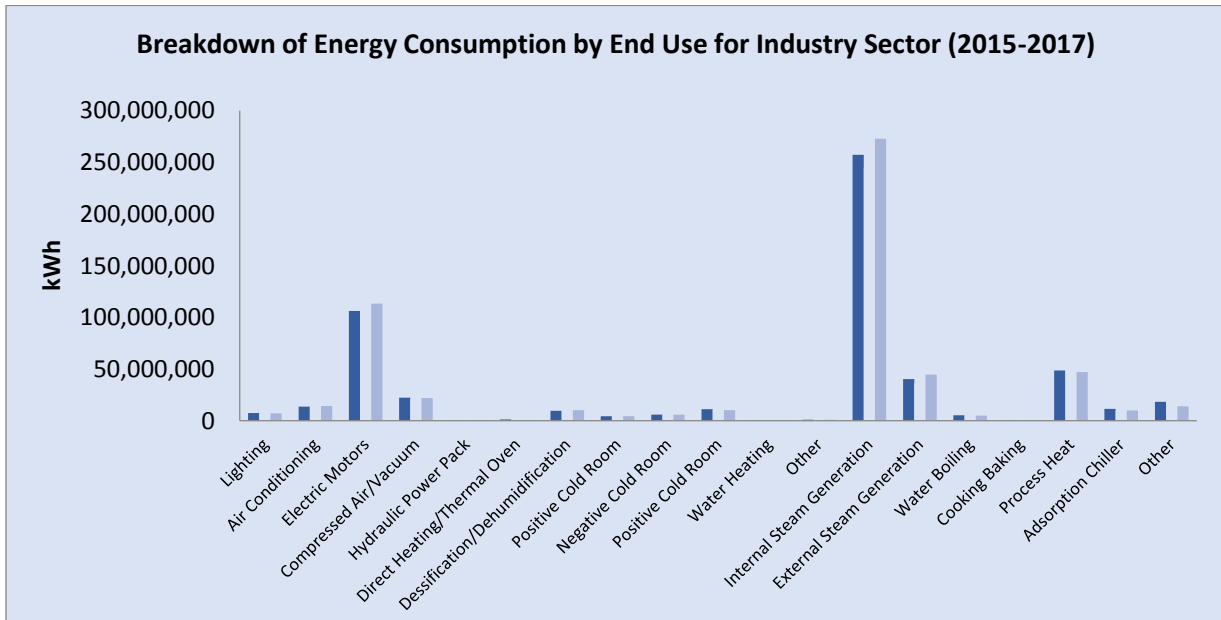
4.4 Breakdown of Energy Consumption by End Use for Industry Sector

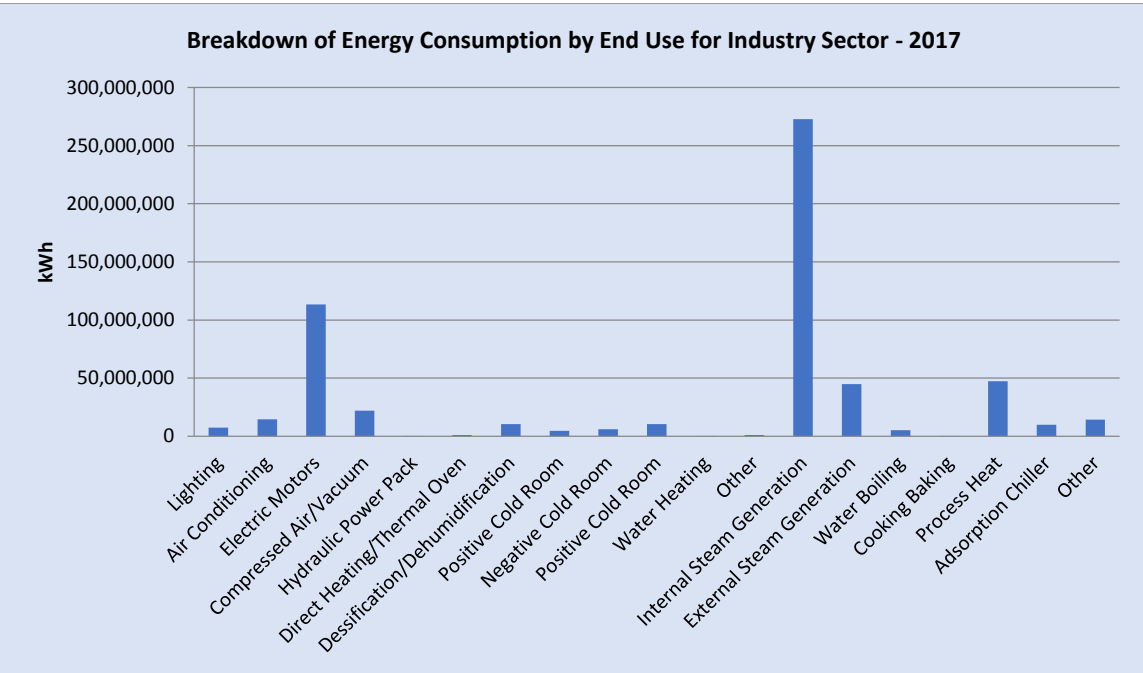
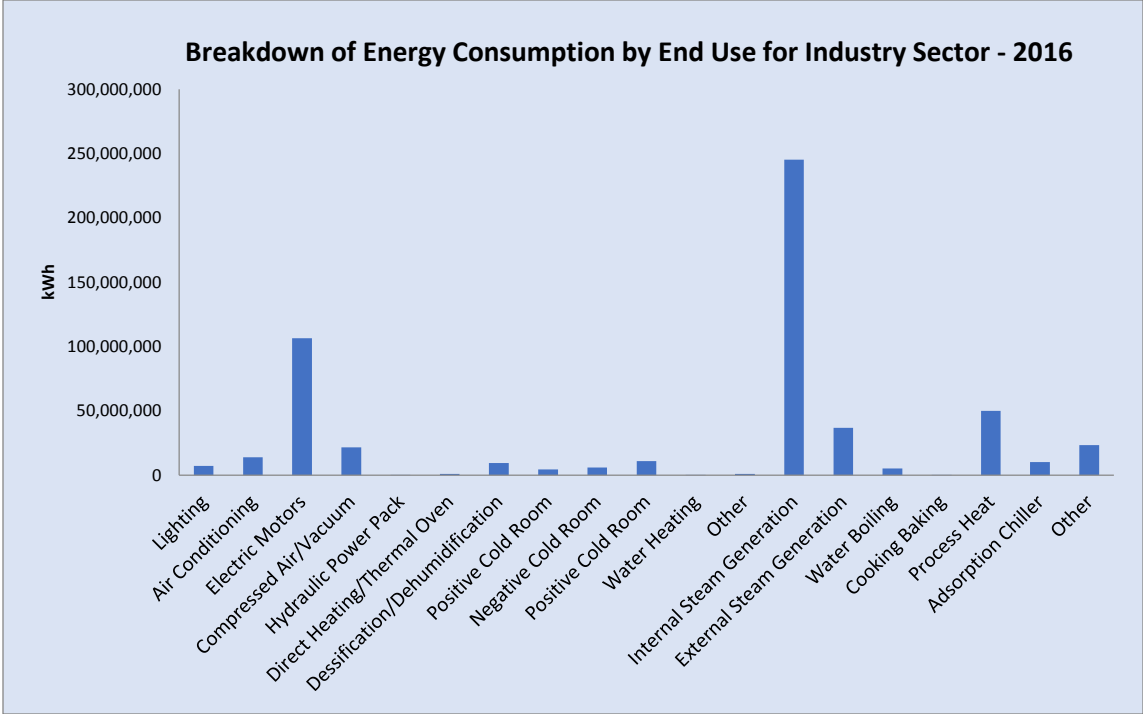
Table 4-3 shows the breakdown of energy use by the industry sector from 2015 to 2017 while the same breakdown is illustrated graphically in Figure 4-3. The energy consumption of the sector was 567 million kWh in 2015, decreased to 553 million kWh in 2016, and increased to 585 million kWh in 2017. During the three years, internal steam generation was the largest end use consuming between 44% and 47% of the total energy to the sector while electric motors were the second largest end user with 19% of the total energy. The third most significant amount of energy was used for process heat during the three years.

Table 4-3: Breakdown of Energy Consumption by End Use for Industry Sector

End Use	2015		2016		2017	
	kWh	%	kWh	%	kWh	%
Electricity Users						
Lighting	7,523,983	1.33	7,118,430	1.29	7,298,861	1.25
Air Conditioning	13,804,858	2.44	13,860,139	2.51	14,487,446	2.48
Electric Motors	106,478,938	18.79	106,414,327	19.25	113,369,719	19.38
Compressed Air/Vacuum	22,540,852	3.98	21,546,269	3.90	22,050,112	3.77
Hydraulic Power Pack	204,295	0.04	232,800	0.04	197,706	0.03
Direct Heating/Thermal Oven	1,371,784	0.24	975,197	0.18	904,177	0.15
Dessification/Dehumidification	9,708,661	1.71	9,396,707	1.70	10,332,618	1.77
Positive Cold Room	4,463,126	0.79	4,528,623	0.82	4,552,943	0.78
Negative Cold Room	6,030,245	1.06	5,931,946	1.07	5,984,069	1.02
Positive Cold Room	11,402,329	2.01	10,989,687	1.99	10,414,615	1.78
Water Heating	251,344	0.04	262,503	0.05	238,860	0.04
Other	979,455	0.17	962,153	0.17	1,012,035	0.17
Heating Fuel Users	-					
Internal Steam Generation	257,347,214	45.41	245,177,917	44.34	272,781,018	46.63
External Steam Generation	40,405,066	7.13	36,735,569	6.64	44,717,501	7.64
Water Boiling	5,482,869	0.97	5,258,361	0.95	5,016,913	0.86
Cooking Baking	21,956	0.00	90,099	0.02	223,602	0.04
Process Heat	48,878,055	8.63	49,913,600	9.03	47,310,504	8.09
Adsorption Chiller	11,488,785	2.03	10,055,388	1.82	9,911,328	1.69
Other	18,302,352	3.23	23,479,109	4.25	14,182,522	2.42
Total	566,686,166	100.00	552,928,822	100.00	584,986,548	100.00

Figure 4-3: Charts Showing Breakdown of Energy Consumption by End Use for Industry Sector





4.5 Breakdown of Energy End Use within Sub-Sectors of the SME Sector

Tables 4-4, 4-5 and 4-6 shows the breakdown of energy end use within sub-sectors for the SME sector for 2015, 2016 and 2017 respectively. The number of firms available for analysis within each sub-sector varied from 1 in the beverages sub-sector to 22 in the textiles sub-sector. Therefore, a percentage comparison of energy end use within each sub-sector would be more meaningful rather than a comparison across sub-sectors. A summary of the findings for each sub-sector is given in the following paragraphs.

- 4.5.1 Bakery: Most of the energy within this sub-sector was consumed for cooking/baking, 52%, 49% and 48% in 2015, 2016 and 2017 respectively. The next biggest share of energy was utilized for electric motors between 30% and 31% of annual total energy over the three years. Compressed air/vacuum, air conditioning and direct heating/thermal oven were third, fourth and fifth largest energy users in the sub-sector with respectively 9%, 4% and 3/4% of the annual total energy over the three years. The other end energy use, i.e lighting, positive cold room, negative cold room, process chilled water and water heating; were below 1.5 % of the total energy during the three-year period.
- 4.5.2 Beverages: The largest amount of energy was used for water boiling during the three year period, 63% in 2015, 69% in 2016 and 72% in 2017. The second largest energy user was electric motors with a share of total energy of 23% in 2015, 19% in 2016 and 17% in 2017. In decreasing order of energy consumption, the next energy users were compressed air/vacuum, air conditioners and lighting.
- 4.5.3 Chemicals and Chemical Products: The leading end energy user was internal steam generation over the three years, 31%, 28% and 45% of total energy in 2015, 2016 and 2017 respectively followed by electric motors 28% in 2015, 27.7% in 2016, and 21% in 2017. The third most important energy user during the period was air conditioners with a consumption of 24% of total energy in 2015 and 2016, and 20% in 2017. The next end users in decreasing order of importance were lighting, compressed air/vacuum, and process heat.

- 4.5.4 Construction: Most of the energy in this sub-sector was utilized for process heat, 80% of total energy in 2015, 68% in the next two years. Absorption chillers, which were non-existent in 2015, became the second most significant energy user in 2016 and 2017 with 13% of the total energy. Electric motors, the second most important end user in 2015 with 13% of total energy, slipped into third place in 2016 and 2017 with a share of around 10% to 11% of total energy. Compressed air/vacuum was immediately behind electric motors with a share of around 4% to 5% of total energy. The next end user of decreasing order were air conditioning, lighting and hydraulic power pack.
- 4.5.5 Fabricated Metal Products: Energy was mostly used for process heat in this sub-sector, 75% of total energy in 2015 and 73% in 2016 and 2017. The second most important end user was electric motors with around 18% of total energy during the three years. Air condition was the third ranking end use consumption between 4% to 7% of total energy followed by compressed air/vacuum with a consumption of around 2% of total energy. Lighting and direct heating/thermal oven were other end uses with very small amounts of energy consumption.
- 4.5.6 Food Products: Energy use was more diversified in this sub-sector, with negative cold room being around 15% and cooking/baking ranging between 13% and 17% as the leading consumers of the annual total energy. The next end energy uses were in decreasing order electric motors, around 13% to 14% of total energy, external steam generation, around 12/13% of total energy, process heat around 11% to 12% of total energy, dessification/dehumidification, around 7% of total energy, and air conditioning, around 6% of total energy from 2015 to 2017. Other energy end uses for the three years were direct heating/thermal oven, compressed air/vacuum, lighting, positive cold room, and water boiling.
- 4.5.7 Paper and Paper Products: The firms in this subsector used most of their energy, around 75% of the annual total energy over the 3 years, for running their electric motors. The next most important energy uses were for air conditioners, around 14% to 15% of annual total energy from 2015 to 2017, and compressed air, around 10% of annual total energy over the three years. Other much lesser amounts of energy were applied for lighting and internal steam generation.

- 4.5.8 Plastic Products: The share of total energy utilized by end users was nearly the same over the three years. Electric motors were the leading consumers between 43% and 45% of total energy followed by direct heating/thermal oven, between 23% and 25% of total energy. The third most significant end energy use was processed chilled water with between 16% and 17% of total energy. Compressed air, around 8% of total energy, air conditioners around 6% of total energy, and lighting around 1% of total energy, were the next most important end uses.
- 4.5.9 Printing: This sub-sector consumed nearly all its energy in only 4 appliances: lighting, air conditioning, electric motors, and compressed air/vacuum. Most of the energy powered electric motors between 63% and 64% of total energy over the three years. The second most important energy use was air conditioners with a share between 19% and 20% during the three year period. Lighting used was between 8% and 9% of the total energy and compressed air/vacuum consumed around 7% of the total energy during the same period.
- 4.5.10 Textiles: The share of energy utilized by various appliances and applications in this sub-sector changed significantly from 2015 to 2017. The consumption by internal steam generation, which was very high, around 71% of total energy, in 2015, went down both in absolute terms and percentagewise to around 30% in 2016 and around 12% in 2017. The share of electric motors, second biggest consumer in 2015 rose steadily from around 16% of total energy in that year to around 37% in 2016, and around 46% in 2017. In 2016 and 2017, electric motors were the leading energy consumers. Another important end use was circulating boilers which utilized around 5% of total energy in 2015, around 15% in 2016, and around 20% in 2017. The other end uses in decreasing order of total energy share were compressed air/vacuum, air conditioners, direct heating/thermal oven, lighting, external steam generation and water heating.

