2017 SECTOR ENERGY CONSUMPTION REPORT

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Mission: To coordinate the National Statistical System (NSS) and produce accurate, timely and reliable culturally relevant and internationally comparable statistical data for evidence-based planning, decision making, research, policy, program formulation and monitoring and evaluation to satisfy the needs of users and producers.

MISSION STATEMENT OF THE BUREAU OF STATISTICS

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Table of Contents

List of Figures vii
List of Tables x
PREFACE xvi
CHAPTER 1: SURVEY DESIGN 1
1.0 Introduction 1
1.1 Sample Design 1
1.2 Sample Size 1
1.3 Trainings 1
1.4 Fieldwork 2
1.5 Challenges 2
CHAPTER 2: HEALTH SECTOR 3
2.0 Introduction 3
2.1 Results 3
2.1.1 Employment 3
2.1.2 Operation Days and Hours 4
2.1.3 Building Structures 6
2.1.3.1 Usable Area 6
2.1.3.2 Insulation of Buildings 6
2.1.3.3 Heated and Cooled Area 7
2.1.4 Kitchen Appliances 7
2.1.4.1 Ownership of Appliances 8
2.1.5 Petroleum Products 8
2.1.6 Hard Coal 9
2.1.6.1 Quantities of Hard Coal 9
2.1.7 Renewables 10
2.1.8 Solar Photovoltaic (PV) 11
2.1.9 Petroleum Products 12
2.1.10 Grid Electricity 13
2.1.10.1 Institutions Electricity Usage 14
2.1.11 Generators 15
2.1.11.1 Electricity Generated by Generators 16

2.1.12 Heating and Cooling System 16
2.1.13 Motion and Light Sensors 17
2.1.14 Diagnostic Equipment 19
2.1.15 Sterilization Medical Equipment 19
2.1.16 Refrigeration 20
2.1.17 Solar Water Heating Systems (SWH) 21
CHAPTER 3: ACCOMMODATION AND FOOD SERVICES SECTOR 23
3.0 Introduction 23
3.1 Type of Establishment 24
3.2 Permanent and Temporary Employment 24
3.2.1 Permanent employees 25
3.2.2 Temporary employees 25
3.3 Hard Coal 26
3.3.1 Main Use of Hard Coal 26
3.3.2 General use of Hard Coal 26
3.4 Biofuels 27
3.4.1 Biofuels in Establishment 27
3.4.2 Biofuels and District 28
3.4.3 Amount paid for Biofuels 29
3.5 Solar Electricity 29
3.6 Grid Electricity 30
3.7 Petroleum Products 30
3.7.1 Petroleum for Operations 31
3.7.2 Petroleum for Transportation 31
3.7.2.1 Fuel Used 31
3.8 Days of Operation per Week 32
3.9 Independent Heating and Cooling Systems 33
3.9.1 Electricity Consumption of Independent Systems 34
3.10 Lighting 35
3.10.1 Light Bulbs 37
3.10.2 Electricity Consumption of Bulbs 37
3.11 Laundry Equipment 38

3.11.1 Average Age of Laundry Equipment 39
3.11.2 Electricity Consumption of Laundry Equipment 40
3.12 Kitchen Equipment and Appliances 40
3.12.1 Average Age of Kitchen Equipment 41
3.12.2 Electricity Consumption of Kitchen Equipment.....42
3.13 Small Equipment 42
3.13.1 Average Age of Small Equipment.....43
3.13.2 Electricity Consumption of Small Equipment.....44
3.14 Cooking Facilities.....44
3.14.1 Main Fuel Used for Cooking.....45
3.15 Refrigeration Equipment 46
3.16 Water Heating.....46
3.16.1 Water Heating Equipment.....47
3.17 Generator 48
CHAPTER 4: AGRICULTURE SECTOR.....49
4.0 Introduction.....49
4.1 Economic Activity 49
4.2 Ownership of Facilities.....50
4.3 Renewables and Waste 51
4.4 Solar Photovoltaic (PV) 52
4.5 Grid Electricity 53
4.5.1 Main Uses of Electricity 55
4.6 Conventional Energies 56
4.7 Petroleum Products 58
4.8 Lubricants 60
4.9 Agriculture Operation 61
4.9.1 Working Hours 62
4.9.2 Buildings Occupied.....62
4.10 Independent Systems.....63
4.11 Control Sensors 64
4.12 Greenhouses.....66
4.13 Greenhouse with Installed Energy Equipment 66

4.14 Generators 67
4.14.1 Uses of Generators 68
4.15 Transport 69
4.16 Machinery in Crop Production 69
4.16.1 Mechanized Area 70
4.17 Breeding Area 71
CHAPTER 5: GOVERNMENT SECTOR 73
5.0 Introduction 73
5.1 Government Employees 73
5.2 Electricity Generation 74
5.3 Hard Coal Usage 76
5.4 Renewables and Waste 78
5.5 Grid Electricity 78
5.6 Occupancy 80
5.6.1 Days of Operation 80
5.7 Usable area 81
5.8 Central Heating/Cooling System 82
5.9 Independent Heating/Cooling System 84
5.10 Lighting 86
5.11 Office Equipment 87
5.12 Household Appliances 88
5.13 Cooking Facilities 89
5.14 Refrigeration 90
5.15 Generators 91
5.16 Freight Transport 92
CHAPTER 6: EDUCATION 94
6.0 Introduction 94
6.1 Ownership of Institutions 94
6.2 Employment 95
6.3 Enrolment 96
6.4 Hard Coal 97
6.5 Renewables and Waste 98

6.6 Solar Photovoltaic (PV) 100
6.7 Electricity 102
6.7.1 Grid electricity access 102
6.7.2 Electricity Consumption 104
6.8. Petroleum Products 104
6.8.1 Petroleum sub-sector 105
6.8.2 Lubricants 107
6.9 Building Characteristics 108
6.9.1 Insulation 108
6.9.2 Area Heated and Cooled 109
6.10 Central Heating or Cooling System 110
6.11 Independent Heating or Cooling Systems 111
6.12 Lighting (Grid Electricity) 114
6.12.1 Light Sensors 114
6.12.2 Motion Sensor 115
6.12.3 Light Bulb 116
6.12.4 Energy Consumed 117
6.13 Lighting (Solar Electricity) 117
6.13.1 Motion Sensor 117
6.14 Office Equipment 119
6.15 Household Appliances 121
6.15.1 Electricity Consumption 121
6.16 Cooking facilities 122
6.16.1 Fuel Used for Cooking 123
6.17 Refrigeration 124
6.18 Solar Water Heating 126
6.18.1 Solar Electricity 126
6.19 Generators 126
6.19.1 Generator Electricity 127
6.20 Transport 127
6.21 Additional Information 128
6.21.1 Upgrade 129

6.21.2 Constraints 130
References 131
ANNEX 134

List of Figures

Figure 2.1: Percentage Distribution of Insulated Buildings – 2017 SECS 7
Figure 2.2: Percentage Distribution of Institutions using Hard Coal by Type – 2017 SECS 9
Figure 2.3: Number of Institutions using Refrigeration Equipment – 2017 SECS. 21
Figure 2.4: Number of Institutions with Solar Water Heating Systems – 2017 SECS. 22
Figure 3.1: Amount Paid (Maloti) by Type of Establishment and Biofuels – 2017 SECS 29
Figure 3.2: Quantity of Unleaded Petrol (litres) Used for Operations by Type of Establishment – 2017 SECS 31
Figure 3.3: Quantity of Fuel Type Used (litres) and Type of Establishment – 2017 SECS 32
Figure 3.4: Percentage Distribution of Establishments using Independent Systems – 2017 SECS 34
Figure 3.5: Percentage Distribution of Type of Establishments using Light Sensor – 2017 SECS 36
Figure 3.6: Percentage Distribution of Type of Establishment Using Motion Sensor – 2017 SECS 36
Figure 3.7: Electricity Consumption (kWh) for Lighting by Type of Bulb – 2017 SECS 38
Figure 3.8: Percentage Distribution of Type of Establishment Using Laundry Equipment – 2017 SECS 39
Figure 3.9: Electricity Consumption (kWh) by Type of Laundry Equipment – 2017 SECS 40
Figure 3.10: Percentage Distribution of Establishment Using Small Equipment – 2017 SECS 43
Figure 3.11: Electricity Consumption (kWh) of Small Equipment by Type – 2017 SECS 44
Figure 3.12: Percentage Distribution of Establishments with Cooking Facilities – 2017 SECS 45
Figure 3.13: Percentage Distribution of Establishment by Main Fuel Used for Cooking – 2017 SECS 45
Figure 3.14: Percentage Distributions of Type of Establishment by Refrigeration Equipment – 2017 SECS 46
Figure 3.15: Percentage Distribution of Establishments Using Water Heating Equipment- 2017 SECS 47
Figure 4.1: Percentage Distribution of Agriculture Facilities by Economic Activity - 2017 SECS 49
Figure 4.2: Percentage Distribution of Facilities by Ecological Zone and Use of Renewables and Waste - 2017 SECS 51
Figure 4.3: Percentage Distribution of Facilities by Use of Grid Electricity and District - 2017 SECS 54
Figure 4.4: Percentage Distribution of Facilities Using Lubricants by Zone – 2017 SECS 60
Figure 4.5: Percentage Distribution of Facilities by Independent Systems - 2017 SECS..... 63
Figure 4.6: Percentage Distribution of Facilities by Type of Bulbs used for Lighting - 2017 SECS 65
Figure 4.7: Percentage Share of Agricultural Establishments with Greenhouse – 2017 SECS . 66
Figure 4.8: Percentage Distribution of Agricultural Establishments with Installed Energy Equipment – 2017 SECS 67
Figure 4.9: Percentage Share of Agricultural Establishments Using a Generator – 2017 SECS 67
Figure 4.10: Percentage Distribution of Uses of a Generator – 2017 SECS 68
Figure 4.11: Percentage Distribution of Agricultural Establishments using Agricultural Machines for Crop Production – 2017 SECS 70
Figure 4.12: Percentage Distribution of Mechanized Area – 2017 SECS 71
Figure 4.13: Percentage Distribution of Heated and Lighted Breeding Area – 2017 SECS 71

Figure 5.1: Percentage Distribution of Departments by Ownership of Backup Source – 2017 SECS 74
Figure 5.2: Percentage Distribution of Departments by Electricity Generated (kWh) Using Backup with Data Loggers – 2017 SECS 75
Figure 5.3: Percentage Distribution of Departments by Electricity (kWh) Generated Using Backup Source Without Data Loggers – 2017 SECS 75
Figure 5.4: Percentage Distribution of Departments by Hard Coal Usage – 2017 SECS 76
Figure 5.5: Percentage Distribution of Departments/Ministries by Type of Hard Coal – 2017 SECS 77
Figure 5.6: Percentage Distribution of Departments by Type of Hard Coal and Main Use – 2017 SECS 77
Figure 5.7: Percentage Share of Departments by Days of Operation per Week - 2017 SECS ... 80
Figure 5.8: Percentage Distribution of Departments by Hours of Operation per Day – 2017 SECS 81
Figure 5.9: Usable Area (m^2) of Buildings - 2017 SECS 82
Figure 5.10: Percentage Distribution of Departments by Use of Central Heating or Cooling System - 2017 SECS 83
Figure 5.11: Percentage Distribution of Departments by Use of Independent Heating or Cooling Systems - 2017 SECS 84
Figure 5.12: Percentage Distribution of Departments by Type of Independent Heating/ Cooling System Used - 2017 SECS 85
Figure 5.13: Percentage Distribution of Departments with Light Sensors and Motion Sensors - 2017 SECS 86
Figure 5.14: Quantity of Electricity (kWh) Used for Lighting by Type of Bulb - 2017 SECS 87
Figure 5.15: Percentage Distribution of Office Equipment by Type- 2017 SECS 88
Figure 5.16: Percentage Distribution of Household Appliances by Type – 2017 SECS..... 89
Figure 5.17: Percentage Distribution of Government Institutions by Type of Fuel Used in Cooking Facilities – 2017 SECS 90
Figure 5.18: Percentage Distribution of Government Institutions with Refrigeration – 2017 SECS 91
Figure 5.19: Percentage distribution of Government Institutions with Generators – 2017 SECS, ... 92
Figure 5.20: Quantity (litres) of Fuel by Type of Vehicle – 2017 SECS 93
Figure 6.1: Percentage Distribution of Higher Learning Institutions using Renewables and Wastes – 2017 SECS 99
Figure 6.2: Number of Solar Panels Used in Below Tertiary Institutions..... 102
Figure 6.3: Number of Solar Panels Used in Higher Learning Institutions 102
Figure 6.4: Percentage Share of Higher Learning Institutions Connected to Grid Electricity - 2017 SECS 103
Figure 6.5: Percentage Distribution of Higher Learning Institutions Using Petroleum Products – 2017 SECS. 106
Figure 6.6: Percentage Distribution of Higher Learning Institutions Using Lubricants – 2017 SECS 107
Figure 6.7: Percentage Distribution of Higher Learning Institutions Using Central Heating or Cooling System – 2017 SECS 111
Figure 6.8: Percentage Distribution of Below Tertiary Institutions With motion -2017 SECS. 115
Figure 6.9: Percentage Distribution of Higher Learning Institutions With Motion Sensors – 2017 SECS 116

