



Energy
Efficiency
Management
Office

Survey on Energy Use/Consumption and Energy Efficiency in the Services Sector

Prepared by VERDE

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Table of Contents

Executive Summary	5
A. Background, Objectives.....	7
A1. Introduction	7
A2. General Objectives	7
B. Approach and Methodology.....	10
B1 Background	10
B2. Preparation of questionnaire	11
B3. Summary of Approach	12
B4. Survey method	12
B5. Survey outcomes and data checks	13
B6. Analysis	13
C. List of companies surveyed.....	15
D. Services sector overall analysis	17
D1. Energy source breakdown.....	17
D2. Energy Source breakdown	18
Chart 4 Energy Source breakdown	18
D3. Energy expense breakdown.....	19
D4. Energy indicators	21
D5. Intensity measures.....	22
D6. The Broader context.....	25
E. Sub-sectoral Analysis	26
E1. Arts, Recreation and Entertainment	26
E2. Food services activities (Excluding accommodation and food production)	33
E3. Human Health and Social work activities	41
E4. Education.....	49
E5. Wholesale and Retail trade	56
E6. Information and Communication and Call centres	64
E7. Storage	70
E8. Professional, Scientific and Technical activities.....	77
E9. Financial and Insurance activities	83
F. Conclusion	90
G. EUI in the broader economic context	91
H. Issues faced	97
I. Data robustness and Quality Assurance	98
J. Ending notes and Disclaimers	100

Table of charts

Chart 1 Sub-sector breakdown	10
Chart 2 Differential target vs actual sample	15
Chart 3 Energy source breakdown	17
Chart 4 Energy Source breakdown	18
Chart 5 Energy expense breakdown.....	19
Chart 6 Sub sector Electricity Energy Use Intensity per unit of turnover	22
Chart 7 Sub Sector Electricity Energy Use Intensity per employee	22
Chart 8 Sub Sector Electricity Energy Use Intensity per built area.....	23
Chart 9 Sub Sector Electricity Energy Use Intensity per gross area	23
Chart 10 Sub Sector Electricity Energy Use Intensity per foot count.....	24
Chart 11 Sub Sector Electricity Energy Use Intensity per hour of operation	24
Chart 12 Arts, Entertainment and Recreation - Electricity source breakdown.....	27
Chart 13 Arts, Entertainment and Recreation - Electricity use breakdown.....	28
Chart 14 Arts, Entertainment and Recreation – Electricity EUI per unit of turnover.....	29
Chart 15 Arts, Entertainment and Recreation – Electricity EUI per employee	29
Chart 16 Arts, Entertainment and Recreation – Electricity EUI per foot count.....	29
Chart 17 Arts, Entertainment and Recreation – Electricity EUI per built area	30
Chart 18 Arts, Entertainment and Recreation – Average power factor.....	31
Chart 19 Arts, Entertainment and Recreation – Electricity EUI per hour of operation	31
Chart 20 Arts, Entertainment and Recreation – Fossil Fuel consumption Transport vs. Non transport.....	32
Chart 21 Food Services Activities - Electricity source breakdown	34
Chart 22 Food Services Activities – Electricity use breakdown.....	35
Chart 23 Food Services Activities – Electricity EUI per unit of turnover	36
Chart 24 Food Services Activities – Electricity EUI per employee.....	36
Chart 25 Food Services Activities – Electricity EUI per foot count	36
Chart 26 Food Services Activities – Electricity EUI per built area	37
Chart 27 Food Services Activities – Electricity EUI per hour of operation.....	38
Chart 28 Food Services Activities – Fossil Fuel consumption Transport vs Non transport	40
Chart 29 Human Health and Social work activities - Electricity source breakdown.....	42
Chart 30 Human Health and Social work activities – Electricity use breakdown	43
Chart 31 Human Health and Social work activities – Electricity EUI per unit of turnover.....	44
Chart 32 Human Health and Social work activities – Electricity EUI per employee	44
Chart 33 Human Health and Social work activities – Electricity EUI per foot count.....	45
Chart 34 Human Health and Social work activities – Electricity EUI per built area	45
Chart 35 Human Health and Social work activities – Electricity EUI per gross area	46
Chart 36 Human Health and Social work activities – Average power factor.....	46
Chart 37 Human Health and Social work activities – Electricity EUI per hour of operation	47
Chart 38 Human Health and Social work activities – Fossil Fuel consumption Transport vs Non transport.....	48
Chart 39 Education - Electricity source breakdown	50
Chart 40 Education – Electricity use breakdown.....	51
Chart 41 Education – Electricity EUI per unit of turnover	52
Chart 42 Education – Electricity EUI per employee	52
Chart 43 Education – Electricity EUI per built area	53
Chart 44 Education – Electricity EUI per gross area.....	53
Chart 45 Education – Average power factor	54
Chart 46 Education – Electricity EUI per hour of operation.....	54
Chart 47 Education – Fossil Fuel consumption Transport vs Non transport	55
Chart 48 Wholesale and Retail trade - Electricity source breakdown	57
Chart 49 Wholesale and Retail trade - Electricity use breakdown	58
Chart 50 Wholesale and Retail trade – Electricity EUI per unit of turnover	59
Chart 51 Wholesale and Retail trade – Electricity EUI per employee.....	59
Chart 52 Wholesale and Retail trade – Electricity EUI per foot count	60
Chart 53 Wholesale and Retail trade – Electricity EUI per built area.....	60
Chart 54 Wholesale and Retail trade – Electricity EUI per gross area	61
Chart 55 Wholesale and Retail trade – Average power factor	61
Chart 56 Wholesale and Retail trade – Electricity EUI per hour of operation.....	62
Chart 57 Wholesale and Retail trade – Fossil Fuel consumption Transport vs Non transport.....	63
Chart 58 Information and Communication and Call centres - Electricity source breakdown	65
Chart 59 Information and Communication and Call centres – Electricity use breakdown	66
Chart 60 Information and Communication and Call centres – Electricity EUI per unit of turnover.....	66
Chart 61 Information and Communication and Call centres – Electricity EUI per employee	67
Chart 62 Information and Communication and Call centres – Electricity EUI per built area.....	67
Chart 63 Information and Communication and Call centres – Average power factor.....	68

Chart 64 Information and Communication and Call centres – Electricity EUI per hour of operation	68
Chart 65 Information and Communication and Call centres – Fossil Fuel consumption Transport vs Non transport.....	69
Chart 66 Storage - Electricity source breakdown.....	71
Chart 67 Storage – Electricity use breakdown	72
Chart 68 Storage – Electricity EUI per unit of turnover	73
Chart 69 Storage – Electricity EUI per employee	73
Chart 70 Storage – Electricity EUI per built area	74
Chart 71 Storage – Average power factor.....	74
Chart 72 Storage – Electricity EUI per hour of operation	75
Chart 73 Storage – Fossil Fuel consumption Transport vs Non transport	76
Chart 74 Professional, Scientific and Technical activities - Electricity source breakdown.....	78
Chart 75 Professional, Scientific and Technical activities – Electricity use breakdown.....	79
Chart 76 Professional, Scientific and Technical activities – Electricity EUI per unit of turnover	79
Chart 77 Professional, Scientific and Technical activities – Electricity EUI per employee	80
Chart 78 Professional, Scientific and Technical activities – Electricity EUI per built area	80
Chart 79 Professional, Scientific and Technical activities – Average power factor.....	81
Chart 80 Professional, Scientific and Technical activities – Electricity EUI per hour of operation	81
Chart 81 Professional, Scientific and Technical activities – Fossil Fuel consumption Transport vs Non transport	82
Chart 82 Financial and Insurance activities - Electricity source breakdown	84
Chart 83 Financial and Insurance activities – Electricity use breakdown.....	85
Chart 84 Financial and Insurance activities – Electricity EUI per unit of turnover	86
Chart 85 Financial and Insurance activities – Electricity EUI per employee.....	86
Chart 86 Financial and Insurance activities – Electricity EUI per foot count	87
Chart 87 Financial and Insurance activities – Electricity EUI per built area.....	87
Chart 88 Financial and Insurance activities – Electricity EUI per gross area.....	88
Chart 89 Financial and Insurance activities – Average power factor	88
Chart 90 Financial and Insurance activities – Electricity EUI per hour of operation.....	88
Chart 91 Financial and Insurance activities – Fossil Fuel consumption Transport vs Non transport	89
Chart 92 – Sub sector contribution to GVA vs Electricity consumption	93

Table of tables

Table 1 Objectives of the study and tasks	8
Table 2 Target number of establishments	10
Table 3 Approach	12
Table 4 Actual number of establishments	15
Table 5 Availability of data	20
Table 6 Conversion factors	21
Table 7 Intensity measures	22
Table 8 Factsheet Arts, Entertainment and Recreation	27
Table 9 Arts, Entertainment and Recreation – Fossil fuel Electricity Equivalent	32
Table 10 Factsheet Food Services Activities	34
Table 11 Food Services Activities – Fossil fuel Electricity Equivalent	38
Table 12 Factsheet Human Health and Social work activities	42
Table 13 Human Health and Social work activities – Fossil fuel Electricity Equivalent	47
Table 14 Factsheet Education	50
Table 15 Education – Fossil fuel Electricity Equivalent	55
Table 16 Factsheet Wholesale and Retail trade	57
Table 17 Wholesale and Retail trade – Fossil fuel Electricity Equivalent	62
Table 18 Factsheet Information and Communication and Call centres	65
Table 19 Information and Communication and Call centres – Fossil fuel Electricity Equivalent	69
Table 20 Factsheet Storage	71
Table 21 Storage – Fossil fuel Electricity Equivalent	75
Table 22 Factsheet Professional, Scientific and Technical activities	78
Table 23 Professional, Scientific and Technical activities - Fossil fuel Electricity Equivalent	82
Table 24 Factsheet Financial and Insurance activities	84
Table 25 Financial and Insurance activities – Fossil fuel Electricity Equivalent	89
Table 26 Calculation of sub sectoral Electricity consumption estimate	91
Table 27 Data required and ideal measures	94

Executive Summary

The Ministry of Energy and Public Utilities (MEPU) and the Energy Efficiency Management Office (EEMO) commissioned VERDE Frontier Solutions Ltd (VERDE) to undertake a survey in the services sector with the following objectives:

- a) to obtain a breakdown of energy use/energy consumption in the Services sector. This should cover electricity, fossil fuels, gas and renewable energy sources, as may be applicable, and according to different end use;
- b) to obtain details on the renewable energy technology installations (photovoltaic and solar water systems) and on stand-by generators installed in the sector;
- c) to determine the level of energy efficiency of the Services sector, through Energy Use Intensity (EUI) calculations.

The tender document mandated VERDE to conduct surveys for a minimum total of 80 establishments, representing 9 sub sectors of the services industry. A total of 108 organisations were included on a list of potential survey respondents, to achieve the minimum target of 80 participants.

A three pronged approach was used in order to collect the data. (1) Telephone calls were made to all selected organisations to book slots for the interviews. (2) On premise meetings were held with each shortlisted organisation based on a standard overall approach, which was designed so as to gather maximum information on energy use. (3) Data and questionnaire validation by way of phone calls, electronic mails and meetings. The data collection period lasted for three and a half months.

Summary of results

It is observed across the whole services sector that energy comprises primarily Electricity at an aggregated 93.81% over the four years under consideration when it comes to expenses. Gas and Diesel expenses stood at an aggregated 2.23% and 2.08% respectively, with Gas being used mainly in the Food services and Wholesale and Retail sub-sectors. Diesel was used across most sub-sectors, with usage related to transport and generators. Other forms of energy were used minimally to nil. Other key insights emanating from the report are summarised below:

- It is observed that energy expenses have been relatively constant from 2015 to 2018. Gasoline and Diesel expenses were seen to be higher in the services sector in the year 2017 as compared to other years under study.
- Out of 83 organisations surveyed, 53 did not keep any records of their electricity bills.
- Most organisations do not have their building foot count.
- Electricity EUI per hour of operation, which is the benchmark utilised for the services sector is lowest for Food Services and highest for Storage at 3.5 kWh/hour of operation/year and 941.9 kWh/hour of operation/year respectively.
- Financial and Insurance activities was second highest with 705.4 kWh/hour of operation/year while Professional, Scientific and Technical activities was third highest with 397.5 kWh/hour of operation/year.
- The electricity EUI per employee per year is highest for Storage and lowest for Food services.
- Electricity EUI across news broadcast and laboratories (in professional, scientific and technical activities) is comparatively high, when built area is considered.
- The highest electricity EUI per gross area per year are Financial and Insurance activities and Wholesale and Retail trade.
- Electricity Energy Use Intensity per foot count per year is found to be within the range 0 – 2213 kWh/foot count/year.
- Companies utilising diesel for transport stand at 37 out of 83, 24 use gasoline and only 4 use LPG.
- The highest number of vehicles used is observed across Wholesale and Retail and Insurance and Financial activities.
- The average power factor is lowest for Education at 0.821 and highest for Food services at 0.975.

- It is estimated that the services sector has an estimated 16.7% electricity consumption (as a percentage of country electric consumption) and a 4.6% electricity consumption (as a percentage of country energy consumption).

The survey showed an enormous disparity among survey respondents in their appreciation and levels of interest in energy efficiency in their organisations. The survey results point to serious concerns by the fact that energy efficiency has not sufficiently managed to attract the attention of business leaders. An increased effort from energy efficiency stakeholders and partner institutions in communicating the benefits of energy efficiency as concretely as possible are required. A complete lack of appreciation of energy efficiency in transport was also observed. Companies barely have proper records on the expenses relating to transport and have no set procedure in place so as to decrease those costs.

Those have been highlighted as important barriers to energy efficiency and the implementation of required measures by business leaders.

A. Background, Objectives

A1. Introduction

The Ministry of Energy and Public Utilities (MEPU) is responsible for the design and implementation of energy policies, as well as energy efficiency matters. In this respect, the Energy Efficiency Management Office (EEMO), falling under the aegis of the MEPU, was set up in 2011 with the objective of promoting the efficient use of energy and promoting national awareness for the efficient use of energy as a means to reduce carbon emissions and protect the environment.

There is data in respect of the overall energy consumption within the services sector but there is no disaggregated data in terms of sub-sectors to enable calculation of energy use intensities and also to determine if energy is being used efficiently. There is also a lack of information as regards to the end use of energy in these sectors, e.g. electricity use or thermal use.

The services sector is a major contributor to the Gross Value Added of Mauritius but is also a major energy consuming industry. Changes in the mix and activities of this sector will have a direct incidence on the energy use in the country. Due to lack of data, this cannot be quantified and this affects long term planning. Hence the need to further expand this sectoral energy consumption database for Mauritius with disaggregated data.

A2. General Objectives

A tender was issued in September 2018 by the MEPU titled MEPU/OAB/05/18-19 Procurement of Services for a Survey on Energy Use/Consumption and Energy Efficiency in the Services Sector.

The general objective of the assignment is to assist the MEPU and the EEMO in achieving the following functions, necessary to attain its objects, with respect to the Services sector:

- I. collect and maintain disaggregated data on energy use/consumption and energy efficiency;
- II. issue guidelines for energy conservation and the judicious use of energy; and
- III. establish energy consumption standards/energy baseline.

The specific objectives of the assignment are:

- a) to obtain a breakdown of energy use/energy consumption in the Services sector. This should cover electricity, fossil fuels, gas and renewable energy sources, as may be applicable, and according to different end use;
- b) to obtain details on the renewable energy technology installations (photovoltaic and solar water systems) and on stand-by generators installed in the sector;
- c) to determine the level of energy efficiency of the Services sector, through Energy Use Intensity (EUI) calculations.

The objectives have been further broken down into the following tasks as detailed out in the table below.

Table 1 Objectives of the study and tasks

Task	Consideration	Expected Outcomes
1	Gathering and compiling the following data of the establishments for the past three years	<ul style="list-style-type: none"> ▪ The CEB Tariff, gross surface area (in m²) and the total built area (in m²) of the establishment being surveyed; ▪ The total annual energy use (in kWh, kVA, kVAh & Power factor) of the establishment, 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 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; ▪ The average annual electricity generation (in kWh) from solar PV systems and consumption of such generated electricity (in kWh); ▪ 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; ▪ The total annual electricity use (in kWh) for specific uses, including equipment, lighting, air conditioning and motive power; ▪ The total annual electricity use (in kWh) for thermal purposes, including water heating, steam generation and direct heating; ▪ The type and quantity of fuel use for thermal purposes, including water heating, steam generation and direct heating; ▪ The annual cost of fuel used; and ▪ The annual production of the establishment.
2	Provide a breakdown of the energy consumption	For each establishment to be surveyed for equipment, lighting, air conditioning, motive power, direct heating, water heating and steam generation (internal and external separately) and other uses as required.
3	Determine the Energy Use Intensities (EUI) of the establishments	<ul style="list-style-type: none"> ▪ In terms of kWh per production output, as applicable, 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. ▪ With respect to transport used, fuel economy shall be calculated as total annual distance covered per litres of fuel used for the past three years and must be provided in km/l.

4	Investigate and display through appropriate charts the relationship of EUI and production output, as applicable, for the different subsectors and categories.	<ul style="list-style-type: none">▪ Any other correlation, association, inter-variable analyses will be undertaken as part of the analytics.
5	Reporting and presentation of findings	<ul style="list-style-type: none">▪ The reporting will be based on the reporting guidelines of ESOMAR, MRS and OR Society.▪ Word template of the report will be provided▪ Excel of the data and analyses will be provided

B. Approach and Methodology

B1 Background

An energy consumption survey has been undertaken amongst stakeholders to assess energy usage in the services sector. The objective of the survey is to determine energy consumption, primarily across main players in the identified sub sectors sector and, assess the breakdown of usage across different energy sources and to determine the level of energy efficiency in the sector. The estimated energy consumption of the different types of energy sources consumed by the targeted organisations will serve as a basis to estimate the total energy consumption of each sub-sector.

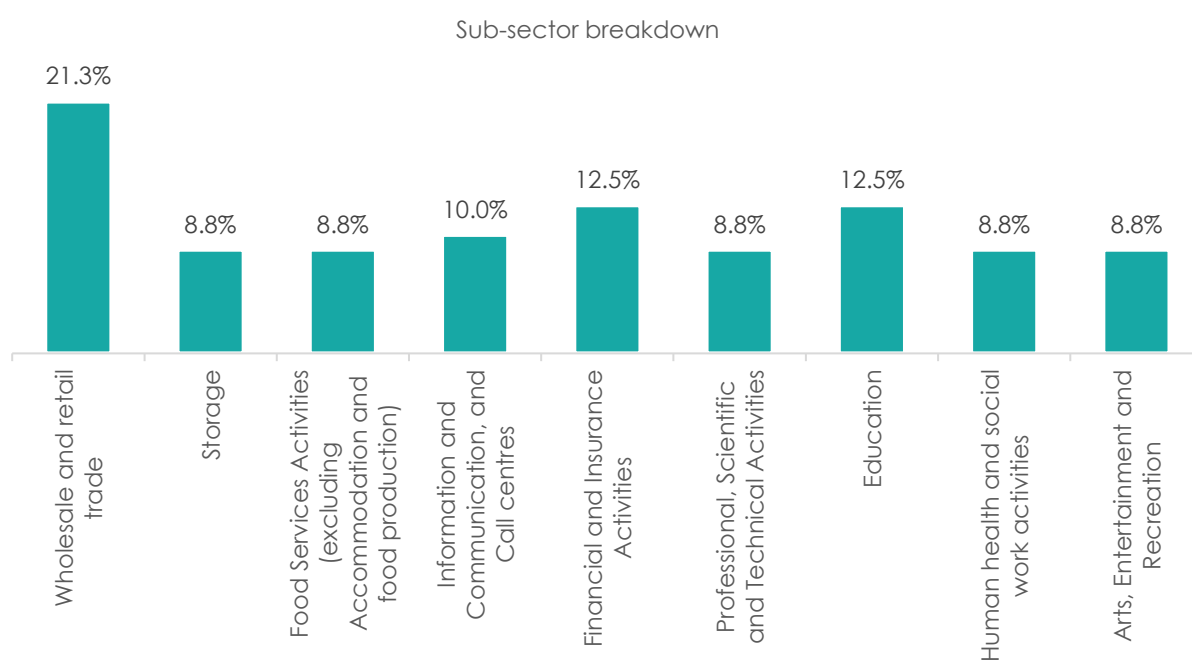
The tender document has mandated the service provider to conduct surveys for the minimum number of establishments, per subsector, as listed below:

Table 2 Target number of establishments

Services Sub-Sector	Minimum number of establishments to be surveyed
Wholesale and retail trade	17
Storage	7
Food Services Activities (excluding accommodation and food production)	7
Information and communication and call centres	8
Financial and Insurance Activities	10
Professional, scientific and technical activities	7
Education	10
Human health and social work activities	7
Arts, Entertainment and Recreation	7
TOTAL	80

80 organisations were targeted to be surveyed, with the focus being on large organisations which would provide a more accurate estimate of energy usage across each sub-sector of activity. The proposed sampling breakdown is as per below:

Chart 1 Sub-sector breakdown



The target sample of companies has been based on an initial database which VERDE had initially put together, and was shortlisted. Subsequently, the list, including back up companies, were validated with the Client based on specific criteria which would more thoroughly provide a snapshot of each sub-sector.

B2. Preparation of questionnaire

The questionnaire for the structured interviews was prepared in close consultation with the Client, whilst ensuring that the main objectives and key data were collected across all surveyed organisations. The questionnaire consisted of two parts: (1) General company information and (2) Energy consumption details. For the services sector, general information on the sub-sector included the name of the organisation, the size, number of employees, main processes, major products, yearly production and gross annual revenue amongst others.

The energy consumption part comprised:

- the breakdown in terms of energy sources and main uses (electricity, fossil fuels, gas and renewable energy sources)
- the CEB Tariff, gross surface area (in m²) and the total built area (in m²) of the establishment being surveyed
- the total annual energy use (in kWh and kVAh) of the establishment, including where necessary instrumented measurements, with breakdown showing electricity consumption, fossil fuel use and renewable energy use 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
- the average annual electricity generation (in kWh) from solar PV systems and consumption of such generated electricity (in kWh)
- 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
- the total annual electricity use (in kWh) for specific uses, including equipment, lighting, air conditioning and motive power
- the total annual electricity use (in kWh) for thermal purposes, including water heating, steam generation and direct heating
- the type and quantity of fuel use for thermal purposes, including water heating, steam generation and direct heating
- the annual cost of fuel used
- the annual production of the establishment
- details on the renewable energy technology installations (photovoltaic and solar water systems) and on stand-by generators installed in the sector
- determine the level of energy efficiency of the services sector through calculations of Energy Use Intensity (EUI) calculations

The data collected through the questionnaire was therefore expected to provide a complete view of the profile of various type of uses and electrical installations, which would enable VERDE to gather the data and to subsequently benchmark energy consumption standards/energy baseline across required sub-sectors.

The team has opted for a stratified sampling to meet the total required number of interviews. A summary of the approach is provided below.

B3. Summary of Approach

The survey is the cornerstone of the project through collection of data on energy use/consumption and energy efficiency in the sub sectors. To this end, all personnel involved have brought in their expertise to first prepare an execution plan. The latter was approved vetted by the Client prior to commencing of the data collection process and further worked upon to prepare an execution report that has guided the survey process. This process has helped to ensure that the survey is as accurate as possible.

Table 3 Approach

Survey Audience	Details	Tools	Technique
Organisations from the identified stakeholders	80 or so interviews with the representative of the organisation, who is most appropriate to provide the information	Primarily Computer Assisted/Smartphone Assisted Personal Interviewing using a structured questionnaire	Non-random stratified sampling

The following framework has been applied:

- Questionnaire validation by the MEPU/EEMO and pilot testing at the level of VERDE
- The consultant appointed by VERDE has provided technical assistance in face to face interviews using the structured questionnaire, together with VERDE personnel
- Interviews with companies and stakeholders undertaken using pre-planned time slots as scheduled by VERDE
- Further phone calls, electronic mails and meetings to ensure that questionnaires are provided in time (a deadline of mid-march 2019 was communicated to all contacted companies of the target sample)

To be in line with the ICC/ESOMAR international code of market research and data collection, the following has been applied:

- Above 40% accompaniment of engineering consultant in the interviews
- Minimum of 80% back-checking of questionnaires and double verification of figures with MEPU
- 100% logic scrutiny of questionnaires
- Minimum of 85% back checking of data loading

B4. Survey method

Telephone calls were made to all selected organisations to book slots for the interviews. A full schema was put together, which the VERDE team aligned to for swift progress of the assignment. It took an average of 3 weeks for slots to actually be booked with organisations.

In practice, take up of site surveys varied significantly amongst sectors, and a lower proportion of respondents who expressed an interest during the telephone call actually participated in the interview, mainly due to the increased time and effort from personnel. The rejection rate has been tracked, but this was catered for through back-up organisations which were included on the approved target sample list. A total of 108 organisations were included on the list, to achieve the minimum target of 80 participants.

On premise interviews were thereafter undertaken with each shortlisted organisation based on a standard overall approach, which was designed so as to gather maximum information on energy use. An initial pilot of the interview was undertaken to ensure that no misunderstanding and no misinterpretation of data would occur.

The interview was broken down into two key elements (the core survey and subsector specific questions). The core survey was designed to collect data which was required for all records, regardless of sub-sector. Where required, the question text of core survey questions was tailored to suit a specific sub-sector or sector, but the subject matter of each core survey question was expected to remain the same throughout the study. Development of the sub-sector specific questions was designed and led by the energy expert (electrical engineer).

B5. Survey outcomes and data checks

The site interviews provided detailed information on the energy end use consumption, activities (extent and intensity), and insights on the barriers and enablers to implementing energy efficiency measures across each organisation. Where necessary assumptions were used for particular sub-sectors. Examples of updates include typical floor area conventions and net to gross ratios comparing whole building floor area with that associated with core activities as well as consumption estimates based on equipment inventory. Data collected on site was also used to verify and, if necessary, correct and overwrite findings from the interviews. The site survey process gathered a broad range of data across the following subject areas:

- Activities
- Occupancy
- Equipment list
- Building fabric information
- Energy end-use breakdown
- Abatement measures that had been implemented or were suitable for the site
- The potential energy savings that viable measures could achieve
- Energy consumption data (whole building and sub-metered)
- Information relating to barriers and enablers affecting the site and recipient organisation

Data collection procedures are expected to be varied in such studies, as they depend primarily on the skillset of the individual interviewer and his ability to retrieve the necessary information. This is why the engineer within the VERDE team has been specifically chosen, based on his skillset and experience in the sector. Similarly, the detail and quality of outcomes from the interview process was highly dependent upon the involvement and engagement of the respective contact persons, and the quality of data they were able to provide relating to the premises.

VERDE has in place appropriate quality assurance standards to ensure that all data collected is verified and tested prior to analysing.

B6. Analysis

Once all data was collected, the data was cleaned and mined thoroughly. The technical data was transferred to an excel sheet and graphs created to determine the recurrent patterns of supply and high consumption during particular months.

Records were screened for outliers before being reviewed for quality. Where extreme values were identified the record was referred to the respondent and if no other figure was communicated, it was excluded. This outlier exclusion provided an additional filtering for any records for which the respondent may have misunderstood the extent of the building or premises they were being asked to provide responses for. The quality procedure identified the proportion of questions for which no response was provided ('Don't know' responses). The number of 'don't know' responses was monitored record-by-record across the full question set including sub-groups of questions critical to the generation of energy predictions. Any records which failed to meet the minimum data quality thresholds, measured by the percentage of 'don't know' responses, were excluded.

Exclusion of these records was deemed necessary on the grounds that a significant prevalence of 'don't know' responses is considered indicative of a respondent who lacked engagement or had a poor understanding of their building's core services and equipment. In practice, different exclusion thresholds are required for different subsectors, due to the difference in the content and quantity of sub-sector specific questions applied in each case. If the same thresholds are applied across the board, an excessively high proportion of the sample will need to be excluded from certain subsectors. In certain sub-sectors, further exclusions are required during the analysis process in exceptional cases.

Responses to certain survey questions, particularly those occurring in the core survey, are essential for correct function of the energy use model and abatement model. For example, fundamental information on whether the building had heating, ventilation and air conditioning systems installed was essential to determining whether these should be included in the energy. It is not possible to exclude all records where 'don't know' responses occurred in essential survey questions, as this would have excluded an excessively high proportion of the remaining records. Therefore, in order to produce a dataset which could be used in the analysis, record amendment was conducted on the remaining data.

C. List of companies surveyed

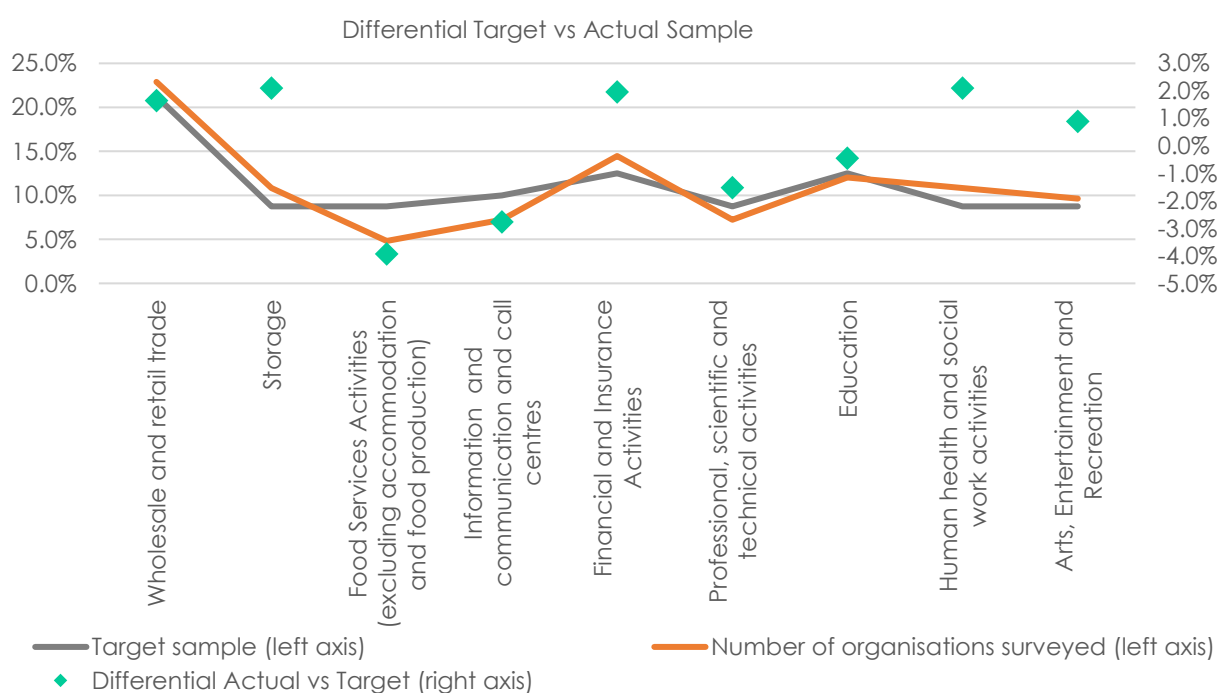
The data collected for the respective sub-sectors of the industry for the calendar years 2015, 2016 and 2017 (figures for 2018 were not available in most instances) were used to examine the enterprises' energy consumption and efficiency in greater detail. The analyses concentrated on cross-cutting technologies which they use and sector-specific, energy-relevant equipment features like lighting, office appliances, air conditioning, common rooms (used during work breaks etc.) and canteens. Furthermore, company data and questions concerning energy management, i.e. how the topic of energy is managed, the implementation of energy-saving measures and estimates of energy costs were analysed. These analyses were based on unweighted raw data of the questioned companies.

In view of the low case numbers in respective sub sectors, the information is not strictly representative of a population; however, since the quota was fulfilled even in the sub-groups, the results are very useful for a more detailed insight into the sectors. The final sample obtained is as follows:

Table 4 Actual number of establishments

Services Sub-Sector	Target sample	Number of organisations surveyed
Wholesale and retail trade	17	19
Storage	7	9
Food Services Activities (excluding accommodation and food production)	7	4
Information and communication and call centres	8	6
Financial and Insurance Activities	10	12
Professional, scientific and technical activities	7	6
Education	10	10
Human health and social work activities	7	9
Arts, Entertainment and Recreation	7	8
TOTAL	80	83

Chart 2 Differential target vs actual sample



The sub sectors where the actual sample was lower than the required sample were:

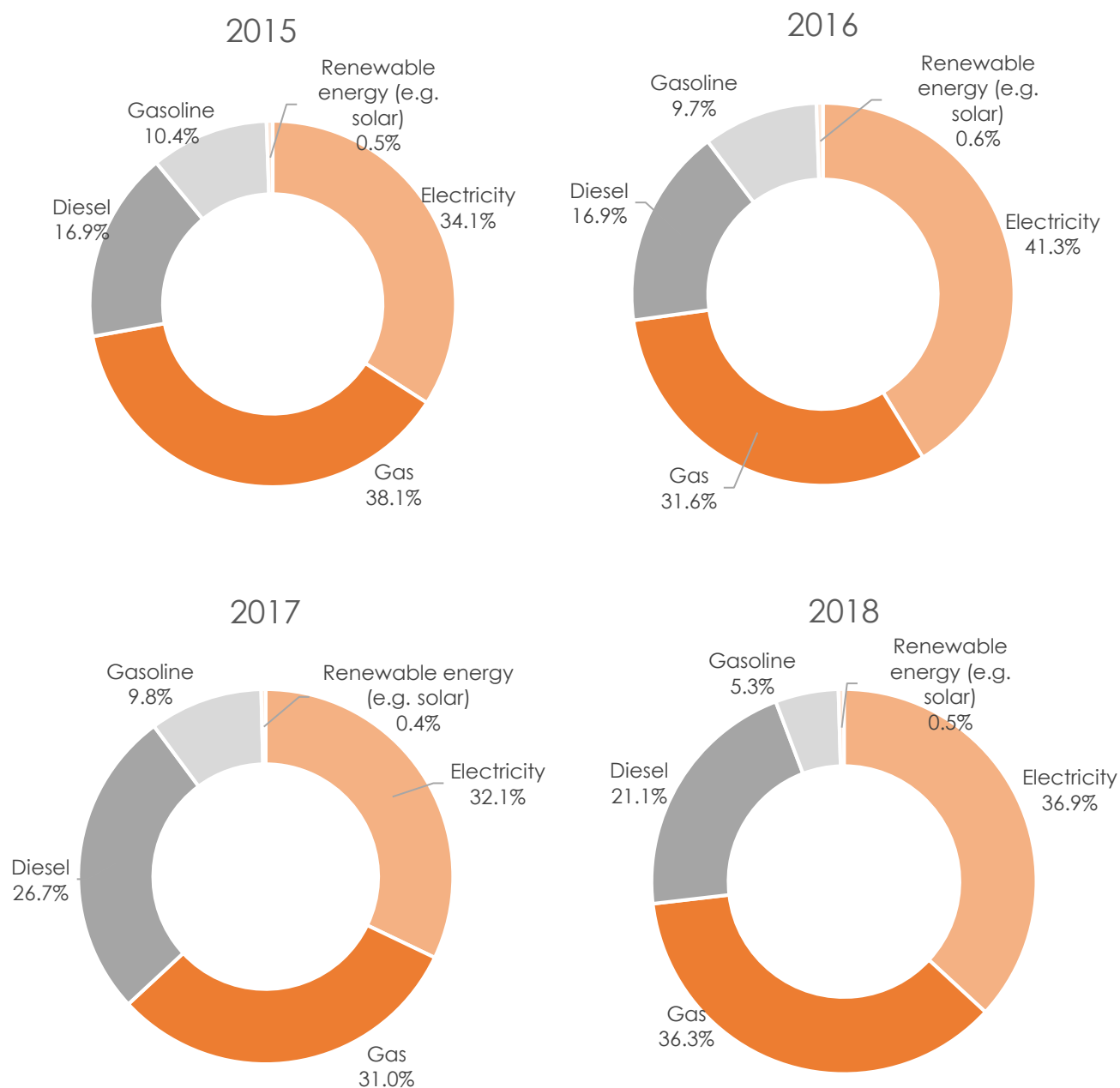
- Food services activities;
- Information and call centers; and
- Professional, scientific and technical activities.

D. Services sector overall analysis

D1. Energy source breakdown

The breakdown in terms of energy source for the whole sample is provided below, when electricity equivalent ratios are used. Percentages are based on kWh_{eq} values.