Table 4-4: Breakdown of End Energy Use by Sub-sectors for SMEs in 2015

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Electricity Users																				
Lighting	26,048	0.31	2,480	1.57	80,847	8.83	71,309	1.49	6,186	0.34	62,364	2.00	1,697	0.23	11,839	1.04	89,352	8.48	174,942	0.72
Air Conditioners	313,524	3.72	7,441	4.70	220,979	24.14	73,538	1.54	67,937	3.76	180,603	5.78	106,726	14.60	67,247	5.92	201,680	19.15	468,849	1.92
Electric Motors	2,487,920	29.54	36,080	22.81	258,975	28.29	601,686	12.59	317,221	17.54	421,149	13.47	549,707	75.20	492,929	43.37	670,336	63.64	3,828,989	15.71
Compressed Air/Vacuum	754,926	8.96	12,402	7.84	52,259	5.71	213,795	4.47	35,565	1.97	113,448	3.63	70,120	9.59	89,838	7.90	68,960	6.55	1,027,939	4.22
Hydraulic Power Pack	-	-	-	-	-	-	2,425	0.05	-	-	-	-	-	-	-	-	-	-	2,595	0.01
Direct Heating/ Thermal Oven	262,164	3.11	-	-	-	-	-	-	6,749	0.37	137,904	4.41	-	-	279,368	24.58	-	-	262,983	1.08
Dessification/ Dehumidification	-	-	-	-	-	-	-	-	-	-	227,075	7.26	-	-	-	-	-	-	-	-
Positive Cold Room	110,679	1.31	-	-	-	-	-	-	-	-	22,545	0.72	-	-	-	-	-	-	-	-
Negative Cold Room	85,932	1.02	-	-	-	-	-	-	-	-	477,987	15.29	-	-	-	-	-	-	-	-
Process Chilled Water	17,103	0.20	-	-	-	-	-	-	-	-	-	-	-	-	180,329	15.87	-	-	-	-
Heating	2,623	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,007	0.01
Other	2,315	0.03	-	-	-	-	-	-	12,258	0.68	129,705	4.15	-	-	14,944	1.31	23,054	2.19	32,867	0.13

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Heating Fuel Users																				
Internal Steam Generation	-	-	-	-	287,424	31.39	-	-	-	-	-	-	2,785	0.38	-	-	-	-	17,287,200	70.92
External Steam Generation	-	-	-	-	-	-	-	-	-	-	398,580	12.75	-	-	-	-	-	-	-	-
Water Boiling	-	-	99,800	63.08	-	-	-	-	-	-	114,770	3.67	-	-	-	-	-	-	-	-
Cooking/Baking	4,358,215	51.75	-	-	-	-	-	-	-	-	425,779	13.62	-	-	-	-	-	-	-	-
Process Heat	-	-	-	-	15,060	1.64	3,815,200	79.85	1,362,400	75.34	385,349	12.33	-	-	-	-	-	-	-	-
Adsorption Chiller	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	28,740	0.92	-	-	-	-	-	-	1,285,200	5.27
Total	8,421,448	100.00	158,204	100.00	915,544	100.00	4,777,954	100.00	1,808,315	100.00	3,125,998	100.00	731,035	100.00	1,136,495	100.00	1,053,382	100.00	24,374,570	100.00
Number of Firms in Sample	10		1		2		4		5		13		2		4		12		22	

Table 4-5: Breakdown of End Energy Use by Sub-sectors for SMEs in 2016

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles		
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	
Electricity Users																					
Lighting	26,173	0.33	2,268	1.30	99,458	9.84	66,171	1.30	6,462	0.36	61,203	1.93	1,697	0.23	12,461	1.03	88,316	8.54	133,132	1.37	
Air Conditioners	314,089	3.91	6,805	3.91	268,835	26.6	94,223	1.84	97,647	5.50	179,486	5.65	106,725	14.6	72,229	5.97	205,146	19.8	430,872	4.45	
Electric Motors	2,473,595	30.8	32,993	18.9	283,373	28.0	582,914	11.4	318,164	17.9	447,024	14.0	549,702	75.2	540,096	44.6	653,008	63.1	3,538,163	36.5	
Compressed Air/Vacuum	754,538	9.40	11,341	6.52	64,116	6.35	241,175	4.72	36,865	2.08	113,821	3.58	70,120	9.59	93,533	7.73	67,397	6.51	970,379	10.0	
Hydraulic Power Pack	-	-	-	-	-	-	2,812	0.06	-	-	-	-	-	-	-	-	-	-	2,685	0.03	
Direct Heating/Thermal Oven	268,233	3.34	-	-	-	-	-	-	5,193	0.29	146,384	4.61	-	-	279,368	23.1	0	-	188,671	1.95	
Dessification/Dehumidification	-	-	-	-	-	-	-	-	-	-	215,686	6.79	-	-	-	-	-	-	-	-	
Positive Cold Room	111,493	1.39	-	-	-	-	-	-	-	-	22,171	0.70	-	-	-	-	-	-	-	-	
Negative Cold Room	88,518	1.10	-	-	-	-	-	-	-	-	478,097	15.0	-	-	-	-	-	-	-	-	
Process Chilled Water	18,618	0.23	-	-	-	-	-	-	-	-	-	-	-	-	196,594	16.2	6	-	-	-	
Water Heating	3,405	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,865	0.05	
Other	3,055	0.04	-	-	-	-	-	-	12,060	0.68	123,120	3.88	-	-	14,944	1.24	20,641	2.00	38,950	0.40	

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Heating Fuel Users																				
Internal Steam Generation	-	-	-	-	279,440	27.66	-	-	-	-	-	-	2,785	0.38	-	-	-	-	2,888,129	29.82
External Steam Generation	-	-	-	-	-	-	-	-	-	-	398,490	12.54	-	-	-	-	-	-	-	-
Water Boiling	-	-	120,469	69.28	-	-	-	-	-	-	104,790	3.30	-	-	-	-	-	-	-	-
Cooking/Baking	3,969,414	49.43	-	-	-	-	-	-	-	-	486,791	15.32	-	-	-	-	-	-	-	-
Process Heat	-	-	-	-	15,060	1.49	3,463,800	67.82	1,297,759	73.15	371,805	11.70	-	-	-	-	-	-	-	-
Adsorption Chiller	-	-	-	-	-	-	656,325	12.85	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	28,363	0.89	-	-	-	-	-	-	1,489,702	15.38
Total	8,031,131	100.00	173,876	100.00	1,010,282	100.00	5,107,420	100.00	1,774,149	100.00	3,177,232	100.00	731,029	100.00	1,209,226	100.00	1,034,508	100.00	9,685,550	100.00
Number of Firms in Sample	10		1		2		4		5		13		2		4		12		22	

Table 4-6: Breakdown of End Energy Use by Sub-sectors for SMEs in 2017

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles		
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	
Electricity Users																					
Lighting	27,013	0.34	2,070	1.19	62,889	7.35	61,800	1.16	6,354	0.36	60,026	1.83	1,730	0.22	12,516	1.06	89,398	8.38	97,455	1.29	
Air Conditioners	315,644	3.96	6,210	3.58	174,800	20.4	113,317	2.13	115,964	6.58	181,216	5.52	113,408	14.4	72,229	6.13	200,453	18.7	433,352	5.75	
Electric Motors	2,479,614	31.1	30,108	17.3	178,890	20.9	551,909	10.3	312,520	17.7	464,211	14.1	591,471	75.3	508,501	43.1	684,023	64.1	3,464,940	46.0	
Compressed Air/Vacuum	754,538	9.47	10,350	5.97	40,816	4.77	268,864	5.05	31,369	1.78	103,793	3.16	75,382	9.61	93,728	7.96	72,924	6.84	877,613	11.6	
Hydraulic Power Pack	-	-	-	-	-	-	2,812	0.05	-	-	-	-	-	-	-	-	-	-	2,569	0.03	
Direct Heating/Thermal Oven	279,523	3.51	-	-	-	-	-	-	4,636	0.26	154,084	4.69	-	-	279,368	23.7	2	-	183,806	2.44	
Dessification/Dehumidification	-	-	-	-	-	-	-	-	-	-	219,311	6.68	-	-	-	-	-	-	-	-	
Positive Cold Room	113,077	1.42	-	-	-	-	-	-	-	-	22,949	0.70	-	-	-	-	-	-	-	-	
Negative Cold Room	94,124	1.18	-	-	-	-	-	-	-	-	500,771	15.2	-	-	-	-	-	-	-	-	
Process Chilled Water	21,936	0.28	-	-	-	-	-	-	-	-	-	-	-	196,594	16.6	9	-	-	-	-	
Water Heating	2,505	0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,360	0.08	
Other	3,231	0.04	-	-	-	-	-	-	9,103	0.52	126,057	3.84	-	-	14,944	1.27	19,952	1.87	39,311	0.52	

End Use	Bakery		Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles		
	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	
Heating Fuel Users																					
Internal Steam Generation	-	-	-	-	383,232	44.79	-	-	-	-	-	-	2,785	0.35	-	-	-	-	921,039	12.23	
External Steam Generation	-	-	-	-	-	-	-	-	-	-	398,021	12.12	-	-	-	-	-	-	-	-	
Water Boiling	-	-	124,750	71.91	-	-	-	-	-	-	109,780	3.34	-	-	-	-	-	-	-	-	
Cooking/Baking	3,825,712	47.99	-	-	-	-	-	-	-	-	542,247	16.51	-	-	-	-	-	-	-	-	
Process Heat	54,890	0.69	-	-	15,060	1.76	3,614,400	67.89	1,282,300	72.77	369,920	11.27	-	-	-	-	-	-	-	-	
Adsorption Chiller	-	-	-	-	-	-	710,466	13.35	-	-	-	-	-	-	-	-	-	-	-	-	
Other	-	-	-	-	-	-	-	-	-	-	30,999	0.94	-	-	-	-	-	-	1,504,925	19.98	
Total	7,971,808	100.00	173,487	100.00	855,687	100.00	5,323,568	100.00	1,762,246	100.00	3,283,384	100.00	784,777	100.00	1,177,880	100.00	1,066,749	100.00	7,531,370	100.00	
Number of Firms in Sample	10		1		2		4		5		13		2		4		12		22		

4.6 Breakdown of Energy End Use within Sub-Sectors of the Industry Sector

Tables 4-7, 4-8 and 4-9 gives the breakdown of energy end use within sub-sectors of the industry sector in 2015, 2016 and 2017 respectively. The number of firms available for analysis varies from 2 in the plastic products sub-sector to 24 in the textiles sub-sector. Therefore, similar to the SME sector, a percentage comparison of energy end use within each sub-sector would be more meaningful rather than a comparison across sub-sectors. A summary of the findings for each sub-sector is given in the following paragraphs.

- 4.6.1 Beverages: Over the three years, the share of energy utilised by the different end uses had a similar pattern. Internal steam generation consumed between 81% and 82% of the annual total energy, Electric motors was a distant second with around 6% to 7% of the annual total energy. The third end use was process chilled water with around 5% of total energy. The other end energy uses were compressed air/vacuum and water boiling, each accounting for around 3% of the annual total energy and with much smaller shares, lighting, air conditioners, and hydraulic power pack.
- 4.6.2 Chemical and Chemical Products: The leading end use was process heat, which utilised around 51% of total energy in 2015, around 49% in 2016, and around 44% in 2017. The second ranking end use was electric motors whose share of total energy increased from around 33% in 2015 to around 34% in 2016 and around 37% in 2017. Compressed air/vacuum, negative cold room, and direct heating/thermal oven consumed respectively 5 to 6%, 2% and 1 to 2% of total annual energy during the three years.
- 4.6.3 Construction: Process heat was the dominant energy consumer with around 68% of total energy in 2015, around 77% in 2015 and around 65% in 2017. The second biggest consumer was electric motors whose share of total energy was around 26% in 2015, around 19% in 2016 and around 29% in 2017. Air conditioning and lighting were the next most significant energy users using between 2% and 3% and 1% of total annual energy. The other end user, accounting for less of 1% of total annual energy, was compressed air/vacuum.

- 4.6.4 *Fabricated Metal Products*: The dominant end use was process heat, which consumed around 80% of total energy in 2015, around 76% in 2016, and around 75% in 2017. The second ranking end use was electric motors whose share of total energy increased from around 13% in 2015 to around 17% in 2016 and around 19% in 2017. Air conditioners, compressed air vacuum, lighting and internal steam generators were other end uses consuming respectively around 3%, 2%, 1% and 0.02% of the total annual energy.
- 4.6.5 *Food Products*: This sub-sector has the highest number of end energy uses. Electric motor was the leading energy user with around 22% of the total annual energy over three years followed by adsorption chillers with corresponding figures of around 13% and 15%. External steam generation and internal steam generation consuming respectively 11% to 14% and 8% to 10% of the total annual energy over the three year period were the third and fourth ranking energy uses. The fifth most significant energy use was negative cold room with around 8% of the total annual energy during the period. Air conditioners, positive cold room and process heat were the sixth, seventh and eighth ranking energy uses with around 6/7%, 6% and 5/6% respectively of total annual energy. Other significant end energy uses were lighting, air conditioning, compressed air/vacuum, hydraulic power pack, direct heating/thermal oven, process chilled water, water heating, water boiling and cooking/baking each consuming less than 3% of the total annual energy.
- 4.6.6 *Paper and Paper Products*: The share of energy among the six end uses was nearly the same over the three years. Electric motors were the leading energy consumer with between 74 and 75% of total annual energy. The next most important energy use was direct heating/thermal oven with between 11% to 12% of the total annual energy. Air conditioners ranked third with around 6% of the total annual energy. Compressed air/vacuum and lighting were during the three years consistently taking a share of respectively around 5% and 3% of the total annual energy. Internal Steam Generation was the only other significant energy use accounting for less than 1% of the total annual energy.