Figure 6.10: Percentage Distribution of Office Equipment by Type in Below Tertiary Institutions – 2017 SECS 119
Figure 6.11: Percentage Distribution of Office Equipment by Type in Higher Learning Institutions – 2017 SECS 120
Figure 6.12: Percentage Distribution of Higher Learning Institutions with Cooking Facilities – 2017 SECS 123
Figure 6.13: Percentage Distribution of Below Tertiary Institutions with Refrigeration Equipment for Food – 2017 SECS 124
Figure 6.14: Percentage Distribution of Higher Learning Institutions With Refrigeration Equipment for Food – 2017 SECS 125
Figure 6.15: Percentage Distribution of Higher Learning Institutions Using Official or Passenger Vehicles – 2017 SECS 128

List of Tables

Table 2.1: Percentage Distribution of Employees by Institution and Sex – 2017 SECS..... 4
Table 2.2: Percentage Distribution of Institution by Operation Days per Week – 2017 SECS 4
Table 2.3: Percentage Distribution of Institutions by Operation Hours per weekday – 2017 SECS..... 5
Table 2.4: Percentage Distribution of Institutions by Operation Hours during Weekends – 2017 SECS 5
Table 2.5: Percentage Distribution of Institutions by Building Structure Occupied – 2017 SECS 6
Table 2.6: Percentage Distribution of Institutions by Type and Usable Area (m^2) – 2017 SECS . 6
Table 2.7: Percentage Distribution of Institutions by Heated and Cooled Area (m^2) – 2017 SECS 7
Table 2.8: Percentage Distribution of Electrical Appliances used by District – 2017 SECS..... 8
Table 2.9: Percentage Distribution of Ownership of Appliances by Type of Institution – 2017 SECS..... 8
Table 2.10: Quantity of Petroleum Product Used in litre by Type of Institution-2017..... 9
Table 2.11: Quantity (kg) of Hard Coal and Energy Emitted (GJ) by Type of Institution – 2017 SECS..... 10
Table 2.12: Number of Institutions using Renewables by Districts – 2017 SECS..... 10
Table 2.13: Percentage Distribution of the Number of Solar Panels by Health Centre – 2017 SECS..... 11
Table 2.14: Electricity Generated (kWh) by Solar Panels and Districts – 2017 SECS 11
Table 2.15: Amount Paid for Lubricants by Type of Institution – 2017 SECS 12
Table 2.16: Quantity of Petroleum Products used for Operation by Type and Institution – 2017 SECS..... 12
Table 2.17: Amount Paid by Type of Petroleum Products and Type of Institution – 2017 SECS13
Table 2.18: Percentage Distribution of Institutions Connected to Grid Electricity by District – 2017 SECS 13
Table 2.19: Type of Institution by Amount paid and Electricity (kWh) used – 2017 SECS 14
Table 2.20: Percentage Distribution of Institutions Connected to Grid by Main Use of Electricity – 2017 SECS..... 14
Table 2.21: Type of Institution by Main Use and Electricity (kWh) Consumed – 2017 SECS ... 15
Table 2.22: Percentage Distribution of Institutions by Main Use of Generators – 2017 SECS.. 15
Table 2.23: Quantity of Fuel used by Type and Type of Institution – 2017 SECS..... 16
Table 2.24: Electricity Generated by Generators by Type of Institution and Usage – 2017 SECS 16
Table 2.25: Percentage Distribution of Institutions using Independent Heating or Cooling System – 2017 SECS..... 17
Table 2.26: Quantity of Electricity and Other Fuels Consumed by Type of System – 2017 SECS 17
Table 2. 27: Percentage Distribution of Institutions with Motion and Light Sensors – 2017 SECS..... 18
Table 2.28: Number of Bulbs and Quantity of Electricity (kWh) Consumed by Type of Bulb – 2017 SECS 18
Table 2.29: Number of Bulbs and Electricity (kWh) Consumed by Type of Bulb – 2017 SECS. 18
Table 2.30: Percentage Distribution of Institutions using Diagnostic Equipment – 2017 SECS19

Table 2.31: Percentage Distribution of Institutions by Type of Diagnostic Equipment and Average Minutes Used per day – 2017 SECS 19
Table 2.32: Percentage Distribution of Institutions using Sterilization Equipment – 2017 SECS 20
Table 2.33: Percentage Distribution of Sterilization Equipment by Type and Average Minutes of use per day – 2017 SECS 20
Table 2.34: Electricity (kWh) Consumed by Type of Refrigeration and Cold Room Equipment – 2017 SECS 21
Table 3.1: Percentage Distribution of Establishments by Type – 2017 SECS 24
Table 3.2: Percentage Distribution of Permanent Employees by Type of Establishment and Sex – 2017 SECS 25
Table 3.3: Percentage Distribution of Temporary Employees by Type of Establishments and Sex – 2017 SECS 26
Table 3.4: Energy (GJ) and Quantity (Kg) of Hard Coal Used by Type and Main Use – 2017 SECS 26
Table 3.5: Energy (GJ) and Quantity (kg) of Hard Coal Used by Type of Establishments – 2017 SECS 27
Table 3.6: Energy (GJ) and Quantity (kg) of Biofuels Used by Type of Establishment – 2017 SECS 28
Table 3.7: Energy (GJ) and Quantity of Biofuels Used (kg) by Type and District – 2017 SECS 28
Table 3.8: Electricity Generated (kWh) Through Solar Panels by Type of Establishment and Main Use – 2017 SECS 30
Table 3.9: Percentage Distribution of Establishments by Type and Electricity Acquisition – 2017 SECS 30
Table 3.10: Percentage Distribution of Establishments by Days of Operation per Week – 2017 SECS 33
Table 3.11: Energy (TJ) and Electricity (kWh) consumed for Heating and Cooling by Type of System – 2017 SECS 35
Table 3.12: Energy (GJ) used for Heating by Type of System – 2017 SECS 35
Table 3.13: Percentage Distribution of Establishments by Type of Bulb – 2017 SECS 37
Table 3.14: Energy (MJ) used for lighting using Other Forms of Lighting by Type of Lamp – 2017 SECS 38
Table 3.15: Percentage Distribution of Establishment by Type of Laundry Equipment and Average Age – 2017 SECS 39
Table 3.16: Percentage Distribution of Type of Establishment Using Kitchen Equipment – 2017 SECS 41
Table 3.17: Percentage Distribution of Kitchen Equipment by Type and Average Age – 2017 SECS 41
Table 3.18: Energy (GJ) and Electricity (kWh) Consumed by Type of Kitchen Equipment – 2017 SECS 42
Table 3.19: Percentage Distribution of Establishments by Type of Equipment and Average Age – 2017 SECS 43
Table 3.20: Percentage Distribution of Establishments Using Water Heating Equipment by District – 2017 SECS 47
Table 4.1: Percentage Distribution of Facilities by Ecological Zone and Ownership - 2017 SECS 50
Table 4.2: Percentage Share of Facilities by Ownership and Economic Activity - 2017 SECS .. 50

Table 4.3: Percentage Distribution of Facilities by Type of Renewables and Waste and Main Use – 2017 SECS 52
Table 4.4: Quantity and Energy of Renewable and Wastes used by Type and Ecological Zones - 2017 SECS 52
Table 4.5: Percentage Distribution of Facilities by Ownership and Use of Solar (PV)- 2017 SECS 53
Table 4.6: Quantity of Electricity Generated (kWh) by Main Use of Solar (PV) - 2017 SECS 53
Table 4.7: Percentage Distribution of Facilities by Amount Paid and Economic Activity - 2017 SECS 54
Table 4.8: Percentage Distribution of Facilities by Use of Grid Electricity and Solar PV – 2017 SECS 55
Table 4.9: Quantity of Grid Electricity (kWh) Used by Ownership - 2017 SECS 55
Table 4.10: Grid Electricity (kWh) Used by Ownership and Main Use - 2017 SECS 56
Table 4.11: Percentage Share of Facilities by Use of Conventional Energies and Economic Activity – 2017 SECS 56
Table 4.12: Percentage Distribution of Facilities by Type of Conventional Energies and Main Use – 2017 SECS 57
Table 4.13: Quantity and Energy of Conventional Energies Used by Type and Economic Activity - 2017 SECS 57
Table 4.14: Percentage Distribution of Facilities by Amount Paid (M) and Type of Conventional Energies - 2017 SECS 58
Table 4.15: Percentage Distribution of Facilities by Economic Activity and Type of Petroleum Product Used - 2017 SECS 58
Table 4.16: Percentage Distribution of Facilities by Type of Petroleum Product and Main Use - 2017 SECS 59
Table 4.17: Percentage Distribution of Facilities by Ownership and Type of Petroleum Product Used - 2017 SECS 59
Table 4.18: Quantity of Lubricants Used for Operation and Transportation by Type - 2017 SECS 61
Table 4.19: Percentage Distribution of Facilities by Economic Activity and Days of Operation per week - 2017 SECS 61
Table 4.20: Percentage Distribution of Facilities by Hours of Operation per day - 2017 SECS 62
Table 4.21: Percentage Distribution of Facilities by Number of Buildings Occupied and Economic Activity – 2017 SECS 63
Table 4.22: Percentage Distribution of Facilities by Type of Independent Systems/Appliance - 2017 SECS 64
Table 4.23: Total Quantity of Fuel consumed by Type of Independent System - 2017 SECS ... 64
Table 4.24: Percentage Distribution of Facilities by Light and Motion Sensor Controls - 2017 SECS 65
Table 4.25: Quantity (L) of Fuel Used in Generator and Agricultural Use - 2017 SECS 69
Table 4.26: Quantity (L) used by Vehicle Type and Fuel Type for Agricultural Purposes - 2017 SECS 69
Table 4.27: Agricultural Equipment by Type and Quantity (kWh and litres) by Type – 2017 SECS 72
Table 5.1: Percentage Distribution of Employees by Type of Employment and Sex-2017 SECS73
Table 5.2: Percentage Distribution of Departments by Type of Renewables and Waste – 2017 SECS 78
Table 5.3: Quantity, Cost and Energy of Renewables by Type and Main Use – 2017 SECS 78

Table 5.4: Percentage Distribution of Departments by Use of Grid Electricity – 2017 SECS 79
Table 5.5: Percentage Distribution of Departments by Connection and Main Use – 2017 SECS 79
Table 5.6: Quantity (kWh) and Cost (M) of electricity by main use – 2017 SECS..... 79
Table 5.7: Total Area (m^2) Occupied by Buildings and Insulation – 2017 SECS 81
Table 5.8: Number of Annual Hours and Quantity of Electricity Used by Type of Central Heating or Cooling System and Use - 2017 SECS..... 83
Table 5.9: Quantity and Energy used by Type of Independent Heating/Cooling System and Use – 2017 SECS..... 85
Table 5.10: Quantity and Energy Used by Type of Independent Heating System – 2017 SECS 86
Table 5.11: Number of Bulbs and Average Hours Switched On per Day for Lighting by Type - 2017 SECS 87
Table 5.12: Type of Office Equipment by Electricity Consumption (kWh) – 2017 SECS..... 88
Table 5.13: Type of Household Appliances by Electricity Consumption (kWh) – 2017 SECS.... 89
Table 5.14: Percentage Distribution of Government Institutions by Ownership and Usage of Cooking Facility – 2017 SECS 90
Table 5.15: Type of Refrigeration by Number and Electricity Consumption (kWh) – 2017 SECS 91
Table 5.16: Main use of Generators by Electricity Generated (kWh) – 2017 SECS 92
Table 5.17: Type of Fuel by Quantity (litres) – 2017 SECS 93
Table 6.1 : Percentage Distribution of Type of Below Tertiary Institutions by Category 2017 SECS.....94
Table 6.2: Percentage Distribution of Type of Higher Learning Institutions by Category – 2017 SECS 95
Table 6.3: Percentage Distribution of Type of Employees by Sex and Below Tertiary Institution – 2017 SECS 95
Table 6.4 : Percentage Distribution of Type of Employees by Sex and Higher Learning Institutions – 2017 SECS 96
Table 6.5: Number of Students by Sex and Category in Below Tertiary Institutions..... 96
Table 6.6: Number of Students by Sex and Category in Higher Learning Institutions 97
Table 6.7: Percentage Distribution of Type of Hard Coal by Main Use in Below Tertiary..... 97
Table 6.8: Percentage Distribution of Hard Coal by Type and Main Use in Higher 98
Table 6.9: Percentage Distribution of High Learning Institutions Using Hard Coal by..... 98
Table 6.10: Quantity (kg) of Hard Coal Used in Below Tertiary Institutions by Type 98
Table 6.11: Percentage Distribution of Institutions using Renewables and Wastes by..... 99
Table 6.12: Quantity (kg) of Renewables and Waste Used in Below Tertiary Institutions..... 100
Table 6.13: Amount (Maloti) Spent on Renewables and Waste in Below Tertiary 100
Table 6.14: Percentage Distribution of Renewables and Waste Use by Type of Higher..... 100
Table 6.15: Percentage Distributions of Below Tertiary Institutions Using Solar PV by Type – 2017 SECS 101
Table 6.16: Percentage distributions of Higher Learning Institutions Using Solar PV by Type – 2017 SECS 101
Table 6.17: Percentage Distribution of Below Tertiary Institutions Connected to Grid Electricity by Districts - 2017 SECS 103
Table 6.18: Quantity (kWh) of Electricity Consumed in Institutions by Main Use 104
Table 6.19: Amount (kWh) of Electricity Consumed in Below Tertiary by Main Use 104
Table 6.20: Percentage Distribution of Below Tertiary Institutions Using Petroleum Products by District – 2017 SECS. 105