Chart 3 Energy source breakdown



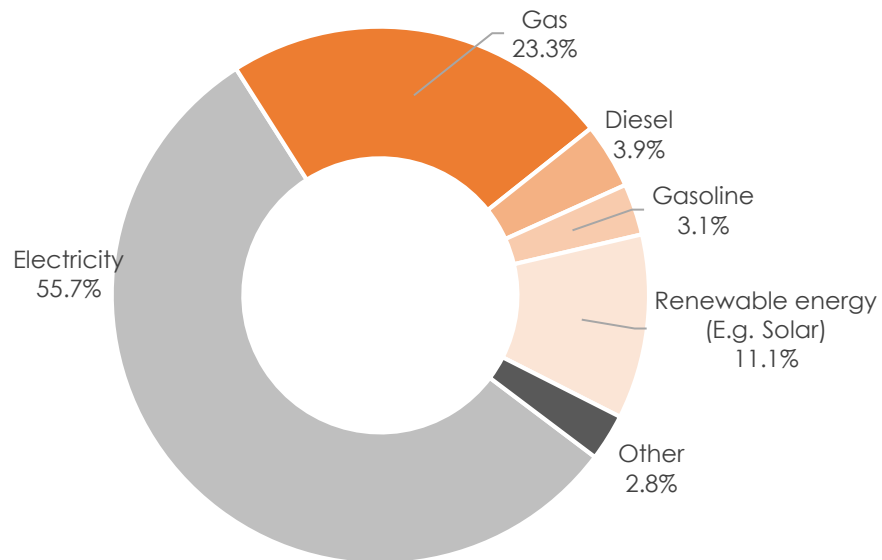
When usage breakdown was undertaken through electricity equivalent ratios, the breakdown (average of 2015, 2016, 2017 and 2018) was as follows: Electricity 36.1%, Gas 34.2%, Diesel 20.4%, Gasoline 8.8% and Renewable Energy at 0.5%.

The sub-sector analysis will focus on the sources of energy which are consistent across organisations and sub-sectors, more specifically where the amount of data obtained is deemed large enough for proper analysis.

D2. Energy Source breakdown

The breakdown in terms of energy source for the whole sample is provided below. The average figures of the breakdown obtained across all sub-sectors have been calculated and depicted on the chart below.

Chart 4 Energy Source breakdown



It is observed that Electricity comprises the bulk of electricity usage at 55.7%, followed by Gas at 23.3%.

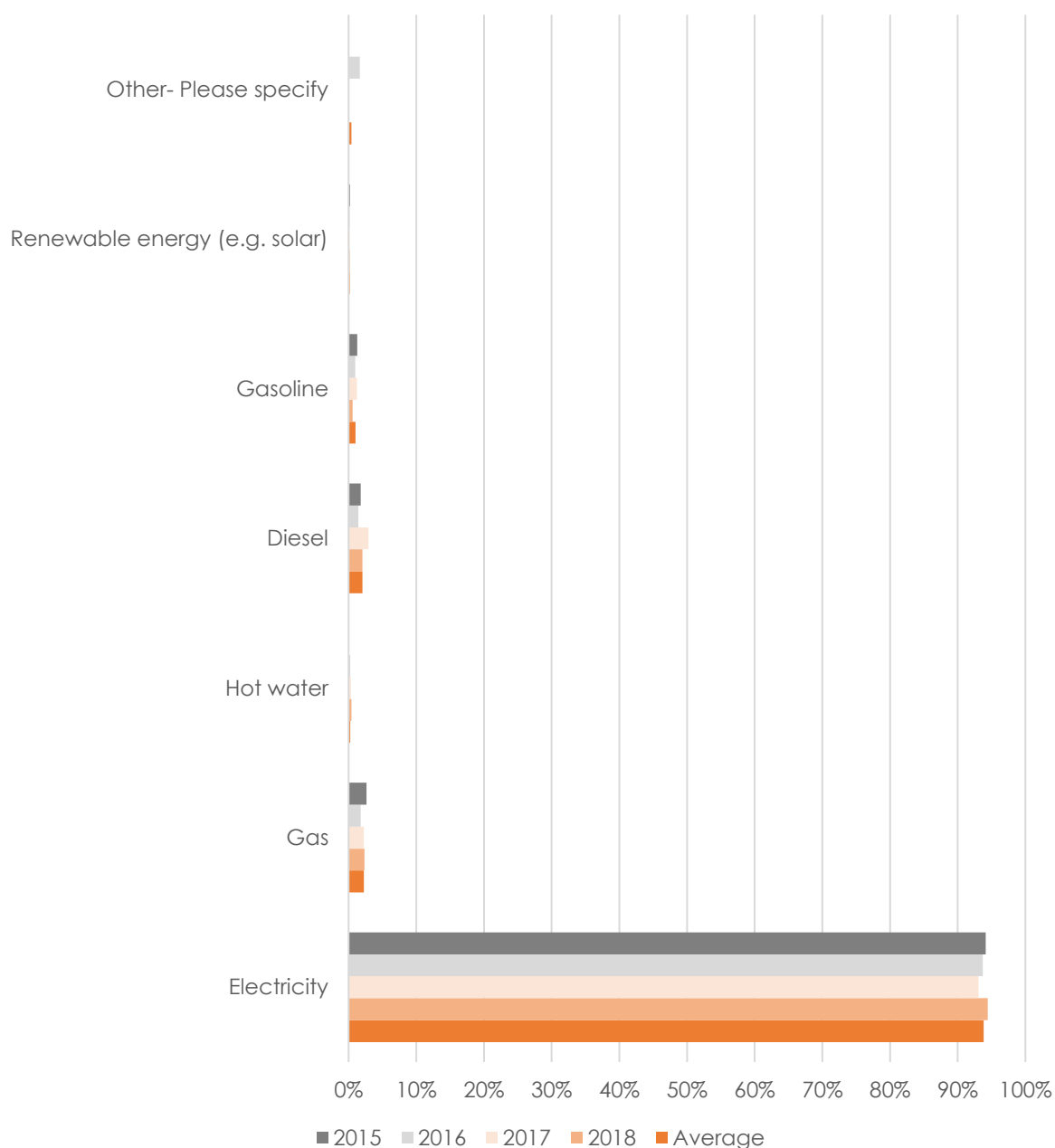
D3. Energy expense breakdown

The breakdown in terms of energy expenses for the whole sample is provided below, for the years 2015, 2016, 2017 and 2018, where available. The average expenses for the four years across energy source have also been calculated as a percentage of total energy expenses. The table below provides a breakdown of the energy expense evolution.

It is observed across the whole services sector that energy expense comprises primarily Electricity at an aggregated 93.8% over the four years under consideration when it comes to expenses. It is to be noted that 2018 figures were available for only a small number of organisations surveyed.

Gas and Diesel expenses stood at an aggregated 2.2% and 2.1% respectively, with Gas being used mainly in the Food services and Wholesale and Retail sub-sectors. Diesel was used across most sub-sectors, with usage related to transport and generators. Other sources of energy were used across specific sub-sectors or across specific organisations, depending on their modus operandi.

Chart 5 Energy expense breakdown



It is observed that energy expenses have been relatively constant from 2015 to 2018. Gasoline and Diesel expenses were seen to be higher in the services sector in the year 2017 as compared to other years under study.

The following provides the breakdown of how many organisations actually use and do not use specific forms of energy. The number of companies where data was provided as well as the percentage with respect to each sub-sector sample has also been provided. The snapshots provide the base for the indicators which have been deemed the most appropriate in the study.

Table 5 Availability of data

Sub sector	Companies having provided footprint			Companies having provided built area			Companies having provided gross area		
	Total	%		Total	%		Total	%	
Art	2	8	25.0%	7	8	87.5%	6	8	75.0%
Food	2	4	50.0%	4	4	100.0%	4	4	100.0%
Health	4	9	44.4%	7	9	77.8%	8	9	88.9%
Education	1	10	10.0%	10	10	100.0%	10	10	100.0%
Wholesale	3	19	15.8%	15	19	78.9%	12	19	63.2%
ICT	1	6	16.7%	6	6	100.0%	5	6	83.3%
Storage	1	9	11.1%	8	9	88.9%	8	9	88.9%
Professional	0	6	0.0%	6	6	100.0%	0	6	0.0%
Insurance	3	12	25.0%	11	12	91.7%	9	12	75.0%
TOTAL	17	83	20.5%	74	83	89.2%	62	83	74.7%

Sub sector	Companies using renewable energy			Companies using generators		
	Total	%		Total	%	
Art	0	8	0.0%	4	8	50.0%
Food	0	4	0.0%	3	4	75.0%
Health	0	9	0.0%	6	9	66.7%
Education	3	10	30.0%	4	10	40.0%
Wholesale	1	19	5.3%	11	19	57.9%
ICT	0	6	0.0%	4	6	66.7%
Storage	0	9	0.0%	7	9	77.8%
Professional	0	6	0.0%	4	6	66.7%
Insurance	1	12	8.3%	8	12	66.7%
TOTAL	5	83	6.0%	51	83	61.4%

Sub sector	Companies using diesel for transport			Companies using gasoline for transport			Companies using LPG for transport		
	Total	%		Total	%		Total	%	
Art	1	8	12.5%	0	8	0.0%	0	8	0.0%
Food	2	4	50.0%	1	4	25.0%	0	4	0.0%
Health	3	9	33.3%	4	9	44.4%	0	9	0.0%
Education	3	10	30.0%	2	10	20.0%	0	10	0.0%
Wholesale	11	19	57.9%	8	19	42.1%	2	19	10.5%
ICT	2	6	33.3%	2	6	33.3%	0	6	0.0%
Storage	5	9	55.6%	3	9	33.3%	1	9	11.1%
Professional	2	6	33.3%	1	6	16.7%	1	6	16.7%
Insurance	8	12	66.7%	3	12	25.0%	0	12	0.0%
TOTAL	37	83	44.6%	24	83	28.9%	4	83	4.8%

Sub sector	Companies using diesel			Companies using gasoline			Companies using LPG		
	Total	%		Total	%		Total	%	
Art	2	8	25.0%	1	8	12.5%	1	8	12.5%
Food	1	4	25.0%	1	4	25.0%	1	4	25.0%
Health	3	9	33.3%	1	9	11.1%	1	9	11.1%
Education	4	10	40.0%	1	10	10.0%	1	10	10.0%
Wholesale	9	19	47.4%	4	19	21.1%	5	19	26.3%
ICT	2	6	33.3%	1	6	16.7%	1	6	16.7%
Storage	2	9	22.2%	1	9	11.1%	0	9	0.0%
Professional	2	6	33.3%	0	6	0.0%	1	6	16.7%
Insurance	4	12	33.3%	1	12	8.3%	1	12	8.3%
TOTAL	29	83	34.9%	11	83	13.3%	12	83	14.5%

On the basis of available data from organisations as included in the sample, the energy efficiency indicators were devised and analysed in the report.

D4. Energy indicators

There are many factors which affect the relationship between energy use and activity. Specific indicators are used across different sectors or sub-sectors, as factors which affect the relationship between energy use and activity differ. Indicators which are appropriate for a sub-sector may not necessarily be convenient to give a good interpretation of energy efficiency in another sub-sector.

Most of the energy consumed in the services sector is used for lighting, heating (cooling), electric devices and water heating. A measure of energy efficiency in output terms (e.g. production) is not plausible, as services companies output an intangible, which is difficult to quantify. Therefore, more relevant activity measures have been analysed.

Two types of indicators have been analysed in the report.

- (1) General Indicators: Electricity Energy Use Intensity (EUI) to compare sub sectors across the following:

- a) Per unit of turnover, which refers to the amount of electric energy consumed to produce 1 unit of turnover.

$$\text{EUI}(\text{turnover}) = \text{Energy consumption in kWh} / \text{Turnover in Rs per year}$$

- b) Per employee, which refers to the amount of electric energy consumed by 1 employee working in the sub sector. In this instance, there was no differentiation made between full time and part time employees.

$$\text{EUI}(\text{employee}) = \text{Energy consumption in kWh} / \text{employee per year}$$

- c) Per foot count, which refers to the amount of electric energy consumed by 1 person visiting the building, where a services company is operating.

$$\text{EUI}(\text{footcount}) = \text{Energy consumption in kWh} / \text{footcount per year}$$

- d) Per built area, which refers to the amount of electric energy consumed per m² of building.

$$\text{EUI}(\text{built area}) = \text{Energy consumption in kWh} / \text{m}^2 \text{ per year}$$

- For benchmarking of energy efficiency across the sub-sectors, the Energy Use Intensity per hour of operation was used. This benchmark refers to the amount of energy consumed by a services company to operate for an hour. The Fossil Fuel Energy Use Intensity Per Hour of Operation (Energy Consumed from Fossil Fuel by Firm (kWh)/Hour of operation/year) was not utilised due to unavailability of sufficient data across organisations surveyed. The main indicator utilised is therefore: **Electricity Energy Use Intensity Per Hour of Operation = Energy Consumed from Electricity by Firm (kWh)/Hour of operation/year**

The following conversion rates were applied to obtain the electricity equivalent figures in kWh_{eq} for each source of energy.

Table 6 Conversion factors

Energy source	Conversion factor to kWh	Price per unit/Rs
Natural gas in cubic metres	8.8	-
LPG in kgs	13.3	33.33
Coal in kgs	8.1	-
Petrol in litres	9.1	-
Diesel oil in litres	10.0	38.00

Gasoline	-	44.00
Renewable energy	-	3.70
Electricity	-	10.00

D5. Intensity measures

The following table provides a snapshot into key measures which have been analysed in this report, as well as the benchmark which has been utilised. Each measure has been further analysed in the sub-sectoral analysis which follows. The figures have been colour-coded for each criterion, with the red representing the highest figures and green representing the lowest figures. The white boxes relate to unavailable figures.

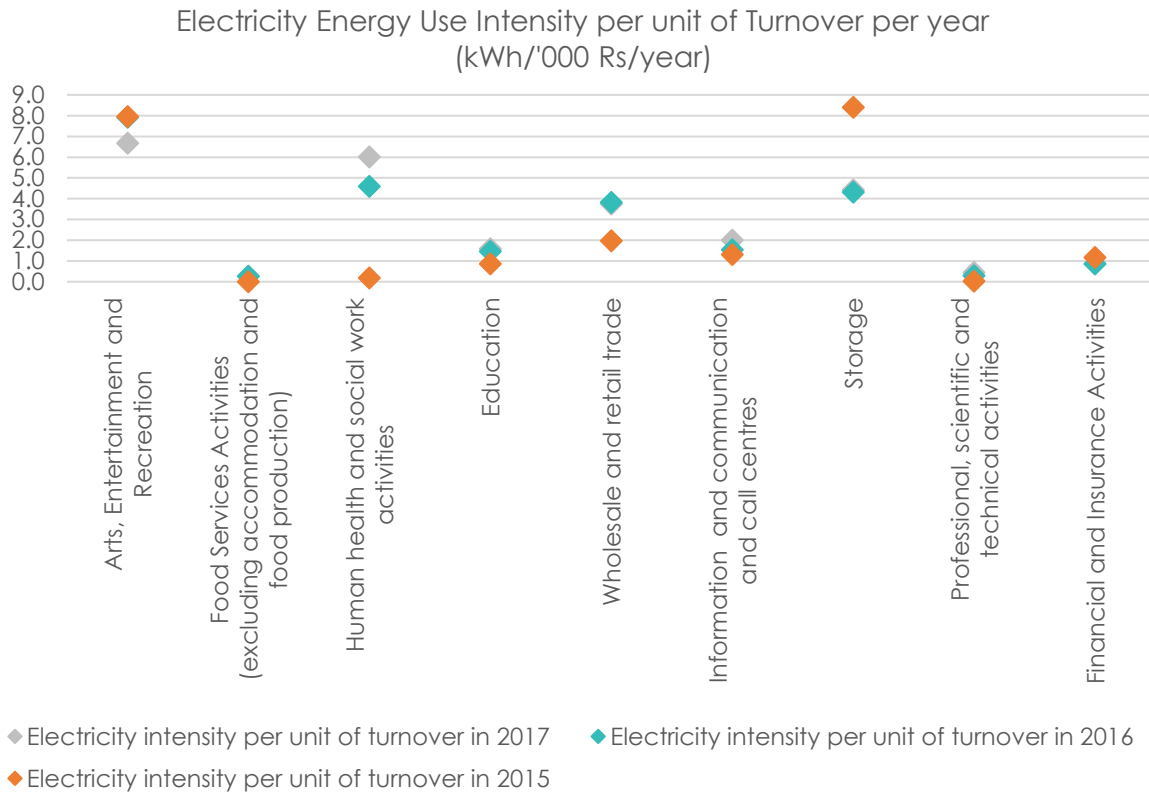
Table 7 Intensity measures

Key figures	Indicators (2017)			
	Electricity energy use intensity per unit of turnover (kWh/'000 Rs/year)	Electricity energy use intensity per employee (kWh/employee/year)	Electricity energy use intensity per foot count (kWh/foot count/year)	Electricity energy use intensity per built area (kWh/m ² /year)
Sub-sector				
Arts, Entertainment and Recreation	6.7	9160.3	3.8	118.0
Food Services Activities (excluding accommodation and food production)	0.3	242.6	0.2	13.6
Human health and social work activities	6.0	4551.2	155.5	93.7
Education	1.6	1099.0	0.0	23.2
Wholesale and retail trade	3.7	6988.1	7.1	233.3
Information and communication and call centres	2.0	964.3	8.9	80.5
Storage	4.4	16634.9	2214.0	203.1
Professional, scientific and technical activities	0.4	1503.9	-	1308.6
Financial and Insurance Activities	0.9	2504.6	24.0	203.5

The following charts illustrate how intensity measures vary across the different sub-sectors being considered.

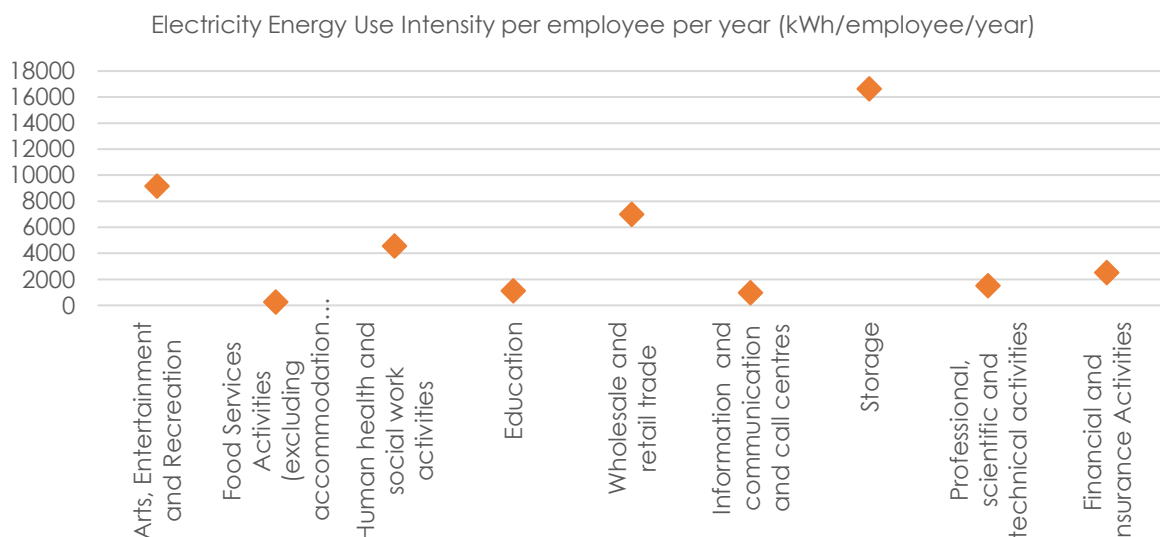
General indicators

Chart 6 Sub sector Electricity Energy Use Intensity per unit of turnover



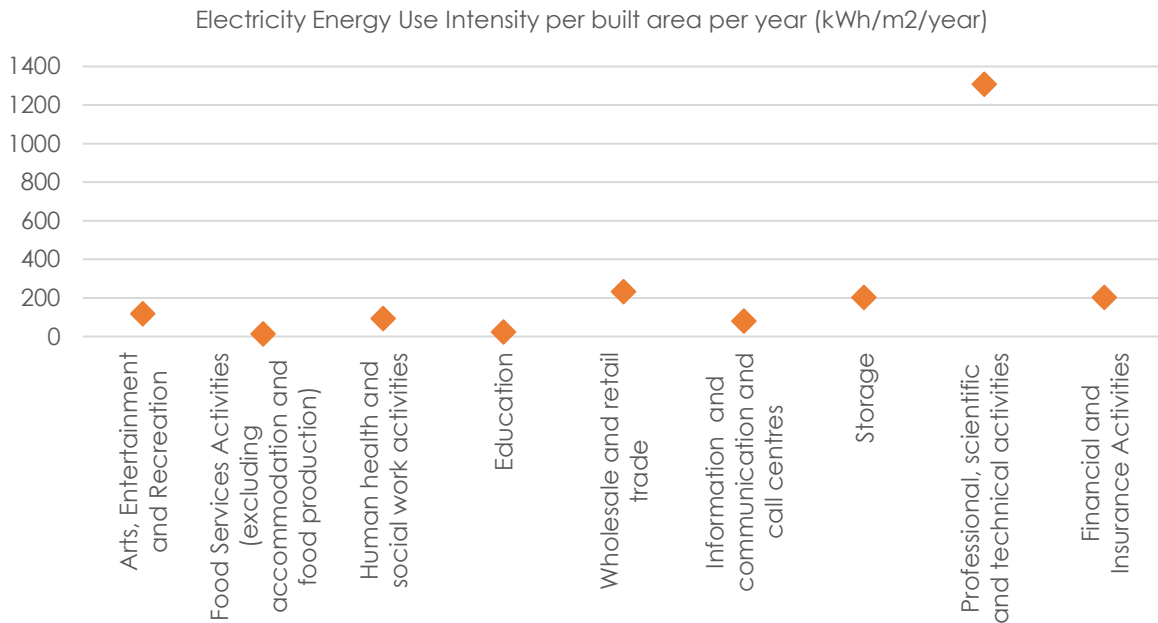
It is observed that, across most subsectors, the trend is upwards, with the electricity consumption increasing as turnover increases. The reverse is observed for Arts, Entertainment and Recreation, which may be attributed to economies of scale, as occupancy increases.

Chart 7 Sub Sector Electricity Energy Use Intensity per employee



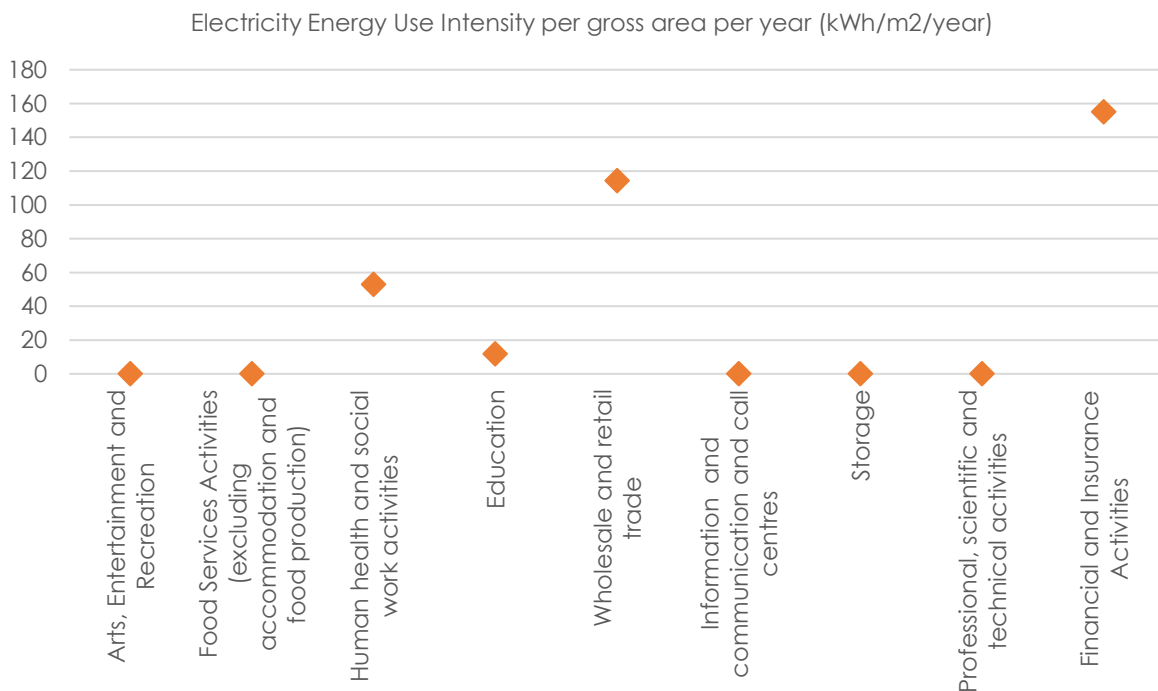
The electricity EUI per employee is highest for Storage and lowest for Food services. High energy consumption across storage sub-sector may be attributed to ventilation, cold rooms and air conditioning coupled with 24hour run time.

Chart 8 Sub Sector Electricity Energy Use Intensity per built area



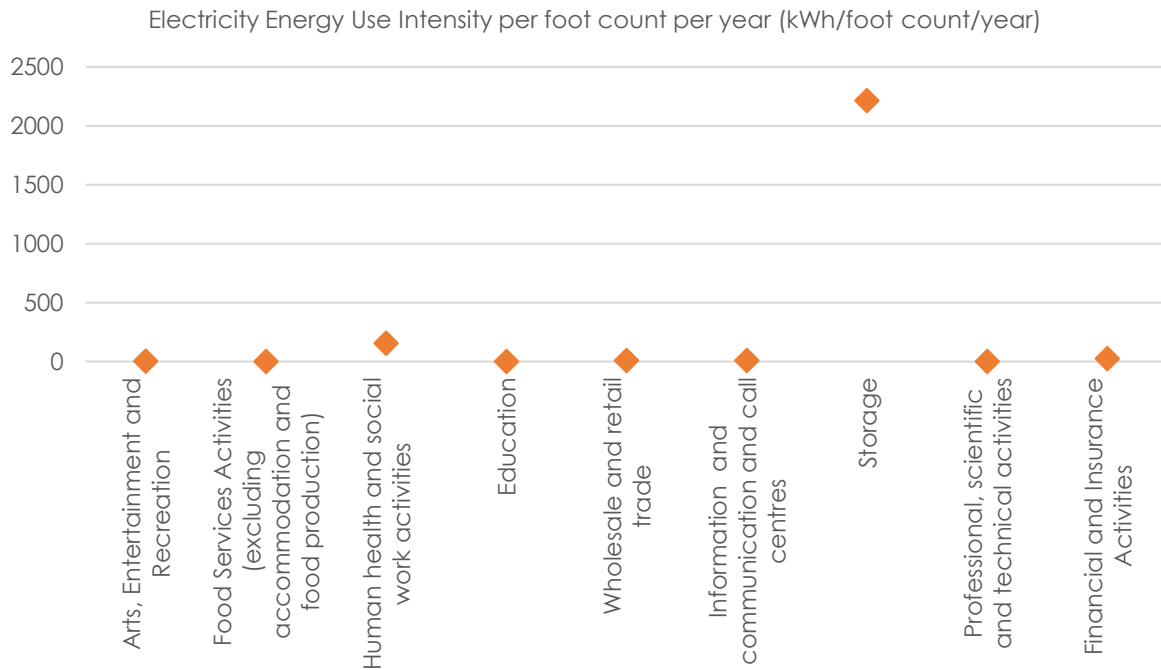
The outlier in the chart above is observed to be the Professional, Scientific and Technical activities sub-sector. Further analysis determined that the electricity EUI across news broadcast and laboratories (in professional, scientific and technical activities) is comparatively high, when built area is considered.

Chart 9 Sub Sector Electricity Energy Use Intensity per gross area



When gross area is analysed, it is observed that the sub-sectors with the highest electricity EUI per gross area per year are Financial and Insurance activities and Wholesale and Retail trade.

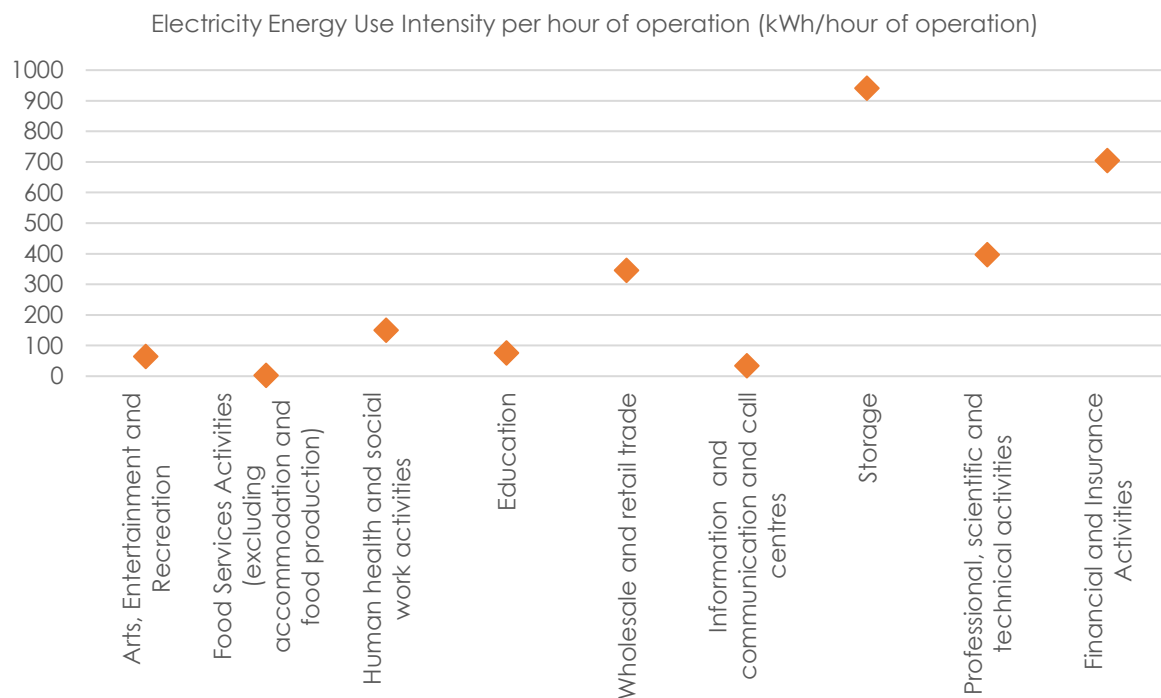
Chart 10 Sub Sector Electricity Energy Use Intensity per foot count



The outlier is Storage, which is due to the low foot count in the facility, as well as the high energy consumption. For the other sub-sectors, Electricity Energy Use Intensity per foot count per year is found to be within the range 0 – 300 kWh/foot count.

Benchmark EUI (Hour of operation)

Chart 11 Sub Sector Electricity Energy Use Intensity per hour of operation



Storage facilities are generally open after normal office hours. Facilities operate 24 hours a day. The Electricity Energy Unit per hour of operation is high as the electricity consumption outweighs the additional number of hours during which the facility operates.

It is derived that for offering a service today, an entity operating in the sub-sectors as represented above, will consume quite a varied amount of electricity to operate for one hour. Reasons which account for those differences include:

- i. Some sub sectors operate quite extensively at different points in time;
- ii. Some sub sectors have servers to maintain client databases (E.g. Financial and Insurance Activities); and
- iii. Some sub-sectors include very large organisations (supermarkets) which consume large amounts of electricity.

D6. The Broader context

Following the above analysis, it was determined that a broader analysis may provide more insights in terms of energy consumption in Mauritius. As such, GVA measures have been utilised to estimate energy consumption for different sub-sectors. The chart below depicts the relationship between GVA and estimate of energy consumption across the sub sectors. A green arrow has been used to represent sub sectors which are intensively consuming electricity while their GVA contribution remain low, although some sectors are mostly concerned with well-being (represented in dotted arrow).

E. Sub-sectoral Analysis

E1. Arts, Recreation and Entertainment

Key take-aways

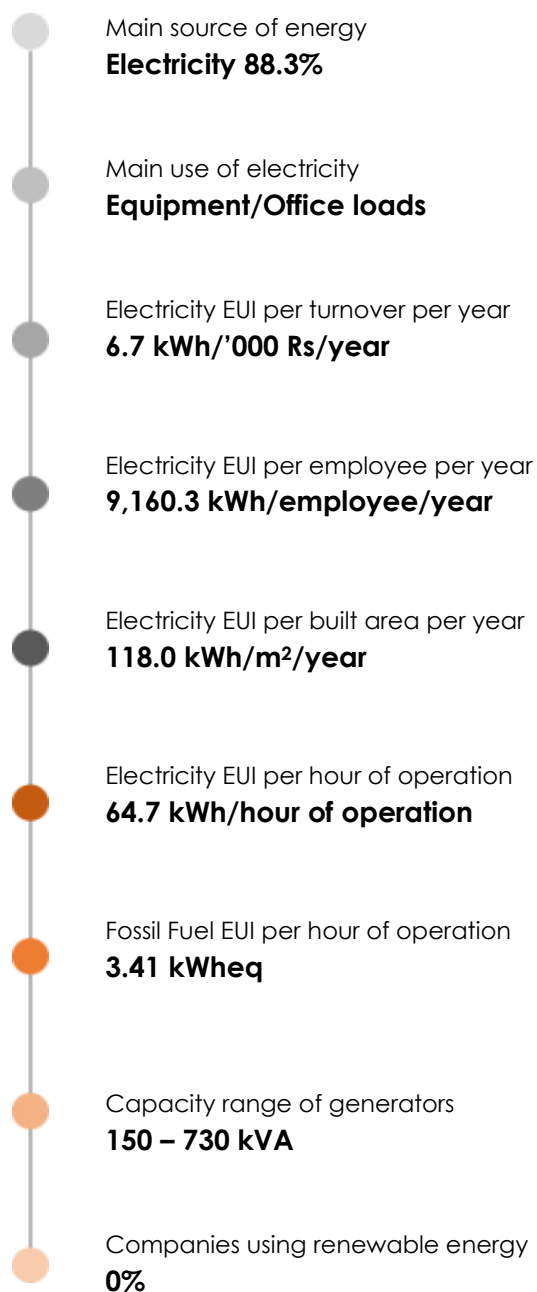
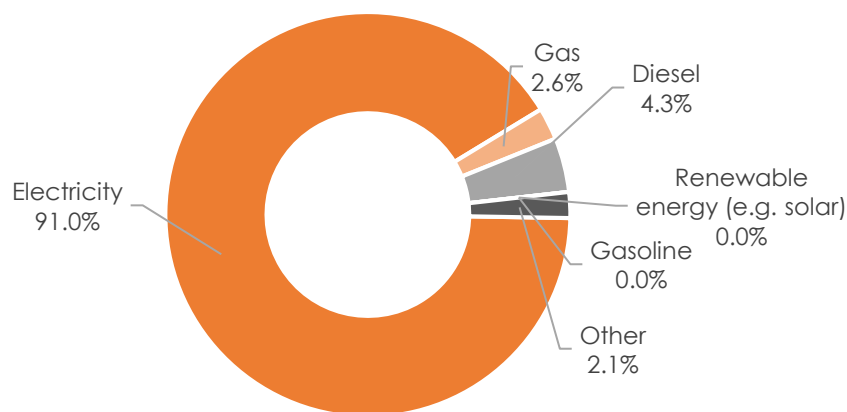


Table 8 Factsheet Arts, Entertainment and Recreation

Sub-sector Arts, Entertainment and Recreation		
Total number of companies surveyed	8	
Selection criteria	Companies short-selected were those who either had the biggest buildings or those who had the highest foot count. This ensured that the data collected is not subjective and that economies of scale are obtained in the data. Companies which form part of the sub sector sample include casinos, conference halls and cinemas. Whilst conference halls operate as and when there are specific events, casinos and cinemas operate every day. Casinos operate until late at night, and include a beverage section. Cinemas also include a food and drinks element.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	7	87.5%
Electricity consumption	8	100.0%
Number of employees	5	62.5%
Foot count	2	25.0%
Built area	7	87.5%
Gross area	0	0.0%
Hours of operation	7	87.5%
Generators output	1	12.5%
Transport	2	25.0%

Energy Source breakdown

Chart 12 Arts, Entertainment and Recreation - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Office use
- Events (sound, light, projectors)
- Gaming machines
- Air-conditioning
- Lighting
- Building operation

- Recreational activities
- Cold rooms
- Equipment
- IT
- Water heating
- Chiller AC system

Main uses of gas:

- Cooking
- Kitchen equipment

Main uses of hot water:

- Cooking
- Hot drinks

Main uses of diesel:

- Back-up generator
- Vehicles

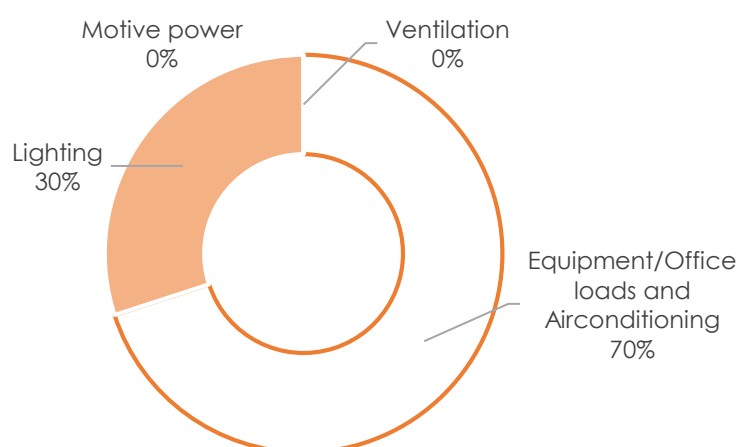
Main uses of other forms of energy:

- Brush cutter
- Lawn mower

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment, office loads and air-conditioning comprise the bulk of electricity use at 70%, followed by Lighting at 30%. It is to be noted that ventilation and motive power figures stand at 0%, which may be attributed to unavailability of data at the level of organisations surveyed.