- 4.6.7 Plastic Products: This sub-sector had only 5 end energy uses. The leading share of energy was utilised in electric motors around 70% of the total annual energy in 2015, around 71% in 2016 and around 67% in 2017. Process chilled water was the next most important energy use, around 16% of total annual energy in 2015 to around 15% in 2016, and around 20% in 2017. Compressed air/vacuum was the third ranking energy use with its share of annual total energy consumption decreasing from around 10% in 2015 to around 9% in 2016 and around 8% in 2017. Air conditioners and lighting consumed respectively around 4% and around less than 1% of the total annual energy over the three years.
- 4.6.8 Printing: This sub-sector also had only 5 end energy uses. Electric motors were the leading energy consumer whose share of the total annual energy increased from around 43% in 2015 to around 45% in 2016 and around 47% in 2017. The second highest amount of energy powered air conditioners with a share of total annual energy that decreased from around 37% in 2015 to around 36% in 2016 and around 33% in 2017. Compressed air was the third most important energy use, between 10% and 11% of the total annual energy during the three years. The fourth ranking energy use was lighting, around 8% of the total annual energy over the three year period. Hydraulic power pack was the only other energy use with less 1% of the total annual energy.
- 4.6.9 Textiles: Internal steam generation was the leading energy consumer, between 48% to 51% from 2015 to 2017. Electric motors taking in between 20 and 21% of the annual total energy over the three years was the second highest energy use. The third ranking energy use was external steam generation accounting for between 8 and 10% of the annual total energy. The fourth ranking energy use was process heat, between 8% and 9% of the total annual energy over the three year period. Compressed air/vacuum, dessification/dehumidification, and lighting consumed respectively around 4%, 3% and 1/2% of the total annual energy during the three years. Other energy users consuming less than 2% of the annual total energy were air conditioners, process chilled water, direct heating/thermal oven, water heating and water boiling.

Table 4-7: Breakdown of End Energy Use by Sub-sectors for Industry Sector in 2015

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	KWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Electricity Users																		
Lighting	317,019	0.32	67,071	0.87	107,715	0.92	195,510	1.41	584,076	0.77	16,943	2.65	15,060	0.37	618,786	8.39	5,601,802	1.63
Air Conditioners	510,152	0.51	469,607	6.06	395,979	3.40	433,959	3.13	4,799,134	6.29	40,860	6.39	171,812	4.23	2,754,145	37.33	4,229,209	1.23
Electric Motors	6,032,690	6.00	2,559,394	33.01	3,022,875	25.95	1,812,901	13.07	16,470,804	21.58	474,360	74.24	2,823,274	69.56	3,141,370	42.58	70,141,270	20.36
Compressed Air/Vacuum	3,015,456	3.00	416,807	5.38	51,078	0.44	251,187	1.81	2,391,208	3.13	29,218	4.57	397,407	9.79	846,326	11.47	15,142,164	4.40
Hydraulic Power Pack	23,817	0.02	-	-	-	-	-	-	152,758	0.20	-	-	-	-	16,426	0.22	11,294	0.00
Direct Heating/Thermal Oven	-	-	106,546	1.37	-	-	-	-	665,389	0.87	75,669	11.84	-	-	-	-	524,180	0.15
Dessifiation/Dehumidification	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,708,661	2.82
Positive Cold Room	-	-	8,218	0.11	-	-	-	-	4,454,908	5.84	-	-	-	-	-	-	-	-
Negative Cold Room	-	-	155,160	2.00	-	-	-	-	5,875,086	7.70	-	-	-	-	-	-	-	-
Process Chilled Water	5,193,939	5.16	-	-	-	-	-	-	1,326,862	1.74	-	-	651,067	16.04	-	-	4,230,461	1.23
Water Heating	-	-	495	0.01	-	-	-	-	213,827	0.28	-	-	-	-	-	-	37,023	0.01
Other	-	-	495	0.01	160,433	1.38	33,936	0.24	429,139	0.56	-	-	-	-	-	-	355,453	0.10

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	KWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Heating Fuel Users																		
Internal Steam Generation	82,049,132	81.57	-	-	-	-	2,570	0.02	7,341,612	9.62	1,906	0.30	-	-	-	-	167,951,994	48.76
External Steam Generation	-	-	-	-	-	-	-	-	8,353,792	10.95	-	-	-	-	-	-	32,051,274	9.31
Water Boiling	3,446,264	3.43	-	-	-	-	-	-	965,605	1.27	-	-	-	-	-	-	1,071,000	0.31
Cooking/Baking	-	-	-	-	-	-	-	-	21,956	0.03	-	-	-	-	-	-	-	-
Process Heat	-	-	3,969,055	51.19	7,911,711	67.92	11,135,990	80.31	4,351,516	5.70	-	-	-	-	-	-	28,551,517	8.29
Adsorption Chiller	-	-	-	-	-	-	-	-	11,488,785	15.05	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	6,432,812	8.43	-	-	-	-	-	-	4,827,808	1.40
Total	100,588,470	100.00	7,752,848	100.00	11,649,790	10.00	13,866,053	100.00	76,319,265	100.00	638,956	100.00	4,058,620	100.00	7,377,054	100.00	344,435,111	100.00
Number of Firms in Sample	9		6		4		5		14		3		2		9		24	

Table 4-8: Breakdown of End Energy Use by Sub-sectors for Industry Sector in 2016

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Electricity Users																		
Lighting	325,763	0.32	66,010	0.91	99,350	0.60	214,879	1.47	581,693	0.75	16,678	2.63	12,217	0.31	594,724	7.93	5,207,116	1.60
Air Conditioners	526,023	0.52	465,697	6.40	381,951	2.30	485,165	3.32	4,799,252	6.21	40,110	6.32	168,590	4.33	2,710,112	36.13	4,283,240	1.32
Electric Motors	6,138,431	6.11	2,501,748	34.38	3,114,316	18.76	2,419,679	16.58	16,730,867	21.65	473,742	74.65	2,778,657	71.35	3,392,357	45.23	68,864,530	21.21
Compressed Air/Vacuum	2,967,885	2.96	414,094	5.69	52,966	0.32	299,683	2.05	2,527,577	3.27	28,841	4.54	350,771	9.01	786,088	10.48	14,118,365	4.35
Hydraulic Power Pack	21,835	0.02	-	-	-	-	-	-	184,929	0.24	-	-	-	-	17,611	0.23	8,424	0.00
Direct Heating/Thermal Oven	-	-	112,116	1.54	-	-	-	-	131,971	0.17	73,457	11.57	-	-	-	-	657,654	0.20
Dessification/Dehumidification	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,396,707	2.89
Positive Cold Room	-	-	7,070	0.10	-	-	-	-	4,521,552	5.85	-	-	-	-	-	-	-	-
Negative Cold Room	-	-	133,496	1.83	-	-	-	-	5,798,450	7.50	-	-	-	-	-	-	-	-
Process Chilled Water	5,319,877	5.31	-	-	-	-	-	-	1,318,942	1.71	-	-	584,301	15.00	-	-	3,766,567	1.16
Water Heating	-	-	505	0.01	-	-	-	-	220,930	0.29	-	-	-	-	-	-	41,067	0.01
Other	-	-	505	0.01	144,129	0.87	35,176	0.24	441,652	0.57	-	-	-	-	-	-	340,690	0.10

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Heating Fuel Users		-		-		-		-		-		-		-		-		-
Internal Steam Generation	81,725,441	81.38	-	-	-	-	3,470	0.02	7,930,752	10.26	1,831	0.29	-	-	-	-	155,516,422	47.89
External Steam Generation	-	-	-	-	-	-	-	-	9,164,106	11.86	-	-	-	-	-	-	27,571,463	8.49
Water Boiling	3,393,142	3.38	-	-	-	-	-	-	794,218	1.03	-	-	-	-	-	-	1,071,000	0.33
Cooking/Baking	-	-	-	-	-	-	-	-	90,099	0.12	-	-	-	-	-	-	-	-
Process Heat	-	-	3,574,480	49.13	12,799,084	77.14	11,136,160	76.31	4,281,279	5.54	-	-	-	-	-	-	28,679,407	8.83
Adsorption Chiller	-	-	-	-	-	-	-	-	10,055,388	13.01	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	7,704,024	9.97	-	-	-	-	-	-	5,218,274	1.61
Total	100,418,397	100.00	7,275,721	100.00	16,591,795	100.00	14,594,212	100.00	77,277,682	100.00	634,658	100.00	3,894,536	100.00	7,500,893	100.00	324,740,928	100.00
Number of Firms in Sample	9		6		4		5		14		3		2		9		24	

Table 4-9: Breakdown of End Energy Use by Sub-sectors for Industry Sector in 2017

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Electricity Users																		
Lighting	329,515	0.33	101,598	1.56	127,231	0.99	197,317	1.32	602,961	0.81	17,416	2.68	8,811	0.24	794,843	8.12	5,119,170	1.41
Air Conditioners	557,374	0.56	469,969	7.20	439,890	3.42	461,987	3.08	4,875,485	6.52	41,340	6.36	153,145	4.12	3,268,139	33.37	4,220,117	1.16
Electric Motors	6,759,812	6.80	2,430,063	37.23	3,684,858	28.68	2,773,725	18.50	16,517,171	22.10	485,557	74.71	2,487,213	66.92	4,636,742	47.35	73,594,578	20.31
Compressed Air/Vacuum	3,108,144	3.13	410,378	6.29	48,949	0.38	283,281	1.89	2,499,208	3.34	30,194	4.65	314,377	8.46	1,076,990	11.00	14,278,592	3.94
Hydraulic Power Pack	-	-	-	-	-	-	-	-	172,706	0.23	-	-	-	-	16,642	0.17	8,358	0.00
Direct Heating/Thermal Oven	-	-	102,772	1.57	-	-	-	-	134,744	0.18	73,457	11.30	-	-	-	-	593,204	0.16
Dessification/Dehumidification	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,332,618	2.85
Positive Cold Room	-	-	6,657	0.10	-	-	-	-	4,546,285	6.08	-	-	-	-	-	-	-	-
Negative Cold Room	-	-	125,692	1.93	-	-	-	-	5,858,376	7.84	-	-	-	-	-	-	-	-
Process Chilled Water	5,271,872	5.31	-	-	-	-	-	-	1,307,791	1.75	-	-	753,050	20.26	-	-	3,081,902	0.85
Water Heating	-	-	541	0.01	-	-	-	-	198,996	0.27	-	-	-	-	-	-	39,323	0.01
Other	-	-	541	0.01	200,297	1.56	34,556	0.23	439,705	0.59	-	-	-	-	-	-	336,935	0.09

End Use	Beverages		Chemicals		Construction		Fabricated Metal Products		Food Products		Paper and Paper Products		Plastic Products		Printing		Textiles	
	kWh	%	kWh	%	KWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%	kWh	%
Heating Fuel Users																		
Internal Steam Generation	80,137,584	80.65	-	-	-	-	3,342	0.02	6,060,670	8.11	1,939	0.30	-	-	-	-	186,577,484	51.49
External Steam Generation	-	-	-	-	-	-	-	-	10,146,544	13.58	-	-	-	-	-	-	34,570,957	9.54
Water Boiling	3,199,505	3.22	-	-	-	-	-	-	1,014,158	1.36	-	-	-	-	-	-	803,250	0.22
Cooking/Baking	-	-	-	-	-	-	-	-	223,602	0.30	-	-	-	-	-	-	-	-
Process Heat	-	-	2,879,182	44.11	8,346,461	64.97	11,236,020	74.96	3,463,195	4.63	-	-	-	-	-	-	27,869,622	7.69
Adsorption Chiller	-	-	-	-	-	-	-	-	9,911,328	13.26	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	6,764,864	9.05	-	-	-	-	-	-	933,682	0.26
Total	99,363,806	100.00	6,527,394	100.00	12,847,685	100.00	14,990,227	100.00	74,737,789	100.00	649,904	100.00	3,716,595	100.00	9,793,356	100.00	362,359,792	100.00
Number of Firms in Sample	9		6		4		5		14		3		2		9		24	

5 Energy Use Intensities (EUI) – Task 3

5.1 Overview

Electric unit intensity (EUI) is defined as the energy consumed by a firm divided either by the quantity of products, EUI per production output (kWh/Production Output), or by built up area, EUI per built up area (kWh/square meters). EUI have been determined for the total energy consumed by each firm, and separately for the electricity and fossil fuel consumed.

Data was available for the determination of EUIs for 146 firms. These are broken down as shown in the following table.

Table 5-1: Number of Firms analysed by sub-sector

Subsector	SME	Industry	Total
Bakery	10		10
Beverages	1	10	11
Chemical & Chemical products	2	6	8
Construction	4	3	7
Fabricated Metal Products, except machinery & equipment	5	4	9
Food products	13	12	25
Paper & Paper products	3	3	6
Plastic Products	3	2	5
Printing	11	8	19
Textiles & Wearing Apparel	22	24	46
Total	74	72	146

5.2 Determination of EUI Per Production Output for SME and Industry Sectors

The EUI per production output has been determined for each firm in the industry and SME sectors. The detailed EUI per production output; for electricity, fossil fuel, and total; are listed by subsector in annexes 2 to 11. The EUIs by subsectors of the SME sector are summarized in Table 5-2. The EUIs by subsectors of the Industry sector are summarized in Table 5-3.

Table 5-2: EIU Per Production Output for SME sector

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
				Electricity	Fossil Fuel	Total
Bakery	Bread	10	Unit	(a) 0.003 to 1.215 (b) 0.004 to 1.080 (c) 0.005 to 0.969	(a) 000 to 1.176 (b) 0.000 to 1.243 (c) 0.002 to 1.172	(a)0.056 to 1.338 (b) 0.056 to 1.409 (c) 0.056 to 1.341
Beverages	Wine	1	Liter	(a) 0.102 (b) 0.118 (c) 0.090	(a) 0.175 (b) 0.266 (c) 0.232	(a) 0.277 (b) 0.384 (c) 0.322
Chemicals	Candels	1	Tons	(a)----- (b)600.00 (c) 500.00	(a) ----- (b) 602.40 (c) 502.00	(a)----- (b)1202.40 (c) 1002.00
	Chemicals, Plastic Injection	1	Tons	(a) 0.139 (b) 0.170 (c) 0.088	(a) 0.067 (b) 0.068 (c) 0.076	(a) 0.206 (b) 0.238 (c) 0.164
Construction	Dry Mortar	1	Tons	(a) 13.649 (b) 11.982 (c) 16.044	(a) 71.824 (b) 65.799 (c) 91.036	(a) 85.473 (b) 77.781 (c) 107.080
	Metal Fabric	1	Tons	(a) 258.586 (b) 220.690 (c) 182.857	(a) 0.00 (b) 0.00 (c) 0.00	(a) 258.586 (b) 220.690 (c) 182.857
	Aluminum Openings	1	Tons	(a) 1.727 (b) 1.560 (c) 2.000	(a) 0.000 (b) 0.000 (c) 0.000	(a) 1.727 (b) 1.560 (c) 2.000
	Steel Foundry	1	Tons	(a) ----- (b) 1582.537 (c) 720.933	(a) ----- (b) 0.000 (c) 0.000	(a)----- (b) 1582.537 (c) 720.933
Fabricated Metal Products	Steel Bars	1	Tons	(a) 805.200 (b) 805.200 (c) 805.200	(a) 0.000 (b) 0.000 (c) 0.000	(a) 805.200 (b) 805.200 (c) 805.200
	Steel Bar Processing	1	Tons	(a) 150.101 (b) 99.463 (c) 58.677	(a) 0.000 (b) 0 000 (c) 0.000	(a) 150.101 (b) 99.463 (c) 58.677
	Aluminum Products	1	Tons	(a) 0.005 (b) 0.005 (c) 0.003	(a) 0.000 (b) 0.000 (c) 0.000	(a) 0.005 (b) 0.005 (c) 0.003