Table 6.21: Quantity of Petroleum Products Used for Operation by Type in Below Tertiary Institutions 106
Table 6.22 : Quantity of Petroleum Products Used for Operation by Type in Higher Learning Institutions 106
Table 6.23: Quantity of Lubricants in Below Tertiary Institutions Used for Transport by Category Type – 2017 SECS 107
Table 6.24: Quantity of Lubricants in Higher Learning Institutions Used for Transport by Type – 2017 SECS 108
Table 6.25: Quantity of Lubricants in Below Tertiary Institutions Used for Operation by Category Type – 2017 SECS 108
Table 6.26: Percentage Distribution of Below Tertiary Institutions Insulated by Category Type – 2017 SECS 109
Table 6.27: Percentage Distribution of Higher Learning Institutions Insulated by Category Type – 2017 SECS 109
Table 6.28: Total Area (m^2) Occupied, Heated and Cooled in Higher Learning Institutions by Category Type 110
Table 6.29 : Quantity of Electricity (kWh) Consumed by Central Heating and Cooling Systems in Higher Learning Institutions by Type – 2017 SECS 110
Table 6.30: Percentage Distribution of Higher Learning Institutions Using Independent Heating or Cooling System by Type – 2017 SECS 111
Table 6.31: Percentage Distribution of Below Tertiary Institutions Using Independent Heating or Cooling System by Type – 2017 SECS 112
Table 6.32: Percentage Distribution of Higher Learning Institutions Using Independent Heating or Cooling System by Type and Energy Source -2017 SECS 112
Table 6.33: Percentage Share of Below Tertiary Institutions Using Independent Heating or Cooling System by Type and Energy Source – 2017 SECS 113
Table 6. 34: Quantity of Energy Consumed in Higher Learning Institutions by Type of Heating or Cooling System – 2017 SECS 113
Table 6.35: Quantity of Energy Consumed in Below Tertiary Institutions by Type of Heating or Cooling System - 2017 SECS 114
Table 6. 36: Percentage Distribution of Below Tertiary Institutions with Light Sensors – 2017 SECS 115
Table 6.37: Percentage Distribution of Higher Learning Institutions With Light Sensors 115
Table 6.38: PPercentage Distribution of Type of Bulbs Used in Below Tertiary Institutions – 2017 SECS 116
Table 6.39: Percentage Distribution of Light Bulbs Used by Type in Higher Learning Institutions – 2017 SECS 117
Table 6.40: Amount of Electricity (kWh) Consumed by Type of Light Bulbs in Higher Learning Institutions by District – 2017 SECS 117
Table 6. 41 Table 6.41: Percentage Distribution of Below Tertiary Institutions with Light and Motion Sensors – 2017 SECS 118
Table 6. 42: Percentage Distribution of Light Bulbs Used by Type in Below Tertiary Institutions – 2017 SECS 118
Table 6.43: Amount of Electricity (kWh) Consumed by Type of Light Bulb in Below Tertiary Institutions – 2017 SECS. 119
Table 6. 44: Electricity (kWh) Consumed by Type of Office Equipment in Below Tertiary Institutions – 2017 SECS 120

Table 6.45: Electricity (kWh) Consumed by Type of Office Equipment in Higher Learning Institutions – 2017 SECS 121
Table 6.46: Amount of Electricity (kWh) Consumed by Type of Household Appliances in Below Tertiary Institutions – 2017 SECS 121
Table 6.47: Amount of Electricity (kWh) Consumed by Type of Household Appliances in Higher Learning Institutions – 2017 SECS 122
Table 6.48: Percentage Distribution of Below Tertiary Institutions by Type With Cooking Facilities – 2017 SECS 122
Table 6.49: Percentage Distribution of Below Tertiary Institutions by Type and Main Fuel Used for Cooking – 2017 SECS 123
Table 6. 50: Percentage Distribution of Higher Learning Institutions by Type and Main Fuel Used for Cooking – 2017 SECS 124
Table 6.51: Amount of Electricity (kWh) Consumed by Type of Refrigeration in Below Tertiary Institutions – 2017 SECS` 125
Table 6.52: Amount of Electricity (kWh) Consumed by Type of Refrigeration in Higher Learning Institution – 2017 SECS 125
Table 6.53: Amount of Electricity (kWh) Generated by Solar Water Heaters in Higher Learning Institutions – 2017 SECS 126
Table 6.54: Quantity (Litres) of Fuel Used by Type to Operate a Generator in Both Institutions – 2017 SECS 126
Table 6. 55: Amount of Electricity (kWh) Generated by Generator in Below Tertiary Institutions – 2017 SECS 127
Table 6.56: Amount of Electricity (kWh) Generated by Generator in Higher Learning Institutions – 2017 SECS 127
Table 6.57: Ppercentage Distribution of Below Tertiary Institutions Using Official or Passenger Vehicles by District – 2017 SECS 128
Table 6.58: Percentage Distribution of Below Tertiary Institutions by Type with Upgrading Plans – 2017 SECS 129
Table 6. 59: Percentage Distribution of Higher Learning Institutions by Type With Upgrading plans – 2017 SECS 129
Table 6.60: Percentage Distribution of Below Tertiary Institutions by Constraints and Upgrade – 2017 SECS 130
Table 6.61: Percentage Distribution of Higher Learning Institutions by Constraints and Upgrade -2017 SECS 130

PREFACE

The Sector Energy Consumption Survey (HECS) was conducted by the Bureau of Statistics under Ministry of Development Planning in partnership with the Department of Energy under the Ministry of Energy and Meteorology. This exercise was done after completion of Household Energy Consumption in 2017 as there was an increasing demand from users of energy statistics.

Energy consumption refers to all the energy used to perform an action, manufacture something or simply inhabit a building. It is essential to understand that energy consumption does not necessarily come from a single energy source and varies, depending on location and infrastructure. This variation can appear in terms of how much is used, what type is used, and the way it is used.

The supply and use of energy in Lesotho continue to change and this includes changes in the type of energy used, how it is used and the intensity of use in different demand sectors. Keeping track of the energy flow/balance of a country is therefore vital and requires continued updating of energy data in order to make sound policy decisions and to develop informed and sustainable plans. Hence the need for timely, accurate, comprehensive and readily accessible energy statistics.

Information from Sector Energy Consumption survey will serve as a monitoring tool for **Sustainable Development Goal 7: Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All**

The Ministry of Development Planning as well as Ministry of Energy and Meteorology wishes to extend its gratitude to all participants of Sector Energy Consumption Survey. Special thanks are dedicated to the analysis team. Finally, we are also thankful to UNDP which provided financial support towards this exercise.

M. Molato

Director, Bureau of Statistics

September, 2022

CHAPTER 1: SURVEY DESIGN

1.0 Introduction

The Bureau of Statistics partnered with the Department of Energy to conduct the Sector Energy Consumption Survey in 2019 following Household Energy Consumption Survey which was conducted in 2017. The reference period for Sector Energy Consumption was 2017. The latter was aimed at obtaining the energy consumption patterns of different sectors within the economy. Information collected from the survey included use of hard coal, other energy sources, appliances, machinery, petroleum products etc. by various sectors. It was also important to gather information regarding energy sources used for cooking, lighting and heating.

1.1 Sample Design

The survey covered the following sectors; Health, Agriculture, Accommodation & Food Services, Government and Education. A list of health facilities was obtained from the Ministry of Health. Agriculture facilities were gathered from Ministry of Agriculture. The Business Register compiled by the National Accounts and Enterprises division within the Bureau of Statistics was used to select hotels, restaurants and bars. From the Ministry of Education, list of schools ranging from Early Childhood Care and Development (ECCD) to Tertiaries in the country was obtained.

1.2 Sample Size

The selection was done using different frames of individual sectors obtained from relevant departments. To compensate for non-response as well as non-coverage of the sampled units, sampling weights were employed to correct those imperfections.

Sector	Selected	Interviewed	Response Rate
Education	360	314	87
Health	86	73	85
Government	78	60	77
Agriculture	127	115	91
Hotels	349	266	76
Total	**1000**	**828**	

1.3 Trainings

Enumerators were trained for two weeks during November 2018. These enumerators comprised staff from the Bureau of Statistics and the Department of Energy. The last two days of the training were dedicated to mock interviews to give practice to the trainees.

1.4 Fieldwork

Data collection was done in two phases in all the districts. The first phase commenced immediately after enumerators' training and lasted for two weeks covering Health sector. The second phase was in August covering Accommodation & Food Services, Agriculture and Government sectors.

There were four teams, each comprising three enumerators and one supervisor. The role of the supervisor was mainly to check the questionnaires for any inconsistencies while in the field. Each team was allocated a hired vehicle.

1.5 Challenges

Industries and mining & quarrying sectors were not included in report because data was not easily accessible due to security reasons and time constraints.

CHAPTER 2: HEALTH SECTOR

2.0 Introduction

National health facilities are essential in addressing the continued health care needs of the country's citizens. These health facilities include clinics, health centres and hospitals. Electricity supply to these facilities has to be constant to keep some lifesaving equipment running. However, some of these health facilities are not connected to the electricity grid especially in the mountains.

Health facilities are categorized based on the services provided and patient capacity. Healthcare facilities can be divided into hospitals (large healthcare facilities), health centres (medium-sized facilities), health clinics (small facilities) and health posts.

Hospitals are the largest infrastructures in terms of patient capacity (over 120 beds) and range of services. They have full-time doctors, nurses and obstetricians as well as technical staff for the operating and maintenance of the infrastructure. Hospitals offer a large variety of services, from first aid to surgery, non-communicable disease treatment and intensive care, and house medical analysis laboratories, diagnostic equipment and storage facilities for blood and vaccines. Hospitals' average daily energy consumption ranges from 15 to 35 kWh.

Health centres provide all vital services (i.e., lifesaving) such as obstetric and surgical services, and treatment for injuries and infections. They have refrigerators for vaccine storage but fewer diagnostic instruments than hospitals. One example is a lack of X-ray machines, which consume a great deal of energy. They have a lower patient capacity than hospitals (60 to 120 beds) and replace hospitals in smaller cities. Average energy consumption of health centres ranges from 10 to 20 kWh, with power needs of 5 kWh.

Health clinics provide most of the vital services, such as first aid, basic surgery and obstetric services. Patient capacity can vary from 0 to ±60 beds. The staff is limited to nurses and obstetricians. Doctors from larger nearby health centres may pay regular visits, if need be. Their average daily energy consumption ranges from 4 to 10 kWh, with power needs of 2.4kW.
https://www.sciencedirect.com/journal/sustainable-energy-technologies-and-assessments

2.1 Results

This section entails results on Energy consumption by Health Sector.

2.1.1 Employment

Employment can be defined as the state of having work. Permanent employment and temporary employment are the two known types of employment. The difference

between the two is the length of the employment contract. Employment of well-trained health professionals in the Health Sector is vital to the delivery of quality health care to the public. These health professionals include (among many) nurses, doctors and hospital administrators.

Table 2.1 tabulates the percentage distribution of employees by institution and sex. Hospitals had the highest percentage of permanent female employees, at 47.7 percent. Clinics had the lowest female permanent employees, constituting 20.4 percent of the total permanent female employees. Health Centers had most male employees who were on temporary employment accounting for 63.7 percent. The least temporary male employees were in clinics, at 10.9 percent. Health Centers also had the most temporary female staff when compared to both Hospitals and Clinics, with 74.7 percent.