Chart 13 Arts, Entertainment and Recreation - Electricity use breakdown

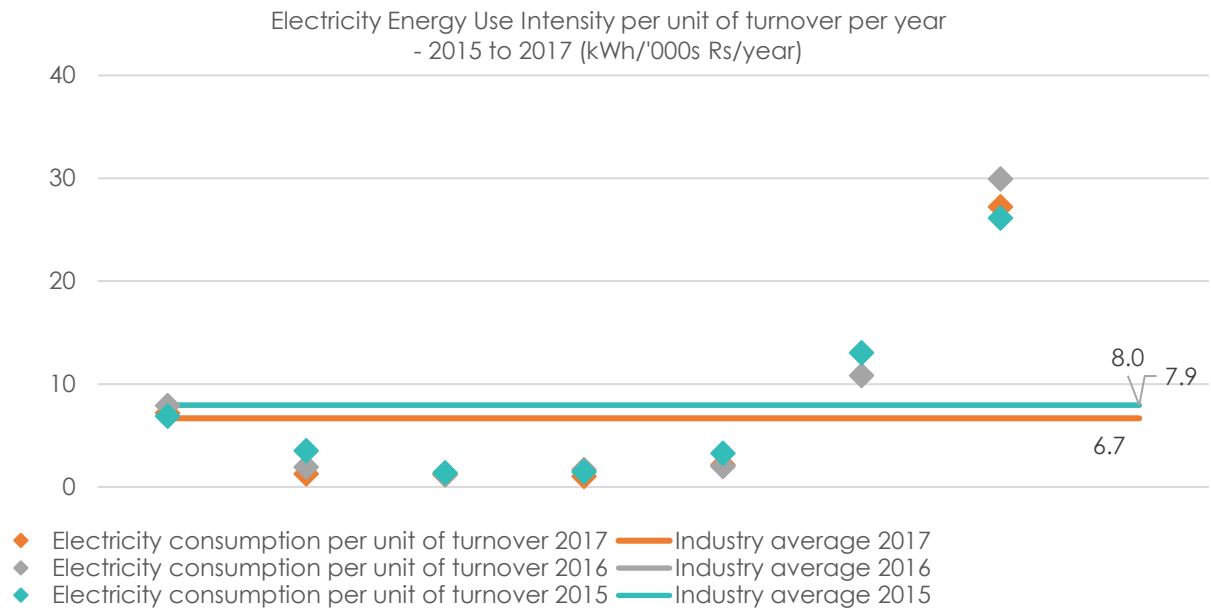


General indicators

Electricity Energy Use Intensity per unit of turnover per year

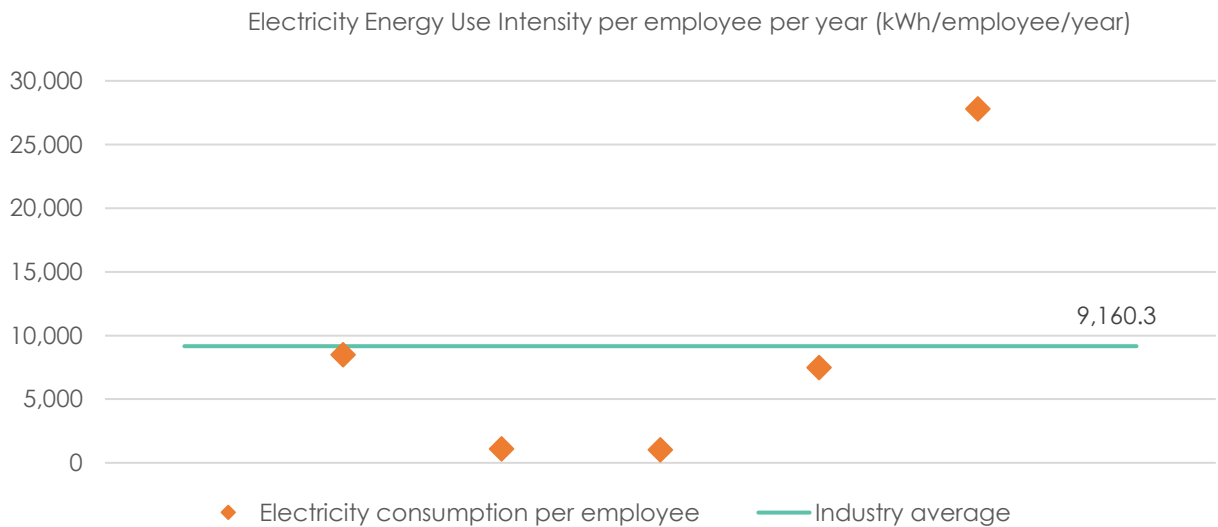
Electricity Energy Use Intensity per unit of turnover from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017.

Chart 14 Arts, Entertainment and Recreation – Electricity EUI per unit of turnover



Electricity Energy Use Intensity per employee per year

Chart 15 Arts, Entertainment and Recreation – Electricity EUI per employee

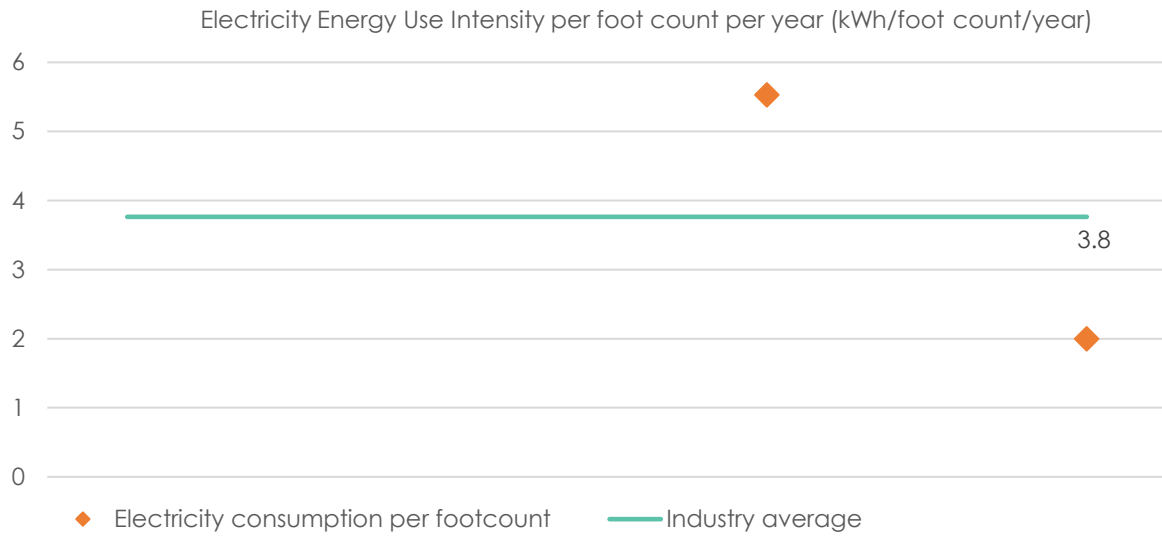


Figures are seen to be quite disparate. The number of employees is not representative of the electricity being consumed, given the divergent nature of the businesses being analysed. For instance, the conference centres would not have a high number of employees, but would consume the most electricity during events. In this instance, the occupancy rate would have provided a more accurate measure. Based on the above data, the average electricity consumption per employee is found to be 9,160.

Electricity Energy Use Intensity per foot count per year

Chart 16 Arts, Entertainment and Recreation – Electricity EUI per foot count

Foot count was not provided for most of the companies under review, as this figure was not available.



Electricity Energy Use Intensity per built area per year

Chart 17 Arts, Entertainment and Recreation – Electricity EUI per built area

Built area was deemed to be another important factor in determining the electricity efficiency. Built areas obtained were seen to vary across organisations under review. Gross area has not been considered in this instance due to disparity in the nature of businesses. For example, the gross area of nature parks is large compared to the built area, with minimum electricity use.

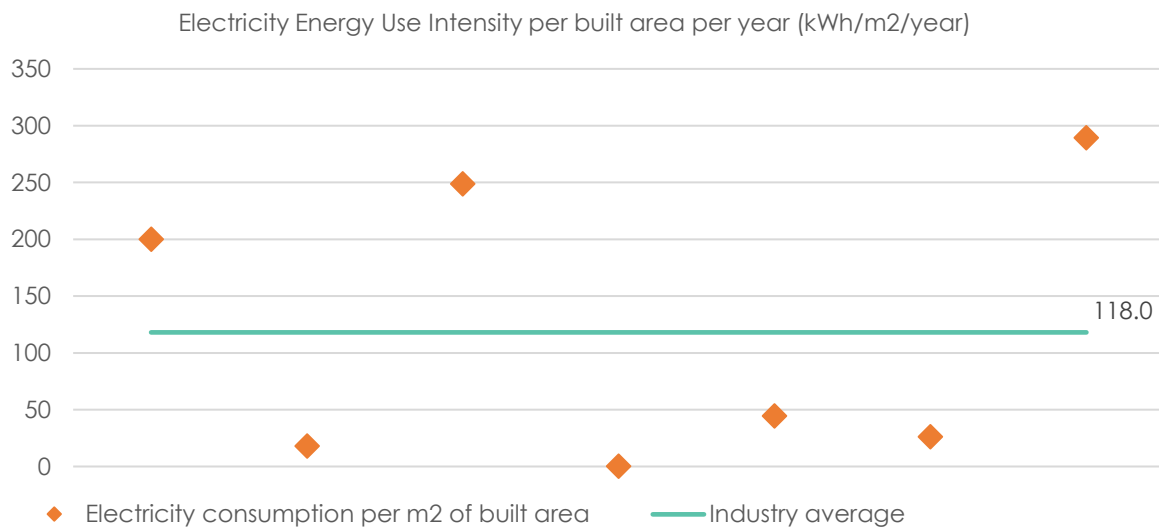
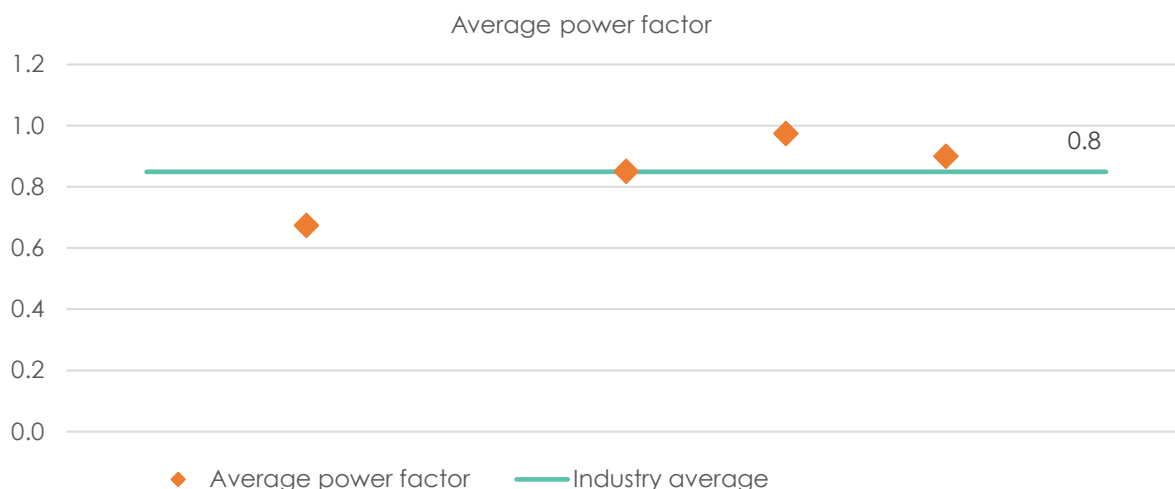


Chart 18 Arts, Entertainment and Recreation – Average power factor

The power factor was seen to range between 0.60 and 0.97, with the average being 0.85.

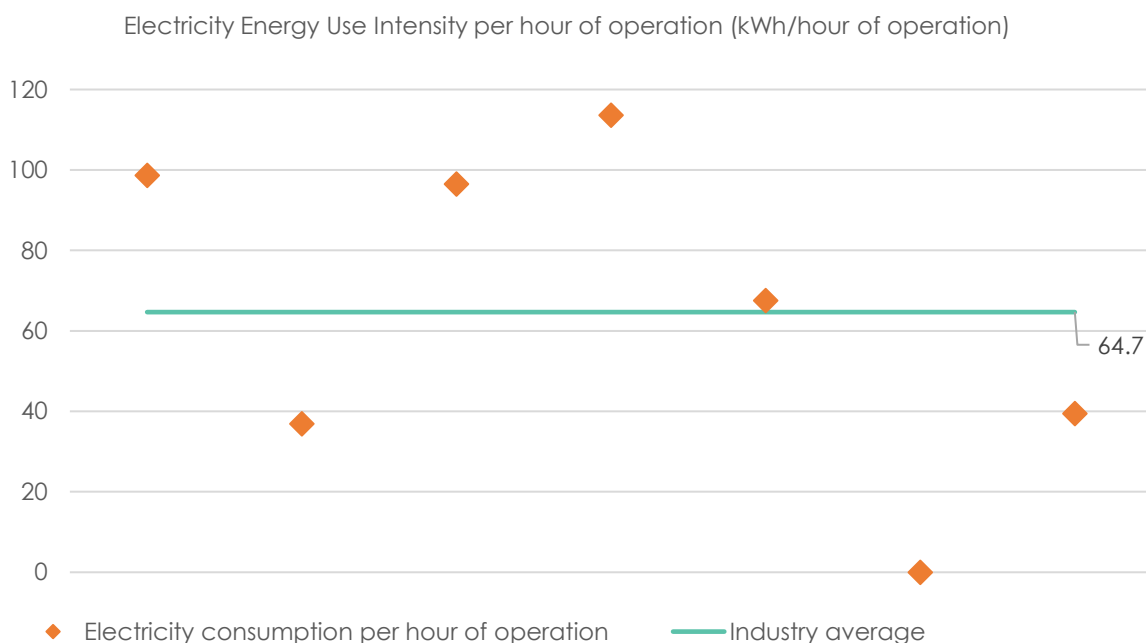


Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

The average electricity consumption per hour of operation is 64.7. The range was found to be between 35 and 115, based on an average of 93 hours of operation per week across organisations under review.

Chart 19 Arts, Entertainment and Recreation – Electricity EUI per hour of operation



The benchmark for the Arts, Entertainment and Recreation was determined to be:
 EUI – kWh/hour of operation: **64.7 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 9 Arts, Entertainment and Recreation – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	-
Gas - Electricity equivalent (kWh _{eq})	-
Diesel - Average amount utilised (lts)	1,650
Diesel - Electricity equivalent (kWh _{eq})	16,500
Hours of operation of the organisation	4,836
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	3.41

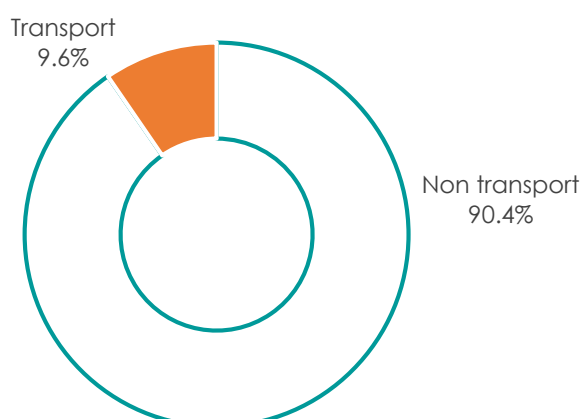
Gas figures were unavailable at the level of organisations surveyed within this sub-sector.

Fossil Fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses were primarily towards non-transport, relating to generators and used for cooking. The number of vehicles was found to be within the range of 2 – 3, with the fuel costs amounting to approximately Rs 190,000 per year. Fuel expenses for transport comprised exclusively Diesel.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	4,992
Diesel - Electricity equivalent (kWh _{eq})	49,921
Gasoline - Average amount utilised (lts)	0
Gasoline - Electricity equivalent (kWh _{eq})	0
Total Fuel - Electricity equivalent (kWh _{eq})	49,921

Chart 20 Arts, Entertainment and Recreation – Fossil Fuel consumption Transport vs. Non transport



E2. Food services activities (Excluding accommodation and food production)

Key take-aways

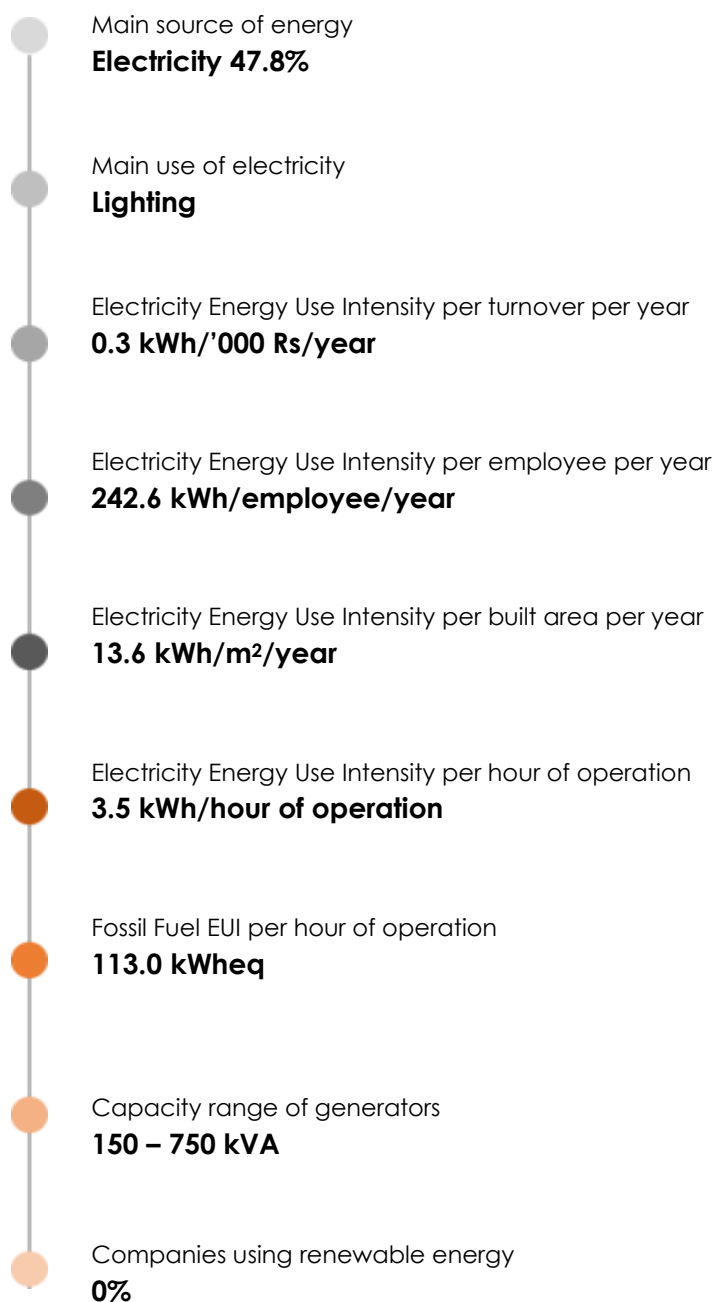
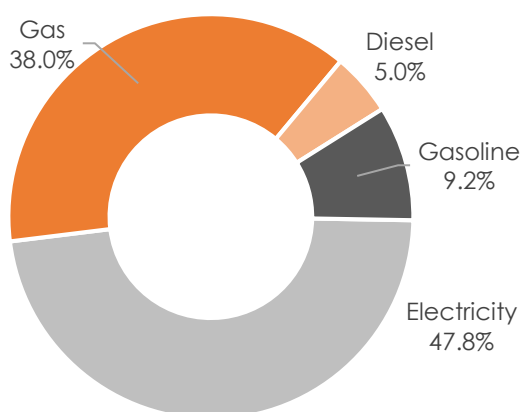


Table 10 Factsheet Food Services Activities

Sub-sector		Food services activities	
Total number of companies surveyed	4		
Selection criteria	Companies short-selected were those which were the most popular and therefore had a significant client base, and which had a relatively large surface area. The sample would relatively cover food related buildings which have approximately a capacity of 160 seatings at one go. Restaurants which are in an open setting do not utilise air conditioning. Restaurants operate during specific times of the day, during lunch and dinner time.		
Data availability on	Number of companies who were able to provide the data	Percentage	
Turnover	4	100.0%	
Electricity consumption	4	100.0%	
Number of employees	3	75.0%	
Foot count	2	50.0%	
Built area	4	100.0%	
Gross area	0	0.0%	
Hours of operation	4	100.0%	
Generators output	0	0.0%	
Transport	3	75.0%	

Energy Source breakdown

Chart 21 Food Services Activities - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Sound system
- Air conditioning
- CCTV
- POS system
- Chiller
- Refrigerator
- Electronic devices

Main uses of gas:

- Cooking
- Gas stoves
- Duck Roaster
- Heating water
- Heater
- Stove
- Kitchen

Main uses of diesel:

- Generator
- Vehicles
- Tractor
- Golf course

Main uses of gasoline:

- Vehicles

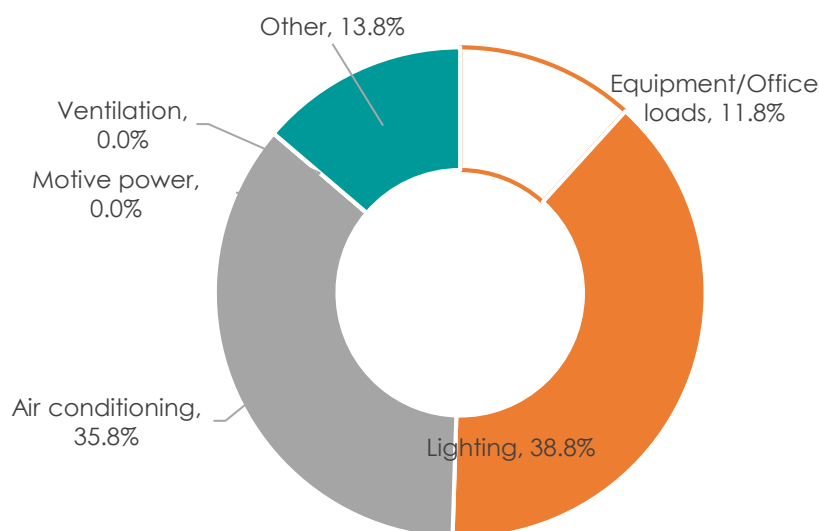
Main uses of other forms of energy:

- Brush cutter
- Lawn mower

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Lighting comprise the bulk of electricity use at 53%, followed by Others at 25% and Equipment/Office loads at 22%. It is to be noted that ventilation, motive power and air conditioning figures which stand at 0% relate to unavailability of data at the level of organisations being considered.

Chart 22 Food Services Activities – Electricity use breakdown



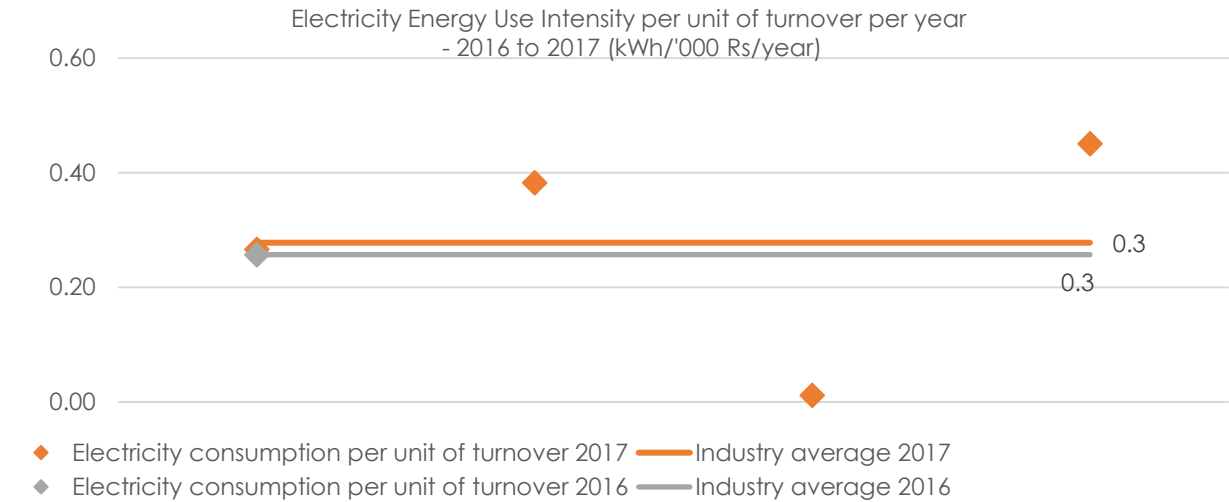
General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2016 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 2 years, while the 3 lines relate to the

industry averages for 2016 and 2017. Figures for 2015 were not available across organisations under review.

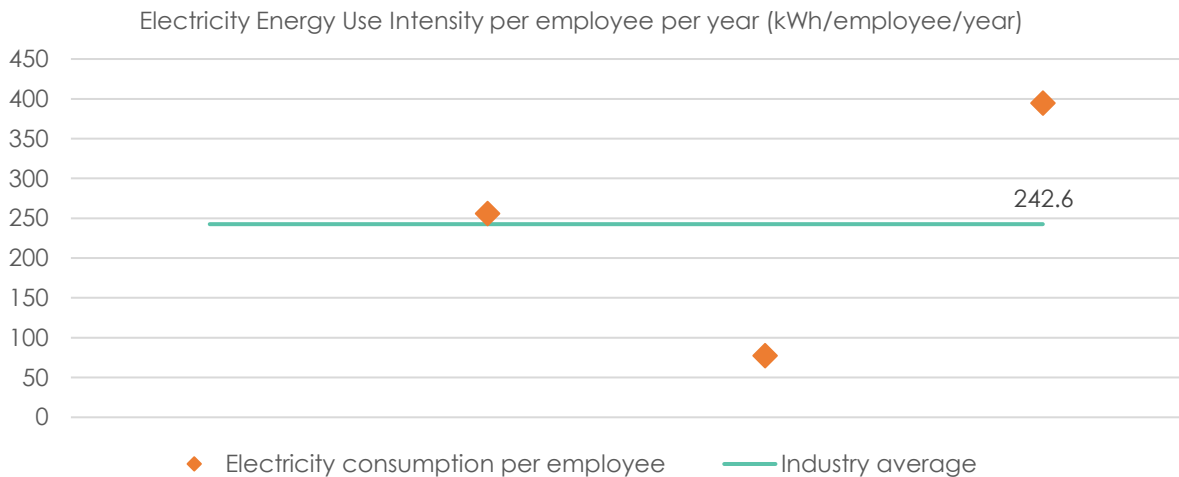
Chart 23 Food Services Activities – Electricity EUI per unit of turnover



figures are increasing on average; this means that turnover is increasing at a slower rate than electricity consumption. As turnover increases, the electricity used per unit of turnover rises.

Electricity Energy Use Intensity per employee per year

Chart 24 Food Services Activities – Electricity EUI per employee

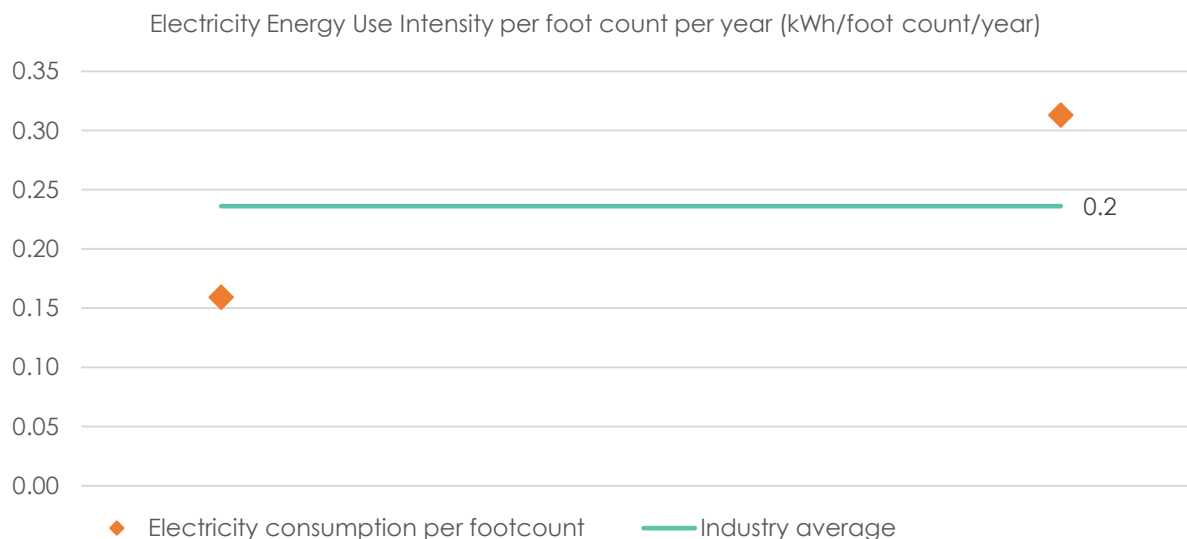


Figures are seen to be quite disparate as different restaurants have different policies in terms of customer experience. For instance, one employee may cater for 20 seats, while one employee may cater for 10 seats. For restaurants, the number of clients would have been a better criterion to assess energy consumption. However, this data is not available and recorded today.

Electricity Energy Use Intensity per foot count per year

Foot count was not provided for some of the companies under review, as this figure was not available. The average figure was found to be 0.236.

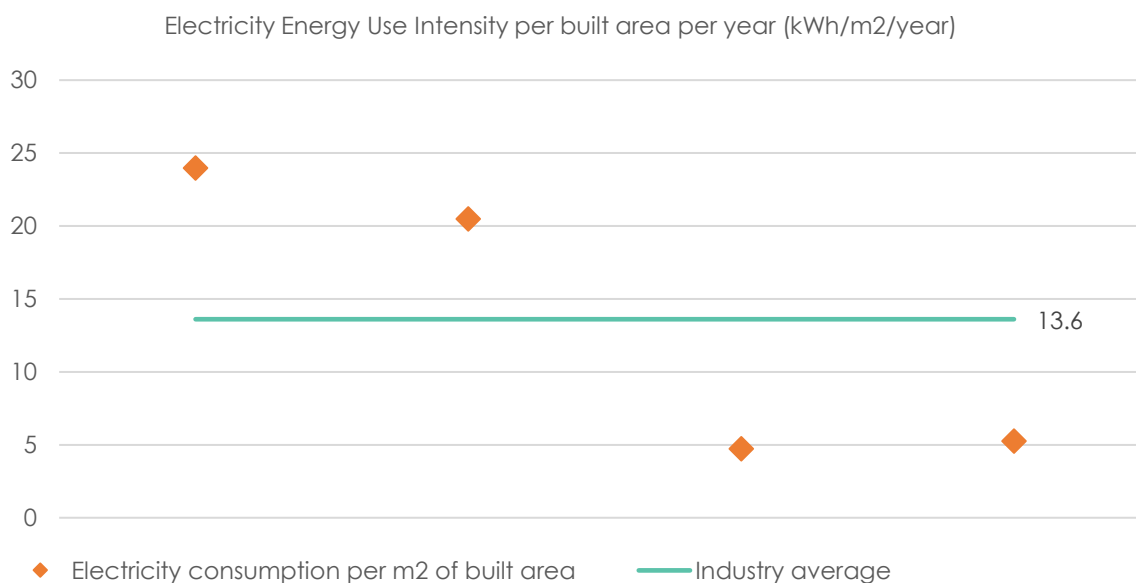
Chart 25 Food Services Activities – Electricity EUI per foot count



Electricity Energy Use Intensity per built area per year

Built areas obtained were seen to vary across organisations under review, but staying within the range 300 – 3,000 m². Gross area was consistent with the built area in all cases. As indicated below, in the Food Services sub-sector, a building consumed on average 13.61 kWh/m²/year as per latest data available.

Chart 26 Food Services Activities – Electricity EUI per built area



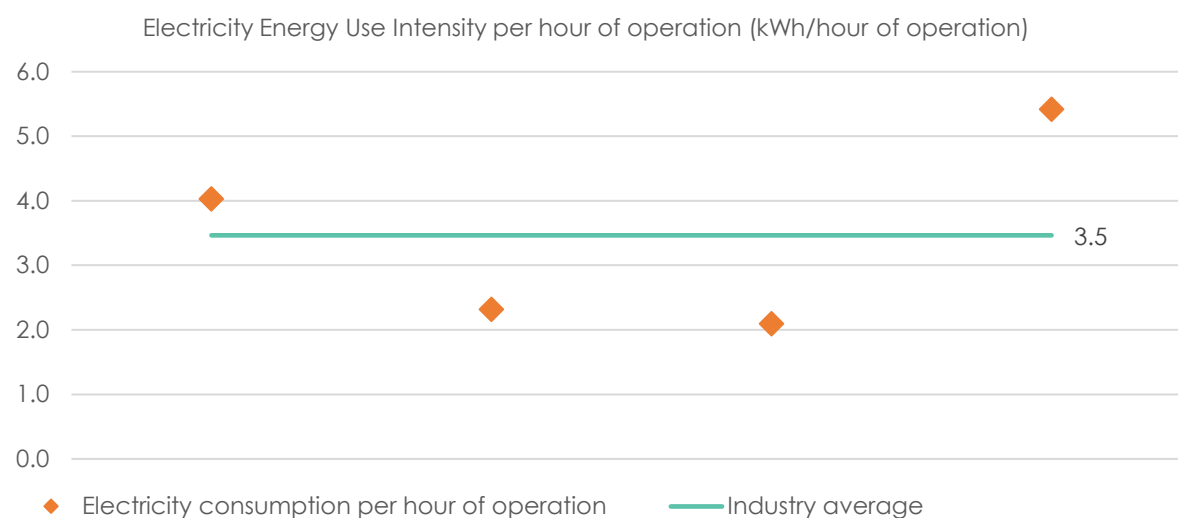
Average power factor

The power factor obtained was 0.975, and was available for only one organisation.

Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 27 Food Services Activities – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 3.5. The range was found to be between 2 and 5.5, based on an average of 65 hours of operation per week across organisations under review.