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
Fabricated Metal Products	Steel Galvanising	1	Tons	(a) 31.725 (b) 46.877 (c) 50.637	(a) 735.637 (b) 586.691 (c) 599.206	(a) 767.362 (b) 633.568 (c) 649.843
	Manufacture	1	Tons	(a) 2291.920 (b) 1835.933 (c) 2116.125	(a) 0.000 (b) 0.000 (c) 0.000	(a) 2291.920 (b) 1835.933 (c) 2116.125
Food Products	Various Food Products	3	Tons	(a) 1,014.940 to 2400.000 (b) 815.172 to 1885.200 (c) 686.284 to 1929.34	(a) 88.507 to 1792.814 (b) 85.160 to 1624.651 (c) 91.853 to 1489.552	(a) 1954.983 to 3724.8002989 (b) 1946.140 to 2989.200 (c) 2021.193 to 2689.667
	Meat	1	Tons	(a)57.167 (b) 60.937 (c) 56.591	(a) 157.876 (b) 157.362 (c) 150.295	(a) 215.043 (b) 218.299 (c) 206.886
	Duck	1	Units	(a) 1.811 (b) 1.660 (c) 1.594	(a) 1.790 (b) 1.667 (c) 1.600	(a) 3.601 (b) 3.327 (c) 3.194
	Bread and Pastry	1	Units	(a) 52.250 (b) 57.610 (c) 102.471	(a) 123.897 (b) 124.440 (c) 208.983	(a) 176.147 (b) 182.050 (c) 311.454
	Ice Cream	1	Liters	(a) 5.772 (b) 6.230 (c) 6.166	(a) 0.000 (a) 0.000 (c) 0.000	(a) 5.772 (b) 6.230 (c) 6.166
	Biscuits	1	Tons	(a) 631.579 (b) 619.048 (c) 618.955	(a) 0.000 (a) 0.000 (c) 0.000	(a) 631.579 (b) 619.048 (c) 618.955
	Roasted Coffee	1	Tons	(a) 373.000 (b) 350.492 (c) 346.333	(a) 0.000 (b) 0.000 (c) 0.000	(a) 373.000 (b) 350.492 (c) 346.333
	Chocolates	1	Kg	(a) 6.519 (b) 3.828 (c) 2.725	(a) 0.964 (b) 0.562 (c) 0.391	(a) 7.483 (b) 4.390 (c) 3.116
	Spices	2	Tons	(a) 52.481 to 197.333 (b) 54.054 to 206.667 (c) 59.918 to 195.000	(a) 0.000 to 110.440 (b) 0.000 to 110.440 (c) 0.000 to 112.950	(a) 52.481 to 307.773 (b) 54.054 to 317.107 (c) 593918 to 307.950
	Pasta	1	Tons	(a) 452.941 (b) 430.588 (c) 437.647	(a) 135.024 (b) 123.282 (c) 129.153	(a) 587.965 (b) 554.870 (c) 566.800
Paper and Paper Products	Carton Products	2	Tons	(a) 70.891 to 1,010.000 (b) 124.967 to 1,098.000 (c) 91.714 to 812.000	(a) 0.000 to 0.314 (b) 0.000 to 0.554 (c) 0.000 to 0.374	(a) 71.205 to 1,010.000 (b) 125.521 to 1,098.000 (c) 92.088 to 812.000

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
	Envelopes	1	Units	(a) 0.0055 (b) 0.0055 (c) 0.0055	(a) 0.000 (b) 0.000 (c) 0.000	(a) 0.0055 (b) 0.0055 (c) 0.0055
Plastics	Plastic Products	1	Tons	(a) 3712.308 (b) 3649.916 (c) 3619.500		a) 3712.308 (b) 3649.916 (c) 3619.500
	Plastic Injection Molding	2	Tons	(a) 3,371.140 to 5,100.000 (b) 2926.943 to 5181.818 (c) 3213.704 to 5428.571	-	(a) 3,371.140 to 5,100.000 (b) 2926.943 to 5181.818 (c) 3213.704 to 5428.571
Printing	Printed Matter	8	Tons	(a) 431.641 to 36,000.0 (b) 166.923 to 36,000.00 (c) 172.994 to 36,000.0	-	(a) 431.641 to 36,000.0 (b) 166.923 to 36,000.00 (c) 172.994 to 36,000.0
	Printed Matter	1	Unit	(a) 0.003 (b) 0.002 (c) 0.002	-	(a) 0.003 (b) 0.002 (c) 0.002
	Files Manufacturing	1	Tons	(a) 63.667 (b) 58.588 (c) 57.667	- - -	(a) 63.667 (b) 58.588 (c) 57.667
	T Shirt Printing	1	Units	(a) 0.9091 (b) 1.4130 (c) 1.5116		(a) 0.9091 (b) 1.4130 (c) 1.5116
Textiles	Apparel	2	Units	(a) 0.2980 tp 0.3635 (b) 0.2971 to 2.8839 (c) 0.2415 to 3.3392		(a) 0.2980 tp 0.3635 (b) 0.2971 to 2.8839 (c) 0.2415 to 3.3392
	Knitted Garments	13	Units	(a) 0.017 to 0.922 (b) 0.016 to 0.813 (c) 0.016 to 0.827	(a) 0.000 to 3.102 (b) 0.000 to 0.521 (c) 0.000 to 0.281	(a) 0.017 to 3.422 (b) 0.016 to 0.813 (c) 0.016 to 0.827
	Ready Made Garments	3	Units	(a) 0.471 to 1.832 (b) 0.582 to 3.358 (c) 0.546 to 8.059		(a) 0.471 to 1.832 (b) 0.582 to 3.358 (c) 0.546 to 8.059
	Textile Prints	1	Units	(a) 0.401 (b) 0.335 (c) 0.503	(a) 1.364 (b) 1.395 (c) 2.050	(a) 1.765 (b) 1.730 (c) 2.553
	Uniforms	1	Units	(a) 0.150 (b) 0.160 (c) 0.170		(a) 0.150 (b) 0.160 (c) 0.170

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
	Shirts	1	Units	(a) 79.000 (b) 58.202 (c) 46.513		(a) 79.000 (b) 58.202 (c) 46.513
	Knitted Fabrics	1	Tons	(a) 1134.192 (b) 1068.634 (c) 1153.012		(a) 1134.192 (b) 1068.634 (c) 1153.012

Table 5-3: EIU Per Production Output for Industry sector

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
				Electricity	Fossil Fuel	Total
Beverages	Rum	5	Liters	(a) 0.017 to 0.940 (b) 0.019 to 0.938 (c) 0.019 to 1.026	(a) 0.024 to 5.722 (b) 0.035 to 5.313 (c) 0.029 to 4.516	(a) 0.055 to 5.926 (b) 0.062 to 5.534 (c) 0.060 to 4.712
	Beer	1	Liters	(a) 0.177 (b) 0.182 (c) 0.179	(a) 0.557 (b) 0.588 (c) 0.525	(a) 0.734 (b) 0.770 (c) 0.704
	Soft Drinks	1	Liters	(a) 0.084 (b) 0.075 (c) 0.079	(a) 0.045 (b) 0.042 (c) 0.037	(a) 0.129 (b) 0.116 (c) 0.116
	Wine	1	Liters	(a)----- (b) 57.716 (c) 8.768	(a)---- (b) 46.749 (c) 7.077	(a)----- (b) 104.465 (c) 15.845
	Tea	2	Kg	(a) 1.062 to 1.467 (b) 1.037 to 1.388 (c) 1.100 to 1.364	(a) 4.290 to 10.751 (b) 4.162 to 11.089 (c) 3.790 to 12.013	(a) 5.352 to 12.718 (b) 5.199 to 12.477 (c) 4.890 to 13.377
Chemicals	Paint	2	Liters	(a) 0.093 to 0.099 (b) 0.088 to 0.088 (c) 0.084 to 0.085	(a) 0.000 to 0.014 (b) 0.000 to 0.013 (c) 0.000 to 0.013	(a) 0.099 to 0.107 (b) 0.078 to 0.101 (c) 0.084 to 0.098
	Acetylene	1	Cu m	(a) 16.773 (b) 14.753 (c) 15.539	(a) 118.741 (b) 107.736 (c) 96.388	(a) 135.514 (b) 122.129 (c) 111.927
	Oxygen	1	Kg	(a) ----- (b)----- (c) 29.356	(a) ----- (b)----- (c) 0.000	(a) ----- (b)----- (c) 29.356
	Chemicals	1	Tons	(a) 52.811 (b) 48.179 (c) 46.924	(a) 0.000 (b) 10.139 (c) 8.015	(a) 52.811 (b) 58.318 (c) 54.939
	Carbon dioxide	1	Kg	(a) 0.241 (b) 0.258 (c) 0.231	(a) 0.000 (b) 0.000 (c) 0.000	(a) 0.241 (b) 0.258 (c) 0.231

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
				Electricity	Fossil Fuel	Total
Construction	Cement	1	Tons	(a) 1.728 (b) 1.873 (c) 2.268	(a) 0.855 (b) 0.798 (c) 0.798	(a) 2.583 (b) 2.671 (c) 3.066
	Asphalt	1	Tons	(a) 10.988 (b) 6.028 (c) 7.525	(a) 146.305 (b) 119.475 (c) 147.423	(a) 157.293 (b) 125.503 (c) 154.948
	Ready Mixed Concrete	1	Tons	(a) 5.725 (b) 5.775 (c) 5.342	(a) 0.000 (b) 0.000 (c) 0.000	(a) 5.725 (b) 5.775 (c) 5.342
Fabricated Metal Products	Steel Bar Processing	1	Tons	(a) 1337.388 (b) 974.332 (c) 1210.701	(a) 0.000 (b) 0.000 (c) 0.000	(a) 1337.388 (b) 974.332 (c) 1210.701
	Steel Galvanising	1	Tons	(a) ----- (b) 44.529 (c) 34.252	(a)----- (b) 564.540 (c) 471.514	(a) ----- (b) 609.069 (c) 505.766
	Steel Bars	1	Tons	(a) 209.460 (b) 291.204 (c) 328.280	(a) 1071.000 (b) 1071.000 (c) 1071.000	(a) 1280.460 (b) 1362.204 (c) 1329.280
	Cutlery	1	Units	(a) 0.002 (b) 0.002 (c) 0.002	(a) 0.000 (b) 0.000 (c) 0.000	(a) 0.002 (b) 0.002 (c) 0.002
Food Products	Processed Fruits, Vegetables	1	Tons	(a) 1807.976 (b)1736.474 (c) 2029.141	(a) 1064.984 (b) 1085.952 (c) 1242.371	(a) 2872.960 (b) 2872.426 (c) 3271.512
	Noodles, Pasta	1	Tons	(a) 66.390 (b) 57.258 (c) 55.553	(a) 377.458 (b) 407.186 (c) 505.136	(a) 443.848 (b) 464.444 (c) 560.689
	Margarine	1	Tons	(a) 226629.333 (b) 354759.500 (c) 292985.333	(a) 261891.834 (b) 407184.000 (c) 316615.500	(a) 488521.167 (b) 761943.500 (c) 609600.833
	Poultry	2	Tons	(a) 462.239 to 611.338 (b) 452.152 to 647.072 (c) 529.721 to 601.696	(a) 59.616 to 128.161 (b) 49.367 to 124.292 (c) 44.938 to 78.106	(a) 590.400 to 670.954 (b) 576.445 to 696.439 (c) 607.827 to 646.633
	Pastry	1	Tons	(a) 1203.808 (b) 1198.037 (c) 1156.000	(a) 451.800 (b) 427.156 (c) 424.190	(a) 1655.608 (b) 1625.193 (c) 1580.190

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
				Electricity	Fossil Fuel	Total
	Flour	1	Tons	(a) 88.036 (b) 86.571 (c) 89.683	(a) 7.689 (b) 7.854 (c) 8.578	(a) 95.725 (b) 94.425 (c) 98.261
	Milk Products	1	Kg	(a) 35.996 (b) 33.753 (c) 33.094	(a) 34.153 (b) 40.125 (c) 36.517	(a) 70.149 (b) 73.878 (c) 69.611
	Refined Oil	2	Tons	(a) 28.951 to 37.950 (b) 43.372 to 58.441 (c) 46.708 to 77.606	(a) 333.200 to 673.224 (b) 682.377 to 669.375 (c) 535.500 to 725.127	(a) 362.151 to 711.174 (b) 725.749 to 727.816 (c) 613.106 to 771.835
	Food Products	1	Pieces	(a) 0.027 (b) 0.021 (c) 0.018	(a) 0.000 (b) 0.000 (c) 0.000	(a) 0.027 (b) 0.021 (c) 0.018
Paper and Paper Products	Paper Products	2	Tons	(a) ----- to 20.743 (b) 20.743 to 66.118 (c) 20.743 to 61.435	(a)----- to 0.000 (b) 0.000 to 0.366 (c) 0.000 to 0.360	(a)----- to 20.743 (b) 20.743 to 66.484 (c) 20.743 to 61.795
	Carton Products	1	Units	(a) 12.083 (b) 11.907 (c) 12.538	(a) 0.000 (b) 0.000 (c) 0.000	(a) 12.083 (b) 11.907 (c) 12.538
Plastics	Plastic Products	1	Tons	(a) 1268.745 (b) 1849.466 (c) 1888.936		(a) 1268.745 (b) 1849.466 (c) 1888.936
	PVC and Polyethylene Pipes	1	Tons	(a) 930.067 (b) 1,031.563 (c) 927.195		(a) 930.067 (b) 1,031.563 (c) 927.195
Printing	Printed Matter	6	Tons	(a) 377.778 to 3,384.933 (b) 393.70 to 3,025.411 (c) 369.231 to 2,682.011		(a) 377.778 to 3,384.933 (b) 393.70 to 3,025.411 (c) 369.231 to 2,682.011
	Printed Matter	1	Pieces	(a) 0.5142 (b) 0.3359 (c) 0.3908		(a) 0.5142 (b) 0.3359 (c) 0.3908
	Light Packing, Magazines	1	Tons	(a) 674.4382 (b) 773.8908 (c) 974.8945		(a) 674.4382 (b) 773.8908 (c) 974.8945
Textiles	Apparel	1	Units	(a) 1.065 (b) 1.371 (c) 1.470		(a) 1.065 (b) 1.371 (c) 1.470

Subsector	Products	No of Firms Analysed	Production Unit for EUI	EUI (kWh/Production Unit)		
				(a) 2015, (b) 2016, (c) 2017		
				Electricity	Fossil Fuel	Total
	Denim	1	Units	(a) 145.428 (b) 125.830 (c) 143.989	(a) 333.066 (b) 262.272 (c) 273.704	(a) 478.494 (b) 388.102 (c) 417.693
	Knitted Fabrics	2	Tons	(a) 2.336 to 2.993 (b) 2.041 to 2.529 (c) 2.578 to 2.639	(a) 1.329 to 13.107 (b) 1.300 to 9.897 (c) 1.683 to 10.338	(a) 3.665 to 16.100 (b) 3.341 to 12.426 (c) 4.261 to 12.977
	Knitted Garments	11	Units	(a) 0.044 to 2.800 (b) 0.042 to 6.311 (c) 0.047 to 3.719	(a) 0.000 to 11.613 (b) 0.000 to 25.847 (c) 0.000 to 17.070	(a) 0.044 to 14.413 (b) 0.042 to 32.158 (c) 0.047 to 20.789
	Swimwear	1	Units	(a) 0.438 (b) 0.433 (c) 0.327		(a) 0.438 (b) 0.433 (c) 0.327
	Textiles	2	Units	(a) 1.733 to 5.981 (b) 1.644 to 6.522 (c) 1.633 to 7.046	(a) 0.000 to 0.637 (b) 0.000 to 0.806 (c) 0.000 to 0.911	(a) 2.369 to 5.981 (b) 2.500 to 6.522 (c) 2.545 to 7.046
	Textiles	1	Tons	(a) 343.98 (b) 499.320 (c) 450.000		(a) 343.98 (b) 499.320 (c) 450.000
	Woven Fabrics	3	Meters	(a) 0.418 to 2.237 (b) 0.403 to 3.000 (c) 0.354 to 2.533	(a) 0.287 to 5.112 (b) 0.260 to 3.848 (c) 0.222 to 4.440	(a) 0.705 to 7.261 (b) 0.663 to 6.848 (c) 0.577 to 6.356
	Woven Shirts	1	Units	(a) 0.756 (b) 0.753 (c) 0.792	(a) 0.894 (b) 0.850 (c) 1.231	(a) 1.650 (b) 1.603 (c) 2.023
	Yarns Spinned	1	Tons	(a) 0.000 (b) 0.000 (c) 0.000	(a) 10.456 (b) 10.417 (c) 10.494	(a) 10.456 (b) 10.418 (c) 10.495

5.3 Determination of EUI by Built Up Area for SME and Industry Sectors

The EUI by built up area in kWh/square meter has been determined for each firm in the industry and SME sectors. The detailed EUI by built up area; for electricity, fossil fuel, and total; are listed by subsector in annexes 12 to 21. The EUIs by categories of the SME sector are summarized in Table 5-4. The EUIs for the Industry sector are summarized in Table 5-5.