Table 2.1: Percentage Distribution of Employees by Institution and Sex – 2017 SECS

Type of Institution	Permanent Employees		Temporary Employees	
	Females	Males	Females	Males
Hospital	47.7	54.0	13.1	25.4
Clinic	20.4	19.8	12.3	10.9
Health Centre	32.0	26.1	74.7	63.7
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**
Total (N)	**3,286**	**1,266**	**934**	**386**

2.1.2 Operation Days and Hours

The days and hours of operation refer to the times health services are administered. Some health institutions operate five days a week while others may operate seven days a week.

Table 2.2 highlights percentage distribution of institutions by operation days per week. Days of operation per week ranged between 5 and 7 days. Institutions which operated 5 days per week constituted 42.9 percent. Institutions that operated 6 days per week accounted for 16.6 percent of all the institutions.

Table 2.2: Percentage Distribution of Institution by Operation Days per Week – 2017 SECS

Days of Operation	Percent
5	42.9
6	16.6
7	40.5
Total (%)	**100.0**

Hours of operation per week include both weekdays (weekdays are only five days from Monday to Friday) and weekends. Different institutions have varying days and hours for conducting their operations.

Table 2.3 indicates percentage distribution of institutions by operation hours per weekday. Most institutions operated 8 hours per weekday, at 45.6 percent. Only 1.7 percent of institutions operated 11 hours per weekday. Institutions that operated 24 hours per weekday accounted for 22.8 percent of all institutions.

Table 2.3: Percentage Distribution of Institutions by Operation Hours per weekday – 2017 SECS

Hours of Operations	Institutions
5	2,7
7	3,8
8	45,6
9	19,8
10	3,6
11	1,7
24	22,8

Hours during the weekend when work is being done by institution staff constitute Hours of Operations.

Table 2.4 tabulates percentage distribution of institutions by operation hours during weekends. Institutions which recorded zero operation hours did not operate on weekends. Institutions which operated 24 hours on weekends constituted 23.8 percent. Institutions which only operated 9 hours on weekends accounted for 1.4 percent

Table 2.4: Percentage Distribution of Institutions by Operation Hours during Weekends – 2017 SECS

Hours of Operation	Institutions
0	25,2
2	2,2
3	4,1
4	12,1
5	16,8
6	2,9
7	1,7
8	9,8
9	1,4
24	23,8

2.1.3 Building Structures

Building structure refers to how the building is constructed. The structure may be one storey building or a multi-storey building with numerous rooms.

Table 2.5 shows percentage distribution of institutions by building structure occupied. Most institutions (68.1 percent) reported to have occupied more than one building. Very few institutions occupied multi-storey buildings (3.6 percent).

Table 2.5: Percentage Distribution of Institutions by Building Structure Occupied – 2017 SECS

Building Structure	Percent
Covers Whole Building	13.4
Covers Part of the Building	14.5
Covers More than One Building	68.1
Multi Storey Building	3.6
Total (%)	**100.0**

2.1.3.1 Usable Area

Usable area refers to the building space occupied by the facility in which operations take place.

Table 2.6 exhibits the percentage distribution of institutions by type and usable area. Clinics constituted 52.1 percent of institutions which occupied usable area of 0 to100 m^2. Health centres accounted for 79.6 percent of institutions within this range. Only hospitals occupied usable areas of 501 m^2 and more.

Table 2.6: Percentage Distribution of Institutions by Type and Usable Area (m^2) – 2017 SECS

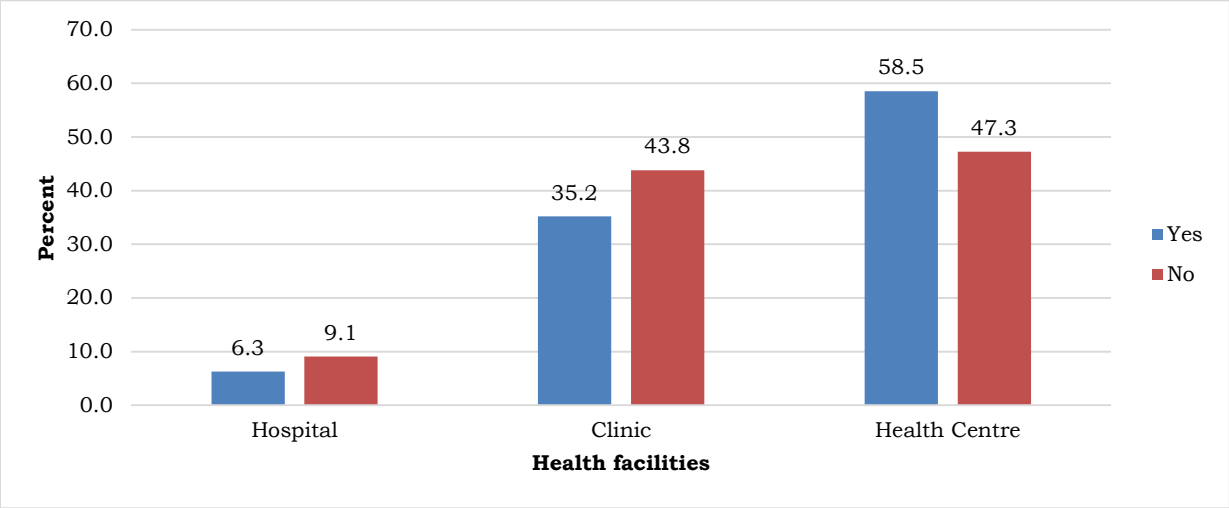
Type of Institution	Total Area					
	0-100	101-200	201-300	301-400	401-500	501+
Hospital	1.7	6.3	12.1	20.4	0.0	100.0
Clinic	52.1	27.8	38.2	0.0	0.0	0.0
Health Centre	46.2	66.0	49.8	79.6	100.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total (N)	**115**	**95**	**33**	**20**	**11**	**2**

2.1.3.2 Insulation of Buildings

A building that is constructed in a manner that allows it to preserve heat in winter is said to be insulated.

Figure 2.1 illustrates the percentage distribution of insulated buildings. The graph highlights that Health centres (58.5 percent) own most buildings which are insulated. Health centres also accounted for 47.3 percent of institutions which did not own buildings which were insulated.

Figure 2.1: Percentage Distribution of Insulated Buildings – 2017 SECS



2.1.3.3 Heated and Cooled Area

The rooms of a building may be heated or cooled. Heating systems (electric resistant heaters, paraffin heaters, central heating systems etc.) are used to warm these rooms during cold seasons. The same applies in warm seasons of the year, when rooms need to be cooled. For instance, electric fans and central cooling systems are used.

Table 2.7 tabulates the percentage distribution of institutions by type and heated area. Within the range of 0 to 50 m², the highest percent of heated and cooled areas were in health centres with 72.9 percent and 64.7 percent respectively. Hospitals accounted for 9.1 percent and 4.1 percent of institutions which had heated and cooled areas of 50 m² and less respectively. Clinics and Health Centres did not report to have heated areas of 100 m² and above.

Table 2.7: Percentage Distribution of Institutions by Heated and Cooled Area (m²) – 2017 SECS

Type of Institution	Heated Area				Cooled Area			
	0-50	51-100	101-150	151+	0-50	51-100	101-150	151+
Hospital	9.1	3.5	100.0	100.0	4.1	0.0	45.4	33.3
Clinic	18.1	40.3	0.0	0.0	31.2	100.0	54.6	66.7
Health Centre	72.9	56.2	0.0	0.0	64.7	0.0	0.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total (N)	**44**	**226**	**4**	**2**	**246**	**10**	**9**	**12**

2.1.4 Kitchen Appliances

Many electrical appliances are used in health institutions. Microwaves, kettles, stoves are some of these appliances. They are used by staff when preparing food for patients.

Table 2.8 exhibits the percentage distribution of electrical appliances used by district. Maseru district had the highest percentage of institutions that used microwaves, at 33.9 percent. The districts of Mohale's Hoek and Mokhotlong had the lowest percent

(1.6) of institutions which used microwaves. Maseru also had the highest percentage (29.6) of institutions that used kettles. The least percentage of institutions that used kettles were in Mokhotlong and Mohale's Hoek with 2.8 each.

Table 2.8: Percentage Distribution of Electrical Appliances used by District – 2017 SECS

District	Kitchen appliances			
	Microwave	Kettle	Stove	Other
Botha-Bothe	4.4	8.5	19.1	4.2
Leribe	12.0	6.4	0.0	1.7
Berea	27.9	19.3	7.1	32.3
Maseru	33.9	29.6	28.6	55.6
Mafeteng	6.6	4.1	19.1	0.0
Mohale's Hoek	1.6	2.8	14.3	2.1
Quthing	4.4	11.5	11.9	2.1
Qacha's Nek	5.5	9.2	0.0	2.1
Mokhotlong	1.6	2.8	0.0	0.0
Thaba-Tseka	2.2	6.0	0.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**
Total (N)	**183**	**436**	**42**	**288**

2.1.4.1 Ownership of Appliances

Data on the number of appliances owned by institutions was also collected. This equipment's are used to perform specific tasks, particularly in the kitchen.

Table 2.9 tabulates the percentage distribution of ownership of appliances by type of institution. Hospitals in the country owned most microwaves, (40.6 percent) as compared to Clinics and Health Centres. The table further reveals that Hospitals had the highest percent (47.9) with regards to stove ownership.

Table 2.9: Percentage Distribution of Ownership of Appliances by Type of Institution – 2017 SECS

Type of institution	Appliances			
	Microwave	Kettle	Stove	Other Appliances
Hospital	40.6	42.3	47.9	46.1
Clinic	34.9	35.2	14.4	49.5
Health Centre	24.5	22.5	37.8	4.9
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**
Total (N)	**182**	**435**	**42**	**282**

2.1.5 Petroleum Products

Petroleum products are used in the operation of generators. This may be the case during power breaks. Health institution vehicles consume petroleum products on a daily basis.

Table 2.10 displays the quantity of petroleum product used in litres by type of institution in litres. Hospitals utilized the least litres of Unleaded Petrol, with 9,324.0

litres. It is further noticed that Hospitals also consumed the highest quantity (24,583.6 litres) of Diesel 50ppm.

Table 2.10: Quantity of Petroleum Product Used in litres by Type of Institution

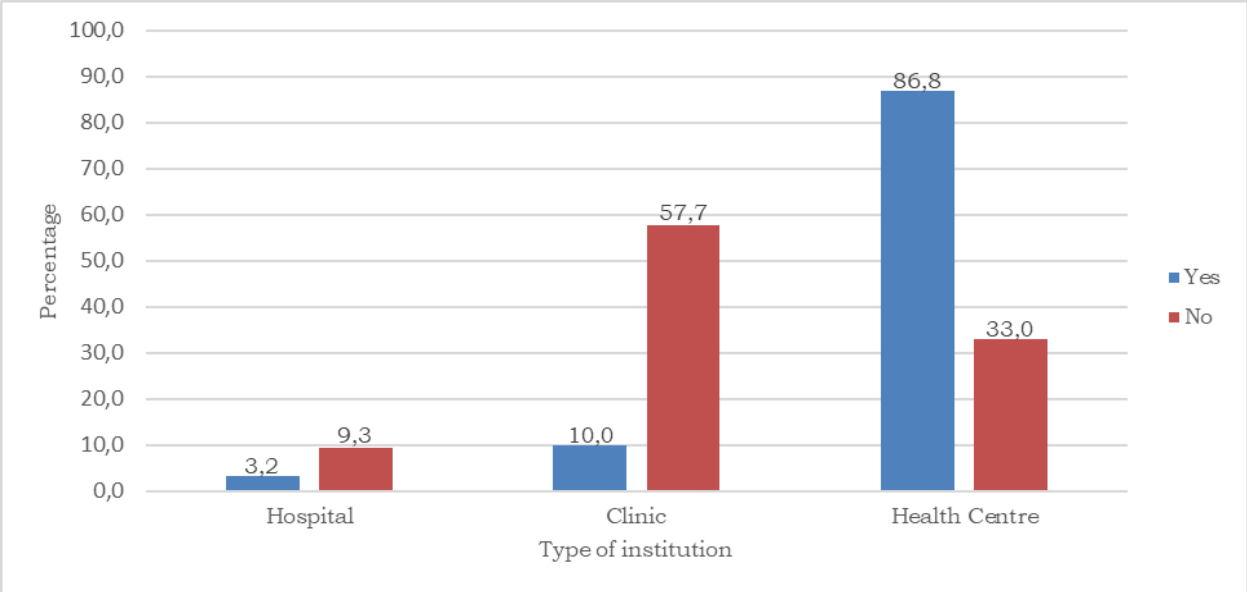
	Fuel Used		
Institution	**Diesel 50ppm**	**Diesel 500ppm**	**Unleaded petrol**
Hospital	24,583.6		9,324.0
Clinic	10,194.2	181.6	21,030.8
Health Centre	5,289.5	320.0	26,899.9
Total	**40,067.3**	**501.6**	**57,254.7**

2.1.6 Hard Coal

Coal is a sedimentary deposit composed predominantly of carbon that is readily combustible. There are four major types of coal which are anthracite, bituminous, subbituminous and lignite. https://www.usgs.gov/faqs/what-are-types-coal

Figure 2.2 portrays the percentage distribution of institutions using hard coal by type in 2017. The figure displays that high percentage (86.8) of health centres used hard coal and the clinics are ranked second with 10.0 percent. The hospitals have the least percentage with 9.3.