The benchmark for the Food services activities was determined to be:
EUI – kWh/hour of operation: **3.5 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 11 Food Services Activities – Fossil fuel Electricity Equivalent

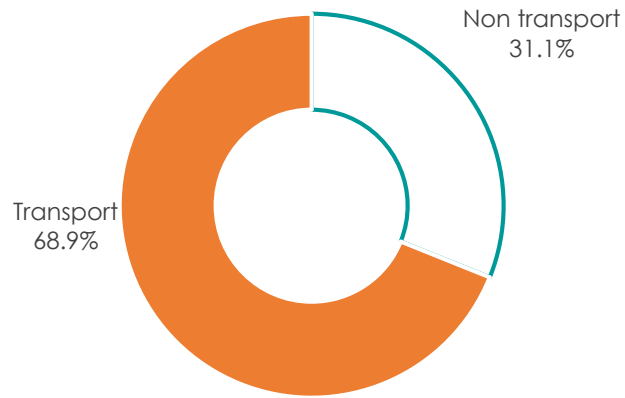
Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	28,252
Gas - Electricity equivalent (kWh)	384,234
Diesel - Average amount utilised (lts)	25
Diesel - Electricity equivalent (kWh)	250
Hours of operation of the organisation	3,393
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	113

Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses utilised were primarily towards non-transport, which is related mainly to cooking. The number of vehicles was found to be 3 in most cases, with the fuel costs amounting to approximately Rs 780,000 per year. Fuel expenses for transport comprised both Diesel and Gasoline in the ratio 92:8 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	20,477
Diesel - Electricity equivalent (kWheq)	204,773
Gasoline - Average amount utilised (lts)	1,533
Gasoline - Electricity equivalent (kWheq)	15,325
Total Fuel - Electricity equivalent (kWheq)	220,098

Chart 28 Food Services Activities – Fossil Fuel consumption Transport vs Non transport



E3. Human Health and Social work activities

Key take-aways

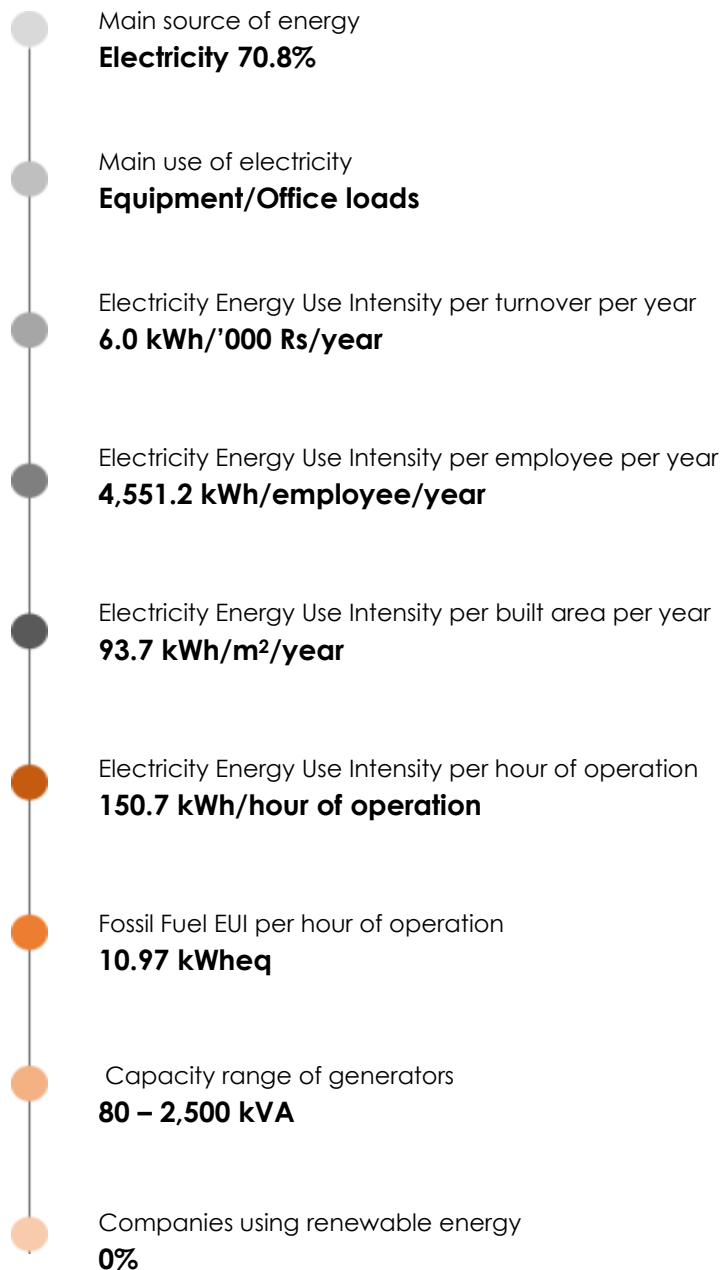
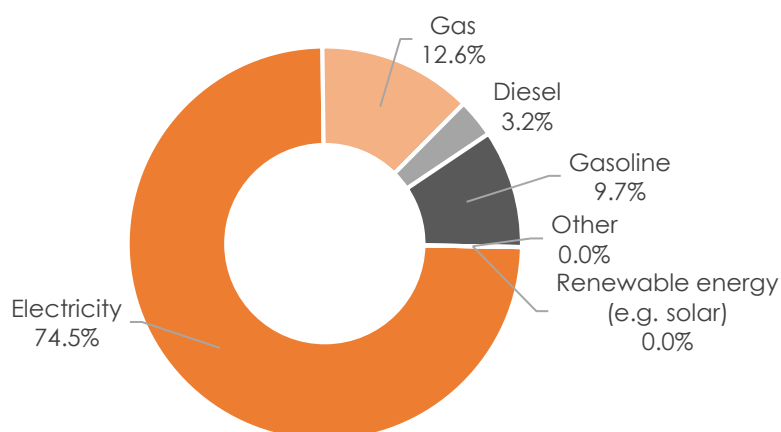


Table 12 Factsheet Human Health and Social work activities

Sub-sector Human health and Social work activities		
Total number of companies surveyed	9	
Selection criteria	Companies short-selected were those who either had the biggest buildings and which were likely to be high consumers of energy. Both public and private health care providers were considered and dominated the sub sector sample. Hospitals and clinics vary in size, with some having different buildings and others having one main building. Offering also vary, with private clinics having more advanced equipment and incorporating a food and drink section and a pharmacy.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	7	77.8%
Electricity consumption	9	100.0%
Number of employees	5	55.6%
Foot count	4	44.4%
Built area	7	77.8%
Gross area	8	88.9%
Hours of operation	9	100.0%
Generators output	4	44.4%
Transport	2	22.2%

Energy Source breakdown

Chart 29 Human Health and Social work activities - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Air conditioners
- Lighting
- Office equipment
- Powering all medical and non-medical equipment
- Cooking
- Washing

- Pumps
- Overall Healthcare operation
- Computers
- Laundry

Main uses of gas:

- Water
- Kitchen
- Cooking
- Dryer

Main uses of hot water:

- Rooms
- Jacuzzi / Sauna
- For patient/staff shower
- Cleaning
- Ambulance
- Biomedical equipment

Main uses of diesel:

- Generator
- Vehicles

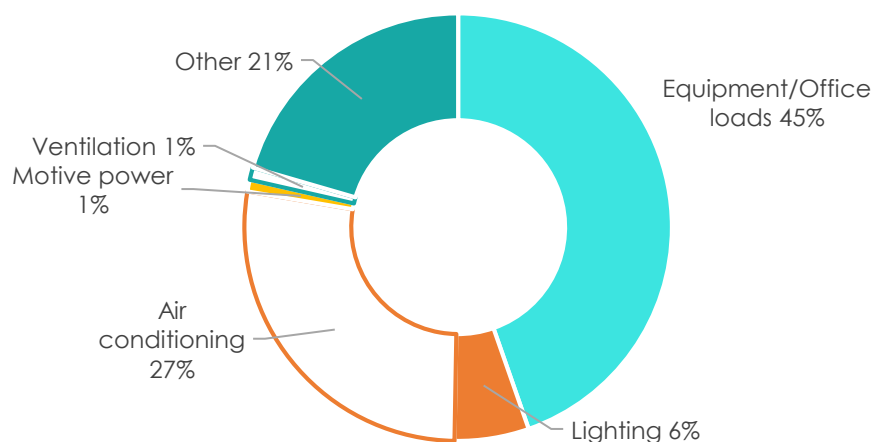
Main uses of gasoline:

- Vehicles

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment/Office loads comprise the bulk of electricity use at 45%, followed by Air conditioning at 27%, Others at 21% and Lighting at 6%.

Chart 30 Human Health and Social work activities – Electricity use breakdown

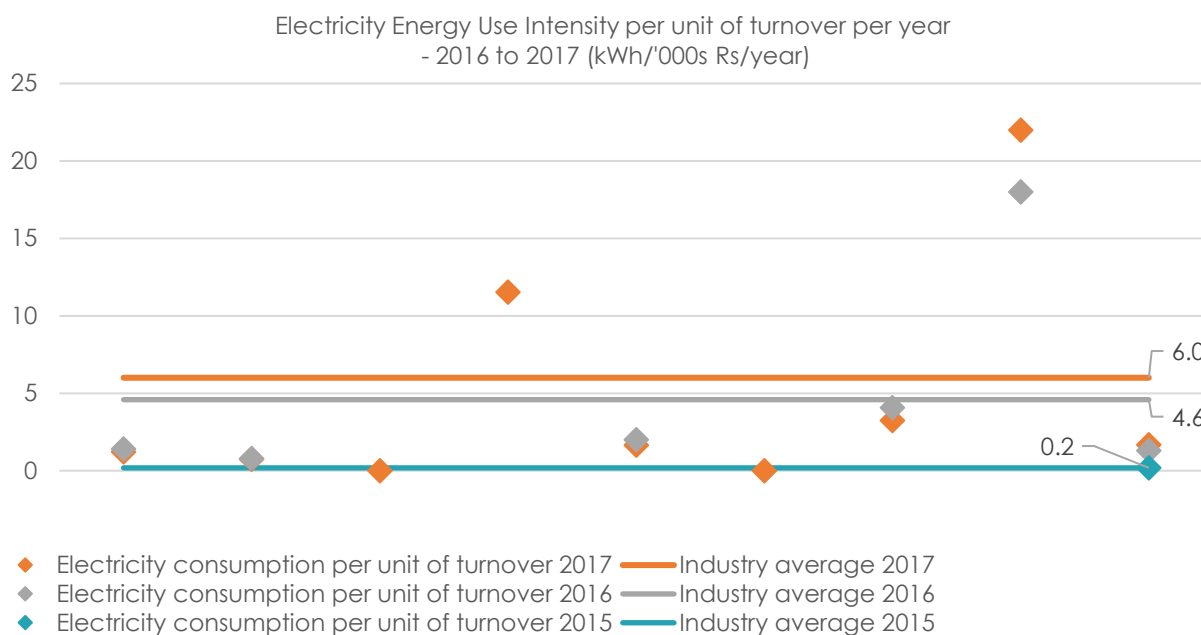


General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2016 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over the years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017. Figures for 2015 were available only for 1 organisation.

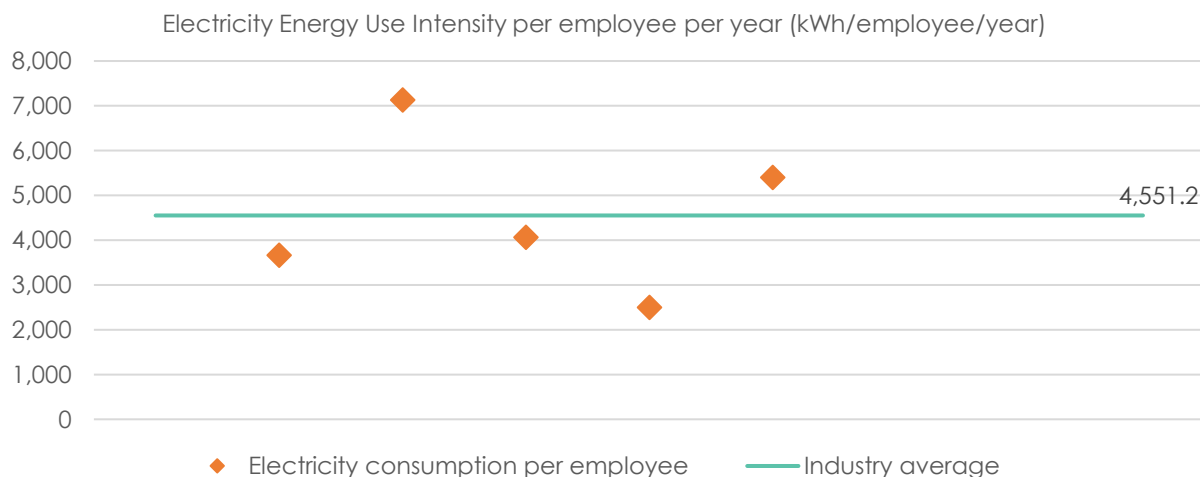
Chart 31 Human Health and Social work activities – Electricity EUI per unit of turnover



It is observed that the industry average is on an increasing trend from 2015 to 2017. Given that turnover figures are on average increasing; this means that turnover is increasing at a slower rate than electricity consumption. As turnover increases, the electricity used per unit of turnover rises.

Electricity Energy Use Intensity per employee per year

Chart 32 Human Health and Social work activities – Electricity EUI per employee

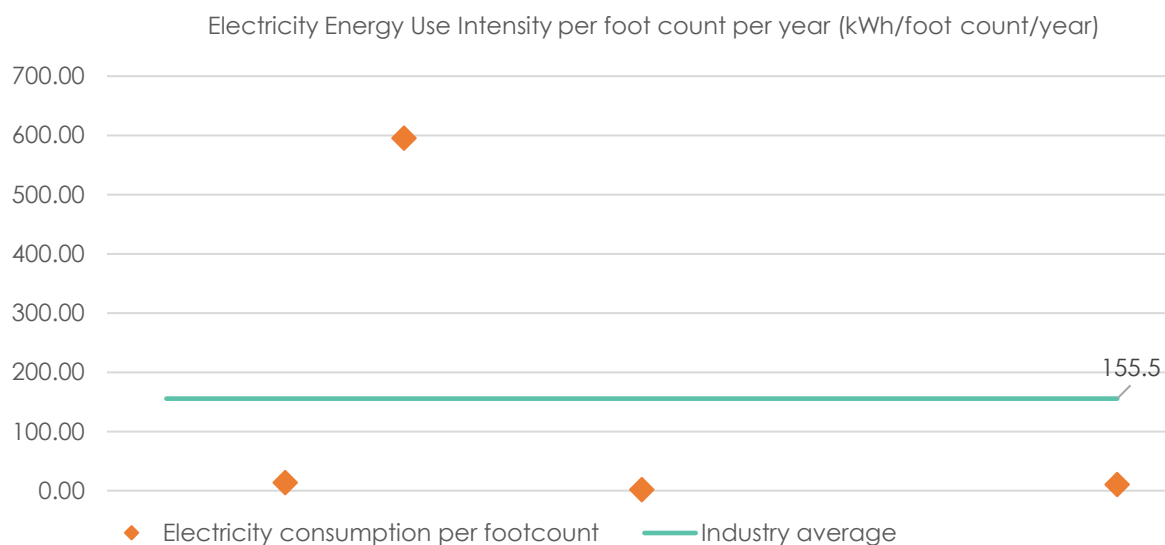


Figures are seen to be comparatively more consistent as compared to other sub sectors. The number of employees is however not representative of the electricity being consumed, given the nature of the businesses being analysed. The number of patients (both in-patients and out-patients) would have been a better criterion to assess energy consumption.

Electricity Energy Use Intensity per foot count per year

Foot count was not provided for some of the companies under review, as this figure was not available. The average figure was found to be 155.5.

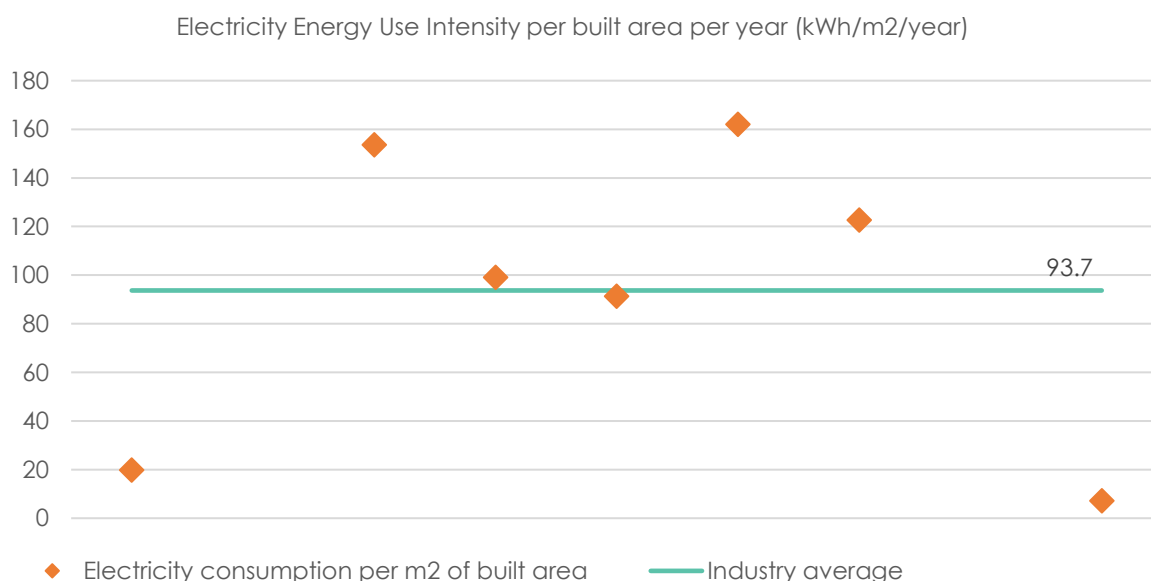
Chart 33 Human Health and Social work activities – Electricity EUI per foot count



Electricity Energy Use Intensity per built area per year

Built areas obtained were seen to have 2 different ranges, the first range being 2,000 – 5,000 m², and the second range being 10,000 – 30,000 m².

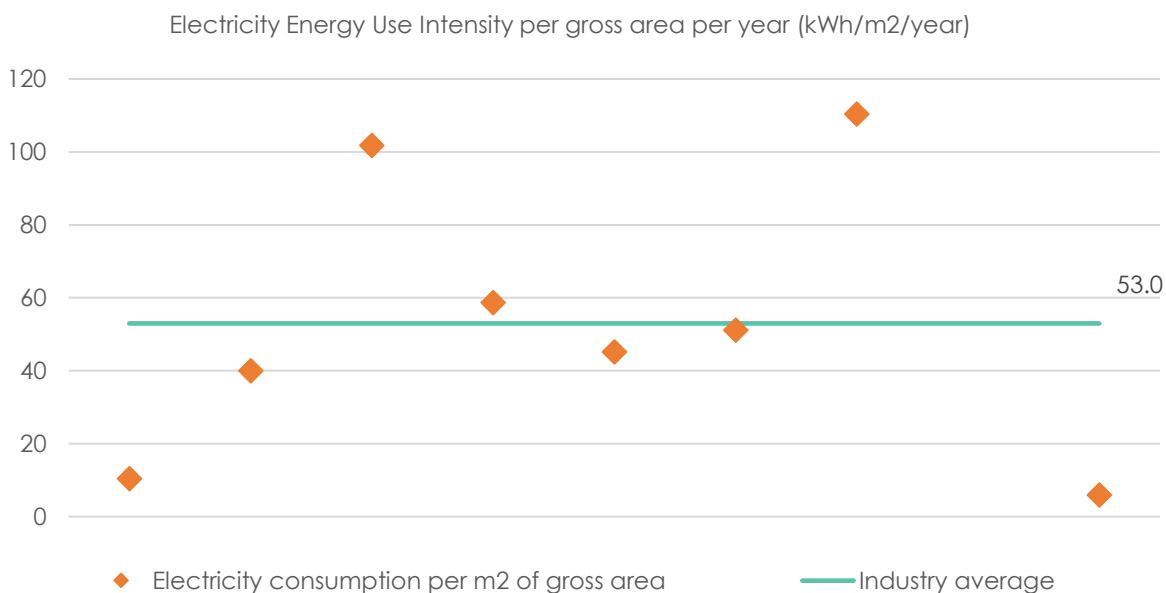
Chart 34 Human Health and Social work activities – Electricity EUI per built area



Electricity Energy Use Intensity per gross area per year

Electricity consumption per gross area was also analysed across this sub-segment, given that figures were available and differ from the built area. The average was found to be 53.0.

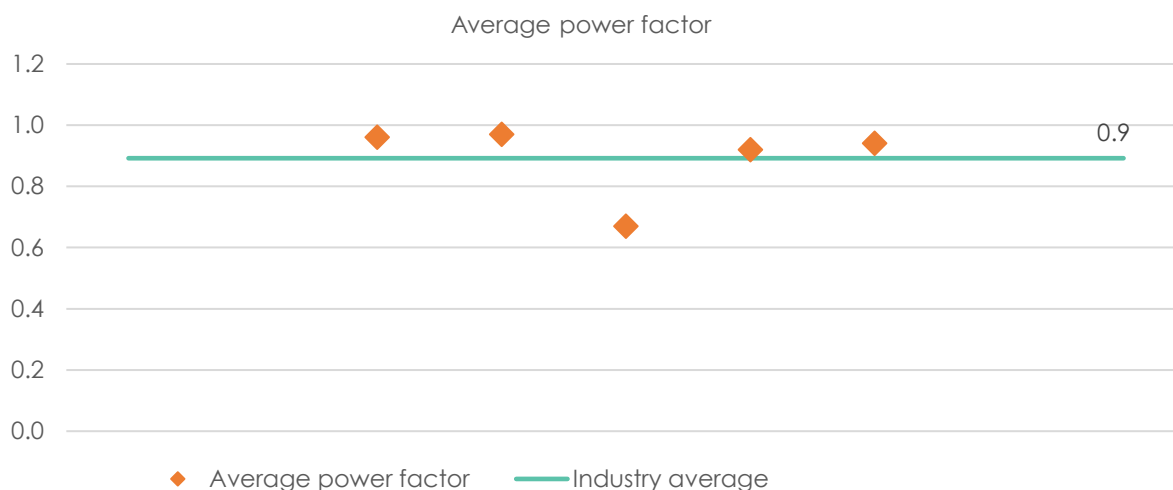
Chart 35 Human Health and Social work activities – Electricity EUI per gross area



Average power factor

The power factor was seen to range between 0.86 and 0.97, with the average being 0.89.

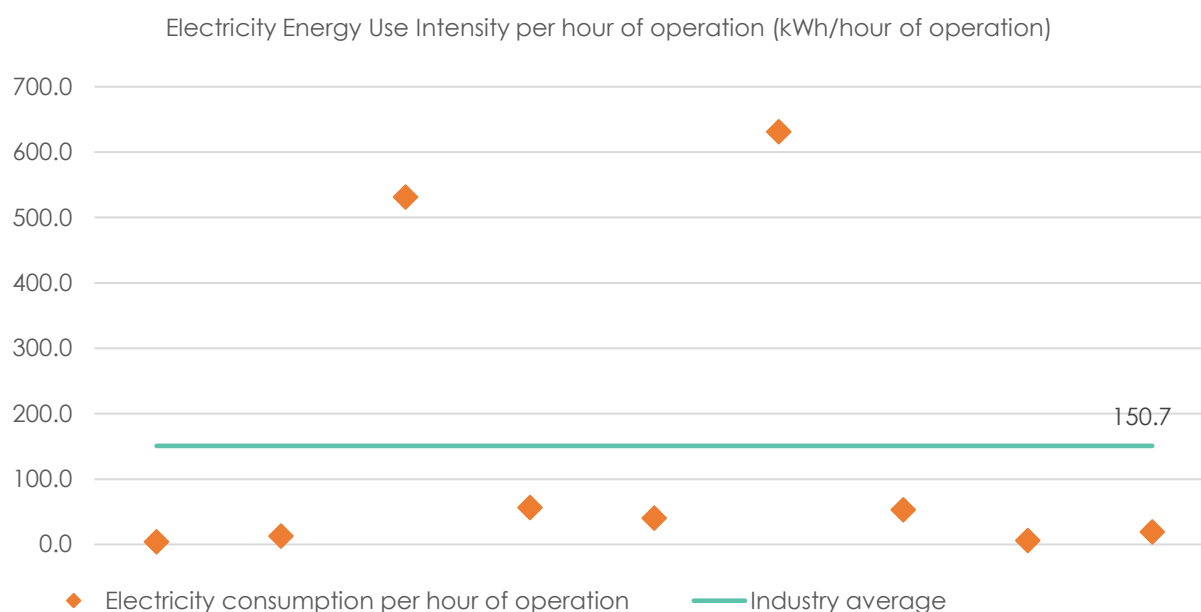
Chart 36 Human Health and Social work activities – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 37 Human Health and Social work activities – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 150.8, which is significantly higher than across other sub-sectors. The range was found to be wide, between 4 and 540, based on an average of 129 hours of operation per week across organisations under review.

The benchmark for the Human Health and Social work activities sub sector was determined to be:
 EUI – kWh/hour of operation: **150.7 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 13 Human Health and Social work activities – Fossil fuel Electricity Equivalent

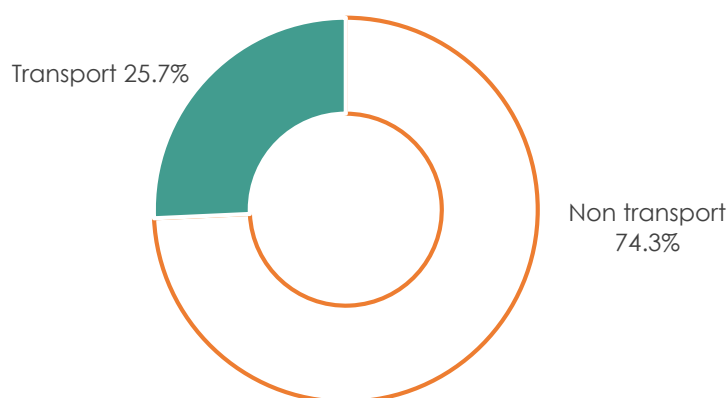
Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	5,305
Gas - Electricity equivalent (kWh _{eq})	72,146
Diesel - Average amount utilised (lts)	148
Diesel - Electricity equivalent (kWh _{eq})	1,481
Hours of operation of the organisation	6,713
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	10.97

Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses utilised were primarily towards non-transport, which is related mainly to cooking. The number of vehicles was found to range between 1 and 7, with the fuel costs amounting to approximately Rs 1,100,000 per year. Fuel expenses for transport comprised both Diesel and Gasoline in the ratio 42:58 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (Its)	28,936
Diesel - Electricity equivalent (kWh _{eq})	289,364
Gasoline - Average amount utilised (Its)	3,891
Gasoline - Electricity equivalent (kWh _{eq})	38,909
Total Fuel - Electricity equivalent (kWh_{eq})	328,272

Chart 38 Human Health and Social work activities – Fossil Fuel consumption Transport vs Non transport



E4. Education

Key take-aways

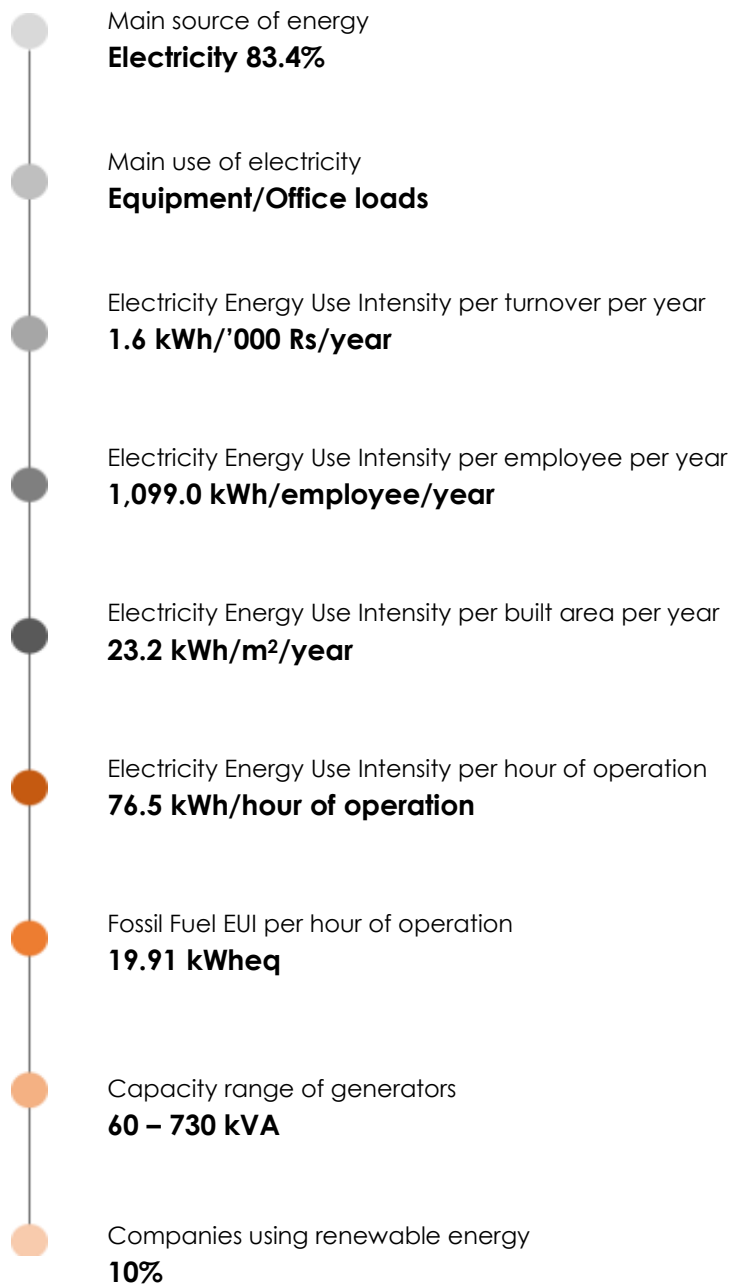
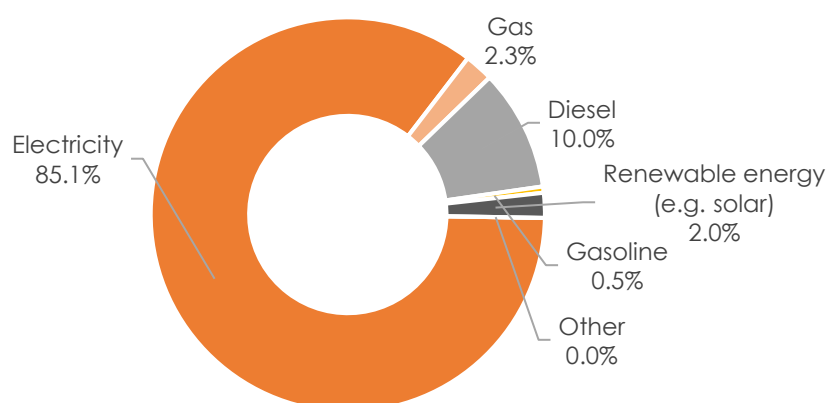


Table 14 Factsheet Education

Sub-sector Education		
Total number of companies surveyed	10	
Selection criteria	Companies short-selected were a mix of secondary, tertiary and vocational educational institutions regrouping the largest number of students. Institutions considered vary in size, in offerings and in the number of students which they can accommodate. Public universities, for example, comprise a number of buildings and are on a large extent of land, inclusive of a food and drink section. Private universities remain relatively smaller and usually comprise only one building, with no food and drink facility. Some of other institutions incorporate both day care, pre-primary and primary level students.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	3	30.0%
Electricity consumption	9	90.0%
Number of employees	7	70.0%
Foot count	1	10.0%
Built area	4	40.0%
Gross area	9	90.0%
Hours of operation	8	80.0%
Generators output	4	40.0%
Transport	4	40.0%

Energy Source breakdown

Chart 39 Education - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Air conditioning
- Lighting
- Powering of equipment
- Office

- Training and administrative activities
- Classroom, lecture theatres
- Ovens,
- Ventilation
- Water heating
- IT equipment
- Water pump
- Workshop machinery

Main uses of gas:

- Cooking water
- Laboratories

Main uses of hot water:

- Laboratories
- Bathrooms of gyms

Main uses of diesel:

- Generator
- Vehicles

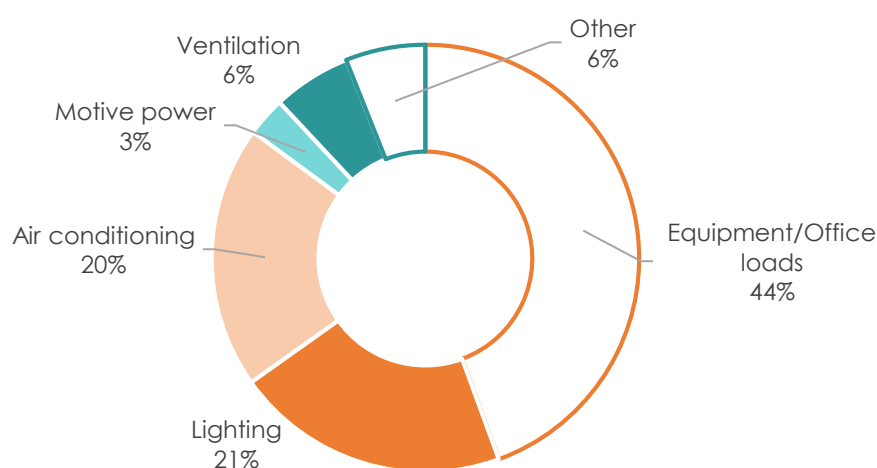
Main uses of gasoline:

- Brush cutter

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment/Office loads comprise the bulk of electricity use at 44%, followed by Lighting at 21%, Air conditioning at 20%, Ventilation and Others at 6% each and Motive power at 3%.

Chart 40 Education – Electricity use breakdown

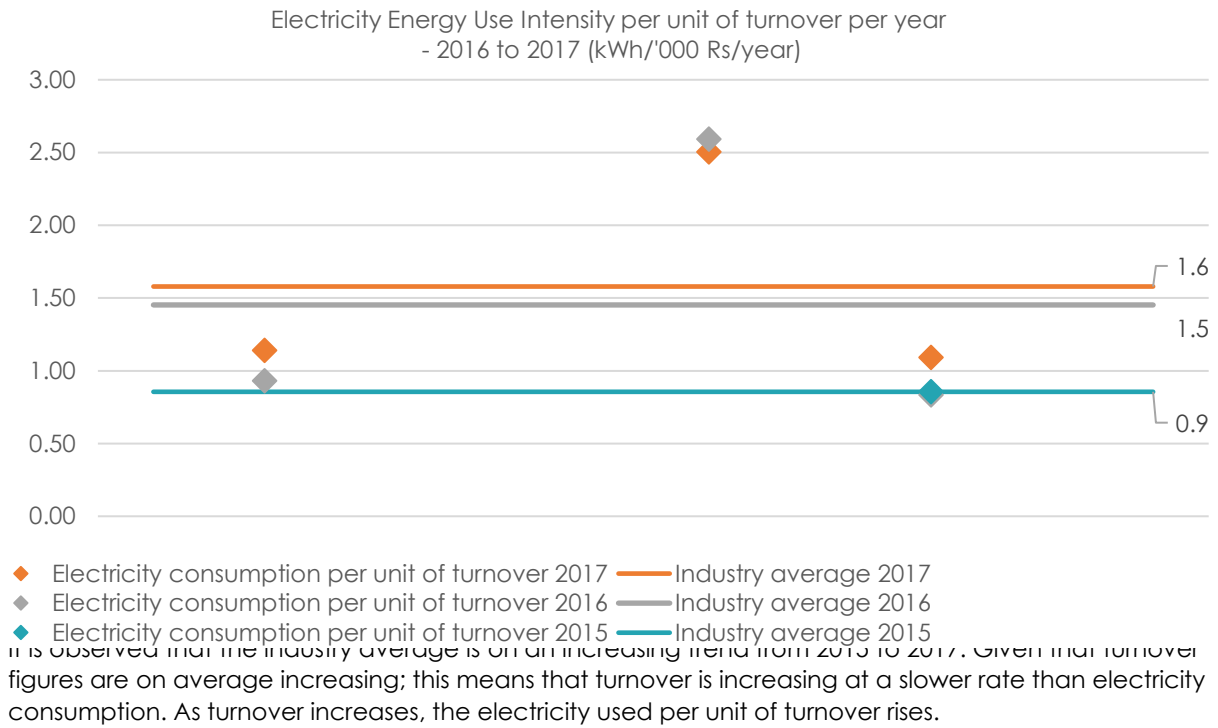


General indicators

Electricity Energy Use Intensity per unit of turnover per year

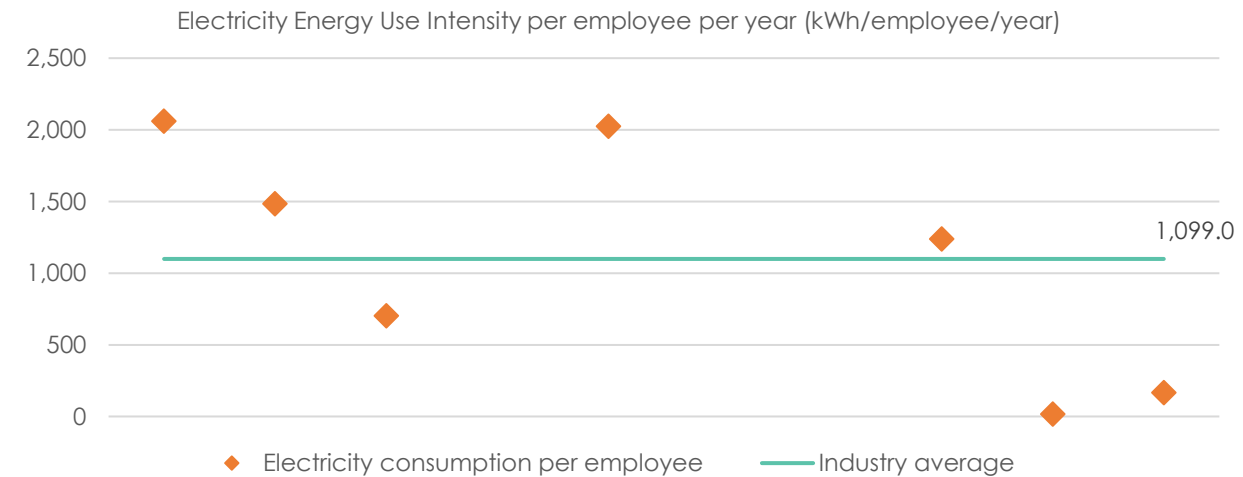
Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017.