Table 5-4: EUI by Built Up Area for SME Sector

Subsector	Products	No of Firms Analysed	EUI (kWh/square meter)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
Bakery	Bread	10	(a) 58 to 1,935 (b) 58 to 1,815 (c) 58 to 1,815	(a) 0 to 11,695 (b) 0 to 10,136 (c) 3 to 9,840	(a) 216 to 13,631 (b) 217 to 11,929 (c) 217 to 11,544
Beverages	Wine	1	(a) 3 (b) 2 (c) 2	(a) 5 (b) 5 (c) 6	(a) 8 (b) 7 (c) 8
Chemicals	Candela	1	(a) 17 (b) 17 (c) 17	(a) 17 (b) 17 (c) 17	(a) 34 (b) 34 (c) 34
	Chemicals	1	(a) 37 (b) 44 (c) 28	(a) 18 (b) 17 (c) 24	(a) 55 (b) 61 (c) 52
Construction	Steel Foundry	1	(a) 487 (b) 487 (c) 487	(a) 0 (b) 0 (c) 0	(a) 487 (b) 487 (c) 487
	Aluminum openings	1	(a) 2 (b) 2 (c) 2	(a) 0 (b) 0 (c) 0	(a) 2 (b) 2 (c) 2
	Metal Fabric	1	(a) 16 (b) 16 (c) 16	(a) 0 (b) 0 (c) 0	(a) 16 (b) 16 (c) 16
	Dry mortar	1	(a) 210 (b) 217 (c) 221	(a) 1,107 (b) 1,194 (c) 1,252	(a) 1,318 (b) 1,411 (c) 1,473
Fabricated Metal Products	Steel bar processing	1	(a) 18 (b) 14 (c) 10	(a) 0 (b) 0 (c) 0	(a) 18 (b) 14 (c) 10
	Manufacture	1	(a) 344 (b) 330 (c) 339	(a) 0 (b) 0 (c) 0	(a) 344 (b) 330 (c) 339
	Steel Galvanising	1	(a) 12 (b) 21 (c) 22	(a) 281 (b) 268 (c) 264	(a) 293 (b) 289 (c) 287

Subsector	Products	No of Firms Analysed	EUI (kWh/square meter)		
			(a) 2015, (b) 2016, (c) 2017		
	Steel bars	1	(a) 40 (b) 40 (c) 40	(a) 0 (b) 0 (c) 0	a) 40 (b) 40 (c) 40
	Aluminum products	1	a) 33 (b) 36 (c) 26	(a) 0 (b) 0 (c) 0	a) 33 (b) 36 (c) 26
Food Products	Various Food Products	3	(a) 42 to 461 (b) 44 to 435 (c) 46 to 490	(a) 8 to 255 (b) 7 to 255 (c) 8 to 255	(a) 117 to 716 (b) 131 to 689 (c) 146 to 744
	Meat	1	(a) 23 (b) 25 (c) 24	(a) 64 (b) 64 (c) 64	(a) 87 (b) 89 (c) 88
	Duck	1	(a) 111 (b) 111 (c) 111	(a) 109 (b) 111 (c) 111	(a) 220 (b) 222 (c) 222
	Bread and Pastry	1	(a) 159 (b) 168 (c) 177	(a) 378 (b) 362 (c) 360	(a) 537 (b) 530 (c) 537
	Coffee	1	(a) 41 (b) 39 (c) 38	(a) 0 (b) 0 (c) 0	(a) 41 (b) 39 (c) 38
	Ice Cream	1	(a) 395 (b) 427 (c) 422	(a) 10 (b) 10 (c) 10	(a) 406 (b) 437 (c) 433
	Spices	2	(a) 6 to 59 (b) 6 to 68 (c) 6 to 84	(a) 0 to 3 (b) 0 to 3 (c) 0 to 4	(a) 9 to 59 (b) 10 to 68 (c) 10 to 84
	Pasta	1	(a) 241 (b) 229 (c) 233	(a) 72 (b) 65 (c) 69	(a) 312 (b) 294 (c) 301
	Biscuits	1	(a) 45 (b) 49 (c) 51	(a) 355 (b) 397 (c) 418	(a) 400 (b) 446 (c) 469
	Chocolates	1	(a) 18 (b) 18 (c) 19	(a) 3 (b) 3 (c) 3	(a) 21 (b) 21 (c) 21

Subsector	Products	No of Firms Analysed	EUI (kWh/square meter)		
			(a) 2015,	(b) 2016,	(c) 2017
Paper and Paper Products	Carton Products	2	(a) 11 to 78 (b) 12 to 78 (c) 13 to 84	(a) 0 (b) 0 (c) 0	(a) 11 to 78 (b) 12 to 78 (c) 13 to 84
	Envelopes	1	(a) 128 (b) 128 (c) 128	(a) 0 (b) 0 (c) 0	(a) 128 (b) 128 (c) 128
Plastics	Material Produced	1	(a) 622 (b) 622 (c) 622	(a) 0 (b) 0 (c) 0	(a) 622 (b) 622 (c) 622
	Plastic Injection Molding	2	(a) 276 to 785 (b) 294 to 877 (c) 249 to 877	(a) 0 (b) 0 (c) 0	(a) 276 to 785 (b) 294 to 877 (c) 249 to 877
Printing	Printed Matter	9	(a) 5 to 313 (b) 7 to 291 (c) 9 to 330	(a) 0 (b) 0 (c) 0	(a) 5 to 313 (b) 7 to 291 (c) 9 to 330
	T Shirts	1	(a) 70 (b) 70 (c) 70	(a) 0 (b) 0 (c) 0	(a) 70 (b) 70 (c) 70
	Files Manufacturing	1	(a) 1 (b) 1 (c) 1	(a) 0 (b) 0 (c) 0	(a) 1 (b) 1 (c) 1
Textiles	Apparel	2	(a) 7 to 18 (b) 21 to 51 (c) 19 to 56	(a) 0 (b) 0 (c) 0	(a) 7 to 18 (b) 21 to 51 (c) 19 to 56
	Knitted Garments	13	(a) 8 to 530 (b) 9 to 620 (b) 8 to 509	(a) 0 to 1296 (b) 0 to 234 (c) 0 to 88	(a) 8 to 1429 (b) 9 to 620 (c) 8 to 509
	Ready Made Garments	3	(a) 13 to 93 (b) 13 to 93 (c) 13 to 93	(a) 0 (b) 0 (c) 0	(a) 13 to 93 (b) 13 to 93 (c) 13 to 93
	Textile Prints	1	(a) 163 (b) 133 (c) 136	(a) 553 (b) 553 (c) 553	(a) 716 (b) 686 (c) 689
	Uniforms	1	(a) 9 (b) 10 (c) 10	(a) 0 (b) 0 (c) 0	(a) 9 (b) 10 (c) 10

Subsector	Products	No of Firms Analysed	EUI (kWh/square meter)		
			(a) 2015, (b) 2016, (c) 2017		
	Knitted Fabrics	1	(a) 147 (b) 148 (c) 147	(a) 0 (b) 0 (c) 0	(a) 147 (b) 148 (c) 147
	Shirts	1	(a) 81 (b) 72 (c) 72	(a) 0 (b) 0 (c) 0	(a) 81 (b) 72 (c) 72

Table 5-5: EUI by Built Up Area for Industry Sector

Subsector	Products	No of Firms Analysed	EUI (kWh/square meters)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
Beverages	Rum	5	(a) 14 to 279 (b) 14 to 329 (c) 15 to 351	(a) 6 to 8,592 (b) 8 to 7,875 (c) 5 to 8,582	(a) 20 to 8,871 (b) 22 to 8,204 (c) 20 to 8,932
	Beer	1	(a) 418 (b) 428 (c) 429	(a) 1,314 (b) 1,384 (c) 1,256	(a) 1,733 (b) 1,812 (c) 1,685
	Soft Drinks	1	(a) 453 (b) 426 (c) 497	(a) 245 (b) 239 (c) 236	(a) 698 (b) 665 (c) 732
	Wine	1	(a) 90 (b) 91 (c) 94	(a) 67 (b) 74 (c) 76	(a) 156 (b) 165 (c) 170
	Tea	1	(a) 104 (b) 104 (c) 104	(a) 419 (b) 419 (c) 359	(a) 522 (b) 523 (c) 463
Chemicals	Paint	2	(a) 42 to 53 (b) 40 to 47 (c) 38 to 45	(a) 0 to 6 (b) 0 to 6 (c) 0 to 6	(a) 48 to 53 (b) 46 to 47 (c) 44 to 45
	Acetylene	1	(a) 299 (b) 257 (c) 242	(a) 2114 (b) 1870 (c) 1501	(a) 2413 (b) 2127 (c) 1742
	Oxygen	1	(a) 636 (b) 636 (c) 636	(a) 0 (b) 0 (c) 0	(a) 636 (b) 636 (c) 636
	Chemicals	1	(a) 64 (b) 65 (c) 70	(a) 0 (b) 14 (c) 12	(a) 64 (b) 79 (c) 82

Subsector	Products	No of Firms Analysed	EUI (kWh/square meters)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
	Carbon Dioxide	1	(a) 2521 (b) 2800 (c) 2708	(a) 0 (b) 0 (c) 0	(a) 2521 (b) 2800 (c) 2708
Construction	Cement	1	(a) 474 (b) 551 (c) 667	(a) 235 (b) 235 (c) 235	(a) 709 (b) 786 (c) 902
	Asphalt	1	(a) 635 (b) 712 (c) 457	(a) 8,454 (b) 14,104 (c) 8,957	(a) 9,089 (b) 14,816 (c) 9,414
	Ready Mixed Concrete	1	(a) 52 (b) 52 (c) 52	(a) 0 (b) 0 (c) 0	(a) 52 (b) 52 (c) 52
Fabricated Metal Products	Steel Processing	1	(a) 56 (b) 53 (c) 51	(a) 0 (b) 0 (c) 0	(a) 56 (b) 53 (c) 51
	Steel bars	1	(a) 322 (b) 448 (c) 505	(a) 1646 (b) 1646 (c) 1646	(a) 1968 (b) 2094 (c) 2151
	Cutlery	1	(a) 19 (b) 18 (c) 17	(a) 0 (b) 0 (c) 0	(a) 19 (b) 18 (c) 17
	Steel Galvanizing	1	(a) 380 (b) 394 (c) 387	(a) 4990 (b) 4991 (c) 5323	(a) 5370 (b) 5384 (c) 5710
Food Products	Processed Fruits, Vegetables	1	(a) 709 (b) 702 (c) 636	(a) 418 (b) 439 (c) 389	(a) 1,127 (b) 1,140 (c) 1026
	Noodles, Pasta	1	(a) 135 (b) 120 (c) 101	(a) 769 (b) 857 (c) 922	(a) 904 (b) 977 (c) 1,023

Subsector	Products	No of Firms Analysed	EUI (kWh/square meters)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
	Margarine	1	(a) 179 (b) 187 (c) 232	(a) 207 (b) 215 (c) 251	(a) 387 (b) 402 (c) 482
	Poultry	2	(a) 583 to 1,225 (b) 586 to 1,253 (c) 593 to 1,279	(a) 119 to 162 (b) 96 to 161 (c) 87 to 96	(a) 744 to 1345 (b) 746 to 1348 (c) 680 to 1,375
	Pastry	1	(a) 212 (b) 223 (c) 235	(a) 80 (b) 80 (c) 86	(a) 292 (b) 303 (c) 321
	Flour	1	(a) 6,546 (b) 6,488 (c) 6,458	(a) 572 (b) 589 (c) 618	(a) 7,118 (b) 7,076 (c) 7,076
	Milk Products	1	(a) 995 (b) 982 (c) 963	(a) 944 (b) 1,167 (c) 1,062	(a) 1,939 (b) 2,149 (c) 2,025
	Food Products	1	(a) 889 (b) 889 (c) 889	(a) 6 (b) 6 (c) 6	(a) 895 (b) 895 (c) 8955
	Refined Oil	1	(a) 99 (b) 99 (c) 99	(a) 1,762 (b) 1,562 (c) 1,542	(a) 1,861 (b) 1,662 (c) 1,641
	Various Food Items	1	(a) 43 (b) 42 (c) 42	(a) 95 (b) 98 (c) 83	(a) 138 (b) 141 (c) 125
Paper and Paper Products	Paper Products	2	(a) 6 to 87 (b) 6 to 87 (c) 6 to 87	(a) 0 to 1 (b) 0 to 1 (c) 0 to 1	(a) 6 to 88 (b) 6 to 88 (c) 6 to 88
	Carton Products	1	(a) 208 (b) 205 (c) 216	(a) 0 (b) 0 (c) 0	(a) 208 (b) 205 (c) 216