Figure 2.2: Percentage Distribution of Institutions using Hard Coal by Type – 2017 SECS



2.1.6.1 Quantities of Hard Coal

Hard coal quantities are also discussed in this section

Table 2.11 demonstrates the quantity of hard coal by type of institutions and energy emitted in Gigajoules (GJ). It is observed that the greater amount (117,556 kilograms) of Bituminous was used in health centres emitting 3,056.5GJ of energy when burnt.

The hospitals follow with a quantity of 1,000 kilograms releasing 26.0GJ of energy. In clinics, the quantity of Bituminous used was less (554 kilograms) and amount of energy released was 14.4GJ. It is also noted that, in both hospitals and clinics, the usage of Anthracite (1,500 kilograms and 3,600 kilograms respectively) is higher as compared to Bituminous.

Table 2.11: Quantity (kg) of Hard Coal and Energy Emitted (GJ) by Type of Institution – 2017 SECS

Type of Institution	Anthracite	Energy Emitted	Bituminous	Energy Emitted
Hospital	1,500	39.0	1,000	26.0
Clinic	3,600	93.6	554	14.4
Health Centre	90,128	2,343.3	117,556	3,056.5
Total	**95,228**	**2,475.9**	**119,110**	**3,096.9**

2.1.7 Renewables

Wood is considered humankind's very first source of energy. Today it is still the most important single source of renewable energy providing about 6% of the global total primary energy supply. Wood fuel is a fuel, such as firewood, charcoal, chips, sheets, pellets, and sawdust. Today, burning of wood is the largest use of energy derived from a solid fuel biomass. https://aip.scitation.org/doi/10.1063/1.5047972

Table 2.12 presents the percentage distribution of institutions using renewables by districts in 2017. It is observed that, majority of the health institutions in Maseru (42.9 percent) did not use renewables and about 22.2 percent used. The health institutions in Leribe (15.2 percent) mostly used renewables followed by Thaba-Tseka (10.8 percent) as well as Mohale's Hoek with 10.4 percent.

Table 2.12: Number of Institutions using Renewables by Districts – 2017 SECS

District	Used	Not Used
Botha-Bothe	7.3	5.8
Leribe	15.2	12.4
Berea	6.6	11.5
Maseru	22.2	42.9
Mafeteng	8.3	9.8
Mohale's Hoek	10.4	4.2
Quthing	3.3	5.4
Qacha's Nek	9.5	1.4
Mokhotlong	6.6	4.3
Thaba-Tseka	10.8	2.3
Total (%)	**100.0**	**100.0**
Total (N)	**137**	**139**

2.1.8 Solar Photovoltaic (PV)

PV systems convert solar energy into electricity. In rural areas without electricity grid access, standalone PV systems are an alternative energy generation option. The generated electricity can be instantaneously consumed or stored (e.g. in batteries) to be consumed at night. In rural areas, health facilities conduct several health and non-health services. https://iea-pvps.org/wp-content/uploads/2020/01/IEA-PVPS_T9-15_2014_PV_for_rural_health_facilities.pd

Table 2.13 presents the percentage distribution of the number of solar panels by health centres. It is noted that majority (52.4 percent) of the health centres own between 20 to 24 solar panels. The minimum number (less than 5) of solar panels was owned by 21.4 percent of the health centres.

Table 2.13: Percentage Distribution of the Number of Solar Panels by Health Centre – 2017 SECS

Number of Solar Panels	Percentage
Less than 5	21.4
05 - 09	16.1
10 -14	3.7
15 - 19	5.1
20 - 24	52.4
25+	13.8
Total (%)	**100.0**
Total (N)	**82**

Table 2.14 demonstrates the electricity generated through solar panels in kilowatt hour by districts. The table reveals that districts with the highest generation of electricity through solar panels are Mohale's Hoek (24,601.5kWh) and Maseru (17,704.5kWh). The least electricity generation (1,287kWh) was obtained in Leribe. Quthing's electricity generation is zero (0) implying that health centres in Quthing did not supply information on the use of solar PV.

Table 2.14: Electricity Generated (kWh) by Solar Panels and Districts – 2017 SECS

District	Electricity Generated
Botha-Bothe	1,375.0
Leribe	1,287.0
Berea	1,683.0
Maseru	17,704.5
Mafeteng	2,337.5
Mohale's Hoek	24,601.5
Quthing	0.0
Qacha's Nek	2,420.0
Mokhotlong	2,227.5
Thaba-Tseka	3,748.8
Total	**57,384.8**

Table 2.15 shows amount paid for lubricants by type of institution. The amount paid for grease is higher (M1,800.00) in hospitals and less (M270.00) in clinics. The hospitals spent more on grease than brake fluid (M800.00). Motor oil amounting to M1,080.00 was only used in clinics. The table further shows that, about M120.00 is spent for other products such as two stroke oil in Health Centres.

Table 2.15: Amount Paid for Lubricants by Type of Institution – 2017 SECS

Type of Institution	Grease	Brake Fluid	Motor oil	Other
Hospital	1,800.00	800.00	0.00	0.00
Clinic	270.00	72.00	1,080.00	0.00
Health Centre	0.00	0.00	0.00	120.00
Total	**2,070.00**	**872.00**	**1,080.00**	**120.00**

2.1.9 Petroleum Products

Crude oil and other liquids produced from fossil fuels are refined into petroleum products that people use for many different purposes. Biofuels are also used as petroleum products, mainly in mixtures with gasoline and diesel fuel.

Petroleum has historically been the largest major energy source for total annual energy consumption. Petroleum products are used to propel vehicles, to heat buildings, and to produce electricity. Some petroleum products are used mainly for operations such as powering appliances, cooking, heating in homes (space heating), welding and etc. https://www.eia.gov/energyexplained/oil-and-petroleum-products.

Table 2.16 presents the quantity of petroleum products used for operation by type of institution. From the table, it is shown that Diesel 50ppm (138,028 litres) was the most consumed petroleum product in hospitals and Diesel 500ppm was the second most consumed with 55,914.64 litres. Liquefied Petroleum Gas (15,897.46 kilograms) and Paraffin (8,793.45 litres) were mainly used in clinics.

Table 2.16: Quantity of Petroleum Products used for Operation by Type and Institution – 2017 SECS

Petroleum	Hospital	Clinic	Health Centre	Total
Diesel 50ppm (L)	138,028.00	0.00	280.00	138,308
Diesel 500ppm (L)	55,914.64	0.00	0.00	55,914.64
Unleaded Petrol (L)	50.00	0.00	2,402.00	2,452.00
Paraffin (L)	11,928.68	8,793.45	24,047.66	44,769.79
Acetylene (kg)	124.00	0.00	0.00	124.00
LPG (kg)	22,614.48	15,897.46	65,845.36	104,357.30
Heavy Oil (L)	320.00	0.00	0.00	320.00

Table 2.17 shows amount paid on petroleum products by type of institution. The table shows that the hospitals spent more (M3,723,647.76) on petroleum products followed by health centres with a sum of M1,826,578.38. Health centres spent more (M1,570,039.78) on LPG and M1,522,913.26 by hospitals. Clinics spent less (M295,183.82).

Table 2.17: Amount Paid by Type of Petroleum Products and Type of Institution – 2017 SECS

Petroleum	Hospital	Clinic	Health Centre	Total
Diesel 50ppm	1,464,477.08	0.00	4,200.00	1,468,677.08
Diesel 500ppm	581,502.86	0.00	0.00	581,502.86
Unleaded petrol	501.20	0.00	38,160.32	38,661.52
Paraffin	86,003.36	92,070.12	214,178.28	392251.75
Acetylene	17,050.00	0.00	0.00	17,050.00
LPG	1,522,913.26	295,183.82	1,570,039.78	3,388,136.86
Heavy oil	51,200.00	0.00	0.00	51,200.00
Total	**3,723,647.76**	**387,253.94**	**1,826,578.38**	**5,937,480.07**

2.1.10 Grid Electricity

Hospitals and clinics located near an electricity grid connection have traditionally relied on grid power as a primary energy source. Reliable electricity can be an effective tool in improving core components of health systems. In addition to targeting direct factors within the health systems such as health workforce and health financing, investments in supporting infrastructure are warranted to achieve the health SDGs. https://jhpn.biomedcentral.com/track/pdf/10.1186/s41043-019-0164-6.pdf

Table 2.18 shows the percentage distribution of institutions connected to grid electricity by district. From the table, most health institutions (37.7 percent) in Maseru were connected to grid electricity followed by Leribe with 15.9 percent. It is also observed that a greater percentage of the health institutions in Mohale's Hoek (15.9 percent) and Qacha's Nek (15.7percent) were not connected to grid electricity.

Table 2.18: Percentage Distribution of Institutions Connected to Grid Electricity by District – 2017 SECS

Districts	Connected	Not Connected
Botha-Bothe	7.1	4.7
Leribe	15.9	7.4
Berea	9.2	8.5
Maseru	37.7	17.7
Mafeteng	9.4	8.1
Mohale's Hoek	4.3	15.9
Quthing	5.8	0
Qacha's Nek	1.9	15.7
Mokhotlong	2.9	12.8
Thaba-Tseka	5.6	9.1
Total (%)	**100.0**	**100.0**
Total (N)	**206**	**70**

Electricity used by various institutions varied according to their different needs.

Table 2.19 presents the type of institution by amount paid and electricity used. From the table, hospitals spent more (M5,488,935.52) on electricity and the amount of electricity consumed was 4,497,592.54 kWh. Health centres spent less (M2,142,993.50) on electricity and the amount of electricity used was 1,320,475.68 kWh.

Table 2.19: Type of Institution by Amount paid and Electricity (kWh) used – 2017 SECS

Type of Institution	Amount Paid	Electricity Used
Hospital	5,488,935.52	4,497,592.54
Clinic	3,470,520.13	2,172,703.30
Health Centre	2,142,993.50	1,320,475.68
Total	**11,102,449.15**	**7,990,771.51**

2.1.10.1 Institutions Electricity Usage

Health facilities have thermal energy needs for cooking and water heating, sterilization, space heating and incineration of medical waste. Such needs are more significant in larger health facilities delivering more complex health services or offering inpatient services. https://energypedia.info/wiki/Energy_for_Rural_Health_Centers

Table 2.20 shows the percentage distribution of institutions connected to grid by main use of electricity. In general, clinics and health centres did not use electricity mainly for cooking. The table further shows that, most of electricity in hospitals was used for powering appliances (77.8 percent). Most clinics used electricity in powering appliance (48.9 percent) followed by lighting (35.7 percent). In health centres, electricity was used mostly for lighting (55.7) followed by powering appliances (23.2).

Table 2.20: Percentage Distribution of Institutions Connected to Grid by Main Use of Electricity – 2017 SECS

	Main Use				Total	
Type of Institution	Space Heating	Lighting	Cooking	Powering Appliances	N	Percentage
Hospital	0.0	11.1	11.1	77.8	18	100.0
Clinic	15.4	35.7	0.0	48.9	96	100.0
Health Centre	21.1	55.7	0.0	23.2	89	100.0

Table 2.21 presents the type of institution by main use and electricity consumed. The table reveals that, in hospitals and clinics, electricity was mainly used for powering appliances (2,633,281.64 kWh and 1,465,608.92 kWh respectively). Electricity used for lighting was 1,088,070 kWh in hospitals and 554,902.96 kWh in clinics. The

opposite was observed with health centres where electricity (528,101.90 kWh) was used for lighting followed by 431,579.48 kWh used for powering appliances.

Table 2.21: Type of Institution by Main Use and Electricity (kWh) Consumed – 2017 SECS

Type of Institution	Main Use			
	Space Heating	Lighting	Cooking	Powering Appliances
Hospital	0.00	1,088,070.00	776,240.90	2,633,281.64
Clinic	152,191.42	554,902.96	0.00	1,465,608.92
Health Centre	360,794.30	528,101.90	0.00	431,579.48
Total	**512,985.72**	**2,171,074.86**	**776,240.90**	**4,530,470.04**

2.1.11 Generators

Standby generators are a reliable backup power solution that can help keep hospitals up and running, even during a power outage and are also one of the most common backup power solutions used throughout the industry. Backup generators in hospitals are not strictly for keeping medical equipment and life saving devices functional like oxygen pumps, ventilators, and powered surgical equipment, but they also keep heating and cooling systems working, security and detection systems running and keep the lights on. https://woodstockpower.com/blog/importance-of-backup-generators-for-hospitals-healthcare.