Chart 41 Education – Electricity EUI per unit of turnover



Electricity Energy Use Intensity per employee per year

Chart 42 Education – Electricity EUI per employee



For educational institutions, a better measure would have been the number of students given that different teacher to student ratios apply across different types of educational institutions.

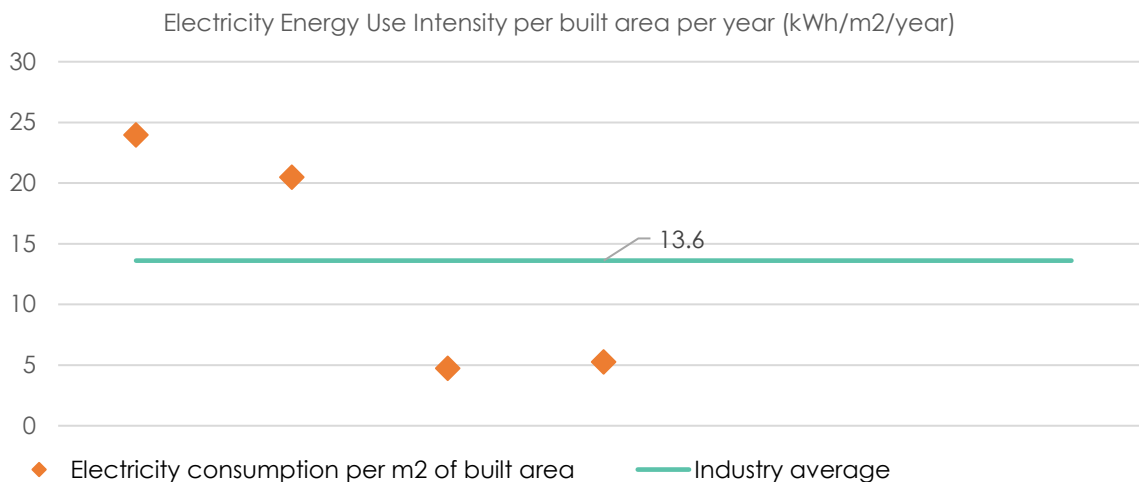
Electricity Energy Use Intensity per foot count per year

Foot count was provided from only one educational institution, and figure was determined to be 40,000. The electricity consumption per foot count per year was therefore found to be 0.0 kWh/footcount/year.

Electricity Energy Use Intensity per built area per year

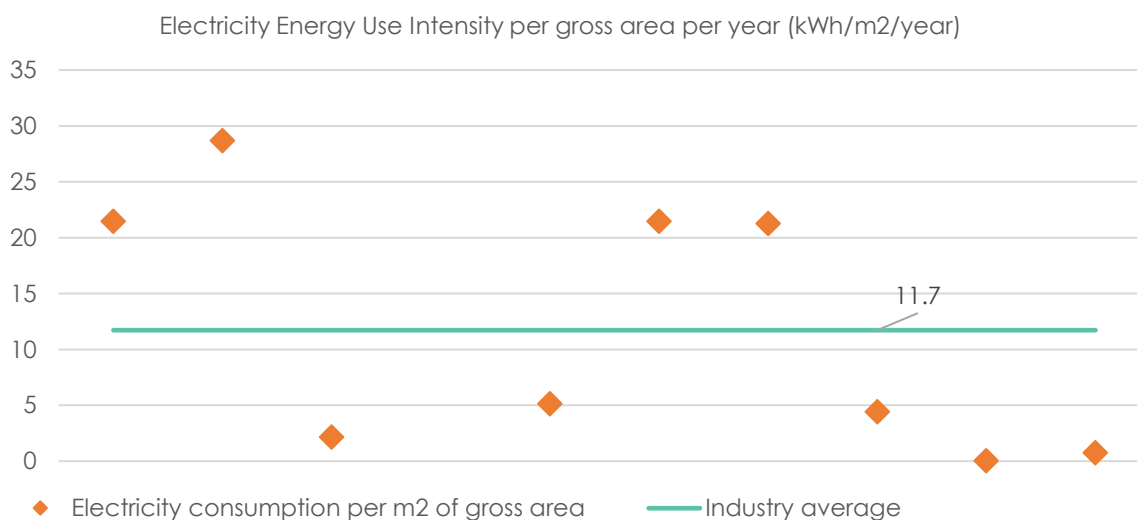
Built areas obtained were seen to vary across organisations under review, but staying within the range 300 – 3,000 m².

Chart 43 Education – Electricity EUI per built area



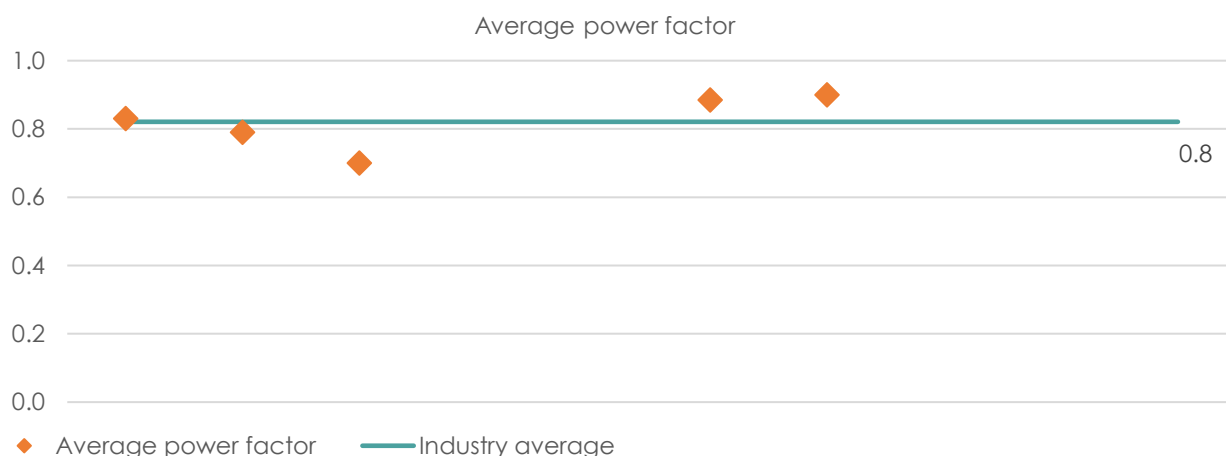
Electricity consumption per gross area was also analysed across this sub-segment, given that figures were available and differed from the built area. The average was found to be 11.7kWh/m²/year.

Chart 44 Education – Electricity EUI per gross area



The average power factor obtained was 0.821, with all organisations being within the range 0.70 and 0.90.

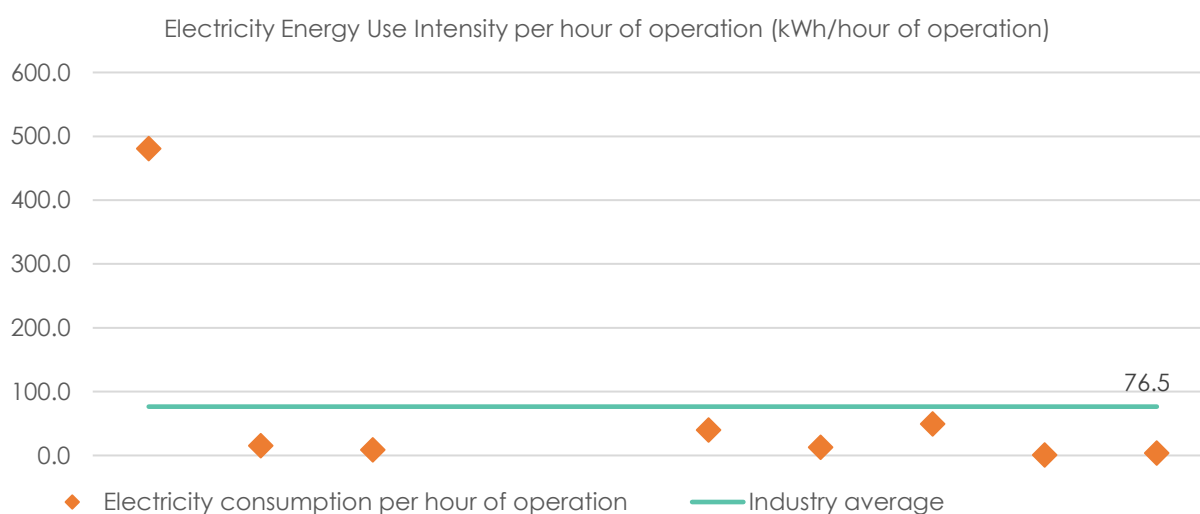
Chart 45 Education – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 46 Education – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 76.45. The range was found to be wide, ranging between 1 and 480, based on an average of 48.6 hours of operation per week across organisations under review. One organisation, which refers to a large extent of land with a number of blocks, is the outlier in the sample due to its high electricity consumption. Excluding this institution, the average electricity consumption per hour of operation stands at 25.96.

The benchmark for the Education sub sector was determined to be:
 EUI – kWh/hour of operation: **76.5 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 15 Education – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	4,000
Gas - Electricity equivalent (kWh)	54,400
Diesel - Average amount utilised (lts)	150
Diesel - Electricity equivalent (kWh)	1,497
Hours of operation of the organisation	2,808
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	19.91

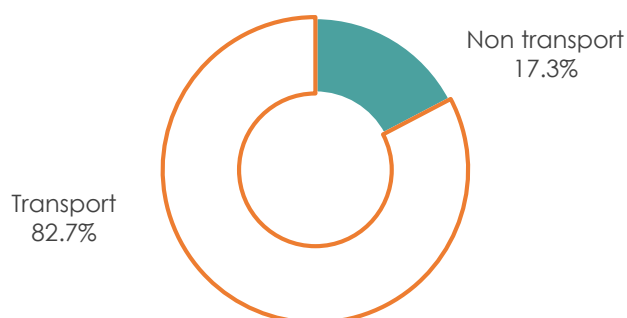
Only 2 institutions had available information on gas usage. Out of them, one was an outlier as the operating model was different to the others. As such, figures from 1 institution only was used for gas measures.

Fossil fuel consumption Transport vs. Non Transport

The breakdown of fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel utilised was primarily towards transport. The number of vehicles was found to be between 2 and 5, with the fuel costs amounting to approximately Rs 1,250,000 per year. Fuel expenses for transport comprised both Diesel and Gasoline in the ratio 85:15 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	33,070
Diesel - Electricity equivalent (kWh _{eq})	330,699
Gasoline - Average amount utilised (lts)	4,051
Gasoline - Electricity equivalent (kWh _{eq})	40,512
Total Fuel - Electricity equivalent (kWh _{eq})	371,212

Chart 47 Education – Fossil Fuel consumption Transport vs Non transport



E5. Wholesale and Retail trade

Key take-aways

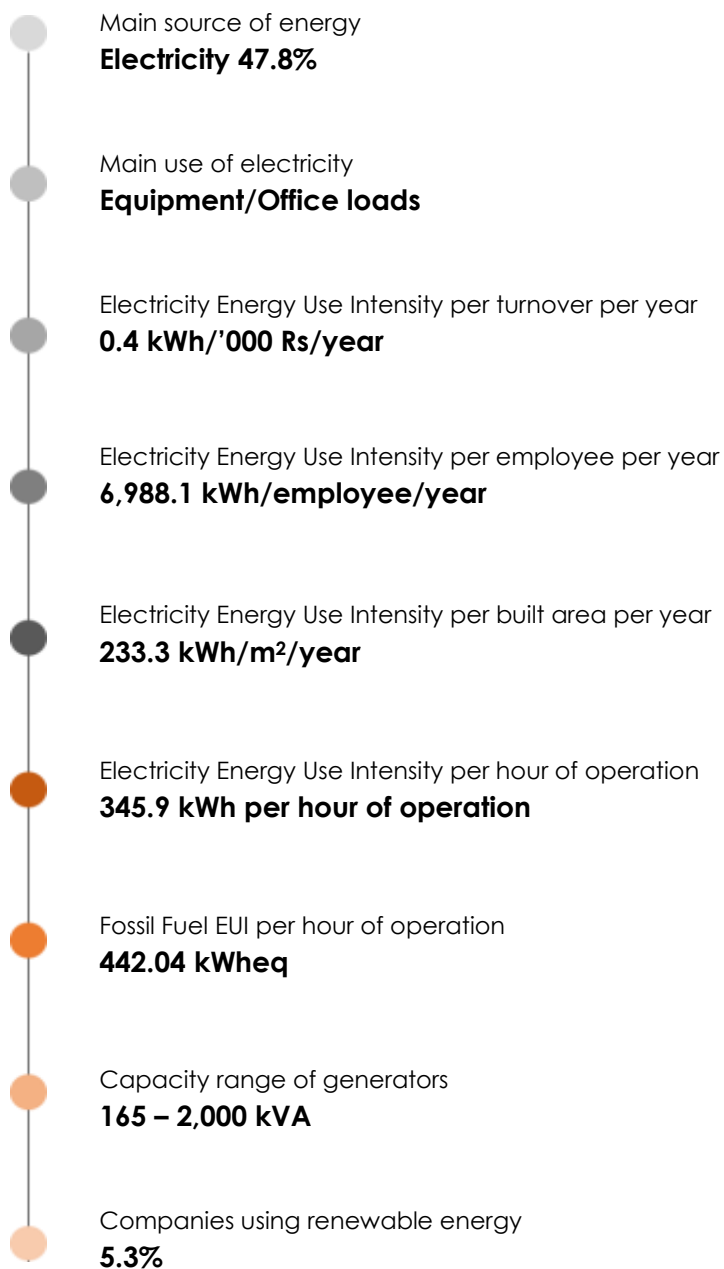
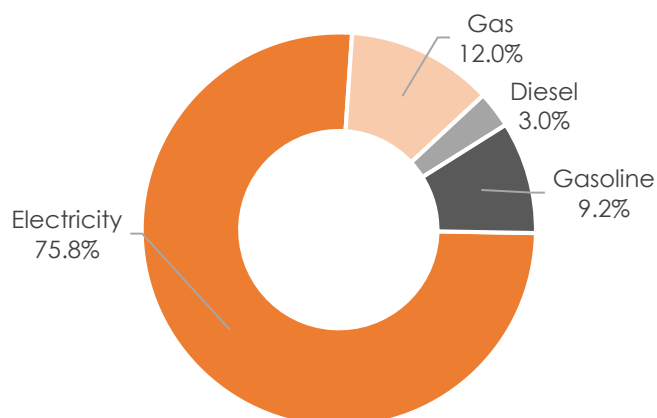


Table 16 Factsheet Wholesale and Retail trade

Sub-sector Wholesale and Retail trade		
Total number of companies surveyed	19	
Selection criteria	Companies short-selected were those who either had the biggest buildings or those who had the highest turnover figures. Types of organisations included supermarkets, distributors, as well as different types of service providers (e.g. office equipment, consumer goods, paint, etc.). Supermarkets under review are different from one another, with some supermarkets having a bakery section. Other organisations only focus on one specific product or non-consumer goods like paint and IT equipment.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	19	100.0%
Electricity consumption	19	100.0%
Number of employees	5	26.3%
Foot count	3	15.8%
Built area	15	78.9%
Gross area	12	63.2%
Hours of operation	16	84.2%
Generators output	5	26.3%
Transport	9	47.4%

Energy Source breakdown

Chart 48 Wholesale and Retail trade - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Machinery and equipment
- Production
- Office
- Air conditioning
- Refrigeration

- Building purposes
- Cold rooms
- Lifts
- Production
- Bottling
- Cooling
- Manufacturing, machineries
- Electric motors
- Tills
- Sliding doors
- Kitchen
- Bakery and pastry equipment
- Chillers
- Air handling unit
- Pumps
- POS

Main uses of gas:

- Bakery
- Kitchen
- Fork lift
- Oven

Main uses of hot water:

- Cleaning
- Kitchen
- Humidity regulator

Main uses of diesel:

- Generator (stand-by and running)
- Vehicles
- Boiler

Main uses of gasoline:

- Vehicles

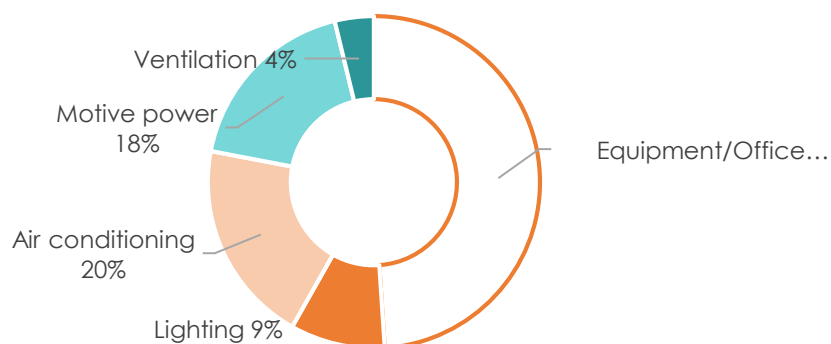
Main uses of renewable energy:

- Lighting

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment/Office loads comprise the bulk of electricity use at 49%, followed by Air conditioning at 20%, Motive power at 18%, Lighting at 9% and Ventilation at 4%.

Chart 49 Wholesale and Retail trade - Electricity use breakdown

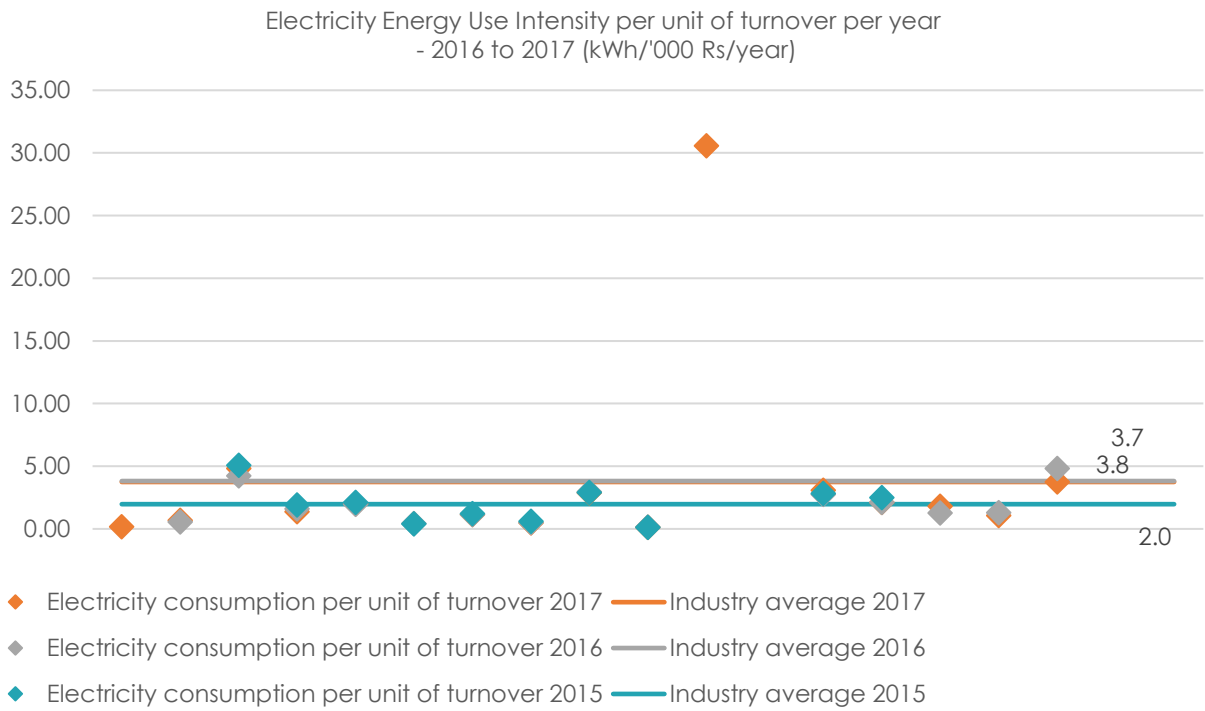


General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017.

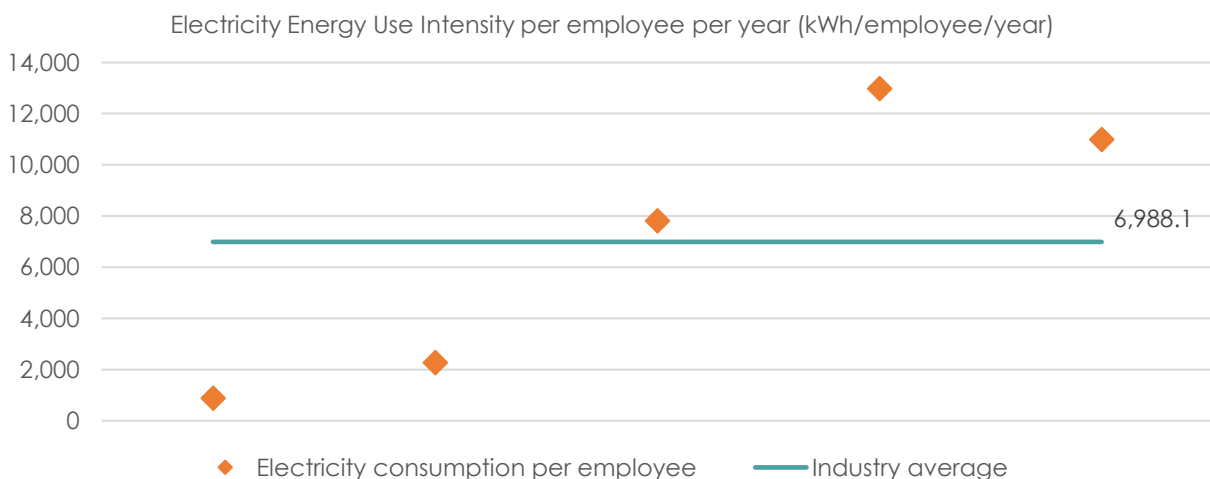
Chart 50 Wholesale and Retail trade – Electricity EUI per unit of turnover



It is observed that the industry average is on an increasing trend from 2015 to 2017. Given that turnover figures are on average increasing; this means that turnover is increasing at a slower rate than electricity consumption. As turnover increases, the electricity used per unit of turnover rises.

Electricity Energy Use Intensity per employee per year

Chart 51 Wholesale and Retail trade – Electricity EUI per employee

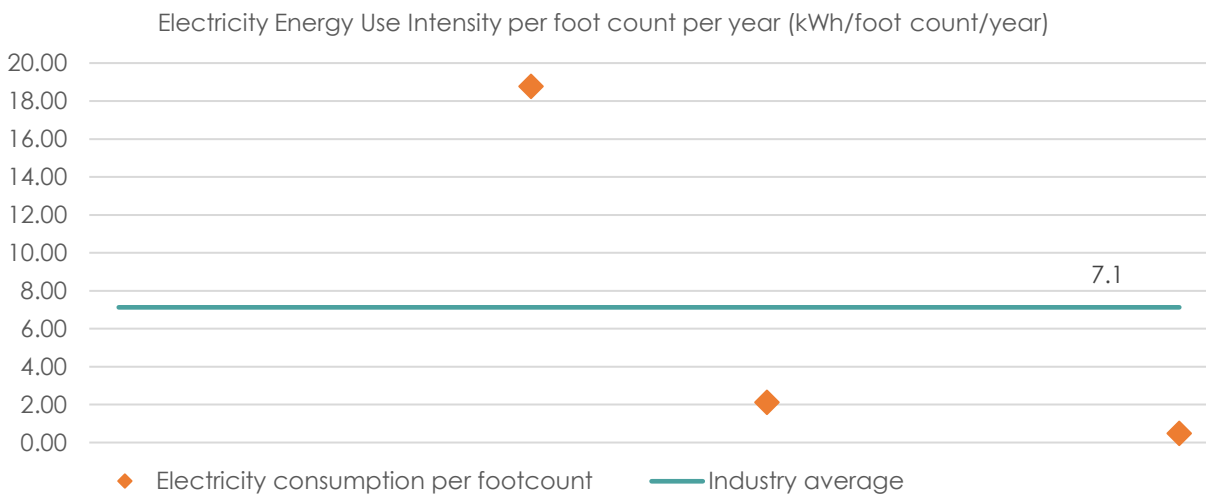


Figures are seen to range from 800 to 13,000, which is a comparatively wide range. Different size of businesses account for this. Given the distribution nature of the organisations, the number of clients would have been a better criterion to assess energy consumption.

Electricity Energy Use Intensity per foot count per year

Only a small percentage of organisations under review provided their foot count, and it was stated that the number of clients is difficult to estimate. Figures obtained are therefore very disparate.

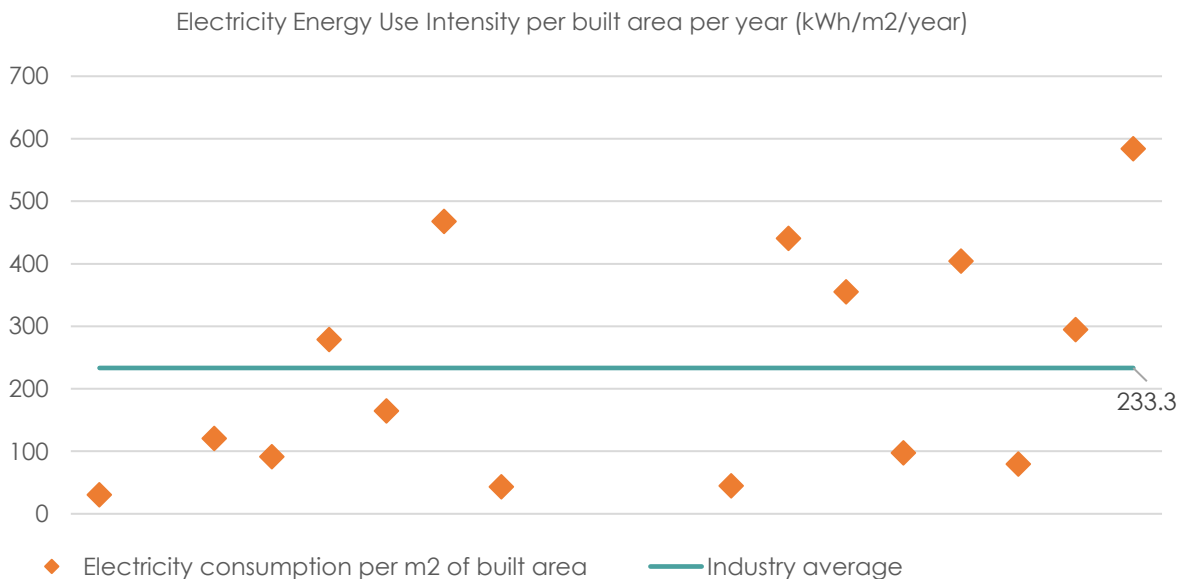
Chart 52 Wholesale and Retail trade – Electricity EUI per foot count



Electricity Energy Use Intensity per built area per year

Built areas obtained were seen to vary across organisations under review, with figures obtained within the range 1,400 – 40,000 m2.

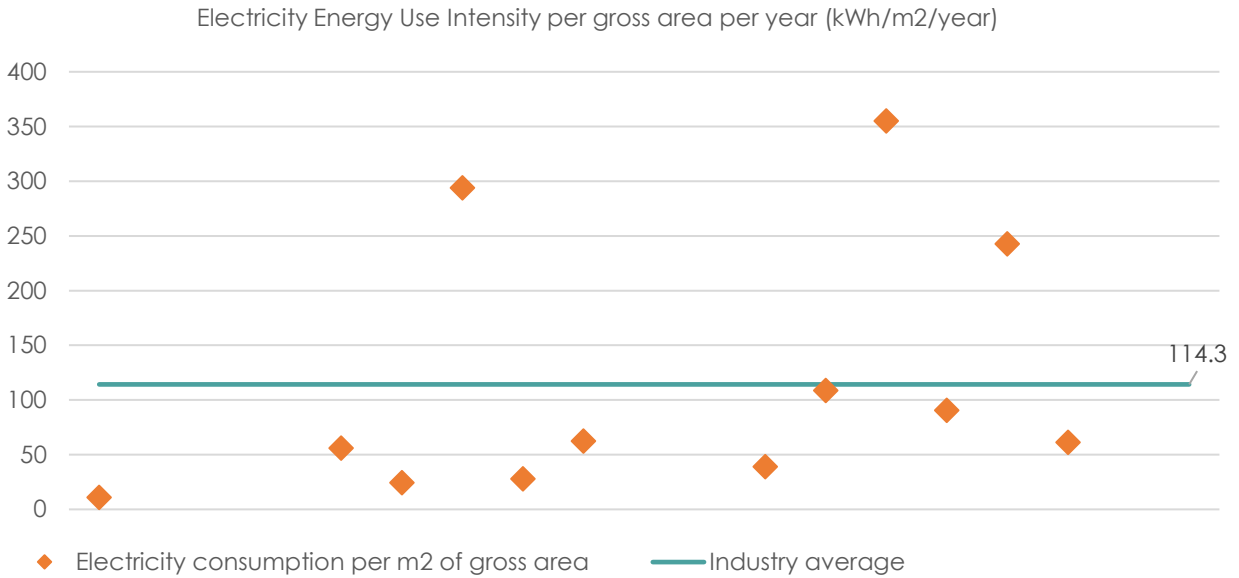
Chart 53 Wholesale and Retail trade – Electricity EUI per built area



Electricity Energy Use Intensity per built area per year

Gross area was also considered as this figure was obtained from organisations under review, and the nature of the business dictates that this measure is important in determination of energy efficiency. The measure is seen to decrease by approximately half when the gross area is considered, compared to the built area.

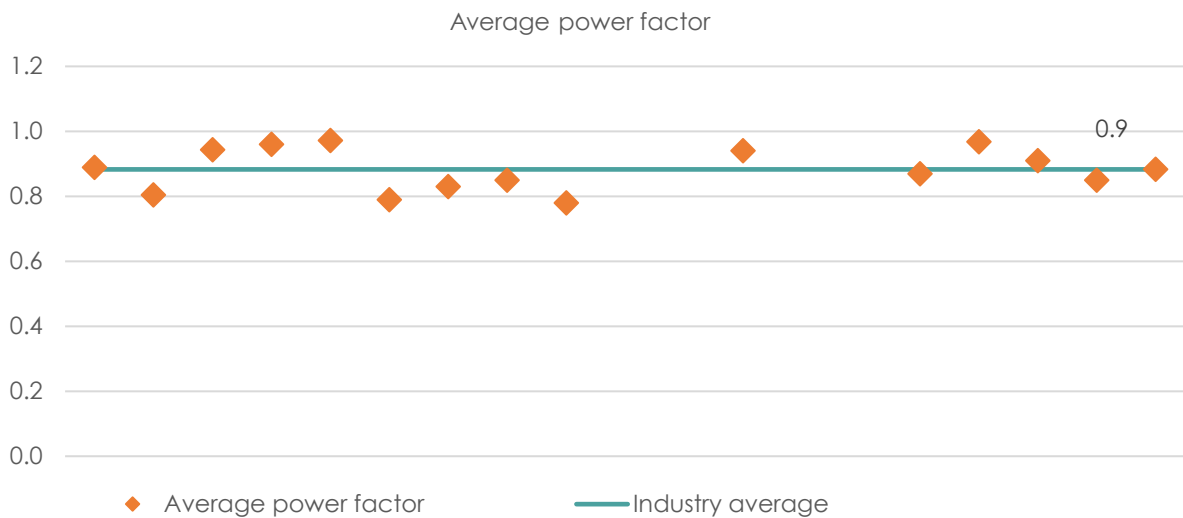
Chart 54 Wholesale and Retail trade – Electricity EUI per gross area



Average power factor

The average power factor obtained was 0.88, with all organisations being within the range 0.78 and 0.97.

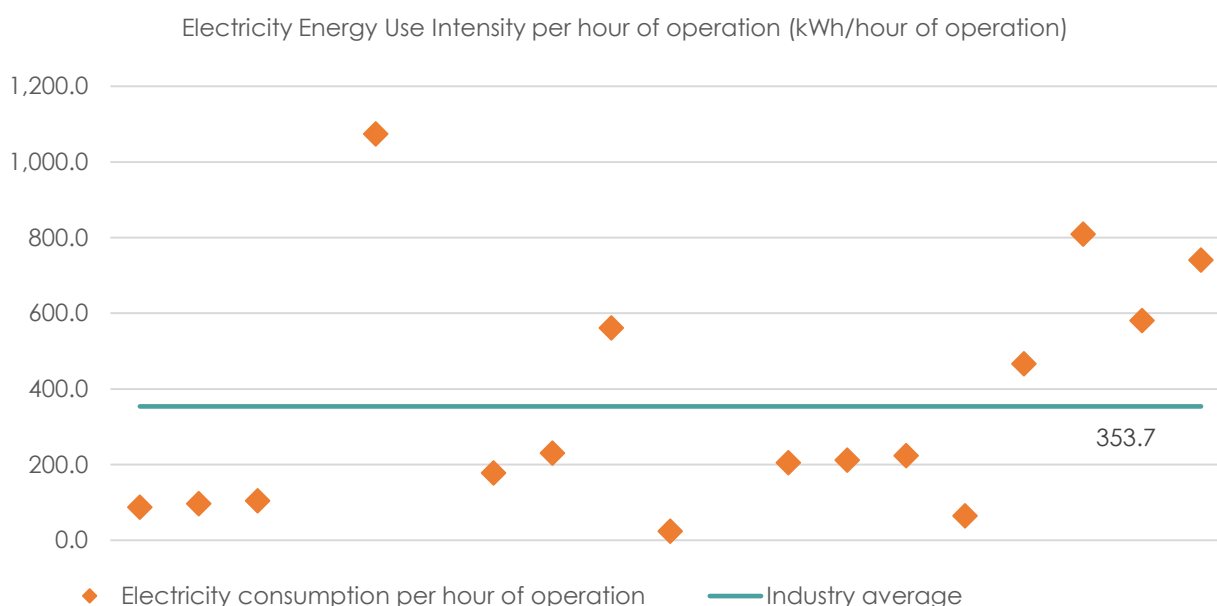
Chart 55 Wholesale and Retail trade – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 56 Wholesale and Retail trade – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 353.7. This figure is based on an average of 53 hours of operation per week across organisations under review.