Subsector	Products	No of Firms Analysed	EUI (kWh/square meters)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
Plastics Products	Plastic Products	1	(a) 1,334 (b) 1,431 (c) 1,354	(a) 0 (b) 0 (c) 0	(a) 1,334 (b) 1,431 (c) 1,354
	PVC and Polyethylene Pipes	1	(a) 1,986 (b) 1,474 (c) 1,440	(a) 0 (b) 0 (c) 0	(a) 1,986 (b) 1,474 (c) 1,440
Printing	Printed Matter	7	(a) 87 to 5,719 (b) 92 to 5,258 (c) 88 to 5061	(a) 0 (b) 0 (c) 0	(a) 87 to 5,719 (b) 92 to 5,258 (c) 88 to 5061
	Light Packing, Magazines	1	(a) 289 (b) 328 (c) 557	(a) 0 (b) 0 (c) 0	(a) 289 (b) 328 (c) 557
Textiles	Apparel	1	(a) 5 (b) 5 (c) 5	(a) 0 (b) 0 (c) 0	(a) 5 (b) 5 (c) 5
	Denim	1	(a) 262 (b) 252 (c) 274	(a) 600 (b) 525 (c) 520	(a) 861 (b) 776 (c) 794
	Knitted Fabrics	2	(a) 80 to 259 (b) 77 to 259 (c) 68 to 326	(a) 45 to 1,134 (b) 49 to 1,013 (c) 45 to 1,276	(a) 125 to 1,393 (b) 125 to 1,272 (c) 113 to 1,602
	Knitted Garments	11	(a) 31 to 656 (b) 37 to 656 (c) 34 to 656	(a) 0 to 8,906 (b) 0 to 8,906 (c) 0 to 8,906	(a) 31 to 9,563 (b) 37 to 9,563 (c) 34 to 9,563
	Swimwear	1	(a) 191 (b) 189 (c) 143	(a) 0 (b) 0 (c) 0	(a) 191 (b) 189 (c) 143
	Textiles	3	(a) 48 to 191 (b) 48 to 195 (c) 44 to 202	(a) 0 to 70 (b) 0 to 96 (c) 0 to 113	(a) 48 to 261 (b) 48 to 290 (c) 44 to 314

Subsector	Products	No of Firms Analysed	EUI (kWh/square meters)		
			(a) 2015, (b) 2016, (c) 2017		
			Electricity	Fossil Fuel	Total
	Woven Fabrics	3	(a) 70 to 826 (b) 81 to 826 (c) 83 to 829	(a) 48 to 1,896 (b) 52 to 1,942 (c) 52 to 1,920	(a) 119 to 2,693 (b) 134 to 2,768 (c) 136 to 2.749
	Woven Shirts	1	(a) 367 (b) 327 (c) 290	(a) 434 (b) 369 (c) 450	(a) 801 (b) 696 (c) 740

6 Energy Use Intensities (EUI) – Task 4

6.1 Overview

All the values of EUI for the SME and Industry sectors were examined to find any convergence of values for the same product. Further, relationships were sought between EUI per production output and quantity of products. For that purpose, correlation coefficients were calculated when there were reasonable data on four or more firms having the same product output. Table 6-1 was then used to interpret the values of correlation coefficient in terms of the strength or weakness between the two variables: EUI per product output and quantity of products.

Table 6-1: Correlation Coefficient and Relationship between Variables

Correlation Coefficient	Linear Positive Relationship	Correlation Coefficient	Linear Negative Relationship
1	Perfect	-1	Perfect
0.700 to 0.999	Strong	-0.999 to -0.700	Strong
0.300 to 0.699	Moderate	-0.699 to -0.300	Moderate
0.001 to 0.299	Weak	-0.299 to -0.001	Weak
0	None	0	None

Source: Bruce Ratner – Quantitative Methods in Direct Marketing

6.2 Analysis of EUI Per Production Output for the SME Sector

6.2.1 Bakery

The data of the 10 bakeries that responded to the survey are tabulated in Annex 2. A regression analysis of the data revealed that there was a weak relationship between EUI per unit of bread and quantity of breads baked. When data for four bakeries lying far from the regression line are ignored, a strong negative relationship was found between EUI per unit of bread and quantity of bread for the six remaining bakeries as indicated by the values of correlation coefficients shown in table 6-2. The relevant regression graphs are attached in Annex 22.

Table 6-2: Correlation Coefficient between EUI (kWh/Number of Breads) and Number of Breads

Year	Correlation Coefficient		
	Electricity	Fossil Fuel	Total
2015	-0.797	-0.802	-0.805
2016	-0.753	-0.769	-0.770
2017	-0.756	-0.799	-0.797

The relationships between EUI per unit of bread and quantity of breads for 2015, 2016 and 2017 of the six retained bakeries are shown in Table 6-3. There is a very slight decrease in EUI with an increase in the quantity of breads baked. In 2015, 2016 and 2017 respectively, the production of one bread required, on average, 0.1182, 0.1146 and 0.116 kWh of electricity; 0.7825, 0.7672 and 0.7574 kWh of fossil fuels; and a total amount of energy equal to 0.9007, 0.8815 and 0.8734 kWh.

**Table 6-3: Relationship between EUI (kWh/Number of Breads) and Number of Breads
(Refer to Annex 22 for Regression Lines)**

Year	Relationship (y=EUI, x = Number of Breads)		
	Electricity	Fossil Fuel	Total
2015	$y = -7E-09x + 0.1182$	$y = -6E-08x + 0.7825$	$y = -7E-08x + 0.9007$
2016	$y = -7E-09x + 0.1146$	$y = -6E-08x + 0.7672$	$y = -7E-08x + 0.8818$
2017	$y = -8E-09x + 0.116$	$y = -6E-08x + 0.7574$	$y = -7E-08x + 0.8734$

6.2.2 Beverages

The data of the only beverage firm in the SME sector that responded to the survey, a producer of wine, is shown at Annex 3. In Table 6-4, the data have been sorted according to increase in volume of wine produced. The fossil fuel and total EUI decrease when volume of wine increases whereas it was not clear the electricity EUI do not show a clear pattern.

Table 6-4: Data for Wine Producer Sorted According to Volume of Product

Year	Volume (liters)	EUI (kWh/liter)		
		Electricity	Fossil Fuel	Total
2016	453,150	0.1179	0.2658	0.3837
2017	538650	0.0905	0.2316	0.3221
2015	570285	0.1024	0.1750	0.2774

6.2.3 Chemicals and Chemicals Products

The data for the two firms that responded to the survey are indicated in Annex 4. One firm is engaged in the production candles and the other one in detergents. In Table 6-5, the data have been sorted out according to increase in weight of products. The electricity and total EUI decrease with increase in weight of the two products whereas the fossil fuel EUI do not show a clear pattern.

Table 6-5: Data for Chemical Firms Sorted According to Increase in Weight of Products

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Candles	2016	25	600.000	602.400	1202.400
	2017	30	500.000	502.000	1002.000
Detergents	2016	4,111,592	0.1704	0.0680	0.2384
	2015	4,304,143	0.1389	0.0668	0.2057
	2017	5,020,287	0.0881	0.0763	0.1645

6.2.4 Construction

The data for the four firms that responded to the survey are shown in Annex 5. One of the firms is a steel foundry, the second one produces aluminum openings and the third one metal fabrics. The three firms use electricity as their only source of energy and their data have been sorted according to increase in weight of products in Table 6-6. The electricity EUI (equal to total EUI) decrease with increase in weight of products.

Table 6-6: Data for Construction Firms Using Electricity as Their Only Source of Energy Sorted According to Weight of Products

Product	Year	Weight (Tons)	Electricity EUI (kWh/Ton) (equal to Total EUI)
Aluminum Openings	2017	190	2.0000
	2015	220	1.7273
	2016	250	1.5600
Metal Fabrics	2015	99	258.5859
	2016	116	220.6897
	2017	140	182.8571
Steel Foundry	2016	123	1582.5366
	2017	270	720.9333

The fourth firm produces dry mortar and uses electricity and fossil fuel as its source of energy. The data for the firm sorted according to increase in weight of product are shown in Table 6-7. The electricity, fossil fuel and total EUIs of the firm decrease with increase in weight of product.

Table 6-7: Data for Dry Mortar Producer Sorted According to Weight of Product

Year	Weight (Tons)	EUI (kWh/Ton)		
		Electricity	Fossil Fuel	Total
2017	48,496	16.0440	91.0357	1047.0797
2015	54,372	13.6490	71.8237	85.4727
2016	63,985	11.9818	65.7986	77.7804

6.2.5 Fabricated Metal Products (FMP)

The data for the five firms that responded to the survey are shown in Annex 6. They were each engaged in different activity namely steel galvanizing, steel bar processing, manufacture of steel parts, steel bars and aluminum products. An analysis of their data revealed a clear pattern for two of them, the one engaged in steel bar processing and the manufacturer of steel parts. They both use electricity as their only source of energy. Their data when sorted by weight of products indicates that their electricity EUI (equal to total EUI) decrease with increase in weight of products.

Table 6-8: Data for FMP Firms Sorted According to Weight of Products

Product	Year	Weight (Tons)	Electricity EUI (kWh/Ton) (equal to Total EUI)
Steel Bar Processing	2015	93	150.1075
	2016	108	99.4630
	2017	136	58.6765
Manufacture Steel Parts	2015	150	2291.9200
	2017	160	2116.1250
	2016	180	1835.9333

6.2.6 Food Products

Data of thirteen firms that responded to the survey are shown in Annex 7. A regression analysis of the data revealed a weak relationship between EUI per unit weight of food products and weight of food products. After ignoring the data of eight firms that were furthest from the regression line, a strong negative relationship was found between EUI per unit weight of food products and weight of food products for electricity and total energy of the remaining five firms while a moderate negative relationship was found between the corresponding variables for fossil fuels. These deductions were made from the values of correlation coefficient reproduced in Table 6-9. Annex 23 shows the relevant regression charts.

Table 6-9: Correlation Coefficient Between EUI (kWh/Tons of Food Products) and Weight of Food Products (Tons)

Year	Correlation Coefficient		
	Electricity	Fossil Fuel	Total
2015	-0.813	-0.676	-0.745
2016	-0.871	-0.680	-0.741
2017	-0.912	-0.675	-0.732

The relationships between EUI per unit weight of food products and weight of food products for the five retained firms are shown in Table 6-10. The quantity of electricity used to produce one ton of food products had a fixed component; 752.83 kWh in 2015, 682.43 kWh in 2016 and 642.85 kWh in 2017, and a component which, for each additional ton of food products produced, decreased by 0.3168 kWh in 2015, 0.2794 kWh in 2016, and 0.2479 kWh in 2017. The amount of fossil fuels required for producing one ton of food products had a fixed component of 2758.2 kWh in 2015, 2804.4 kWh in 2016 and 2797.4 kWh in 2017, and a component that, for each additional ton of food products produced, decreased by 1.3721 kWh in 2015, 1.3831 kWh in 2016 and 1.3124 kWh in 2017. The total energy required for producing one ton of food products had a fixed component of 3511 kWh in 2015, 3486.8 kWh in 2016 and 3440 kWh in 2017, and a component, which for each additional of food produced, decreased by 1.6889 kWh in 2015, 1.6626 kWh in 2016 and 1.5603 kWh in 2017.

Table 6-10: Relationship between EUI (kWh/Tons of Food Products) and Weight of Food Products (Tons) - (Refer to Annex 23 for Regression Lines)

Year	Relationship (y=EUI, x = Weight of Food Products)		
	Electricity	Fossil Fuel	Total
2015	$y = -0.3168x + 752.83$	$y = -1.3721x + 2758.2$	$y = -1.6889x + 3511$
2016	$y = -0.2794x + 682.43$	$y = -1.3831x + 2804.4$	$y = -1.6626x + 3486.8$
2017	$y = -0.2479x + 642.65$	$y = -1.3124x + 2797.4$	$y = -1.5603x + 3440$

6.2.7 Paper and Paper Products

Data for the three firms that responded to the survey are shown in Annex 8. Two were producing carton products and the third one envelopes. Table 6-11 shows the data for firms producing carton products sorted by increase in weight of products. The electricity, fossil fuel and total EUI of one firm decreases with weight of products while no clear pattern of EUIs emerges out of the data for the other firm. The data also show that while the production of the bigger firm is around 2500 times more than the smaller firm, the electricity and total EUI of the smaller firm is around eight times that of the bigger firm.

Table 6-11: Data for Carton Products Firms Sorted by Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Firm 1	2016	5,030	124.9670	0.5536	125.5206
	2017	7,440	91.738	0.3743	92.0880
	2015	8,867	70.890	0.3140	71.2050
Firm 2	2016	2	1098.00	0.0	1098.00
	2015	2	1010.00	0.0	1010.00
	2017	3	812.00	0.0	812.00

6.2.8 Plastic Products

Data for the three firms in this sub-sector responded to the survey are shown in Annex 9. Two of them were engaged in plastic injection molding and used only electricity as their energy source. Their data sorted according to weight of products are shown in Table 6-12. The values of their EUIs do not display any definite pattern. However, their electricity EUIs (equal to total EUI) are quite close to each other over the three years. Therefore, the lowest value (shaded on Table 6-6) can be used as a benchmark for plastic injection molding.

Table 6-12: Data for Plastic Injection Molding Sorted according to Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton) (equal to Total EUI)
Firm 1	2015	100	5,100.000
	2017	105	5,428.571
	2016	110	5,181.818
Firm 2	2017	54	3,213.704
	2015	57	3,371.140
	2016	70	2,926.943

6.2.9 Printing

Data for the eleven firms that responded to the survey are shown in Annex 10. They all had electricity as their only energy source. A regression analysis of nine of these firms having similar outputs of printed matter showed a weak relationship between EUI per unit weight of printed matter and weight of printed matter. When data from four firms that were furthest from the regression line were ignored, a moderate to strong negative relationship was found between EUI per unit weight of printed matter and weight of printed matter as shown by the correlation coefficients on Table 6-13. The relevant regression graphs are reproduced in Annex 24.

Table 6-13: Correlation Coefficient between EUI (kWh/Tons of Printed Matter) and Weight of Printed Matter (Tons)

Year	Correlation Coefficient – Electricity
2015	-0.698
2016	-0.665
2017	-0.758

The relationships between EUI per unit weight of printed matter and weight of printed matter for 2015, 2016 and 2017 are shown on Table 6-14. The production of one ton of printed documents required electricity with fixed amounts of 8032 kWh in 2015, 8928 kWh in 2016 and 8304 kWh in 2017, and variable amounts which, for each additional ton of printed matter, decreased by 71.134 kWh in 2015, 80.344 kWh in 2016 and 74.557 kWh in 2017.

Table 6-14: Relationship between EUI (kWh/Tons of Printed Matter) and Weight of Printed Matter (Tons) - (Refer to Annex 24 for Regression Lines)

Year	Relationship (y=EUI for Electricity, x = Weight of Printed Documents)
2015	$y = -71.134x + 8032.9$
2016	$y = -80.344x + 8928$
2017	$y = -74.557x + 8304.3$

The two remaining firms were each engaged in different lines of products, one in T shirt printing and the other in file manufacturing. They both use electricity as their only source of energy. Table 6-15 shows data for the file manufacturing firm sorted by increase in weight of products and Table 6-16 data for T- shirt printing sorted by in number of products. The two firms' electricity EUIs (equal to total EUIs) decrease with increase in quantity of products.