Table 2.22 shows the percentage distribution of the institutions by main use of generators. From the table, most (49.0 percent) of the hospitals used generators for both lighting and powering appliances. Hospitals that used generators for powering appliances constituted 24.0 percent. About 47.0 percent of the health centres used generators for powering appliances only and 36.0 percent used generators for lighting and powering appliances. On the other hand, 15.0 percent of the clinics used generators for lighting and powering appliances.

Table 2.22: Percentage Distribution of Institutions by Main Use of Generators – 2017 SECS

Type of Institution	Lighting	Lighting & Powering appliances	Powering Appliances
Hospital	0.0	49.0	24.0
Clinic	0.0	15.0	29.0
Health Centre	100.0	36.0	47.0
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**10**	**20**	**17**

Generators run on various fuels, including natural gas, diesel, gasoline and propane. They typically power off-grid facilities and also serve as back-up power sources for grid-connected hospitals and clinics. They are the most widespread back-up energy

source for healthcare facilities in the Global South. https://www.sciencedirect.com/science/article/pii/S2213138817301376

Table 2.23 presents the quantity of fuel used by type of fuel and institution. It is shown that, in hospitals, generators' consumption for Diesel 50ppm and Diesel 500ppm was 8,820 litres and 8,760 litres respectively. In health centres, the quantity of Unleaded Petrol used was greater (6,428 litres) followed by Diesel 500ppm with 4,975 litres. The quantity of Diesel 50ppm used was less (2,016 litres).

Table 2.23: Quantity of Fuel used by Type and Type of Institution – 2017 SECS

	Type of Institution		
Type of fuel	**Hospital**	**Clinic**	**Health Centre**
Diesel 50ppm	8,820	0	2,016
Diesel 500ppm	8,760	3,035	4,975
Unleaded petrol	0	0	6,428
Total	**17,580**	**3,035**	**13,419**

2.1.11.1 Electricity Generated by Generators

Table 2.24 shows the electricity generated by generators by type of institution and usage. It is observed that, in hospitals about 4,726,600 kWh was generated for both Lighting and Powering appliances. On the other hand, 3,153,600 kWh was generated for powering appliances only. It is further noted that, in clinics more (16,430kWh) electricity was generated for Powering appliances only followed by 2,880 kWh for Lighting and Powering appliances

Table 2.24: Electricity Generated by Generators by Type of Institution and Usage – 2017 SECS

Type of Institution	Lighting	Lighting & Powering appliances	Powering Appliances	Total
Hospital	0.00	4,726,600.00	3,153,600.00	7,880,200.00
Clinic	0.00	2,880.00	16,430.00	19,310.00
Health Centre	21,226.28	56,160.00	19,360.00	96,746.28
Total	**21,226.28**	**4,785,640.00**	**3,189,390.00**	**7,996,256.28**

2.1.12 Heating and Cooling System

Heating is the process of raising the temperature of an enclosed space for the primary purpose of ensuring the comfort of the occupants by regulating the ambient temperature.

The independent heating systems are the systems that uses energy to heat the surrounding. Cooling is the process of removing heat from the space. The independent cooling systems are the systems that uses energy to cool the surrounding.

Table 2.25 presents number of institutions using independent system. All the hospitals (100 percent) within the health sector sample were reported to have used independent system. On the other hand, 91.9 percent of the clinics also reported to have used independent system. In overall, 91.7 percent of health sector reported to have used Independent systems.

Table 2.25: Percentage Distribution of Institutions using Independent Heating or Cooling System – 2017 SECS

	Independent Systems		
Institution	**Use**	**Not Used**	**Total**
Hospital	100.0	0.0	100.0
Clinic	91.9	8.1	100.0
Health Centre	90.6	9.4	100.0
Total	**91.7**	**8.3**	**100.0**

Table 2.26 shows the quantity of energy consumed by each type of independent system used. Electric Resistance heater (2,096,900.60 kWh) recorded the highest consumption than other systems that were used for heating followed by Electric Oil Heater (1,309,449.18 kWh). There were only three systems used for cooling within the health sector amongst which Split A/C Units without Inverter (69,891.00 kWh) used the most energy followed by fans (43,580.30 kWh).

Table 2.26: Quantity of Electricity and Other Fuels Consumed by Type of System – 2017 SECS

	Quantity Consumed		
Independent System	**Heating**	**Cooling**	**Units**
Electric Oil Heater	1,309,449.18		kWh
Electric Resistance Heater	2,096,900.60		kWh
Fan		43,580.30	kWh
Fan Heater	5,163.60		kWh
Gas Heater	28,743.24		kg
Paraffin Heater	13,233.00		Litres
Split A/C Units with Inverter	41,255.60	15,930.56	kWh
Split A/C Units without Inverter	262,640.90	69,891.00	kWh
Other	15,224.80		kg

2.1.13 Motion and Light Sensors

Motion sensor lights, as their name suggests, are activated by motion. These lights use individual sensors meant to detect physical movement around them. A light sensor is a passive sensor that is used to indicate the intensity of the light by examining the radiant energy that exists in a certain range of frequencies. In the spectrum of electromagnetic waves, the ranges of frequencies that are used to detect using a sensor are between infrared to visible and up to ultraviolet. https://www.fierceelectronics.com/sensor/what-a-motion-sensor

Table 2.27 depicts Percentage Distribution of institutions with motion sensors and light sensors. Most health institutions (94.2 percent) did not have motion sensors while only 5.8 percent institutions had. The Light sensors were observed mostly in Hospitals (77.8 percent) and the least were noticed in Clinics (13.1 percent).

Table 2. 27: Percentage Distribution of Institutions with Motion and Light Sensors – 2017 SECS

	Motion Sensor Controls		Light Sensor Controls		
Type of Institution	**Yes**	**No**	**Yes**	**No**	**Total**
Hospital	22.2	77.8	77.8	22.2	100.0
Clinic	3.0	97.0	13.1	86.9	100.0
Health Centre	5.7	94.3	55.3	44.7	100.0
Total	**5.8**	**94.2**	**41.7**	**58.3**	**100.0**

Table 2.28 shows Number of bulbs and quantity of electricity consumed by type of bulb (kWh). The florescent tube bulbs (65) were the most used type consuming 31.89 kWh in the health sector followed by energy saver (49). The least used bulbs were Exam Lamp and Operation lamp which recorded 1 each.

Table 2.28: Number of Bulbs and Quantity of Electricity (kWh) Consumed by Type of Bulb – 2017 SECS

Types of Bulbs	Number of Bulbs	Electricity Consumed
Energy Saver	49	11.10
Exam Lamp	1	0.04
Florescent tube	65	31.89
Halogen	2	1.95
Incandescent Globes	10	8.19
Light-emitting Diodes	12	1.58
Operation Lamp	1	0.07
Total	**140**	**54.82**

This section focuses on institutions which used Solar energy for lighting the premises and it is therefore important to look at the energy consumed by different bulbs.

Table 2.29 presents number of bulbs and electricity consumed by type of bulbs. The total energy consumed from solar energy was 10.49 kWh. Energy savers (24) which were mostly used consumed 2.84 kWh.

Table 2.29: Number of Bulbs and Electricity (kWh) Consumed by Type of Bulb – 2017 SECS

Types of Bulbs	Number of Bulbs	Electricity Consumed
Energy Saver	24	2.84
Fluorescent	18	5.68
Incandescent	3	1.44
Light-emitting Diodes	7	0.52
Total	**52**	**10.49**

2.1.14 Diagnostic Equipment

Diagnosis is probably the most important aspects of health care. Diagnostic medical tools are used by doctors to measure and monitor different aspects of a patient's well-being. Once the diagnosis is performed, the doctor at that point refers to a proper treatment plan for the analysed issue. https://isnmedical.com/medical-diagnostic-equipment-type-and-uses/

Table 2.30 depicts percentage distribution of institutions using diagnostic equipment. All the hospitals (100 percent) reported to have used the diagnostic equipment. Both clinics (55.6 percent) and Health centres (51.6 percent) also reported to have used the diagnostic equipment in 2017. In the entire health sector, institutions that used diagnostic equipment were 56.2 percent.

Table 2.30: Percentage Distribution of Institutions using Diagnostic Equipment – 2017 SECS

Type of Institution	Diagnostic Equipment		Total
	Used	Not Used	
Hospital	100.0	0.0	100
Clinic	55.6	44.4	100
Health Centre	51.6	48.4	100
Total	**56.2**	**43.8**	**100.0**

Table 2.31 presents percentage distribution of institutions by type of diagnostic equipment and average minutes used per day. Almost 50.0 percent of institutions reported to have used Ultra sound and X-ray for less than 30 minutes on average per day.

Table 2.31: Percentage Distribution of Institutions by Type of Diagnostic Equipment and Average Minutes Used per day – 2017 SECS

	Average Minutes				Total	
Equipment	<30	31 - 120	121 - 300	> 300	%	N
Other (Specify)	43.0	14.0	14.0	30.0	100	132
Ultra Sound	50.0	33.0	8.0	8.0	100	12
X Ray	50.0	30.0	10.0	10	100	10

2.1.15 Sterilization Medical Equipment

Improper sterilization has the potential to spread disease or result in a Healthcare-Associated Infection (HAI). Regardless whether you use steam sterilization or a low-temperature sterilization option, to ensure patient safety, it is essential to follow instruction for use, clean the device correctly, verify cleaning and to select the correct sterilization process. Anything less could jeopardize the health of your patients and put your medical facility at risk. https://www.vedantu.com/biology/sterilization

Table 2.32 shows percentage distribution of institutions using sterilization equipment. All the hospitals (100 percent) reported to have used the sterilizing equipment. Almost

58.6 percent of clinics and 38.0 percent of health centres reported to have not used sterilizing equipment.

Table 2.32: Percentage Distribution of Institutions using Sterilization Equipment – 2017 SECS

	Sterilization Equipment		
Type of Institution	**Used**	**Not Used**	**Total**
Hospital	100.0	0	100
Clinic	41.4	58.6	100
Health Centre	62.0	38.0	100
Total	**57.2**	**42.8**	**100**

Table 2.33 shows the percentage distribution of sterilization equipment by type and average minutes of use per day. The total energy consumption of sterilizing equipment was 502,401.94 kWh. All Dish washer for Dishes and Utensils were used for less than 50 minutes per day on average and all the ovens were used between 51 to 150 minutes per day.

Table 2.33: Percentage Distribution of Sterilization Equipment by Type and Average Minutes of use per day – 2017 SECS

	Average Minutes			Total		
Equipment	**<50**	**51 - 150**	**>150**	**Percent**	**N**	**Electricity Consumed**
Dish washer for Dishes and Utensils	100	0	0	100	2	72.00
Other (Specify)	40	23	37	100	60	367,782.57
Ovens	0	100	0	100	1	1,200.00
Washing Machines for Bed and Linen	9	27	64	100	11	89,604.03
Washing Machines for Medical Equipment	36	27	36	100	11	43,743.33
Total						**502,401.94**

2.1.16 Refrigeration

The refrigeration equipment is highly needed in health sector for the maintenance of medicines and the preservation of tissues, plasma and organs. It is essential to have the most reliable cold storage equipment with all the guarantees of adequate preventive and corrective maintenance. https://en.wikipedia.org/wiki/Refrigeration

Figure 2.3 presents number of institutions using refrigeration equipment. Refrigeration equipment were present in all health facility categories. The most refrigeration equipment was reported in Health Centers (155). Hospitals had the least refrigeration equipment (14).

Figure 2.3: Number of Institutions using Refrigeration Equipment – 2017 SECS.