The benchmark for the Wholesale and Retail trade sub sector was determined to be:
 EUI – kWh/hour of operation: **345.9 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 17 Wholesale and Retail trade – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	98,440
Gas - Electricity equivalent (kWh)	1,338,787
Diesel - Average amount utilised (lts)	7,486
Diesel - Electricity equivalent (kWh)	74,862
Hours of operation of the organisation	3,198
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	442.04

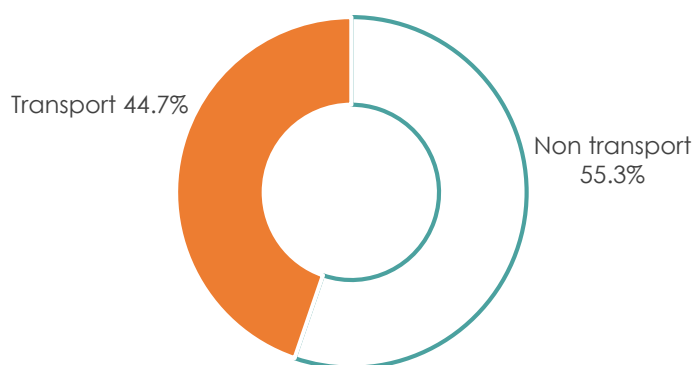
Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses utilised towards transport and non-transport were seen to be very close, at 55.3% of expenses for non-transport and 44.7% for transport. Uses of fossil fuel unrelated to transport included kitchen, bakery and fork lift. The average number of vehicles was found to be 25,

with the fuel costs amounting to approximately Rs 21,000,000 per year. Fuel expenses for transport comprised both Diesel and Gasoline in the ratio 59:41 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	547,900
Diesel - Electricity equivalent (kWh _{eq})	5,478,997
Gasoline - Average amount utilised (lts)	23,941
Gasoline - Electricity equivalent (kWh _{eq})	239,413
Total Fuel - Electricity equivalent (kWh_{eq})	5,718,410

Chart 57 Wholesale and Retail trade – Fossil Fuel consumption Transport vs Non transport



E6. Information and Communication and Call centres

Key take-aways

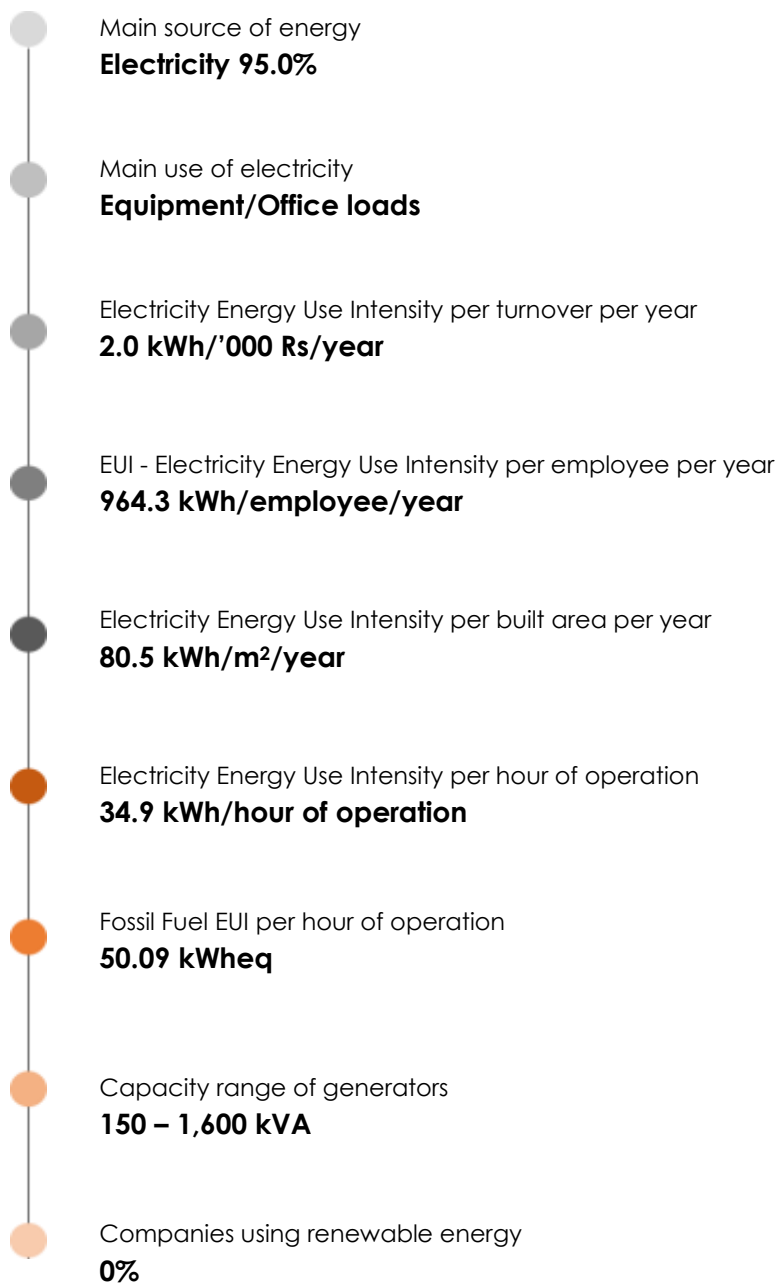
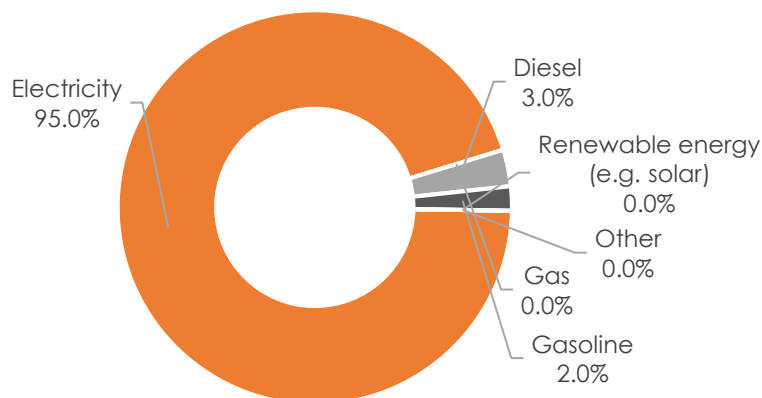


Table 18 Factsheet Information and Communication and Call centres

Sub-sector Information and Communication and Call centres		
Total number of companies surveyed	6	
Selection criteria	Companies short-selected were those who employed the most people. Call centres generally employ a high number of people and their offices occupy large floor areas, within a building.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	3	50.0%
Electricity consumption	5	83.3%
Number of employees	3	50.0%
Foot count	1	16.7%
Built area	4	66.7%
Gross area	0	0.0%
Hours of operation	5	83.3%
Generators output	4	66.7%
Transport	3	50.0%

Energy Source breakdown

Chart 58 Information and Communication and Call centres - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Office
- Air conditioning
- Personal computers
- Electronic equipment
- Telephone
- UPS
- Printers

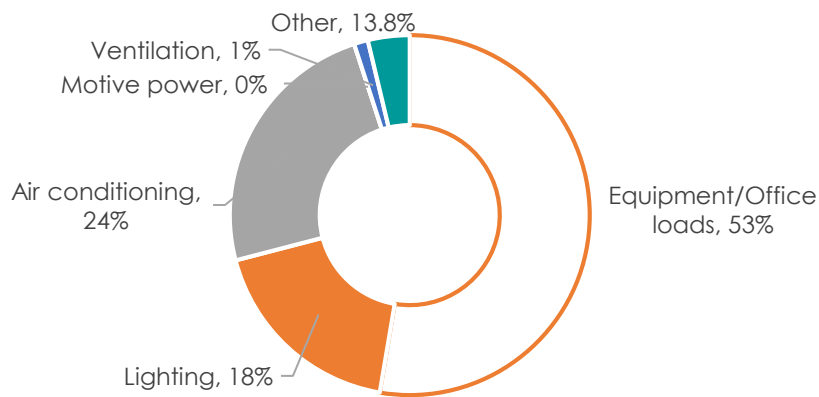
Main uses of diesel and gasoline:

- Vehicles

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment/Office loads comprise the bulk of electricity use at 83.4%, with the rest (16.2%) being attributed to Lighting. Others was minimal at 0.4%. It is to be noted that ventilation, motive power and air conditioning figures which stand at 0% relate to unavailability of data at the level of organisations being considered.

Chart 59 Information and Communication and Call centres – Electricity use breakdown

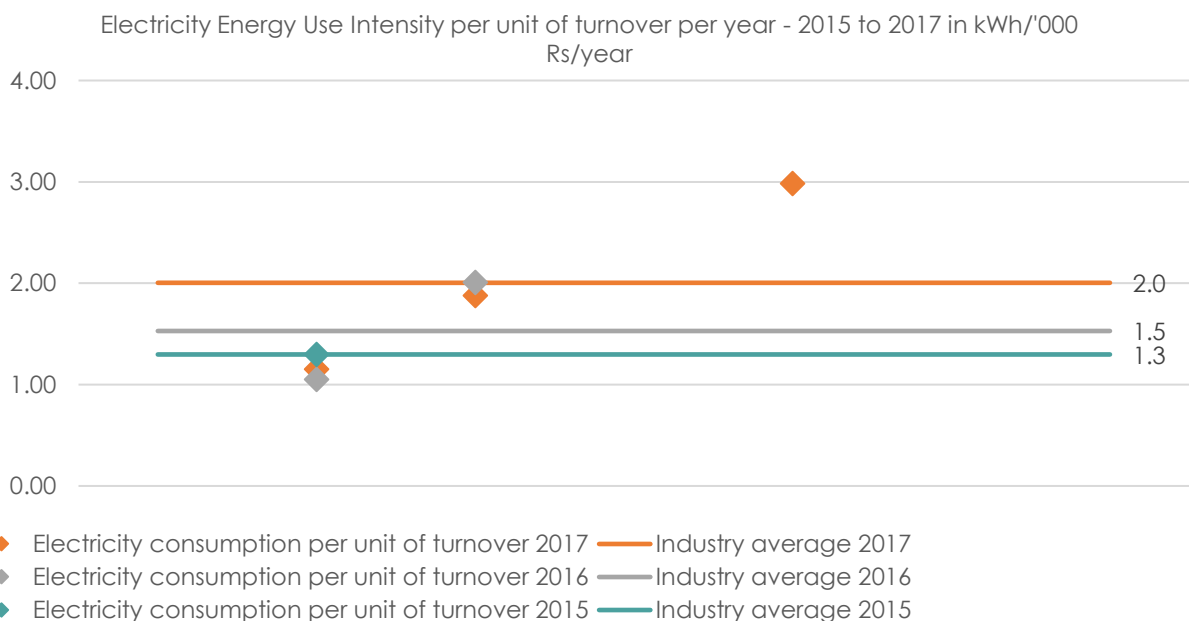


General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017.

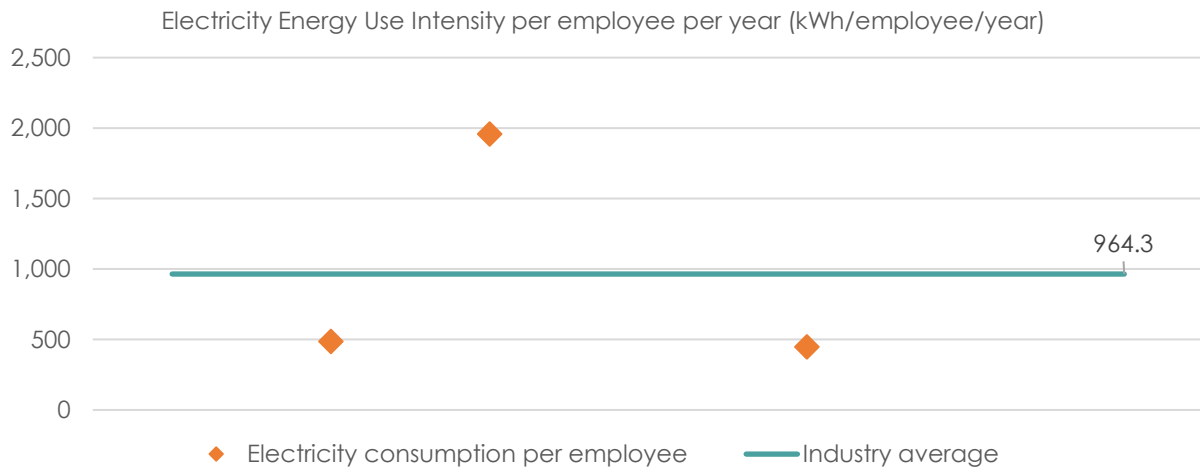
Chart 60 Information and Communication and Call centres – Electricity EUI per unit of turnover



It is observed that the industry average is on an increasing trend from 2015 to 2017. Given that turnover figures are increasing on average; this means that turnover is increasing at a slower rate than electricity consumption. As company size gets bigger, the electricity used per unit of turnover rises.

Electricity Energy Use Intensity per employee per year

Chart 61 Information and Communication and Call centres – Electricity EUI per employee



Figures are seen to range from 400 to 2,000, which is a comparatively wide range. Different size of businesses account for this, as call centres usually employ a comparatively high number of people. Whilst the number of employees may be a good indicator of electricity consumption for call centres, for other companies operating in the ICT sector, the number of clients may be a more realistic measure.

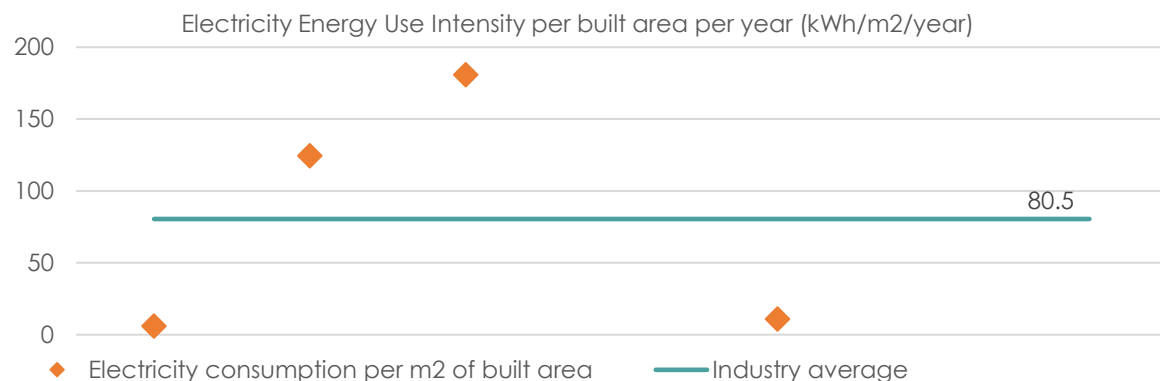
Electricity Energy Use Intensity per foot count per year

Only one organisation was able to estimate its foot count, and this figure was determined to be 1,000 per month. The electricity consumption per foot count per year was therefore found to be 8.9 kWh/footcount/year.

Electricity Energy Use Intensity per built area per year

Built area was deemed to be another important factor in determination of electricity efficiency. Built areas obtained were seen to vary across organisations under review, with figures obtained within the range 1,300 – 30,000 m². Electricity consumption per gross area has not been considered as most organisations under review operate within a building and do not have land.

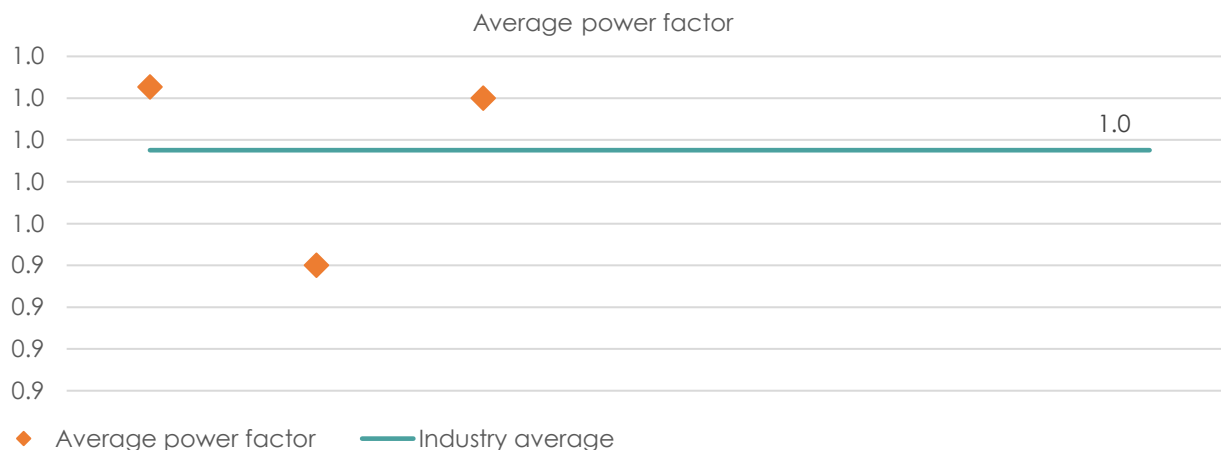
Chart 62 Information and Communication and Call centres – Electricity EUI per built area



Average power factor

The average power factor obtained was 0.97, with all organisations being within the range 0.94 and 0.98.

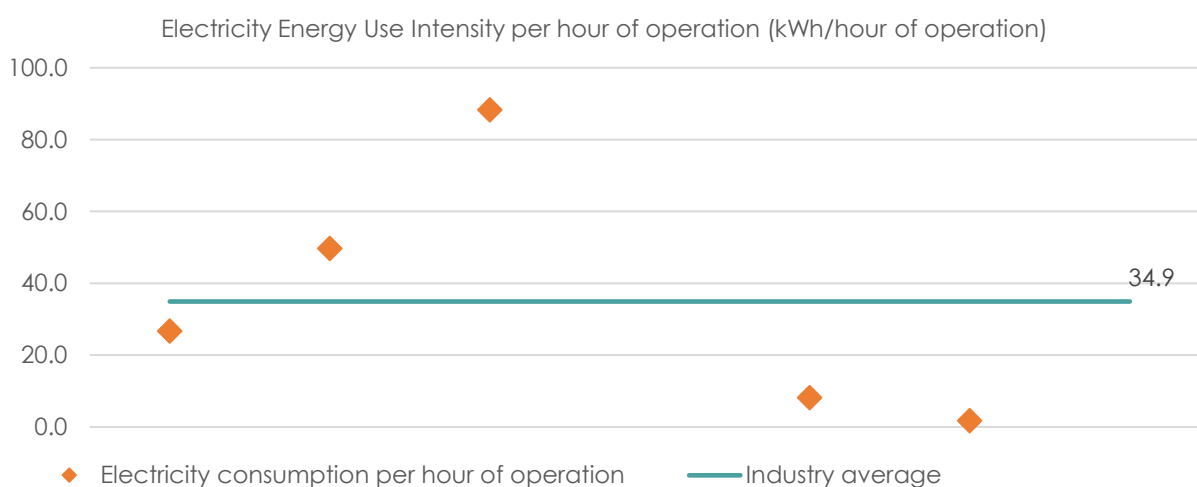
Chart 63 Information and Communication and Call centres – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 64 Information and Communication and Call centres – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 34.9. This figure is based on an average of 132 hours of operation per week across organisations under review.

The benchmark for the Information and Communication and Call centres sub sector was determined to be:
 EUI – kWh/hour of operation: **34.9 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 19 Information and Communication and Call centres – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	0
Gas - Electricity equivalent (kWh)	0
Diesel - Average amount utilised (lts)	86
Diesel - Electricity equivalent (kWh)	861
Hours of operation of the organisation	6,864
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	0.13

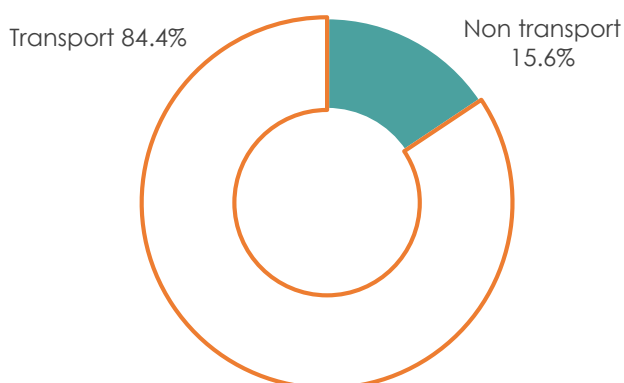
Gas figures were nil across organisations in this sub-sector.

Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Expenses of fossil fuel utilised towards transport and non-transport were 80.5% and 19.5% respectively. The average number of vehicles was found to be 7, with the fuel costs amounting to approximately Rs 965,000 per year. Fuel expenses for transport comprised both Diesel and Gasoline in the ratio 27:73 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	33,151
Diesel - Electricity equivalent (kWh _{eq})	331,510
Gasoline - Average amount utilised (lts)	5,244
Gasoline - Electricity equivalent (kWh _{eq})	52,441
Total Fuel - Electricity equivalent (kWh _{eq})	383,951

Chart 65 Information and Communication and Call centres – Fossil Fuel consumption Transport vs Non transport



E7. Storage

Key take-aways

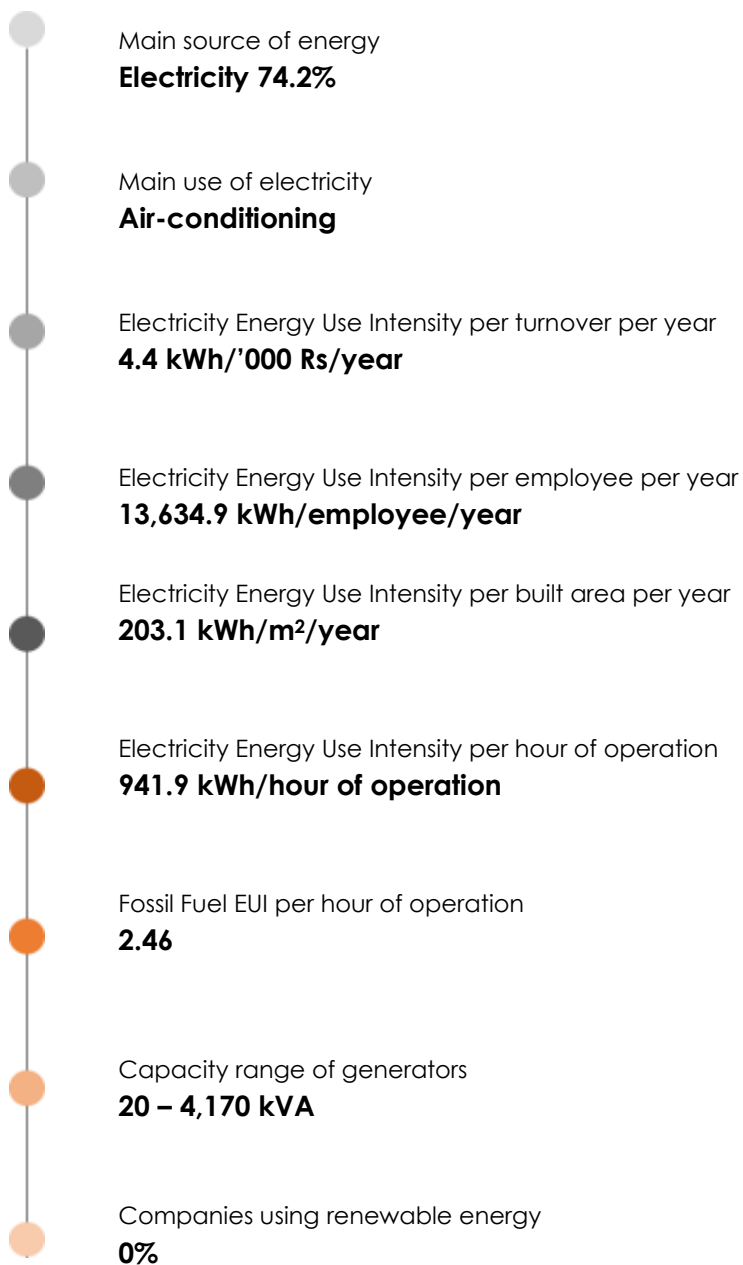
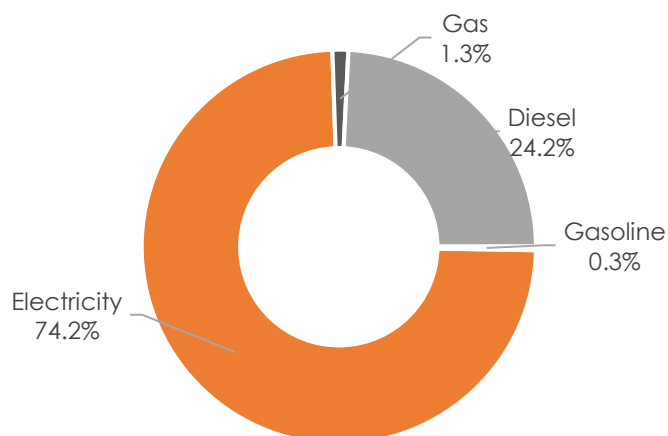


Table 20 Factsheet Storage

Sub-sector		Storage	
Total number of companies surveyed	9		
Selection criteria	Companies in the sample were those who either had the largest storage facility, or those who were the most well-known in the industry. Storage includes own storage of products as well as storage space which is rented out to clients. Storage also comprise cold rooms for seafood products, storage of vegetables, consumer foods and storage for non-consumer goods.		
Data availability on	Number of companies who were able to provide the data	Percentage	
Turnover	9	100.0%	
Electricity consumption	8	88.9%	
Number of employees	8	88.9%	
Foot count	1	11.1%	
Built area	4	44.4%	
Gross area	0	0.0%	
Hours of operation	7	77.8%	
Generators output	5	55.6%	
Transport	8	88.9%	

Energy Source breakdown

Chart 66 Storage - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Office
- Cold rooms
- Manufacturing
- Warehousing
- Administration
- Reception and delivery of raw materials
- Air conditioning

Main uses of gas

- Fork lift
- Messing

Main use of diesel:

- Vehicles
- Forklift
- Loaders

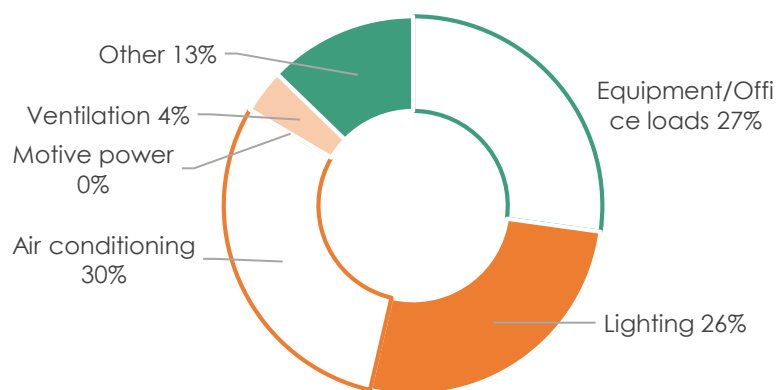
Main uses of gasoline

- Vehicles

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Equipment/Office loads and air conditioning comprise the bulk of electricity use at 27% and 30% respectively, with the rest being attributed to Lighting, Ventilation and Others.

Chart 67 Storage – Electricity use breakdown

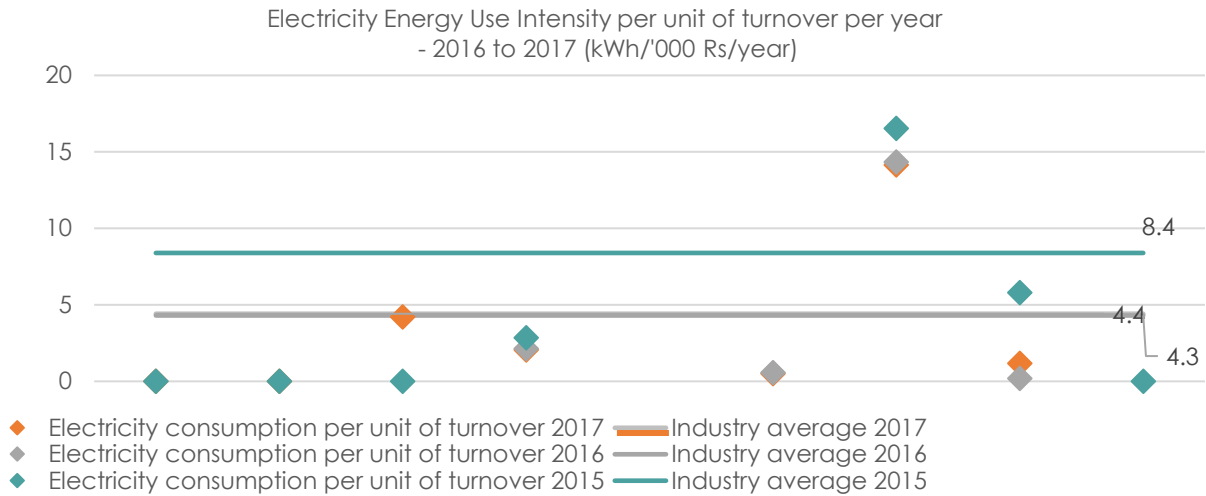


General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017.

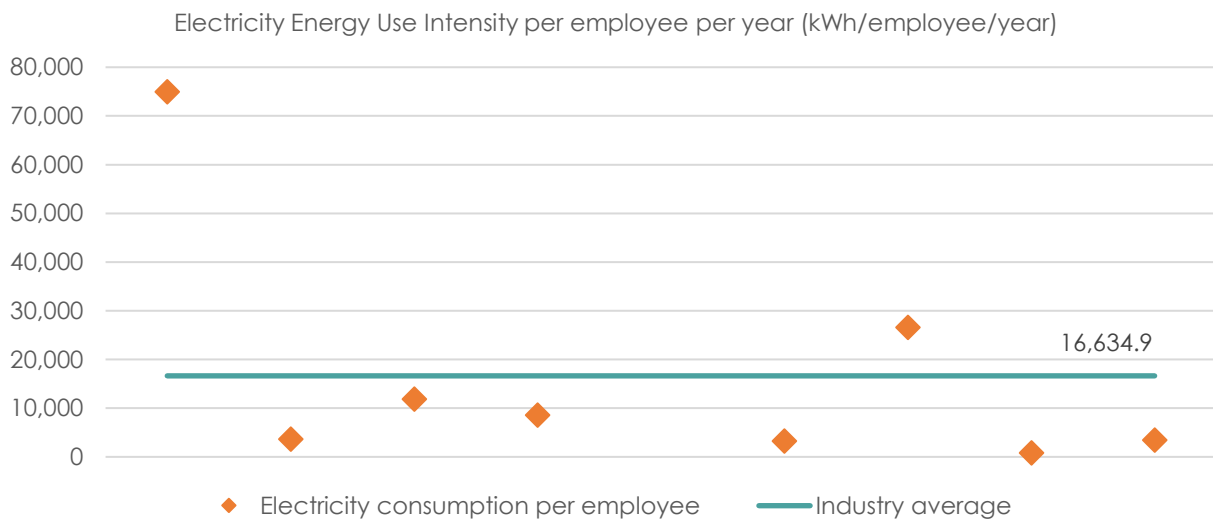
Chart 68 Storage – Electricity EUI per unit of turnover



It is observed that the industry average has decreased considerably from 2015 to 2016, and increased slightly from 2016 to 2017. Figures provided by organisations under review are consistent across 2015, 2016 and 2017. Turnover saw a large increase for 2 organisations from 2015 to 2016, and electricity consumption was seen to decrease across a few organisations during the same time frame.

Electricity Energy Use Intensity per employee per year

Chart 69 Storage – Electricity EUI per employee



Figures are seen to range from 800 to 75,000, which is a comparatively wide range. The storage capacity and occupancy rates may be a better indicator of electricity efficiency rather than the number of employees.

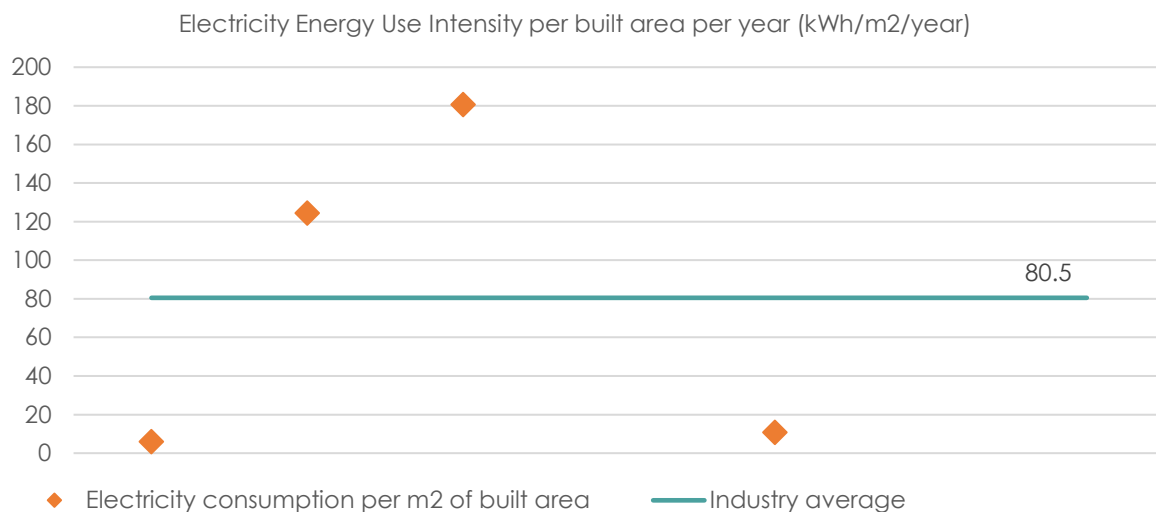
Electricity Energy Use Intensity per foot count per year

Only one organisation was able to estimate its foot count, and this figure was determined to be 165 per month. The electricity consumption per foot count per year was therefore found to be 2,214.0 kWh/footcount/year.

Electricity Energy Use Intensity per built area per year

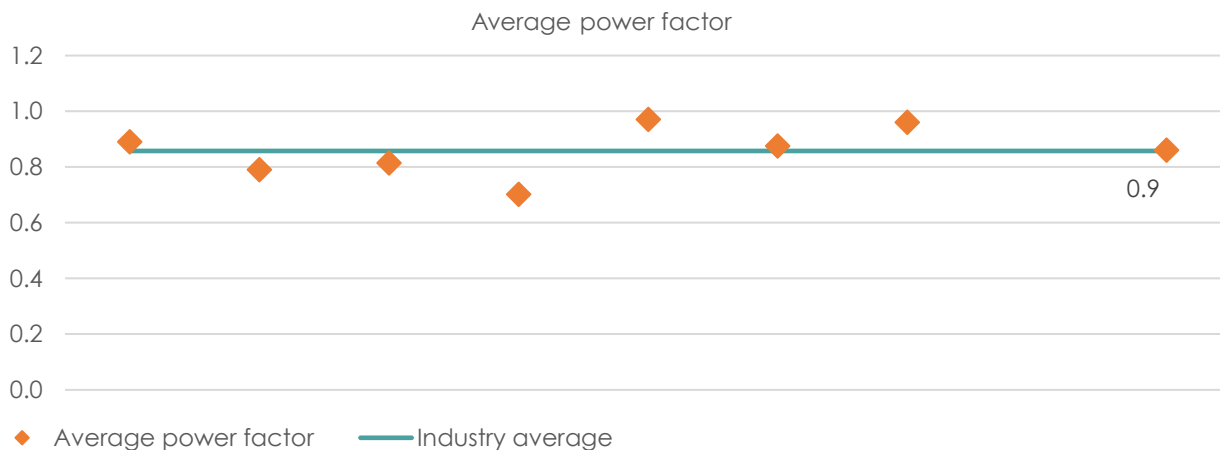
Built area was deemed to be another important factor in determination of electricity efficiency. Built areas obtained were seen to vary across organisations under review, with figures obtained within the range 2,300 – 90,000 m².

Chart 70 Storage – Electricity EUI per built area



The average power factor obtained was 0.86, with all organisations being within the range 0.70 and 0.97.