Table 6-15: Data for File Manufacturing Firm Sorted by Weight of Products

Year	Weight (Tons)	Electricity EUI (kWh/Ton) (=Total EUI)
2015	30	63.6667
2016	34	58.5882
2017	36	57.6667

Table 6-16: Data for T-Shirt Printing Firm Sorted by Quantity of Products

Year	Number (Units)	Electricity EUI (kWh/Unit) (=Total EUI)
2017	8,600	1.5116
2016	9,200	1.4130
2015	14,300	0.9091

6.2.10 Textiles

Data for the twenty-two firms that responded to the survey. are shown in Annex 11. A regression analysis of data for the thirteen firms that produced knitted garments revealed a weak relationship between EUI per unit of knitted garment and number of knitted garments. After discarding the data from seven firms that were further away from the regression line, a strong negative relationship was found between the EUI per unit of knitted garment and number of knitted garments for the six remaining firms as shown by the values of correlation coefficient in Table 6-17. All the six firms used electricity as their only source of energy. The relevant regression graphs are reproduced in Annex 25.

Table 6-17: Correlation Coefficient between EUI (kWh/Unit of Knitted Garment) and Number of Knitted Garments

Year	Correlation Coefficient – Electricity and Total
2015	-0.749
2016	-0.879
2017	-0.844

The relationships between EUI for electricity per unit of knitted garment and number of knitted garments for the six retained firms are shown in Table 6-18. There is a very slight decrease in the quantity of electricity required for producing one unit of knitted garment with an increase in the number of knitted garments. The mean quantity of electricity required to produce one unit of knitted garment was 0.5723 kWh in 2015, 0.617 kWh in 2016 and 0.5771 kWh in 2017.

Table 6-18: Relationship between EUI (kWh/Unit of Knitted Garments) and Number of Knitted Garments – (Refer to Annex 25 for Regression Lines)

y=EUI for Electricity, x = Number of Knitted Garments	
Year	Electricity
2015	$y = -5E-07x + 0.5723$
2016	$y = -4E-07x + 0.617$
2017	$y = -5E-07x + 0.5711$

Three out of the nine remaining firms were producing readymade garments while two others had apparels as their outputs. These five firms used electricity as their only source of energy. Their data sorted by quantity of products are shown in Table 6-19 for ready made garments and Table 6-20 for apparels. Their electricity EUI (equal to total EUI) decrease with increasing quantity of products.

Table 6-19: Data for Firms Producing Ready Made Garments Sorted by Quantity of Products

Firm	Year	Quantity (Units)	Electricity EUI (kWh/Unit) (=Total EUI)
Firm 1	2016	190,200	0.5820
	2017	213,000	0.5459
	2015	227,700	0.4712
Firm 2	2016	12,000	1.4460
	2015	12,000	1.4460
	2017	12,000	1.4460
Firm 3	2017	5,000	8.0592
	2016	12,000	3.3580
	2015	22,000	1.8316

Table 6-20: Data for Firms Producing Apparels Sorted by Quantity of Products

Firm	Year	Quantity (Units)	Electricity EUI (kWh/Unit)
Firm 1	2017	25,000	3.3392
	2016	26,500	2.8839
	2015	28,000	0.3635
Firm 2	2015	6,000	0.2980
	2016	7,000	0.2971
	2017	8,000	0.2415

The four other firms were each manufacturing a different product: knitted fabrics, shirts, uniforms and textile prints. The firms producing knitted fabrics, shirts and uniforms use electricity as their only source of energy. Their data sorted by quantity of products are shown in Tables 6-21 and 6-22. The electricity EUI (equal to total EUI) of knitted fabrics and shirts producing firms decrease with an increase in quantity of products. The electricity EUI (equal to total EUI) of the firm producing uniforms displays no definite pattern. The firm producing textile prints uses electricity and fossil fuel as its sources of energy. The data for the firm sorted by quantity of products is found in Table 6-23. Though its electricity and total EUIs

display no definite tendencies, its fossil fuel EUIs decrease with an increase in quantity of textile prints.

Table 6-21: Data for Firm Producing Knitted Fabrics Sorted by Weight of Product

Year	Weight (Tons)	Electricity EUI (kWh/Ton) (=Total EUI)
2017	2,361	1153.0119
2015	2,407	1134.1919
2016	2,566	1068.6345

Table 6-22; Data for Firms Producing Shirts and Uniforms Sorted by Quantity of Products

Product	Year	Quantity (Units)	Electricity EUI (kWh/Unit) (=Total EUI)
Shirts	2015	1,000	79.0000
	2016	1,200	58.2017
	2017	1,500	46.5613
Uniforms	2015	10,000	0.1500
	2016	10,000	0.1600
	2017	10,000	0.1700

Table 6-23: Data for Firm Producing Textile Prints Sorted by Quantity of Products

Firm	Year	Quantity (Units)	EUI (kWh/Unit)		
			Electricity	Fossil Fuel	Total
Firm 1	2017	627,000	0.5030	2.0498	2.5528
	2016	921,000	0.3354	1.3954	1.7309
	2015	942,000	0.4014	1.3643	1.7658

6.3 Analysis of EUI Per Production Output for the Industry Sector

6.3.1 Bakery

There were no bakeries among the firms surveyed in the industry sector.

6.3.2 Beverages

Data for the ten beverages firms that responded to the survey are shown in Annex 3. Five of the firms were producers of rum. The correlation coefficients between EUI and number of liters of rum produced for these five firms are shown in Table 6-24 while the regression graphs are attached in Annex 26. There is a moderate negative relationship between electricity EUI (kWh/liters) and number of liters, while a weak relationship exists between the two variables for fossil fuel EUI and total EUI.

Table 6-24: Correlation Coefficient between EUI (kWh/Liters) and Volume of Rum

Year	Correlation Coefficient		
	Electricity	Fossil Fuel	Total
2015	-0.649	-0.012	-0.102
2016	-0.677	0.066	-0.033
2017	-0.674	0.131	0.009

The relationship between EUI for electricity per liters of rum and volume of rum is shown in Table 6-25. There is a very slight decrease in quantity of electricity required to produce one liter of rum with increase in the volume of rum produced. The mean quantity of electricity required to produce one liter of rum was 0.5341 kWh in 2015, 0.5732 kWh in 2016, and 0.618 kWh in 2017.

**Table 6-25: Relationship between EUI (kWh/Liters) and Volume of Rum
(Refer to Annex 26 for Regression Lines)**

Year	Relationship (y=EUI for Electricity, x = Liters of Rum)
2015	$y = -5E-08x + 0.5341$
2016	$y = -6E-08x + 0.5732$
2017	$y = -6E-08x + 0.618$

Two of the beverages firms were tea factories. Their data sorted according to weight are indicated in Table 6-26. The values of electricity, fossil fuel and total EUI for the two firms do not exhibit any pattern. However, the values of their respective EUIs are close to each other. The lowest values (shaded on the table) can be used as benchmarks for tea producing firms.

Table 6-26: Data for Tea Factories Sorted by Weight of Tea

Firm	Year	Weight (kg)	EUI (kWh/kg)		
			Electricity	Fossil Fuel	Total
Firm 1	2017	254,296	1.099	3.7905	4.8903
	2015	262,127	1.0617	4.2901	5.3518
	2016	270,203	1.0372	4.1619	5.1991
Firm 2	2017	464,475	1.3635	12.0131	13.3767
	2015	481,443	1.4673	10.7506	12.2179
	2016	484,689	1.3879	11.0886	12.4765

The three remaining beverages firms were respectively producers of beer, wine and soft drinks. Tables 6-27, 6-28 and 6-29 shows their data sorted by volume of beer, wine and soft drinks respectively. The fossil fuel and total EUIs for beer and soft drinks decrease with increase in volume of beer whereas their electricity EUIs do not display any pattern. The electricity, fossil fuel and total EUIs for wine decrease with increase in volume of wine.

Table 6-27: Data for Beer Producer Sorted by Volume of Beer

Year	Volume (Liters)	EUI (kWh/Liter)		
		Electricity	Fossil Fuel	Total
2016	42,349,077	0.1820	0.5881	0.7702
2015	42,503,170	0.1771	0.5566	0.7337
2017	43,106,497	0.1791	0.5246	0.7037

Table 6-28: Data for Wine Producer Sorted by Volume of Wine

Year	Volume (Liters)	EUI (kWh/Liter)		
		Electricity	Fossil Fuel	Total
2016	22,104	57.7161	46.7492	104.4653
2017	150,000	8.7680	7.0775	15.8455

Table 6-29: Data for Soft Drinks Producer Sorted by Volume of Soft Drinks

Year	Volume (Liters)	EUI (kWh/Liter)		
		Electricity	Fossil Fuel	Total
2015	51,412,240	0.0836	0.0452	0.1288
2016	54,218,187	0.0745	0.0418	0.1163
2017	60,057,175	0.0785	0.0372	0.1158

6.3.3 Chemicals and Chemicals products

Data for the six firms that responded to the survey are shown in Annex 4. Two out of the six firms are paint producers. The values of their respective total EUIs are listed on Table 6-30 in chronological order. Though there is no relationship between EUIs and volume of paint, the values of EUIs are found to be quite close to each other in 2015, 2016 and 2017. Further, electricity and total EUI for the two firms declined over the three years implying that they are becoming more energy efficient. Given the closeness of the values, the lowest values of electricity and total EUI (shaded on the table) can be used as a benchmark for paint producers

Table 6-30: EUIs (kWh/liter) for Paint Producers

Firm	Year	Volume (liters)	EUI (kWh/liter)		
			Electricity	Fossil Fuel	Total
Firm 1	2015	3,000,600	0.0926	0.0144	0.1070
	2016	3,000,200	0.0883	0.0133	0.1016
	2017	3,000,300	0.0854	0.0128	0.0982
Firm 2	2015	5,098,695	0.0986	0.0000	0.0986
	2016	5,047,653	0.0881	0.0000	0.0881
	2017	5,087,522	0.0839	0.0000	0.0839

The four other firms produced four different chemicals; oxygen, carbon dioxide, acetylene and miscellaneous chemicals. Firms producing oxygen and carbon dioxide use electricity as their only source of energy. Table 6-31 gives their data sorted by weight of product. There is no relationship between electricity EUI (= total EUI) and weight of products. Tables 6-32 and 6-33 give the data for firms producing acetylene and miscellaneous chemicals sorted by quantity of products. No definite relationship can be established between EUIs and weight of product for the firm producing miscellaneous chemicals. The fossil fuel and total EUIs of the acetylene producing firm increase with increase of volume of acetylene. When viewed chronologically, fossil fuel and total EUI for the acetylene producing firm decrease from 2015 to 2017 meaning that the firm is becoming more energy efficient.

Table 6-31: Data for Firms Producing Carbon Dioxide and Oxygen Sorted by Weight of Products

Product	Year	Weight (kg)	Electricity EUI (kWh/kg) (=Total EUI)
Carbon Dioxide	2015	2,247,419	0.2412
	2016	2,330,897	0.2583
	2017	2,516,632	0.2314
Oxygen	2015	Not available	Not available
	2016	Not available	Not available
	2017	54,720	29.5563

Table 6-32: Data for Firm Producing Acetylene Sorted by Volume of Product

Year	Volume (cu m)	EUI (kWh/cu m)		
		Electricity	Fossil Fuel	Total
2017	28,910	15.5388	96.3883	111.9271
2016	32,339	14.7536	107.3757	122.1293
2015	33,062	16.7729	118.7415	135.5144

Table 6-33: Data for Firm Producing Miscellaneous Chemicals Sorted by Weight of Product

Year	Weight (Tons)	EUI (kWh/Ton)		
		Electricity	Fossil Fuel	Total
2015	5,473	52.8113	0.0000	52.8113
2016	6,130	48.1788	10.1387	58.3175
2017	6,743	46.9245	8.0146	54.9391

6.3.4 Construction

Data for the three construction firms that responded to the survey in this subsector are given in Annex 5. They had as output three different products; cement, asphalt and concrete. Their data sorted by weight of products are shown in Table 6-34. The electricity and total EUI for the cement producer increase with weight of cement and from 2015 to 2017 implying that the firm is becoming less energy efficient. The electricity and total EUIs of the asphalt and concrete producers decrease with increase in weight of asphalt and cement produced.

Table 6-34: Data for Construction Firms Sorted by Weight of Products

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Cement	2015	700,000	1.7279	0.8554	2.5834
	2016	750,000	1.8725	0.7984	2.6709
	2017	750,000	2.2682	0.7984	3.0666
Asphalt	2015	49,984	10.9876	146.305	157.292
	2017	52,554	7.5254	147.4229	154.9483
	2016	102,116	6.0280	119.4748	125.5028
Concrete	2016	36,055	5.7748	0.0000	5.7748
	2015	36,370	5.7248	0.0000	5.7248
	2017	38,979	5.3416	0.0000	5.3416

6.3.5 Fabricated Metal Products

Data for the four firms in this sub-sector that responded to the survey are given in Annex 6. They were each engaged in a different line of activity namely steel processing, steel galvanizing as well as the manufacture of steel bars and cutlery. Table 6-35 shows the data for the processed steel, steel bars and galvanized steel producers sorted by weight produced. The electricity EUI (equal to total EUI) of the processed steel producer decreases with increase in weight of steel processed. The electricity and total EUIs of the steel bar producer increase from 2015 to 2017 even though production has stayed constant implying that the firm has become less energy efficient. The electricity, fossil fuel and total EUIs of the galvanized steel producer decrease with weight produced.

**Table 6-35: Data for Processed Steel, Steel Bars and Galvanised Steel Producers
Sorted by Weight of Products**

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Processed Steel	2015	319	1337.3876	0.0000	1337.3876
	2017	324	1210.7057	0.0000	1210.7057
	2016	417	974.3325	0.0000	974.3325
Steel Bars	2015	9,000	209.4603	1071.0000	1280.4603
	2016	9,000	291.2036	1071.0000	1362.2036
	2017	9,000	328.2800	1071.0000	1399.2800
Galvanised Steel	2016	2,652	44.5294	564.5398	609.0693
	2017	3,387	34.2516	471.5145	505.7660

The data for the firm producing cutlery sorted by quantity of products is given in Table 6-36. The firm uses electricity as its only source of energy. The electricity (equal to total EUI) of the firm decrease with an increase of cutlery produced.

Table 6-36: Data for Firm Producing Cutlery Sorted by Quantity of Products

Year	Quantity (Units)	Electricity EUI (kWh/Unit) (=Total EUI)
2016	82,000,000	0.0020
2015	90,000,000	0.0019
2017	93,000,000	0.0017

6.3.6 Food Products

Data for the twelve firms that responded to the survey in this subsector are given in Annex 7. Two of the firms are factories for poultry processing. Data for the two firms sorted by weight of poultry products are shown in Table 6-37. Electricity and total EUIs for the two firms decrease with weight of poultry produced. The values of the total EUIs for the two firms are close to each other over the 3 years. Therefore, the lowest value (shaded on the table) can be used as benchmark for poultry processing firms.

Table 6-37: Data for Poultry Producing Firms Sorted by Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Firm 1	2017	6,199	529.7211	78.1061	607.8272
	2015	6,985	462.2392	128.1612	590.4004
	2016	7,174	452.1524	124.2923	576.4447
Firm 2	2016	13,054	647.0715	49.3679	696.4394
	2015	13,514	611.3385	59.6156	670.9541
	2017	14,334	601.6955	44.9378	646.6334

Two other firms in this subsector are producers of refined cooking oil. Data for these firms sorted by weight of refined cooking oil produced are shown in Table 6-38. No definite relationships can be established between fossil fuel and total EUIs and weight of refined cooking oil produced. However, electricity EUI for the two firms decrease with increase of refined cooking oil produced.