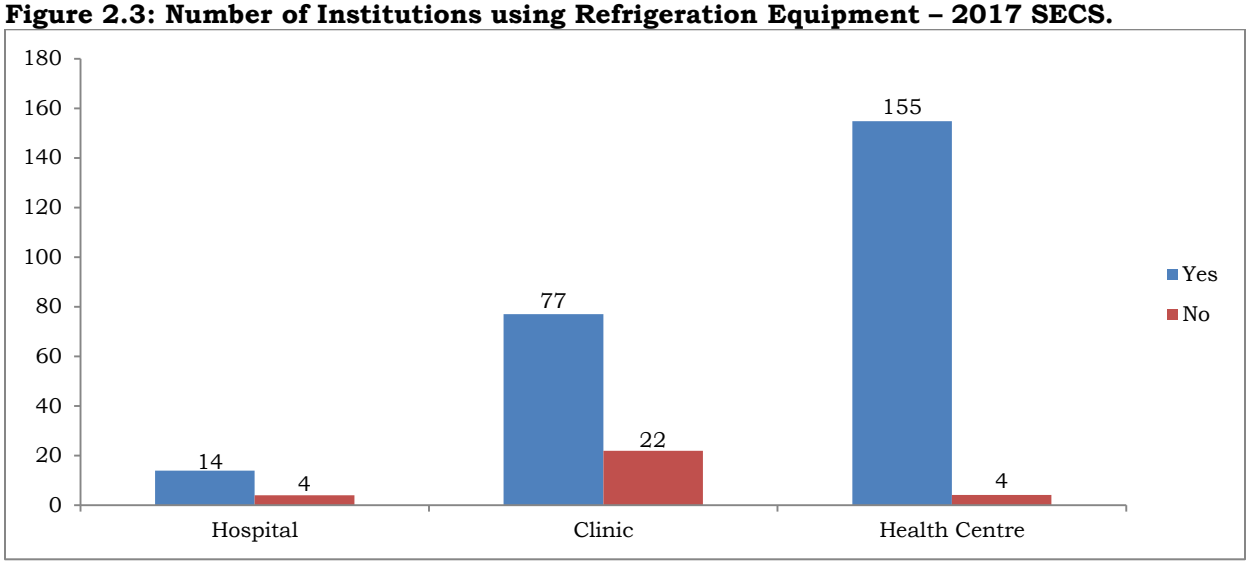


Table 2.34 shows electricity consumed by type of refrigeration equipment and cold room. "Other fridges" consumed the most electricity, with 373.33 kWh. The least electricity was consumed by Blood Plasma Freezers (47.90 kWh). The total energy consumed by both refrigeration equipment and cold rooms was 1,263.1 kWh.

Table 2.34: Electricity (kWh) Consumed by Type of Refrigeration and Cold Room Equipment – 2017 SECS

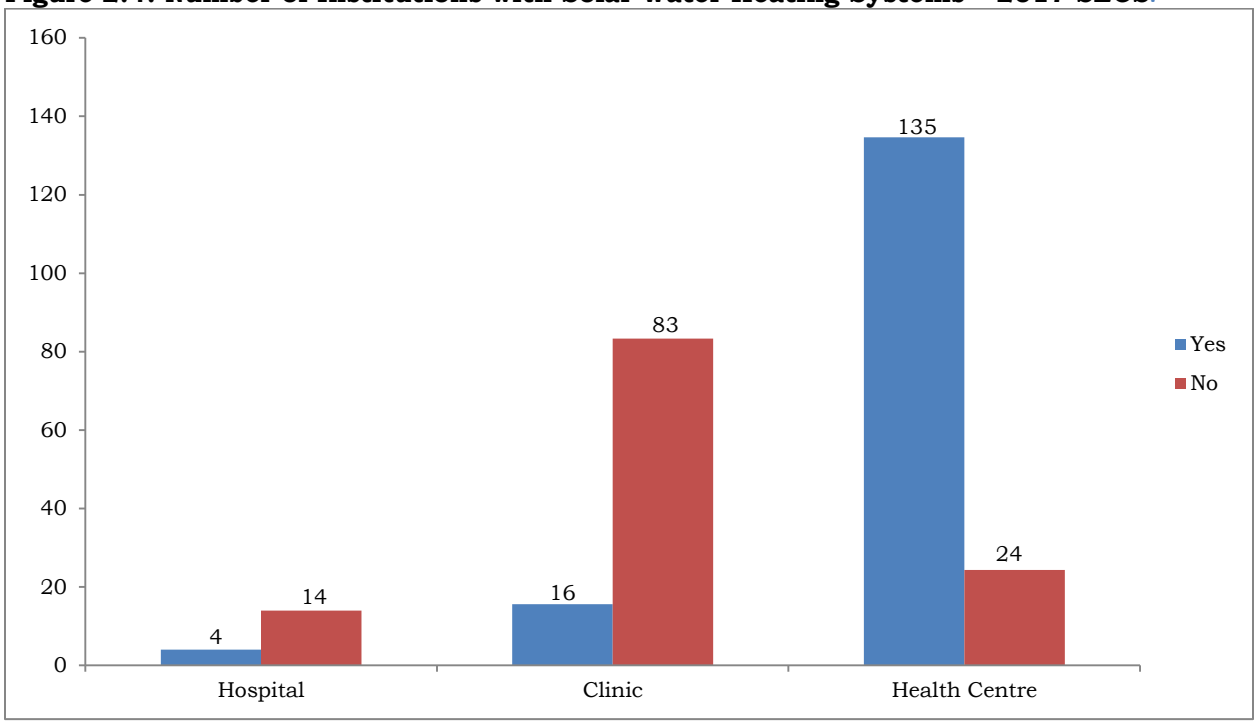
Type of Fridge	Electricity Consumed
Blood Plasma Freezer	47.90
Deep Freezers	360.25
Laboratory Fridge	199.96
Other fridges	373.33
Cold Room	176.88
Mortuary	104.78
Total	**1,263.1**

2.1.17 Solar Water Heating Systems (SWH)

Solar Water Heater uses the power of the sun to heat the water. It assists with the provision of hot water with great efficiency and low energy costs.

Figure 2.4 depicts number of institutions with solar heating systems. Only 4 hospitals had the solar water heating systems. Majority of Health centres (135) used solar water heating systems in 2017.

Figure 2.4: Number of Institutions with Solar Water Heating Systems – 2017 SECS.



CHAPTER 3: ACCOMMODATION AND FOOD SERVICES SECTOR

3.0 Introduction

Bhatia (2002) defines Hotel as establishment that provide accommodation, meals and refreshment for irregular periods of time for those who may reserve their accommodation either in advance or on the premises. The author further describes hotel as establishment that provide facilities to meet the needs of the modern travellers. Guesthouse on the other hand is the type of establishment which is established exclusively for the purpose of providing accommodation and usually offers more of a personal touch than a hotel, as there are fewer guests to accommodate. http://eugo.gov.hu/a-z-index/operation-guest-houses.

Bed and Breakfast, often abbreviated as B&B, is a business that accommodates overnight guests (short period) and offers a breakfast menu included in the price. https://www.webstaurantstore.com/blog/3576/what-is-a-bed-and-breakfast.html

Chalet also referred to as a vacation or beach house is a sleeping accommodation at holiday camps. It is used by the owners two or three times a year and rented the remaining time. https://housing.com/news/chalet/

Olivia (2011) defines Lodge as an establishment that provide accommodation temporarily and no provision for meals. Restaurant which comes from a word "Rest and Rent" is a commercial establishment that provide food and beverages that are cooked and served on the premises to guest/clients/peoples. There are no accommodation systems and facilities. https://fandbfood.com/what-is-restaurant/

Bar/Tavern is an establishment where alcoholic beverages are sold for consumption on the premises but not necessarily food (Britannica. 2022). Catering is an establishment where food is prepared for delivery to the ultimate consumer and is ready for consumption without further preparations. The types of food and set up depends entirely on the price agreed upon. https://www.lawinsider.com/dictionary/catering-establishment

Other (includes cafeteria/canteens): a cafeteria sometimes called a canteen outside the U.S is a self-service restaurant that is provided by organization such as colleges, factory, military camp for its staff where they select various dishes from an open-counter display (Britannica, 2022).

The chapter focuses on the different types of establishments such as hotels, guesthouse, restaurant etc. The analysis will be on the type of establishment, number of employees (permanent and temporary), energy consumption of hard coal, petroleum, solar and grid electricity. Independent heating/cooling systems, lighting

and laundry equipment will also be discussed. Additionally, kitchen equipment and appliances, small equipment, cooking and food refrigeration will be included.

3.1 Type of Establishment

This section will observe energy usage per establishment and their quantities as well as electricity, both grid and solar.

Table 3.1 presents percentage distribution of establishment by type. The table indicates that Bar/Tavern had the highest percentage distribution amounting to 63.9 percent, followed by Restaurant with 19.9 percent. Chalets had the least percent amounting to 0.1.

Table 3.1: Percentage Distribution of Establishments by Type – 2017 SECS

Type of Establishment	Percent
Hotels	1.1
Guesthouse	5.0
Bed and Breakfast	2.4
Chalets	0.1
Lodges	1.9
Restaurant	19.9
Bar/Tavern	63.9
Catering	5.6
Other	0.2
Total (%)	**100.0**
Total (N)	**1,181**

3.2 Permanent and Temporary Employment

Permanent employment is an employment relationship where an individual works for an employer and receives payment directly from them. This type of employment arrangement does not include a set end date. A permanent employee may work on a part-time or full-time basis, which the Bureau of Labor Statistics classifies as employees who work 35 or more hours per week. Permanent employees often receive benefits packages through their employers, though those benefits may differ based on their status as a full- or part-time employee. https://www.indeed.com/career-advice/finding-a-job/permanent-employment

Temporary employment is whereby workers are engaged only for a specific period of time, includes fixed-term, project-or task-based contracts, as well as seasonal or casual work, including day labour. https://www.ilo.org/global/topics/non-standard-employment/WCMS_534826/lang--en/index.htm

3.2.1 Permanent employees

Permanent Employees means employees employed in full-time positions. Full-time employees work the regularly scheduled weekly hours in this agreement. https://www.lawinsider.com/dictionary/permanent-employees

Table 3.2 explains percentage distribution of permanent employees by type of establishment and sex. The table shows that Bar/Tavern had more male and female permanent employees amounting to 49.6 and 33.2 percent respectively. Restaurants appear second with females (26.5 percent) and males (20.3 percent). Chalets had the least male permanent employees with 0.1 percent.

Table 3.2: Percentage Distribution of Permanent Employees by Type of Establishment and Sex – 2017 SECS

	Sex	
Type of Establishment	**Females**	**Males**
Hotels	7.6	9.2
Guesthouse	13.3	6.9
Bed and Breakfast	3.4	2.2
Chalets	0.0	0.1
Lodges	10	10.4
Restaurant	26.5	20.3
Bar/Tavern	33.2	49.6
Catering	5.9	1.2
Other	0.0	0.2
Total (%)	**100**	**100**
Total (N)	**2,483**	**1,767**

3.2.2 Temporary employees

Temporary employees are contracted workers who perform a job for only a short amount of time. A temp can be hired directly by a company or work for a staffing agency that sends them out on temporary jobs. https://www.indeed.com/career-advice/career-development/temporary-employee

Table 3.3 presents percentage distribution of temporary employees by type of establishment and sex. The table indicates that Bar/tavern had highest temporary male employees with 52.9 percent. On the other hand, Restaurants had the maximum percentage (26.7 percent) of temporary female employees. “Other” had the least temporary female employees which constituted 2.2 percent. There were no records of ‘Other’ temporary males’ employees.

Table 3.3: Percentage Distribution of Temporary Employees by Type of Establishments and Sex – 2017 SECS

	Sex	
Type of Establishment	**Females**	**Males**
Hotels	5.5	3.0
Guesthouse	19.3	12.7
Bed and Breakfast	8.3	3.0
Lodges	10.5	0.6
Restaurant	26.7	21.7
Bar/Tavern	19.4	52.9
Catering	8.1	6.2
Other	2.2	0.0
Total (%)	**100.0**	**100.0**
Total (N)	**456**	**338**

3.3 Hard Coal

Hard coal means a hard natural coal that burns slowly and gives intense heat. Hard coal is fossil fuel consisting of carbonized vegetable matter deposited in the Carboniferous period. https://www.vocabulary.com

3.3.1 Main Use of Hard Coal

This section will focus on the main use of anthracites and bituminous within the establishments.

Table 3.4 indicates energy in gigajoules (GJ) and quantity in kilograms (kg) of hard coal used by type and main use. It is observed that Anthracite (269,077.1 kg) was used more than Bituminous with 101,319.8 kg for space heating. It is the same situation with the main use of the coal for cooking as well as the energy used. It is also observed that for water heating, only Bituminous coal was used (500.0 kilogram).

Table 3.4: Energy (GJ) and Quantity (Kg) of Hard Coal Used by Type and Main Use – 2017 SECS

	Main Use					
	Space Heating		Water Heating		Cooking	
Type of Hard Coal	**Quantity**	**Energy**	**Quantity**	**Energy**	**Quantity**	**Energy**
Anthracite	269,077.1	6,996.0	0.0	0.0	73,821.6	1,919.4
Bituminous	101,319.8	2,634.3	500.0	13.0	7,000.0	182.0
Total	**370,396.8**	**9,630.3**	**500.0**	**13.0**	**80,821.6**	**2,101.4**

3.3.2 General use of Hard Coal

Table 3.5 shows energy in gigajoules (GJ) and quantity in kilograms (kg) of hard coal used by type of establishment. Establishments used more quantity of Anthracites which constituted 342,898.7 kg than Bituminous with 108,819.8 kg. Bar/tavern used more of both Anthracites and Bituminous amounting to 250,797.1 kg and 86,143.8

kg. Lodges used the lowest quantity of Anthracite (960.0 kg) while for bituminous, Restaurant used the least quantity of 566.0 kg. Furthermore, establishments used more energy of Anthracites (8,915.4 GJ) than Bituminous with 2,829.3 GJ.