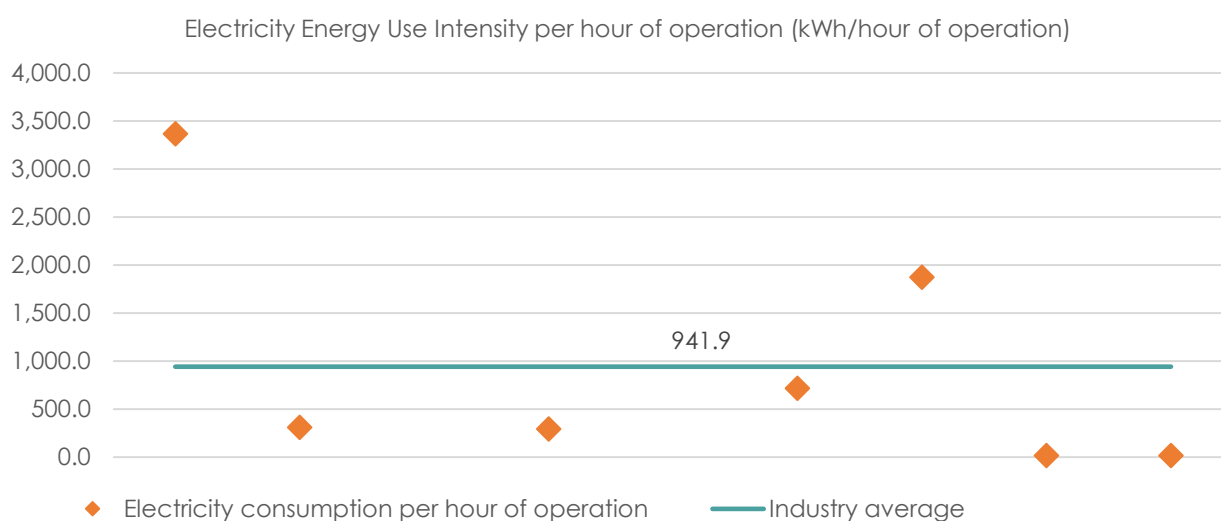
Chart 71 Storage – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 72 Storage – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 941.9 kWh/hour of operation. This figure is based on an average of 67 hours of operation per week across organisations under review.

The benchmark for the Storage sub sector was determined to be:
EUI – kWh/hour of operation: **941.9 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 21 Storage – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	-
Gas - Electricity equivalent (kWh)	-
Diesel - Average amount utilised (lts)	856
Diesel - Electricity equivalent (kWh)	8,556
Hours of operation of the organisation	3,484
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	2.46

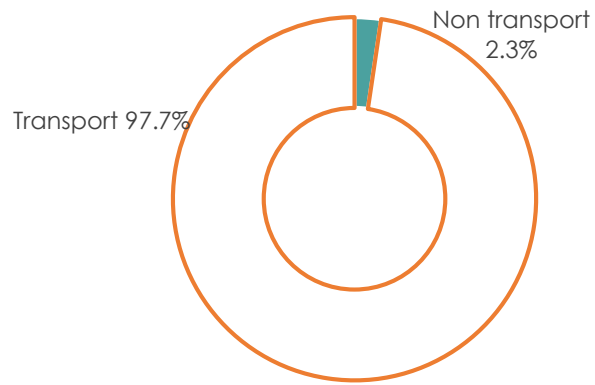
Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil Fuel expenses were mainly utilised towards transport, at 94.2%. The average number of vehicles was found to be 35, with the fuel costs amounting to approximately Rs 24,000,000 per year. Fuel expenses for transport comprised Diesel, Gasoline and LPG in the ratio 83:14:3 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	632,309
Diesel - Electricity equivalent (kWh _{eq})	6,323,086

Gasoline - Average amount utilised (lts)	9,554
Gasoline - Electricity equivalent (kWh _{eq})	95,537
Total Fuel - Electricity equivalent (kWh _{eq})	6,418,623

Chart 73 Storage – Fossil Fuel consumption Transport vs Non transport



E8. Professional, Scientific and Technical activities

Key take-aways

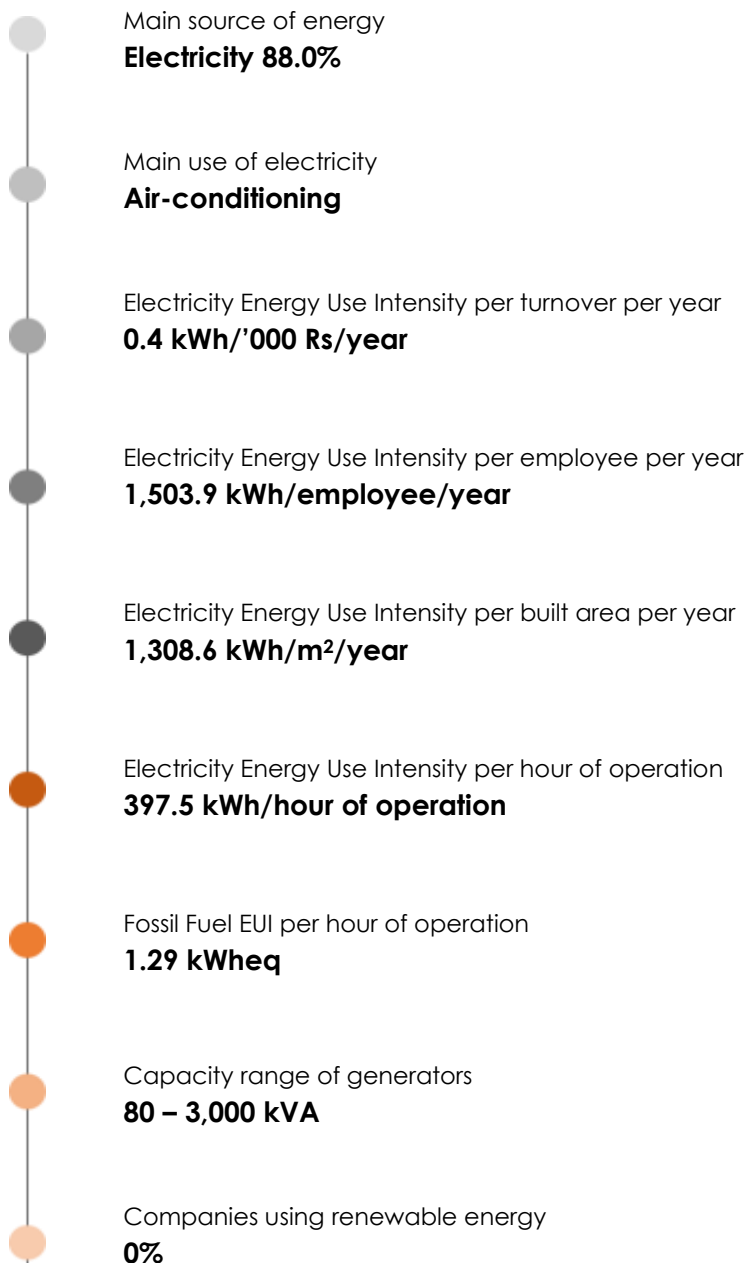
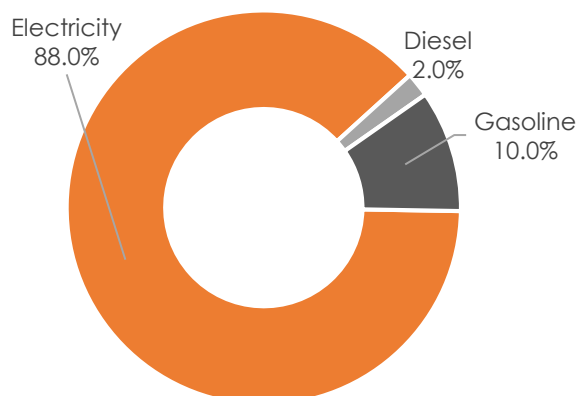


Table 22 Factsheet Professional, Scientific and Technical activities

Sub-sector Professional, Scientific and Technical activities		
Total number of companies surveyed	6	
Selection criteria	Companies short-selected were those who were the most popular and therefore had the largest client base. Companies covered communications, consultancy, pharmaceuticals etc. Laboratories perform tests and have specific equipment in-house. Some companies operate within the IT sector and others provide more professional services like public relations, communication and advertising. In this particular sub-segment, broadcast is an outlier as there is only one public company providing this service.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	2	33.3%
Electricity consumption	5	83.3%
Number of employees	3	50.0%
Foot count	0	0.0%
Built area	5	83.3%
Gross area	0	0.0%
Hours of operation	4	66.7%
Generators output	2	33.3%
Transport	2	33.3%

Energy Source breakdown

Chart 74 Professional, Scientific and Technical activities - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Building services
- Broadcasting equipment
- Air conditioning
- Servers

Main uses of gas

- Bacteriology

Main uses of hot water

- Hot beverage

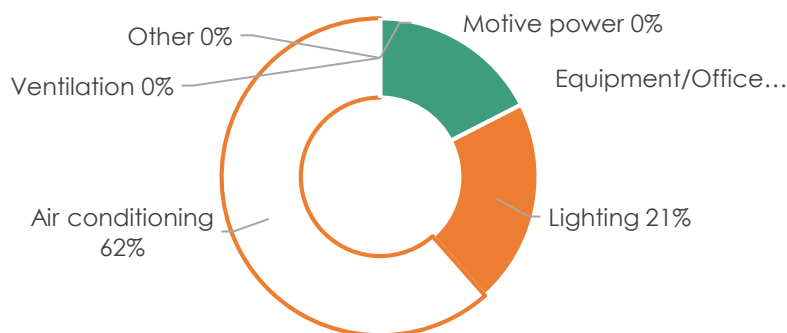
Main use of diesel:

- Vehicles
- Generators

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Air conditioning and Lighting comprise the bulk of electricity use at 62% and 21% respectively, with the rest being attributed to Equipment/Office loads.

Chart 75 Professional, Scientific and Technical activities – Electricity use breakdown

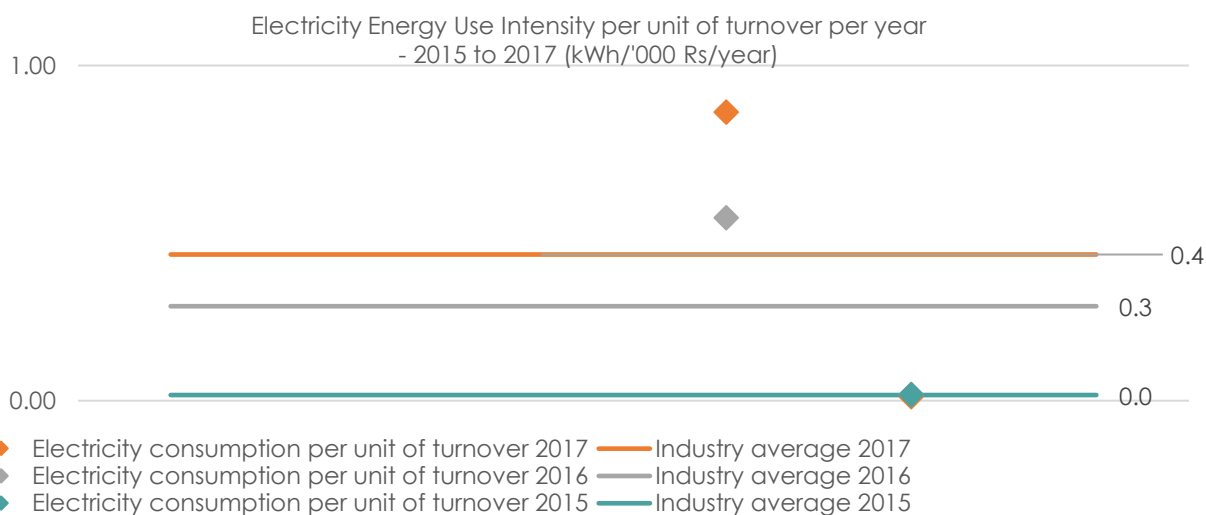


General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines relate to the industry averages for 2015, 2016 and 2017. Only a small number of organisations provided the required information in terms of turnover, stating that the information was confidential.

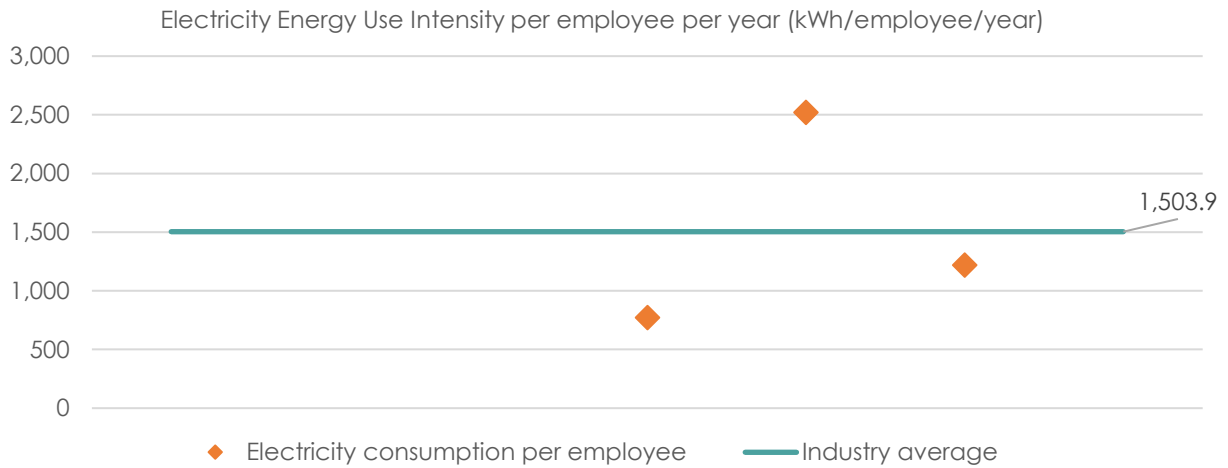
Chart 76 Professional, Scientific and Technical activities – Electricity EUI per unit of turnover



It is observed that the industry average has increased from 2015 to 2017. Turnover across some organisations saw an increase during the 3 years being considered, whilst others witnessed a decrease.

Electricity Energy Use Intensity per employee

Chart 77 Professional, Scientific and Technical activities – Electricity EUI per employee



Figures are seen to range from 750 to 2,500, with the number of employees ranging from 30 to 215. In this sub-sector, the number of employees is a good indicator of electricity usage.

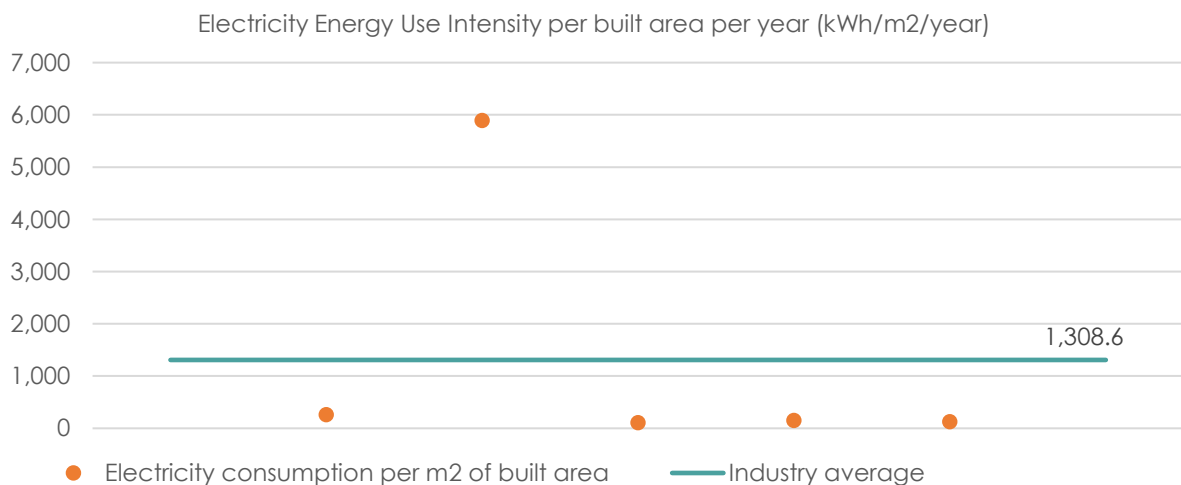
Electricity Energy Use Intensity per foot count per year

Foot count was not provided across these organisations, and it was mentioned that this figure was difficult to estimate.

Electricity Energy Use Intensity per built area per year

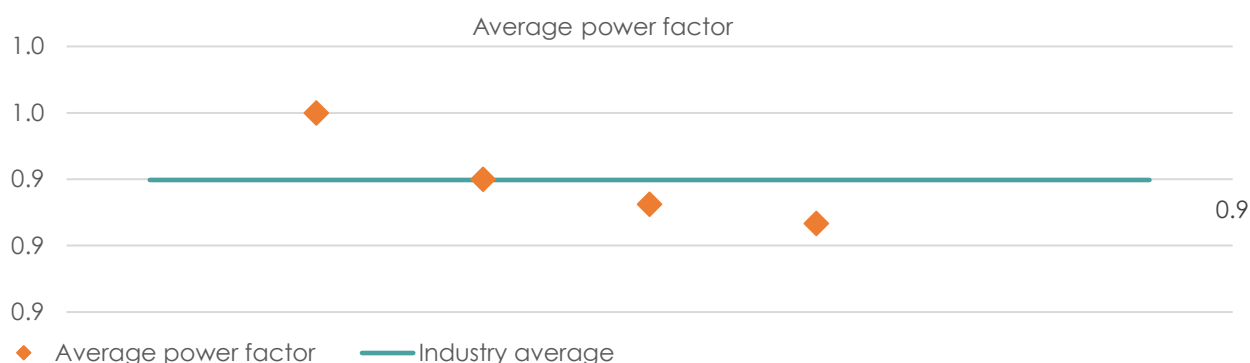
Built areas obtained were seen to vary across organisations under review, with figures obtained within the range 1,000 – 10,500 m². Gross area was not provided by organisations.

Chart 78 Professional, Scientific and Technical activities – Electricity EUI per built area



The average power factor obtained was 0.94, with all organisations being within the range 0.93 and 0.95.

Chart 79 Professional, Scientific and Technical activities – Average power factor

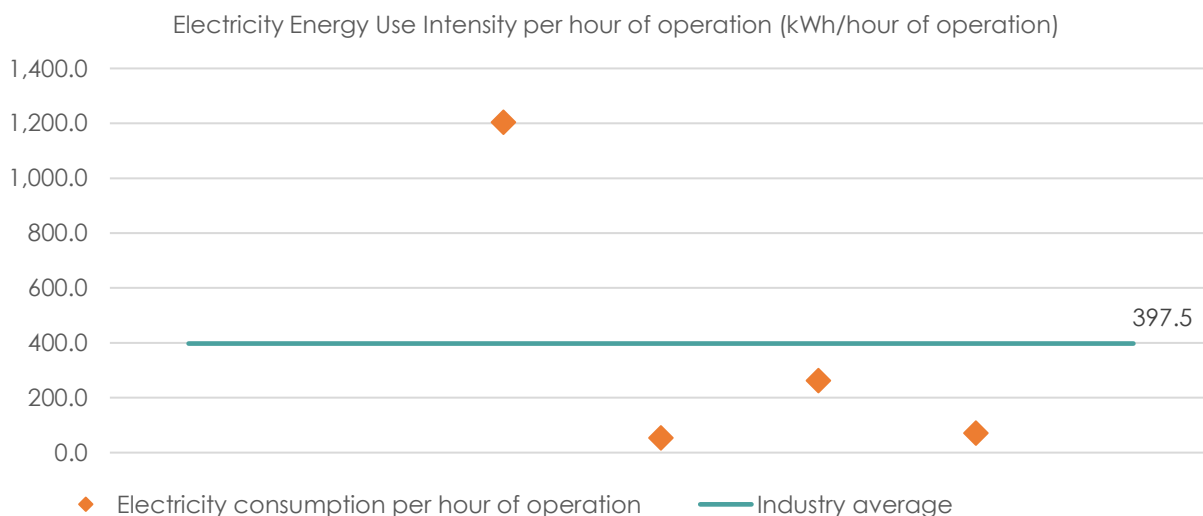


Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

The average electricity consumption per hour of operation is 397.5. This figure is based on an average of 67.5 hours of operation per week across organisations under review.

Chart 80 Professional, Scientific and Technical activities – Electricity EUI per hour of operation



The benchmark for the Professional, scientific and technical activities sub sector was determined to be:
 EUI – kWh/hour of operation: **397.5 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 23 Professional, Scientific and Technical activities - Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	270
Gas - Electricity equivalent (kWh)	3,672
Diesel - Average amount utilised (lts)	87
Diesel - Electricity equivalent (kWh)	869
Hours of operation of the organisation	3,510
Fossil fuel EUI per hour of operation (kWh_{eq}/hour of operation)	1.29

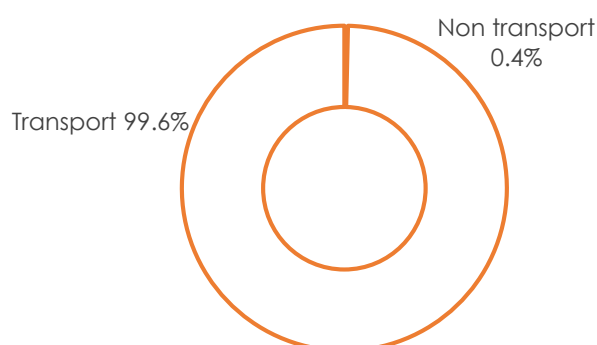
Only one company provided data on fossil fuel usage in this sector. It has been excluded in calculations above so as not to mis-represent the sector, by leveraging on only one particular company's data.

Fossil Fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses were mainly utilised towards transport, at 99.6%. The number of vehicles was found to be between 2 - 3, with the fuel costs amounting to approximately Rs 1,465,000 per year. Fuel expenses for transport comprised Diesel, Gasoline and LPG in the ratio 49.5:49.5:1 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	38,565
Diesel - Electricity equivalent (kWh _{eq})	385,647
Gasoline - Average amount utilised (lts)	16,875
Gasoline - Electricity equivalent (kWh _{eq})	168,750
Total Fuel - Electricity equivalent (kWh _{eq})	554,397

Chart 81 Professional, Scientific and Technical activities – Fossil Fuel consumption Transport vs Non transport



E9. Financial and Insurance activities

Key take-aways

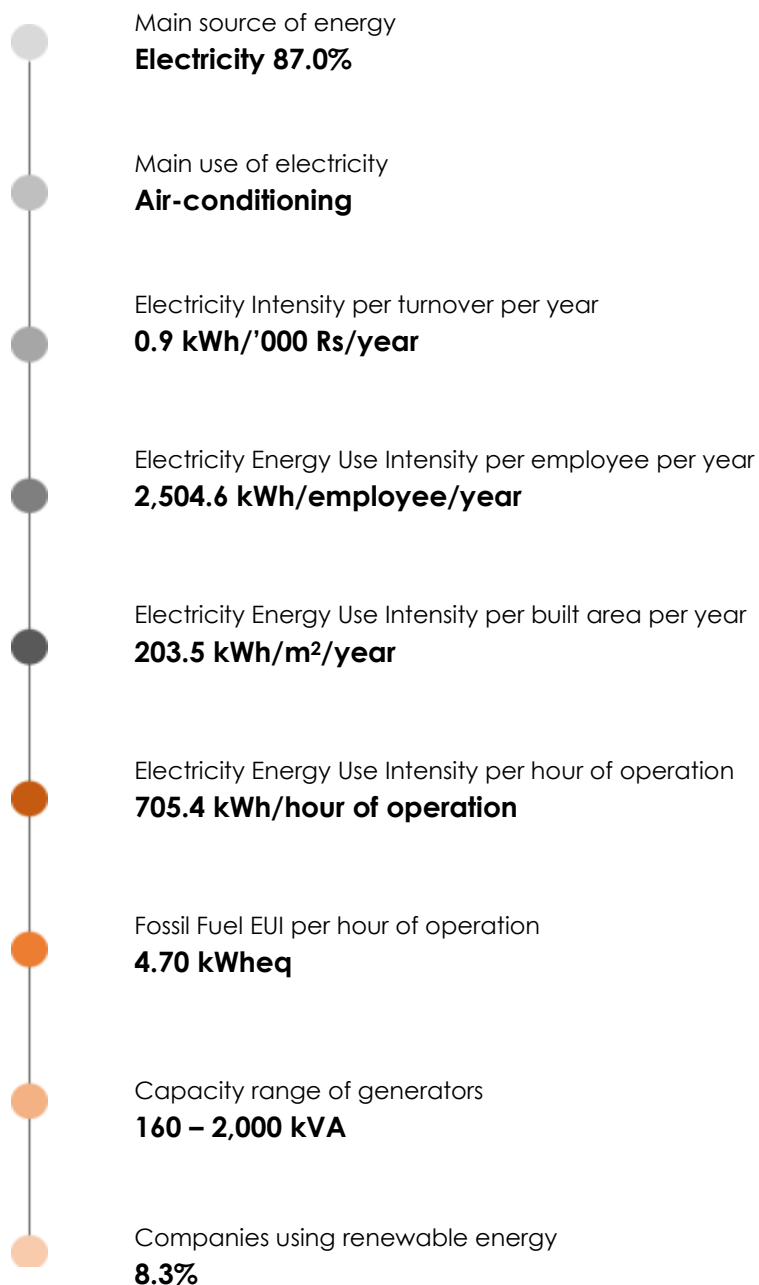
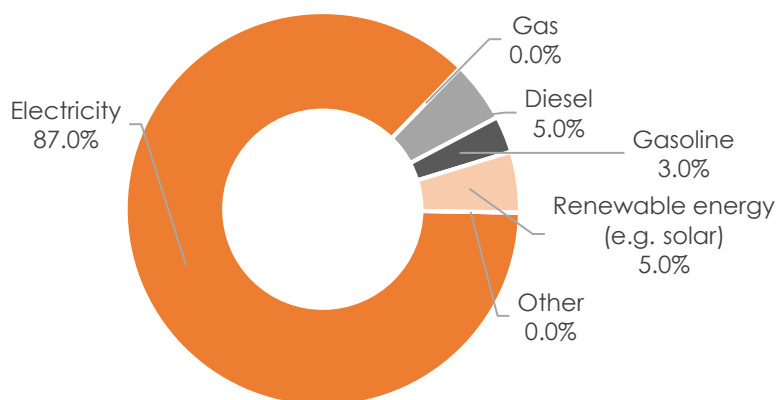


Table 24 Factsheet Financial and Insurance activities

Sub-sector Financial and Insurance activities		
Total number of companies surveyed	12	
Selection criteria	Companies in the sample were the ones with the largest client base and with substantial activities within their main office. A such a mix of banking and insurance related companies were included in the sample. These companies provide professional services to clients, with the output related primarily to human input. Employees have stations and usually operate for fixed hours during the week.	
Data availability on	Number of companies who were able to provide the data	Percentage
Turnover	7	58.3%
Electricity consumption	10	83.3%
Number of employees	11	91.7%
Foot count	3	25.0%
Built area	9	75.0%
Gross area	3	25.0%
Hours of operation	10	83.3%
Generators output	3	25.0%
Transport	5	41.7%

Energy Source breakdown

Chart 82 Financial and Insurance activities - Electricity source breakdown



Energy Use breakdown

Main uses of electricity, as stated by organisations under review:

- Lighting
- Office equipment
- Business operations
- Lifts
- Computers
- Cooling

- Servers
- Electrical power requirement from building
- Printers
- Water dispensers
- Air conditioning

Main uses of gas

- Canteen
- Cooking

Main uses of hot water

- Kitchen

Main use of diesel:

- Vehicles
- Generators

Main use of gasoline:

- Vehicles

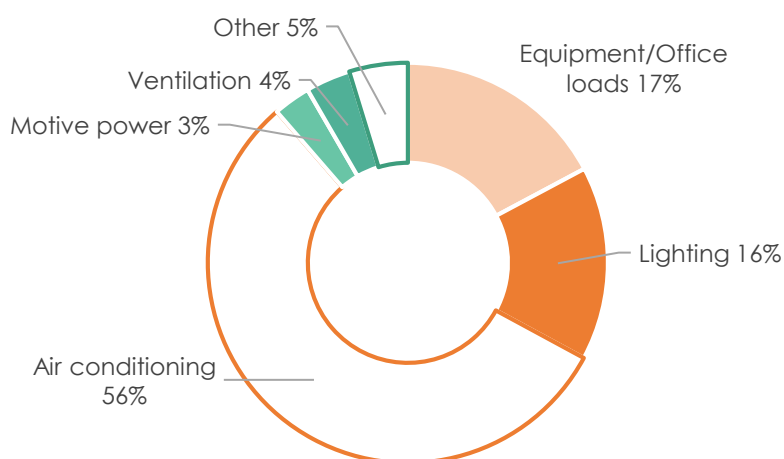
Main use of renewable energy:

- Electrical power

Electricity use breakdown

The following pie chart depicts the breakdown in terms of electricity use. Air conditioning and Equipment/Office loads comprise the bulk of electricity use at 56% and 17% respectively, with the rest being attributed to Lighting (16%), Ventilation (4%) and Motive power (3%).

Chart 83 Financial and Insurance activities – Electricity use breakdown



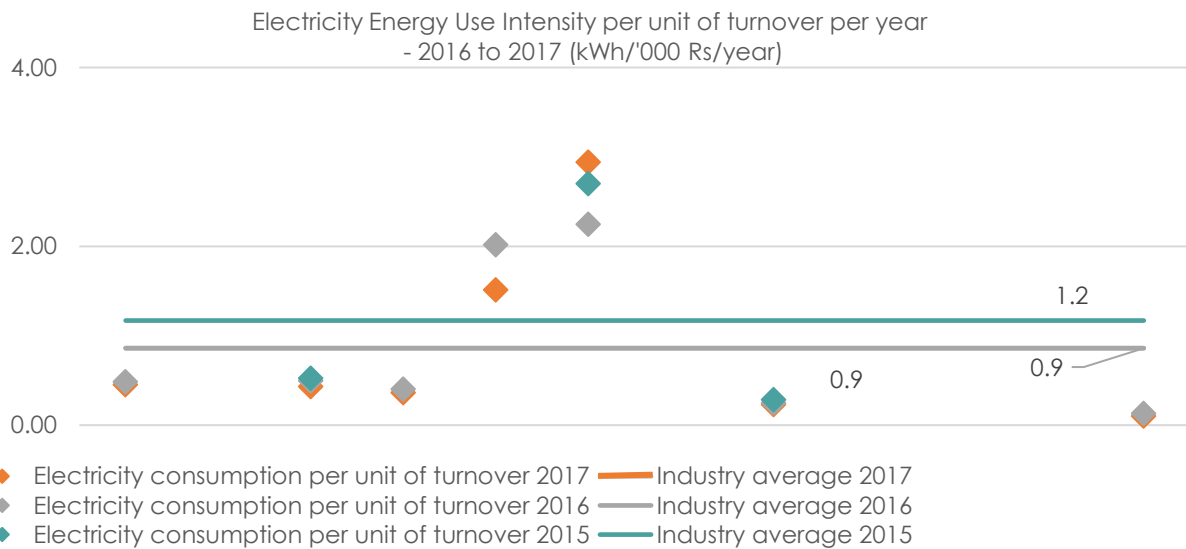
General indicators

Electricity Energy Use Intensity per unit of turnover per year

Electricity Energy Use Intensity per unit of turnover per year from 2015 to 2017 is depicted below. The markers demonstrate how this measure (in kWh/'000 Rs/year) has evolved over 3 years, while the 3 lines

relate to the industry averages for 2015, 2016 and 2017. Only a small number of organisations provided the required information in terms of turnover, stating that the information was confidential.

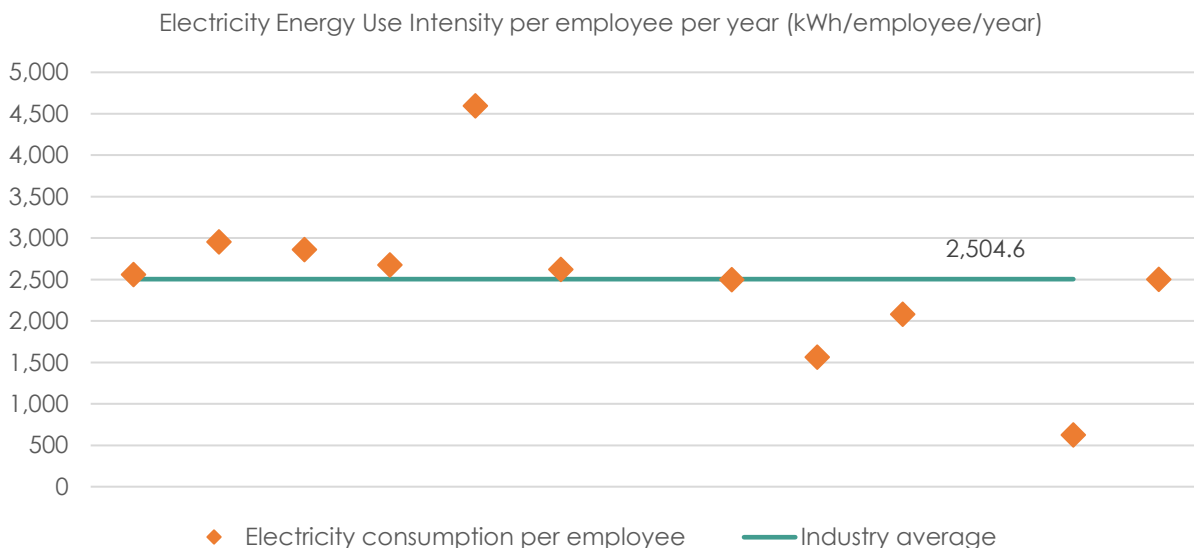
Chart 84 Financial and Insurance activities – Electricity EUI per unit of turnover



It is observed that the industry average has decreased from 2015 to 2016 and slightly increased from 2016 to 2017. Turnover across most organisations saw an increase during the 3 years being considered, which demonstrates that electricity consumption has decreased, stayed the same or increased by a smaller amount compared to turnover from 2016 to 2017.

Electricity Energy Use Intensity per employee per year

Chart 85 Financial and Insurance activities – Electricity EUI per employee

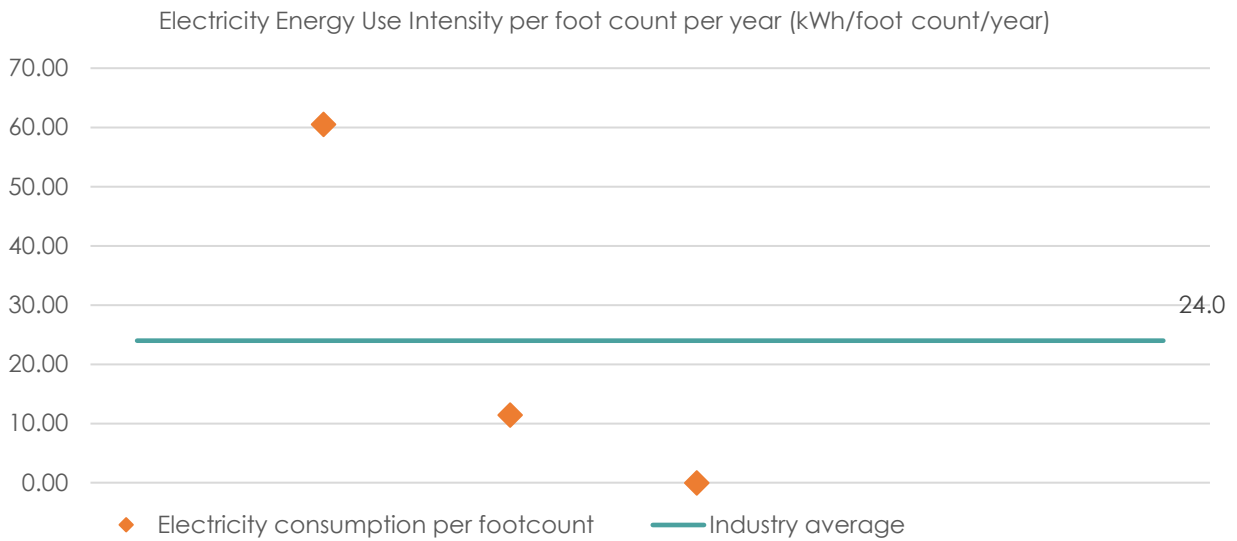


Figures are seen to range from 500 to 4,600, with the number of employees ranging from 300 to 2,700. In this sub-sector, the number of employees is a good indicator of electricity usage.

Electricity Energy Use Intensity per foot count per year

Only 3 organisations provided a foot count, and figures obtained were 150, 1,300 and 36,400.