Table 6-38: Data for Refined Cooking Oil Factories Sorted by Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Firm 1	2017	6,000	77.6060	535.5000	613.1060
	2016	7,200	58.4411	669.3750	727.8161
	2015	14,400	28.9514	333.2000	362.1514
Firm 2	2017	15,600	46.7081	725.1270	771.8351
	2016	16,800	43.3718	682.3771	725.7489
	2015	19,200	37.9504	673.2237	711.1741

Six out of the eight remaining firms had each a different product as output. The products of these six firms are measured in tons. Their data sorted by weight of food products are given in Table 6-39. The electricity EUI of the firm producing various food items decrease with increase of weight of products. The electricity and total EUIs of the firms producing (i) processed fruits and vegetables and (ii) flour decrease with increase in weight of products. The electricity, fossil fuel and total EUIs of the firm producing pastry decrease with increase of weight of pastry produced.

Table 6-39: Data for Food Products Firms Sorted by Weight Produced

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Processed Fruits and Vegetables	2017	1,094	2029.1408	1242.3711	3271.5119
	2015	1,369	1807.9759	1064.9839	2872.9598
	2016	1,410	1736.4745	1085.9515	2822.4260
Noodles and pasta	2017	17,717	55.5525	505.1364	560.6889
	2015	19,768	66.3898	377.4583	443.8481
	2016	20,427	57.2580	407.1864	464.4444
Margarine	2016	2	354759.500	407184.000	761943.500
	2015	3	226629.333	261891.833	488521.166
	2017	3	292985.333	316615.500	609600.833
Various Food Items	2017	683	917.0864	1806.5015	2723.5878
	2016	716	876.5056	2034.8302	2911.3358
	2015	800	805.1663	1752.7777	2557.9439

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Pastry	2015	52	1203.8077	451.8000	1655.6077
	2016	55	1198.0364	427.1564	1625.1927
	2017	60	1156.0000	424.1900	1580.1900
Flour	2017	123,000	89.6833	8.5780	98.2613
	2015	127,000	88.0363	7.6889	95.7252
	2016	128,000	86.5712	7.8541	94.4253

The last two firms manufacture miscellaneous food products and milk products. Their data sorted by quantity of products are given in Tables 6-40 and 6-41. The electricity, fossil fuel and total EUIs of miscellaneous food products decrease with increase in quantity of the products that are manufactured.

Table 6-40: Data for Miscellaneous Food Products Firm Sorted by Quantity of Products

Year	Quantity (Units)	EUI (kWh/Unit)		
		Electricity	Fossil Fuel	Total
2015	8,000,000	0.0267	0.0002	0.0269
2016	10,000,000	0.0213	0.0002	0.0215
2017	12,000,000	0.0178	0.0001	0.0179

Table 6-41: Data for Milk Products Firm Sorted by Weight of Products

Year	Weight (kg)	EUI (kWh/kg)		
		Electricity	Fossil Fuel	Total
2015	19,000	35.9964	34.1527	70.1491
2016	20,000	33.7531	40.1247	73.8778
2017	20,000	33.0941	36.5172	69.6113

6.3.7 Paper and Paper Products

Data for the three firms in this subsector that responded to the survey are shown in Annex 8. Two of these firms manufacture paper products and one carton products. The data for the paper products firms sorted by weight of products are given in Table 6-42 and the carton products firm sorted by quantity of products in Table 6-43. One paper products firm used electricity as its only source of energy. Its output and electricity EUI (equal to total EUI) stayed constant over the three year period. The electricity, fossil fuel and total EUIs of the other paper products firm decrease with increase of products. The carton products firm used electricity as its only source of energy. Its electricity EUI (equal to total EUI) varied annually even though the number of products manufactured yearly stayed constant.

Table 6-42: Data for Firms Manufacturing Paper Products Sorted by Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Firm 1	2015	800	20.7425	0.0000	20.7425
	2016	800	20.7425	0.0000	20.7425
	2017	800	20.7425	0.0000	20.7425
Firm 2	2015	Not Provided	Not Provided	Not Provided	Not Provided
	2016	4,998	66.1176	0.3664	66.4841
	2017	5,379	61.4345	0.3604	61.7949

Table 6-43: Data for Firm Manufacturing Carton Products Sorted by Quantity of Products

Year	Quantity (Units)	Electricity EUI (kWh/Unit) (=Total EUI)
2015	24,000	12.0833
2016	24,000	11.9074
2017	24,000	12.5381

6.3.8 Plastic Products

Data for the two firms in this subsector that responded to the survey are shown in Annex 9. The two firms had different lines of products as output:- miscellaneous plastic products and PVC and polyethylene pipes. Both have electricity as their only source of energy. Their data sorted by weight of products are given in Table 6-44. Their electricity EUIs (equal to total EUIs) decrease with increase in weight of products.

Table 6-44: Data for Plastic Products Firms Sorted by Weight of Products

Product	Year	Weight (Tons)	Electricity EUI (kWh/Ton) (=Total EUI)
Miscellaneous Plastic Products	2017	1,434	1888.9358
	2016	1,548	1849.466
	2015	2,103	1,268.745
PVC and Polyethylene Pipes	2016	1,000	1,031.563
	2017	1,087	927.195
	2015	1,495	930.067

6.3.9 Printing

Data for the eight firms that responded to the survey are given in Annex 10. Six of the firms were engaged in printing documents in bulk. For these six firms, the correlation coefficients between EUI (kWh/ton) for electricity and weight of printed documents in tons are shown in Table 6-16. Since the firms do not use fossil fuels, the correlation coefficients for electricity EUI and total EUI are equal. A weak to moderate negative relationship exists between electricity (and total) EUI and weight of printed products. The regression charts are attached in Annex 27.

Table 6-45: Correlation Coefficient between EUI (kWh/ton) and Weight of Printed Documents (tons)

Year	Correlation Coefficient – Electricity
2015	-0.359
2016	-0.314
2017	-0.271

One of the two remaining firms was a printer of magazines and the other one a printer of individual documents. Both use electricity as their only source of energy. Their data sorted by quantity of products are given in Tables 6-46 and 6-47.

Table 6-46: Data for Firm Printing Individual Documents Sorted by Quantity of Products

Year	Quantity (Pieces)	Electricity EUI (kWh/Piece) (=Total EUI)
2015	2,345,000	0.5142
2016	2,900,300	0.3359
2017	3,330,200	0.3908

Table 6-47: Data for Firm Printing Magazines Sorted by Weight of Products

Year	Weight (Tons)	Electricity EUI (kWh/Ton) (=Total EUI)
2016	3,516	773.8908
2015	3,560	674.4382
2017	4,740	974.8945

6.3.10 Textiles

Data for the twenty four firms in this subsector that responded to the survey are shown in Annex 11. A regression analysis of eleven of these firms that produced knitted garments revealed that a very weak relationship existed between EUIs and number of knitted garments. When the data of six firms that were furthest from the regression line were ignored, the correlation coefficients for the five remaining firms indicate a moderate to strong relationship between EUIs and number of knitted garments. Since only one of the firms use fossil fuels, only the correlation

coefficients for electricity and total energy have been determined. The correlation coefficients are listed in Table 6-18 while the corresponding regression curves are attached in Annex 28.

Table 6-48: Correlation Coefficient between EUI (kWh/Number of Knitted Garments) and Number of Knitted Garments.

Year	Correlation Coefficient	
	Electricity	Total
2015	-0.753	-0.798
2016	-0.687	-0.753
2017	-0.694	-0.687

The relationships between EUI for electricity and total energy and number of knitted garments of the five retained firms are shown on Table 6-19. The EUIs decrease very slightly with an increase in number of knitted garments. The mean quantity of electricity used for producing one knitted garment was 0.501 kWh, 0.5696 kWh and 0.5107 kWh in 2015, 2016 and 2017 respectively. The mean quantity of total energy for producing one knitted garment was 0.5814 kWh, 0.57 kWh and 0.5104 kWh in 2015, 2016 and 2017 respectively.

Table 6-49: Relationship between EUI (kWh/Number of Knitted Garments) and Number of Knitted Garments – (Refer to Annex 28 for Regression Lines)

Year	Relationship (y=EUI, x = Number of Knitted Garments)	
	Electricity	Total
2015	$y = -1E-07x + 0.501$	$y = -1E-07x + 0.5814$
2016	$y = -1E-07x + 0.5696$	$y = -1E-07x + 0.57$
2017	$y = -1E-07x + 0.5107$	$y = -1E-07x + 0.5104$

Three of the firms in this subsector produced woven fabrics. Their data sorted by length of woven fabrics are given in Table 6-50. Their electricity, fossil fuel and total EUIs decrease with increase in length of woven fabrics produced.

Table 6-50: Data for Firms Producing Woven Fabrics Sorted by Length of Products

Firm	Year	Length (Meters)	EUI (kWh/meter)		
			Electricity	Fossil Fuel	Total
Firm 1	2015	9,271,419	2.1486	5.1125	7.2612
	2016	Not Provided	Not Provided	Not Provided	Not Provided
	2017	10,812,480	1.9159	4.4398	6.3557
Firm 2	2016	8,000,500	2.9993	3.8483	6.8476
	2017	10,000,000	2.5331	3.8383	6.3714
	2015	12,000,000	2.2366	3.0370	5.2736
Firm 3	2015	250,000	0.4176	0.2874	0.7050
	2016	300,000	0.4033	0.2595	0.6628
	2017	350,000	0.3543	0.2224	0.5767

Two firms in this subsector produce knitted fabrics. Their data sorted by weight of knitted fabrics are shown in Table 6-51. The data for one of the firms display no relationship between EUIs and weight of knitted fabrics. The electricity, fossil fuel and total EUIs of the other firm decrease with increase in knitted fabrics produced.

Table 6-51: Data for Firms Producing Knitted Fabrics Sorted by Weight of Products

Firm	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Firm 1	2017	170,000	2.5779	1.6834	4.2613
	2015	218,000	2.3355	1.3292	3.6647
	2016	240,000	2.0413	1.2999	3.3413
Firm 2	2015	349,433	2.9929	13.1075	16.1004
	2016	413,458	2.5294	9.8968	12.4262
	2017	498,775	2.6393	10.3380	12.9772

Two other firms in this subsector produce miscellaneous textiles. Their data sorted by number of products are given in Table 6-52. One of the firms uses electricity as its only source of energy. Its electricity EUI (equal to total EUI) decreases with increase in number of products. The electricity EUI of the other

firm also decreases with increase in number of products but its fossil fuel and total EUIs increase with increase in number of products.

Table 6-52: Data for Firms Producing Miscellaneous Textiles Sorted by Number of Products

Firm	Year	Number (Units)	EUI (kWhh/Unit)		
			Electricity	Fossil Fuel	Total
Firm 1	2015	650,000	1.7328	0.6367	2.3695
	2016	700,000	1.6439	0.8060	2.4499
	2017	730,000	1.6334	0.9111	2.5446
Firm 2	2017	13,955	7.0463	0.0000	7.0463
	2016	16,356	6.5215	0.0000	6.5215
	2015	17,720	5.9810	0.0000	5.9810

Another two firms produce spinned yarn and miscellaneous textiles. Their data sorted by weight of products are shown in Table 6-53.

Table 6-53: Data for Firms Producing Spinned Yarn and Miscellaneous Textiles Sorted by Weight of Products

Product	Year	Weight (Tons)	EUI (kWh/Ton)		
			Electricity	Fossil Fuel	Total
Spinned Yarn	2015	10,627,278	0.0004	10.4575	10.4579
	2016	12,137,292	0.0003	10.4174	10.4177
	2017	12,163,078	0.0004	10.4942	10.4946
Miscellaneous Textiles	2015	200	343.9800	0.0000	343.9800
	2016	200	499.3200	0.0000	499.3200
	2017	200	450.0000	0.0000	450.0000

The remaining four firms produce apparel, denim, swimwear, and woven shirts. Their data sorted by number of products are shown in Table 6-54. The apparel and swimwear producing firms use electricity as their only source of energy. Their electricity EUIs (equal to total EUI) decrease with increase in number of products. The electricity, fossil fuel and total EUIs of the firm producing denim decrease with increase in number of denim produced.

**Table 6-54: Data for Firms Producing Apparel, Denim, Swimwear and Woven Shirts Sorted by
Number of Products**

Product	Year	Number (Units)	EUI (kWh/Unit)		
			Electricity	Fossil Fuel	Total
Apparel	2017	24,276	1.4703	0.0000	1.4703
	2016	25,446	1.3712	0.0000	1.3712
	2015	35,334	1.0651	0.0000	1.0651
Denim	2015	180,000	145.4278	333.0663	478.4941
	2017	190,000	143.9895	273.7041	417.6936
	2016	200,000	125.8300	262.2721	388.1021
Swimwear	2015	300,000	0.4378	0.0000	0.4378
	2016	300,000	0.4327	0.0000	0.4327
	2017	300,000	0.3266	0.0000	0.3266
Woven Shirts	2017	10,164,000	0.7922	1.2305	2.0227
	2016	12,061,000	0.7527	0.8503	1.6030
	2015	13,488,000	0.7560	0.8942	1.6502

7 Limitations

The following observations were made throughout the survey:-

1. There is a lack of awareness on the Energy Efficiency Act 2011
2. Not all data were provided by respondents which limited the in-depth analysis for Task 2
3. Not all enterprises have the services of a Maintenance Officers who oversee energy issues
4. CEB consumption were compiled in terms of accounting figures for financial purposes
5. Asset Registers were made on the basic of value of the equipment and not in terms of electric ratings
6. For SMEs almost all inputs on the questionnaire were filled-in by the Accounting department of the enterprises

8 Recommendations

1. Create an awareness of Energy Efficiency Act amongst all incorporated bodies and sole traders registered by the Registrar of Companies
2. It is proposed that there are regular road-shows to educate all consumers on the importance of Efficiency Energy Management
3. Maintenance Officers need to be empowered through continuous dedicated training programme on Energy Efficiency
4. Appropriate guidelines need to be developed to support companies willing to invest in Energy Efficiency Programme
5. Design and develop appropriate technical and financial tools to support companies in implementing an Energy Efficiency Management Programme
6. It is proposed that companies willing to engage in Energy Efficiency Programme be provided financial support at preferential rate of interest as being the case for enterprises under the SME Development Scheme and SME Financing Scheme.
7. Design standard Form (for continuous collection of data) which could be circulated to all incorporated companies
8. In the industry sector, the highest share of energy is used for steam generation by burning fossil fuels. Only three firms use solar water heaters for preheating limited amounts of water that is converted into steam. Therefore, the Government should introduce policies that would induce firms to install solar water heaters on a much wider scale. This will result in savings in cost for the firms, a reduction in fuel imports and a decrease in the emission of greenhouse gases.
9. The biggest bulk of electricity in the industry and SME sectors is utilized to run electric motors. The Government should, therefore, come up with policies that will encourage firms to use more efficient electric motors. Again, this will result in cost savings for the firms, as well as a reduction in fuel imports and a decrease in the emission of greenhouse gases because the CEB generates most of its electricity using fossil fuels.