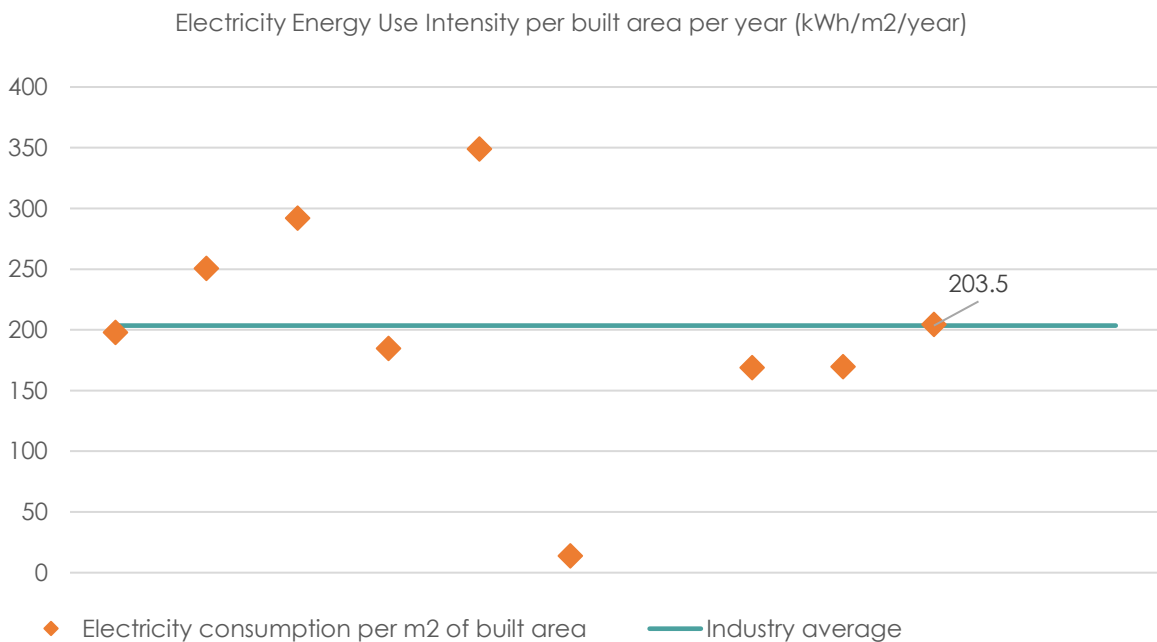
Chart 86 Financial and Insurance activities – Electricity EUI per foot count



Electricity Energy Use Intensity per built area per year

Built areas obtained were seen to vary across organisations under review, with figures obtained within the range 2,000 – 25,000 m².

Chart 87 Financial and Insurance activities – Electricity EUI per built area

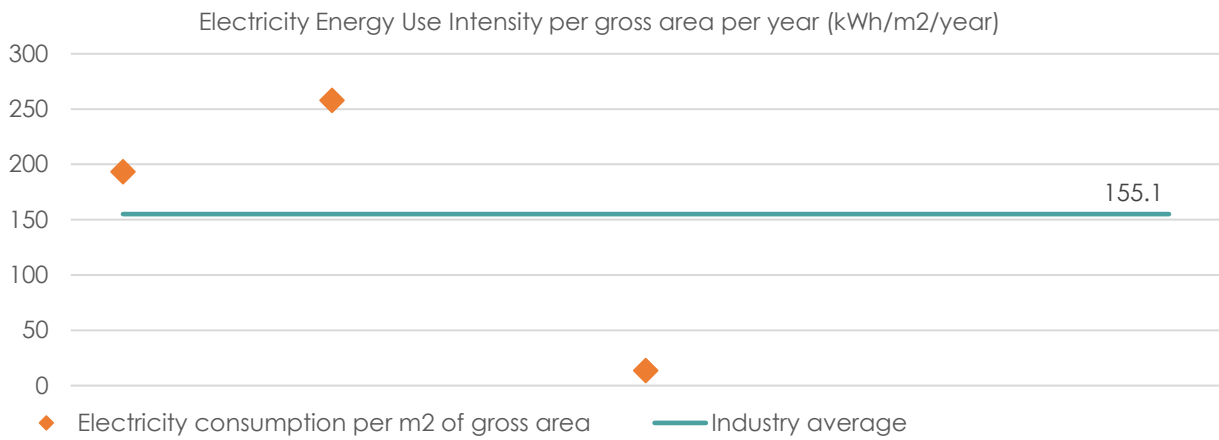


Electricity Energy Use Intensity per gross area per year

Gross area was also considered as this figure was obtained from organisations under review, and the nature of the business dictates that this measure is important in determination of energy efficiency. The

measure is seen to decrease when the gross area is considered compared to the built area. Not all organisations provided this information.

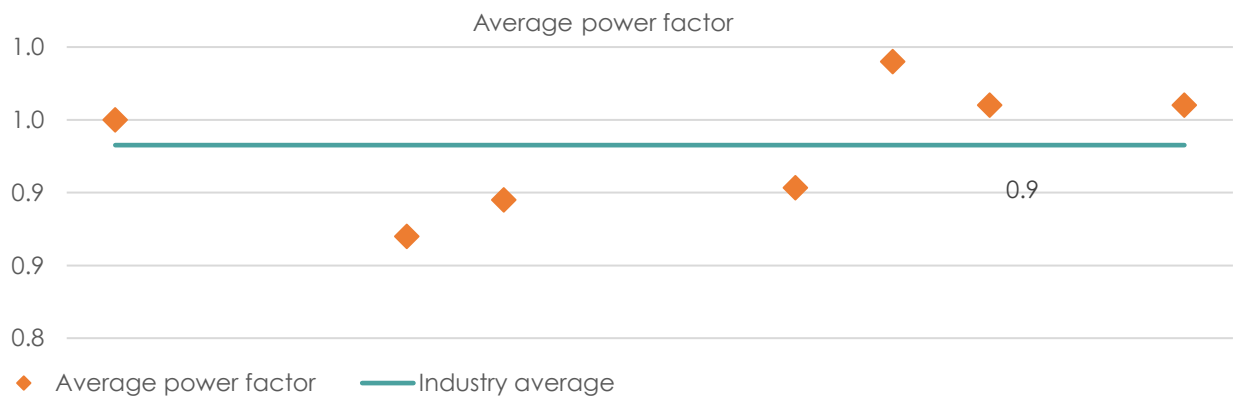
Chart 88 Financial and Insurance activities – Electricity EUI per gross area



Average power factor

The average power factor obtained was 0.93, with all organisations being within the range 0.90 and 0.99.

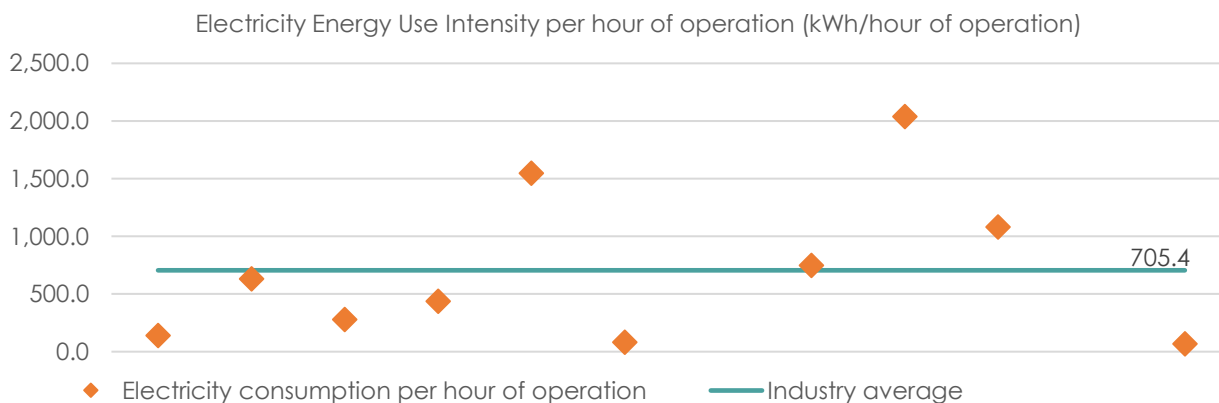
Chart 89 Financial and Insurance activities – Average power factor



Benchmark EUI (hour of operation)

Electricity Energy Use Intensity per hour of operation

Chart 90 Financial and Insurance activities – Electricity EUI per hour of operation



The average electricity consumption per hour of operation is 705.42. This figure is based on an average of 51.1 hours of operation per week across organisations under review.

The benchmark for the Food services activities was determined to be:
EUI – kWh/hour of operation: **705.4 kWh/hour of operation**

Fossil Fuel – Electricity Equivalent

Table 25 Financial and Insurance activities – Fossil fuel Electricity Equivalent

Annual Consumption - Fossil Fuel (excluding transport)	
Gas - Average amount utilised (kgs)	0
Gas - Electricity equivalent (kWh)	0
Diesel - Average amount utilised (lts)	1,248
Diesel - Electricity equivalent (kWh)	12,476
Hours of operation of the organisation	2,656
Fossil fuel EUI per hour of operation (kWh eq/hour of operation)	4.70

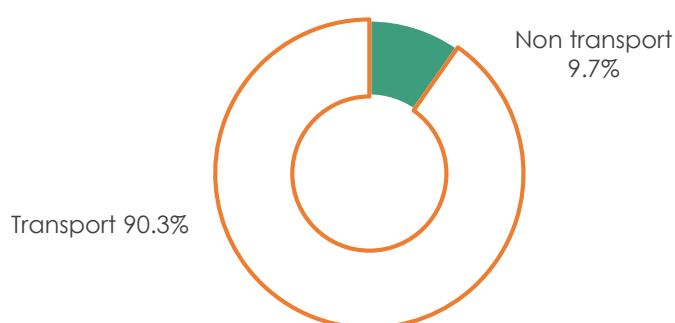
Gas is used by only 1 organisation from the sample and, as such, figures have been disregarded in metrics above as they are not representative of the sub-sector.

Fossil fuel consumption Transport vs. Non Transport

The breakdown of expenses towards fossil fuel utilised for transport was compared to that utilised for non-transport purposes. Fossil fuel expenses were mainly utilised towards transport, at 90.3%. The number of vehicles was found to be 50 - 55, with the fuel costs amounting to approximately Rs 8,750,000 per year. Fuel expenses for transport comprised Diesel and Gasoline 24:76 approximately.

Annual Consumption - Fossil Fuel (for transport)	
Diesel - Average amount utilised (lts)	230,342
Diesel - Electricity equivalent (kWh eq)	2,303,422
Gasoline - Average amount utilised (lts)	58,380
Gasoline - Electricity equivalent (kWh eq)	583,800
Total Fuel - Electricity equivalent (kWh eq)	2,887,222

Chart 91 Financial and Insurance activities – Fossil Fuel consumption Transport vs Non transport



F. Conclusion

The services sector was analysed in its entirety and across sub-sectors. The following was noted:

- All companies on the approved list (108) were contacted and follow up made to reach the 83 completed questionnaires.
- Energy usage comprised primarily electricity and diesel, with other forms of energy being used either minimally or only across specific sub-sectors.
- For the following sub-sectors, LPG comprises a significant part of energy consumption: Human Health and Social work activities, Wholesale and Retail trade and Food services activities.
- Diesel is used for transport and for non-transport (generators), at an overall ratio of 65:35.
- A high number of organisations have stand-by generators (51 out of 83), although a high proportion do not have the figures related to their usage.
- Renewable energy is used minimally, by only 5 companies out of 83.
- Out of 83 organisations surveyed, 53 did not keep any records of their electricity bills.
- Most organisations do not have their building foot count.
- Electricity EUI per hour of operation, which is the benchmark utilised for the services sector is lowest for Food Services and highest for Storage at 3.5 kWh/hour of operation/year and 941.9 kWh/hour of operation/year respectively.
- Financial and Insurance activities was second highest with 705.4 kWh/hour of operation/year while Professional, Scientific and Technical activities was third highest with 397.5 kWh/hour of operation/year.
- The electricity EUI per employee per year is highest for Storage and lowest for Food services.
- Electricity EUI across news broadcast and laboratories (in professional, scientific and technical activities) is comparatively high, when built area is considered.
- The highest electricity EUI per gross area per year are Financial and Insurance activities and Wholesale and Retail trade.
- Electricity Energy Use Intensity per foot count per year is found to be within the range 0 – 2213 kWh/foot count/year.
- The average power factor is lowest for Education at 0.821 and highest for Food services at 0.975.
- Based on figures obtained for air-conditioning, it is likely that survey participants have included cooling/refrigeration under air-conditioning.
- Companies utilising diesel for transport stand at 37 out of 83, 24 use gasoline and only 4 use LPG.
- The highest number of vehicles used is observed across Wholesale and Retail and Insurance and Financial activities.
- Considerable variations were observed across EUI measures. Depending on the nature of business, different analyses and requests for data may be undertaken for subsequent studies.
 1. Arts, Entertainment and Recreation: The number of conferences in a year, together with the occupancy rate per event would be a good variable for calculation of energy efficiency, which would also cater for building size.
 2. Food Services Activities (excluding accommodation and food production): The number of clients received on a monthly/yearly basis, all meals included, would be a good indicator of energy intensity.
 3. Human health and social work activities: The number of patients, broken down into in-patients, out-patients, the number of patients undergoing operations and using different medical equipment would be a good way to measure efficiency, as all equipment being used are going towards treatment of patients.

G. EUI in the broader economic context

In this section, additional analysis has been undertaken to understand energy efficiency in a broader economic context. Data obtained from the survey was extrapolated on country consumption to determine how usage of electricity and other forms of energy varies across different sectors of activity, when analysed at national level.

The electricity EUI as calculated for respective sub sectors by turnover, has been used as a proxy to estimate the sector energy consumption. This method was applied as the sampling procedure is based on a target number of companies to be surveyed, which will serve as a study group, for a larger population. The population was divided into non-overlapping subpopulations or strata, and independent subsamples are drawn separately from every subpopulation following the systematic sampling procedure and by applying different inclusion probabilities. Given that the aforementioned inclusion probabilities were relatively small and differed across the sub sectors, the extrapolation from the sub sector sample to the population cannot be determined using a defined margin of error and a confidence level.

To determine the sectoral electricity consumption in kWh for the respective segments, the Gross Value Added (GVA¹) for that segment was used. The GVA provides an indication of the contribution of the sector under study to economic growth. Therefore, an analysis of contribution to economic growth and the electricity consumption will be made.

The formulae and assumptions, which have been used, are as follows:

- GVA and Contribution of each sub-sector to GVA were obtained from secondary research.
- The Electricity EUI by unit of turnover has been taken from survey figures.
- The respective sub-sectoral Electricity EUI by unit of turnover were mapped on the GVA to estimate the electricity consumption for each sub-sector as a whole.
- The proportion of the sub-sector contribution to national GVA was applied.
- Sub sectoral Electricity Consumption Estimate (kWh) for a specific sub sector = (Electricity EUI by unit of turnover for Sub sector sample X GVA for the sub sector)

Table 26 Calculation of sub sectoral Electricity consumption estimate

Arts, Recreation and Entertainment	2017	2018
GVA for the sub sector in Rs MUR	14,301,000,000	15,541,000,000
Contribution of sub sector to national GVA	2.6%	2.9%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00000667	
Sub sectoral Electricity Consumption Estimate (kWh)	95,387,670	
Food services activities (Excluding accommodation and food production)	2017	2018
GVA for the sub sector in Rs MUR	4,329,600,000	4,516,050,000
Contribution of sub sector to national GVA	0.8%	0.8%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.000000277849	
Sub sectoral Electricity Consumption Estimate (kWh)	1,202,973	
Human Health and Social work activities	2017	2018
GVA for the sub sector in Rs MUR	17,782,000,000	18,860,000,000
Contribution of sub sector to national GVA	3.3%	3.5%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.000006002259	
Sub sectoral Electricity Consumption Estimate (kWh)	106,732,171	

Education	2017	2018
GVA for the sub sector in Rs MUR	19,575,000,000	20,429,000,000
Contribution of sub sector to national GVA	3.6%	3.8%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00145	1.58
Sub sectoral Electricity Consumption Estimate (kWh)	28,430,254	32,258,073
Wholesale and Retail trade	2017	2018
GVA for the sub sector in Rs MUR	45,844,000,000	48,884,000,000
Contribution of sub sector to national GVA	8.5%	9.0%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00382	3.74
Sub sectoral Electricity Consumption Estimate (kWh)	175,105,338	182,989,733
Information and Communication and Call centres	2017	2018
GVA for the sub sector in Rs MUR	16,989,000,000	17,850,000,000
Contribution of sub sector to national GVA	3.1%	3.3%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00153	2.00
Sub sectoral Electricity Consumption Estimate (kWh)	25,972,604	35,775,111
Storage	2017	2018
GVA for the sub sector in Rs MUR	3848700000	4027650000
Contribution of sub sector to national GVA	0.7%	0.7%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00430	4.42
Sub sectoral Electricity Consumption Estimate (kWh)	16567968.03	17794076
Professional, Scientific and Technical activities	2017	2018
GVA for the sub sector in Rs MUR	19,570,000,000	21,322,000,000
Contribution of sub sector to national GVA	3.6%	3.9%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00028	0.44
Sub sectoral Electricity Consumption Estimate (kWh)	5,516,759	9,298,093
Financial and Insurance activities	2017	2018
GVA for the sub sector in Rs MUR	48,260,000,000	50,710,000,000
Contribution of sub sector to national GVA	8.9%	9.4%
Electricity EUI by unit of turnover- Sub sector sample (kWh/Rs)	0.00086	0.86
Sub sectoral Electricity Consumption Estimate (kWh)	41,516,518	43,702,706
Total estimated Gross Value Added for the economy (MUR)		540,866,000,000
Total estimated Gross Value Added of the services sector to total Gross Value Added in the economy (MUR)		202,139,700,000
Total estimated contribution of the services sector to Gross Value Added in the economy		37.4%
Total estimated electricity consumption by the services sector (kWh)		525,140,607
Total estimated electricity consumption by the services sector (% of country electric consumption)		16.63%
Total estimated electricity consumption by the services sector (% of country energy consumption)		4.60%

Source

- i. Energy Survey undertaken by VERDE on behalf of the Energy Efficiency Management Office
- ii. Statistics Mauritius

Assumptions

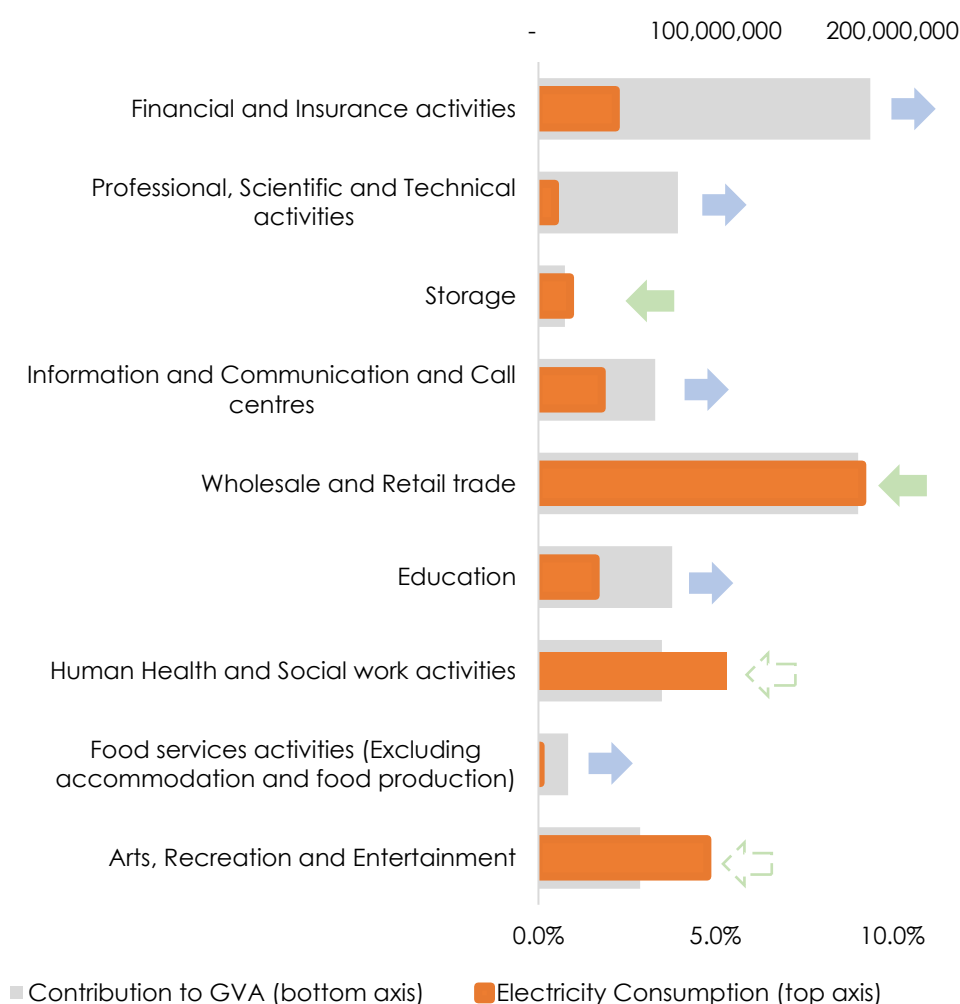
- i. GVA figures have been discounted by 85% for Food Services and Storage as the sub sectors under study exclude accommodation and transport respectively

It is observed from the table above, that the services sector has an estimated 16.7% electricity consumption (as a percentage of country electric consumption) and a 4.6% electricity consumption (as a percentage of country energy consumption).

The chart below depicts the relationship between GVA and estimate of energy consumption across the sub sectors. A green arrow has been used to represent sub sectors which are intensively consuming electricity while their GVA contribution remain low, although some sectors are mostly concerned with well-being (represented in dotted arrow).

Chart 92 – Sub sector contribution to GVA vs Electricity consumption

Sub sector contribution to GVA(%) vs. Electricity Consumption (kWh)



By comparing the sub sector consumption of electricity relative to GVA, energy intensive sectors and less intensive sectors may be tracked, to highlight either a shift towards a more energy-intensive economic structure or a stronger shift to higher-value added services. Based on monetary and economic indicators, care should be taken to the correct interpretation of observed trends. Here, the observations could lead to further analysis to distinguish between the two possible explanations and to

decide on possible policy interventions and issuance of guidelines, e.g. to improve energy efficiency in the energy-intensive industries or to stimulate more high value from sub sectors which have the more potential to contribute to GVA in the economy.

The insights gained can be used to support the discussions surrounding the implementation of new policies and to alleviate some of the concerns of stakeholders (e.g. fears of negative economic impacts on business, in road pricing schemes, of higher appliance prices due to mandatory efficiency standards).

¹Gross value added (GVA) is defined as output (at basic prices) minus intermediate consumption (at purchaser prices); it is the balancing item of the national accounts' production account. The sum of GVA over all industries or sectors plus taxes on products minus subsidies on products gives gross domestic product.

The figures obtained above can be used to provide energy usage per unit of measure across different sub-sectors. Whilst some of these figures are not available at the level of the organisations, further studies to be undertaken may incorporate such elements, which are to be gathered during a specific timeframe to ensure accurate data collection. Organisations will thus need to collect the required data on a monthly data, so that the information may be subsequently utilised for analysis.

Table 27 Data required and ideal measures

Sub-sector	Data that companies may be requested to record on an ongoing basis	Measure to be obtained (per year)
Wholesale and retail trade	The number of people utilising consumer goods of all types. This number is difficult to estimate, given that the same consumer may visit different outlets at different frequencies	The amount of energy required to store, distribute and sell consumer goods to 1 consumer
Storage	The occupancy rate of the storage facility and how it evolves over time	The amount of energy required to store 1 m3 of goods
Food Services Activities (excluding accommodation and food production)	The number of people visiting different food outlets at different times of the day	The amount of energy required to provide an outdoor eating out service to 1 person
Information and communication and call centres	The number of end clients that are being serviced through the call centres and other ICT services	The amount of energy required to provide an outsourcing solution to 1 end customer
Financial and Insurance Activities	The number of primary and secondary clients of all financial services institutions	The amount of energy required to offer access to finance and insurance facilities to 1 person
Professional, scientific and technical activities	The number of clients using a local professional services provider	The amount of energy required to provide professional services to 1 client
Education	The number of students utilising an educational institution. This data is available on the public domain and stands at 287,983 for 2017	The amount of energy required to provide education to 1 student
Human health and social work activities	The number of people visiting different health service providers at different frequencies and/or served through social institutions	The amount of energy required to provide welfare to 1 person
Arts, Entertainment and Recreation	The number of people visiting arts, recreation and entertainment facilities at different frequencies	The amount of energy required to provide entertainment to 1 person

Given that data for the education sector is available, the below provides an example of how much energy is consumed to offer education to 1 student in Mauritius.

Estimated energy (electricity) consumption for the sector (2017): 28,430,254
 Total number of students (2017): 287,983
 EUI - Electricity consumption to provide education to 1 student in 2017: $(28,430,254/287,983)$:
98.7 kWh/student

From a policy perspective, this analysis provides useful information on general policies and their significance in developing guidelines.

Recommendations

1. To make it compulsory to have energy managers in specific companies based on energy consumption and size of company
2. To engage with companies for the implementation of energy efficiency programmes based on consumption and size of company, with particular emphasis on power factor correction
3. To engage with companies and provide technical advice on implementation of renewable energy (solar panels were the most prominent during the data collection period). It is currently quite a lengthy process to get permission for a PV installation by companies or individuals even if it is for the individuals' or companies' own consumption
4. To undertake energy audits and use the information thereof to provide technical advice on energy efficiency
5. To enforce the collection of data relating to energy as a whole and provide companies with standard survey questionnaires to fill periodically
6. To enforce energy efficiency in new buildings by requesting energy efficiency notes in building applications
7. To engage with business leaders in the sector for endorsement on energy efficiency
8. To regularly audit (annual) a sample of companies within sub-sectors and assess their energy efficiency with respect to the sub sector average value, as determined in this report

Enablers

1. Appreciation of business leaders for energy efficiency

The survey showed an enormous disparity among survey respondents in their appreciation and levels of interest in energy efficiency in their organisations. For very few business leaders, the recognition of the economic, social, and environmental benefits of energy efficiency drive/have driven the following:

- Data collection including fault occurrences and record keeping;
- Investment in resources to spend time on energy consumption and maintenance; and
- Funding efforts to improve energy consumption in new projects (for e.g. new buildings and to include solar panels).

The survey results point to serious concerns by the fact that energy efficiency has not sufficiently managed to attract the attention of business leaders. An increased effort from energy efficiency stakeholders and partner institutions in communicating the benefits of energy efficiency as concretely as possible are required.

2. Enforcement

Develop an enforcement mindset for companies to be more participative towards the EEMO's role in promoting awareness for the efficient use of energy as a means to reduce carbon emissions and protect the environment. Survey respondents in general did not know about the EEMO and the

importance of energy efficiency. Likewise, providing data remains a key issue and it is only the element of enforcement which will deter organisations from ignoring energy efficiency requirements.

3. Multi-level involvement and private sector endorsement

Successful energy efficiency policies have to be built upon multilevel involvement of private and public sector, and various stakeholders. In the local context, endorsement of influencers is important so as to create a wave of genuine interest towards the subject. To develop a concept for private sector companies and influencers to embark on nationwide campaigns that will create awareness among business leaders.

4. No energy efficiency concern regarding transport

A main message from the survey is the complete lack of appreciation on energy efficiency in transport. Companies barely have proper records on the expenses relating to transport and have no set procedure in place so as to decrease those costs. An awareness campaign with business leaders is required to have their buy-in on energy efficiency and to tackle transportation costs and the ensuing environmental effects.

5. Building renovation and financing

Another key element was information relating to the buildings which companies utilise and details of those. Most business leaders and maintenance people did not have much information, although they concur that there was no clear thinking towards energy efficiency in the design and building of their premises. Building energy audits could be offered and free advice provided as to how efficiency measures may be adopted.

6. Many other barriers than financing

While recognising the importance of financing and funding for renewable energy and building renovations, many other barriers to energy efficiency remain to be addressed - in the fields of information, awareness raising and training etc. A simplistic approach - thinking that if an energy efficiency investment is economic and access to capital is available, the investment will be made - will in many cases fail due to lack of interest from business leaders towards this thematic.

One instrument to address information barriers are energy advice/energy audit programmes. To consider product-independent energy advice through the setting up of an information desk, accessible to all with required staff.

7. Energy efficiency fund

To consider the setting up of an energy efficiency fund or to make existing funds/programmes more accessible. Organisations were not aware of existing funding schemes that provide businesses with long term, low interest loans supported with professional, independent energy advice for:

- Building renovation
- Building construction
- Implementation of energy saving programmes
- Training and sensitization of staff
- Setting up of renewable energy (specifically solar as many survey respondents were keen on such possibilities but do not have the required information to take an informed decision)

H. Issues faced

The approach was to get into contact with the person who handles energy/facilities. Most companies do not have dedicated personnel to handle energy matters. As such, reaching the concerned person or the one who is most likely to complete the survey proved tedious. The questionnaire was resent by electronic mail to most of the targeted enterprises as they mentioned not having received same or they only remembered having seen the letter somewhere. Accordingly, phone calls were made to all companies and introductory meetings organised. A significant number of companies highlighted that they do not have a specific person looking at energy/facilities and quite often, we were referred to accountants.

In most cases, second meetings and phone calls were planned for fine-tuning. Nonetheless, a number of companies left sections in blank or mentioned that the data is not available.

Most companies expressed difficulties in relation to question 23, section E of the questionnaire.

Difficulties faced

- Most of the companies do not keep records of their electricity data in kWh, kVA, KVAh
- Most of the companies do not keep records of their fuel expenses based on distance travelled
- Many companies used fleet cards and their employees have such benefits, making it impossible to retrieve fuel expenses
- Many companies outsource employee transportation to fleet of taxis, vans and therefore do not have records on fuel expenses and distance travelled
- Companies usually maintained records in terms of overall expenditure on energy without focusing on the intrinsic details behind those costs
- Large organisations have dedicated staff to cater for energy requirements and we were directed to maintenance manager, facilities managers
- Otherwise, company directors and partners handle requests, specifically when it comes from the regulator or a Ministry
- Consistent data for 2015, 2016, 2017 and 2018 were difficult to obtain as responsible persons mention that their predecessors did not keep proper records
- Few companies archived CEB bills
- A number of companies which are tenants do not have any records and we were directed to their syndic or building maintenance officers
- In respect of energy breakdown (question 23, section E), most companies mentioned that it is difficult to answer and they can only provide a best guess – asset registers for energy consuming appliances/machines were requested together with specific details
- Most companies stated that details relating to generators were not available as they are maintained by another service provider – it was also mentioned that power-cuts have been very rare and therefore they do not have any records of those
- Renewable energy was not used by most of the companies, although they expressed a keen interest to be able to use such forms of energy in the future, under the proviso that their expenses on energy are decreased over time
- Restaurants specifically have been difficult to deal with, refusing to participate – mentions of fines were made and they expressed a willingness to pay fines so as not to reveal any information on their business activities

I. Data robustness and Quality Assurance

Quality control measures for the survey were undertaken at different levels of the survey. The levels include:

1. Designing of Data Collection Instruments
2. Development of Fieldwork Training Manual
3. Training of survey personnel;
4. Pre-test and pilot survey;
5. Data collection
6. Management of non-response and;
7. Data processing.

1. Development of Data Collection Instruments

The use of properly designed survey instruments that addresses information needs and expectations of the Client is fundamental to the collection of quality data. In order to address diversity in the operations of manufacturing and retail/services enterprises, the survey instruments entail the core questionnaire plus sub-sector questions. Questions in the questionnaire are worded in such a way that they are easily understood by interviewees and they seek information that responds to the needs of the Client. The survey instruments are designed in a way that reduces bias that may be induced by mis-interpretation of some questions.

2. Development of Fieldwork Training Manual

The training manual was used by supervisors and research assistants for reference during data collection. The manual gives guidance to area supervisors and research assistants on what is expected of them during data collection and on issues that are of importance in collecting quality data. These include duties of area supervisors and research assistants, code of conduct, the relationship between research assistants and supervisors, research ethics, important considerations when conducting interviews, and fundamentals of conducting interviews. The manual also explains the structure of the survey questionnaire, types of questions and how to record responses. In addition, it explains how to navigate through the questionnaire, gives instructions and explanations that make area supervisors and research assistants have a better understanding of questions in the survey.

3. Training of Survey Personnel

Training of supervisors, research assistants and data clerks, on the data collection process, good practices in interviewing, survey instruments and the data entry form, is imperative to ensure quality data. All survey personnel are trained and provided with manuals describing what is expected of them in their respective tasks of data collection and capturing. The aim of the training is to ensure that all research assistants understand the survey instruments thoroughly, and ask questions in a manner that will convey the same message to respondents. Data collection personnel were trained on procedures of collecting data, interview techniques, proper recording of responses, and management of risks and challenges that may emerge during data collection. The training was conducted by partners of VERDE and the consulting engineer. The training included, but was not limited to, the following: (i) description of the survey to the research assistants and potential supervisors; (ii) description of the survey instruments; and (iii) role play - where trainees used questionnaires to rehearse interviews by interviewing each other.

4. Pre- test and Pilot Survey

One way of ensuring quality of data, to be collected during the main survey, is to pre-test survey instruments in the field and to undertake a pilot survey. The core questionnaire plus sub-sectoral modules have been pre-tested in the field. The pre-test helped to establish whether questions are properly worded, clear enough to be easily understood by respondents and to find out if the sequence

of questions is logical. This was helpful in assessing fieldwork logistics, survey instruments and competence of research assistants in administering questionnaires. The pilot survey helped to detect biases due to interviewers so that they can be corrected at this stage before the commencement of the main data collection. This will give all research assistants the required experience of conducting interviews with enterprises prior to the commencement of data collection for the main survey. The experience will help them have a better understanding of the questionnaires and get used to conducting interviews.

5. Data Collection

As part of the field quality control program, a follow-up system where supervisors will follow up to ensure that data is being collected was put in place. The monitored progress of each organisation and took remedial action where necessary. This was essential since it is common for a filled questionnaire to have technical errors despite the fact that information was available. Supervisors then discussed the identified errors and misconceptions with the team at the end of every interview day so that they can be corrected at the early stage of data collection through follow up. Post-checking or re-interviews were undertaken where inconsistencies and irregularities were identified. A control sheet was used to record interviewed enterprises and non-responses. It classified enterprises that fell under partial and full non-response categories.

Completed questionnaires went through different levels of quality checks by research assistants, supervisors and data clerks. At the end of every working day of data collection period, research assistants went through filled questionnaires to check for missing information, inconsistencies, and that markings and/or handwriting are legible where scanned copies have been received. Thereafter, supervisors checked questionnaires on their own, to ensure that they were filled out in accordance with instructions, and responses were legible, clear and consistent, before they were captured for further analysis.

If supervisors discovered questionnaires with missing information or they were not consistent with the way some of the responses have been recorded, such questionnaires were kept separately for further follow up with the interviewees.

6. Management of Non-response

Non-responses emanating from refusals and unwillingness of respondents to cooperate can compromise completeness and quality of data. The rate of non-response resulting from refusals are reduced by, providing guarantees of anonymity of enterprises to ensure confidentiality and increasing motivation of respondents to co-operate through arousal of respondents' interest with appealing opening remarks and questions. Supervisors and additional resources were used for call backs and constant follow ups to ensure that data is being collected in a consistent manner, and to assist organisations in any queries that they may have. Call backs were also used for cases where respondents were away from the premises of enterprises in the first attempt to schedule an interview.

9. Data Processing

The energy expert ensured that the data was correct and comparative to other similar organisations. The system design for data capture also helped in reducing incidences of key-in errors when scanned copies have been received and data was being input manually. The resultant database was cleaned and mined. In the case where data clerks failed to make sense of the recorded responses during data capturing, or data entry programs detect errors, the problematic questionnaires were returned to supervisors who liaised with the interviewees for clarification and/or correction.

J. Ending notes and Disclaimers

This document reports on findings from an energy survey undertaken across different sub-sectors of the services sector, on behalf of the Energy Efficiency Management Office. We gratefully acknowledge the contributions of all of respondents, who provide invaluable data, upon which this report is prepared.

This report has been written in general terms and therefore cannot be relied upon to cover specific situations; application of the principles set out will depend on the particular circumstances involved and we recommend that professional advice is sought before acting or on any of the contents of this publication. VERDE would be pleased to advise on how to apply principles set out in this report to specific circumstances. VERDE accepts no duty of care or liability for any loss occasioned to any person or institution acting or refraining from action as a result of any material in this report.

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VERDE
Suite 024, Rue de la Democratie
Ebene Junction
Ebene
T: 454 9491
E: info@verdefrontier.mu