Table 3.5: Energy (GJ) and Quantity (kg) of Hard Coal Used by Type of Establishments – 2017 SECS

	Hard Coal			
	Anthracites		Bituminous	
Type of Establishment	**Quantity (kg)**	**Energy (GJ)**	**Quantity (kg)**	**Energy (GJ)**
Hotels	8,800.0	228.8	17,850.0	464.1
Guesthouse	3,288.0	85.5	2,400.0	62.4
Bed and Breakfast	1,000.0	26.00	900.0	23.4
Lodges	960.0	25.0	960.0	25.0
Restaurant	78,053.6	2,029.4	566.0	14.7
Bar/Tavern	250,797.1	6,520.7	86,143.8	2,239.7
Total	**342,898.7**	**8,915.4**	**108,819.8**	**2,829.3**

3.4 Biofuels

Biofuels are defined as fuels made from biomass resources or their processing and conversion derivatives. Biomass is defined as all plant and animals' matter on the earths' surface. For example, crops, trees or dung and using it to generate heat, electricity (Sunggyu and Shal, 2013).

3.4.1 Biofuels in Establishment

Table 3.6 indicates energy in gigajoules (GJ) and quantity in kilograms (kg) of biofuels used by type of establishment. Generally, establishments used more quantity of Wood and Other Waste amounting to 546,562.4 kg than 132,968.2 kg of Charcoal. Bar/Tavern used the highest quantities for both Wood and Other Waste constituting 480,732.9 kg and Charcoal with 84,919.5 kg compared to other establishments. Bed and Breakfast used the least quantity of Charcoal (795.0 kg) and Lodges used the least quantity of Wood and Other Waste at 300.00 kg. Wood and Other Waste used more energy of 9,400.9 GJ than Charcoal amounting to 2,287.1 GJ.

Table 3.6: Energy (GJ) and Quantity (kg) of Biofuels Used by Type of Establishment – 2017 SECS

Type of Establishment	Biofuels			
	Charcoal (kg)	Energy (GJ)	Wood and Other Waste (kg)	Energy (GJ)
Hotels	2,216.0	38.1	1,921.3	33.1
Guesthouse	1,239.4	21.3	5,734.8	98.6
Bed and Breakfast	795.0	13.7	8,385.0	144.2
Chalets	0.0	0.0	5,000.0	86.0
Lodges	15,201.0	261.5	300.0	5.2
Restaurant	24,362.4	419.0	39,713.5	683.1
Bar/Tavern	84,919.5	1,460.6	480,732.9	8,268.6
Catering	4,235.0	72.8	4,775.0	82.1
Total	**132,968.2**	**2,287.1**	**546,562.4**	**9,400.9**

3.4.2 Biofuels and District

Table 3.7 indicates energy in gigajoules (GJ) and quantity in kilograms (kg) of biofuels by type and district. Quthing used the greatest quantity of Wood and other Wastes amounting to 273,586.3 kg, followed by Maseru with 93,777.9 kg. In addition, Maseru had the highest quantity of Charcoal with 117,433.2 kg, followed by Mokhotlong which recorded 5,450.0 kg. Botha Bothe had the least quantity for Charcoal (75.0 kg) as well as Wood and other Wastes (2,900.0 kg). Furthermore, Wood and other Wastes emitted more energy (9,400.9 GJ) than Charcoal (2,287.1 GJ).

Table 3.7: Energy (GJ) and Quantity of Biofuels Used (kg) by Type and District – 2017 SECS

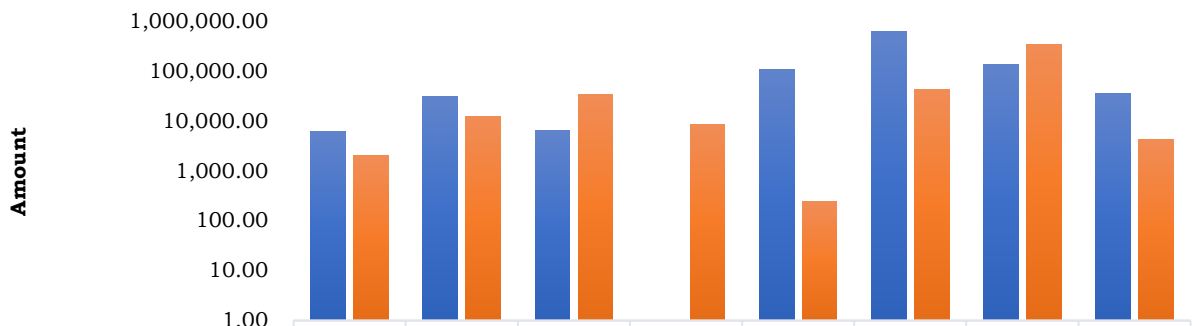
District	Type of Biofuels			
	Charcoal (Kg)	Energy (GJ)	Wood and other Wastes (Kg)	Energy (GJ)
Botha-Bothe	75.0	1.3	2,900.0	49.9
Leribe	2,448.3	42.1	41,105.8	707.0
Berea	182.4	3.1	24,738.2	425.5
Maseru	117,433.2	2,019.9	93,777.9	1,613.0
Mafeteng	2,320.0	39.9	30,008.0	516.1
Mohale's Hoek	833.1	14.3	29,560.0	508.4
Quthing	260.8	4.5	273,586.3	4,705.7
Qacha?s Nek	550.5	9.5	12,852.3	221.1
Mokhotlong	5,450.0	93.7	25,497.5	438.6
Thaba-Tseka	3,415.0	58.7	12,536.5	215.6
Total	**132,968.2**	**2,287.1**	**546,562.4**	**9,400.9**

3.4.3 Amount paid for Biofuels

Establishments indicated different amounts paid for both Charcoal as well as Wood and Other Wastes.

Figure 3.1 presents amount paid by type of establishment and biofuels. On a general note, Restaurants paid a large amount of M624,405 for Charcoal as compared to M6,365.00 paid by Hotels. Bar/Tavern also paid a large amount of M339,340 for Wood and other Wastes as compared to M240.00 paid by Lodges. There were no records of charcoal used in Chalets.

Figure 3.1: Amount Paid (Maloti) by Type of Establishment and Biofuels – 2017 SECS



	Hotels	GuestHouse	Bed and Breakfast	Chalets	Lodges	Restaurant	Bar/Tarvern	Catering
Charcoal	6,365.00	31,607.2	6,620.00		107,000.	624,405.	136,235.	35,870.0
Wood and other Wastes	2,035.00	12,270.2	34,005.0	8,640.00	240.00	43,010.2	339,340.	4,260.00

Establishment Type

3.5 Solar Electricity

Solar photovoltaic (PV) system, also referred to as solar electric systems, capture sunlight energy and convert it into electricity. PV systems can be used for everything in your home, from lights and appliances to electric vehicle. https://sites.energycenter.org/solar/homeowners/learn-about-solar

Table 3.8 presents electricity generated (kWh) through solar panels by type of establishment and main use. It was observed that Bar/Tavern consumed more electricity for lighting constituting 16,800,918.42 kWh, followed by Bed and Breakfast amounting 161,280.00 kWh. Chalets consumed less electricity (6,600.00 kWh) comparatively. Examples of "Other" main use recorded by Bar/Taverns include powering appliances, cell phone charges and space heating which constituted 5,431,339.20 kWh.

Table 3.8: Electricity Generated (kWh) Through Solar Panels by Type of Establishment and Main Use – 2017 SECS

	Main Use	
Type of Establishment	**Lighting**	**Other**
Bed and Breakfast	161,280.00	0.00
Chalets	6,600.00	0.00
Restaurant	30,027.20	0.00
Bar/Tavern	16,800,918.42	5,431,339.20
Total	**16,998,825.62**	**5,431,339.20**

3.6 Grid Electricity

Grid Electricity is the intricate system designed to provide electricity all the way from its generation to the customers that use it for their daily needs. These systems have grown from small local designs, to stretching thousands of kilometers and connecting. https://energyeducation.ca/encyclopedia/Electrical_grid

Table 3.9 represents percentage distribution of establishment by type and electricity acquisition. It is observed that majority (62.0 percent) of Bar/Tavern acquired electricity through purchases. Only Restaurants (63.6 percent) and Bar/Tavern (36.4 percent) reported electricity being included in rent.

Table 3.9: Percentage Distribution of Establishments by Type and Electricity Acquisition – 2017 SECS

	Electricity Acquisition	
Type of Establishment	**Purchased**	**Included in Rent**
Hotels	1.2	0.0
Guesthouse	6.3	0.0
Bed and Breakfast	2.8	0.0
Lodges	1.8	0.0
Restaurant	20.1	63.6
Bar/Tavern	62.0	36.4
Catering	5.7	0.0
Other	0.2	0.0
Total (%)	**100.0**	**100.0**
Total (N)	**943**	**29**

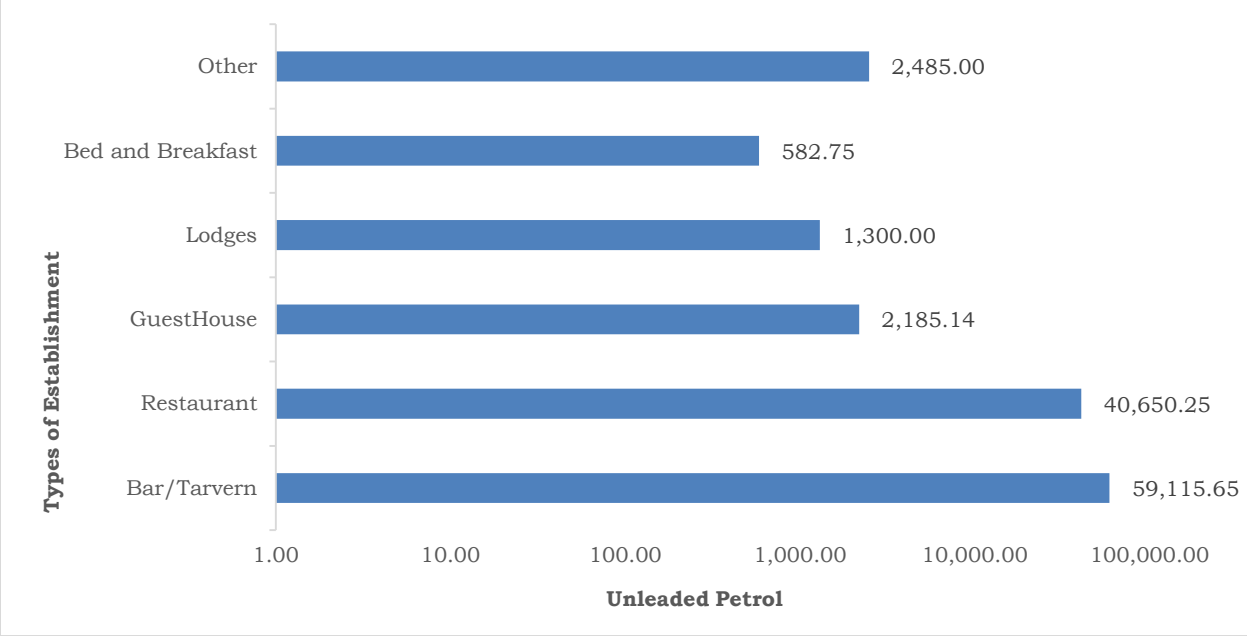
3.7 Petroleum Products

Petroleum products are materials derived from crude oil (petroleum) as it is processed in oil refineries. Petroleum products are complex mixtures derived from crude oil and have similar chemical and physical properties. https://ag.ny.gov/environmental/oil-spill/what-are-petroleum-products

3.7.1 Petroleum for Operations

Figure 3.2 depicts quantity of unleaded petrol used for operations by type of establishment. It is observed that Bar/Tavern used the most quantity of Unleaded Petrol with 59,115.65 litres for operation, followed by Restaurants with 40,650.25 litres. Bed and Breakfast used the least quantity of Unleaded Petrol for operation recording only 582.75 litres.

Figure 3.2: Quantity of Unleaded Petrol (Litres) Used for Operations by Type of Establishment – 2017 SECS



3.7.2 Petroleum for Transportation

Transportation defines the movement of goods and persons from place to place and the various means by which such movement is accomplished. It is a system for taking people or goods from one place to another, for example using buses or trains https://www.britannica.com/biography/Henry-Miller-Shreve

Diesel fuel is the common term for the distillate fuel oil sold for use in motor vehicles. https://www.eia.gov/energyexplained/diesel-fuel

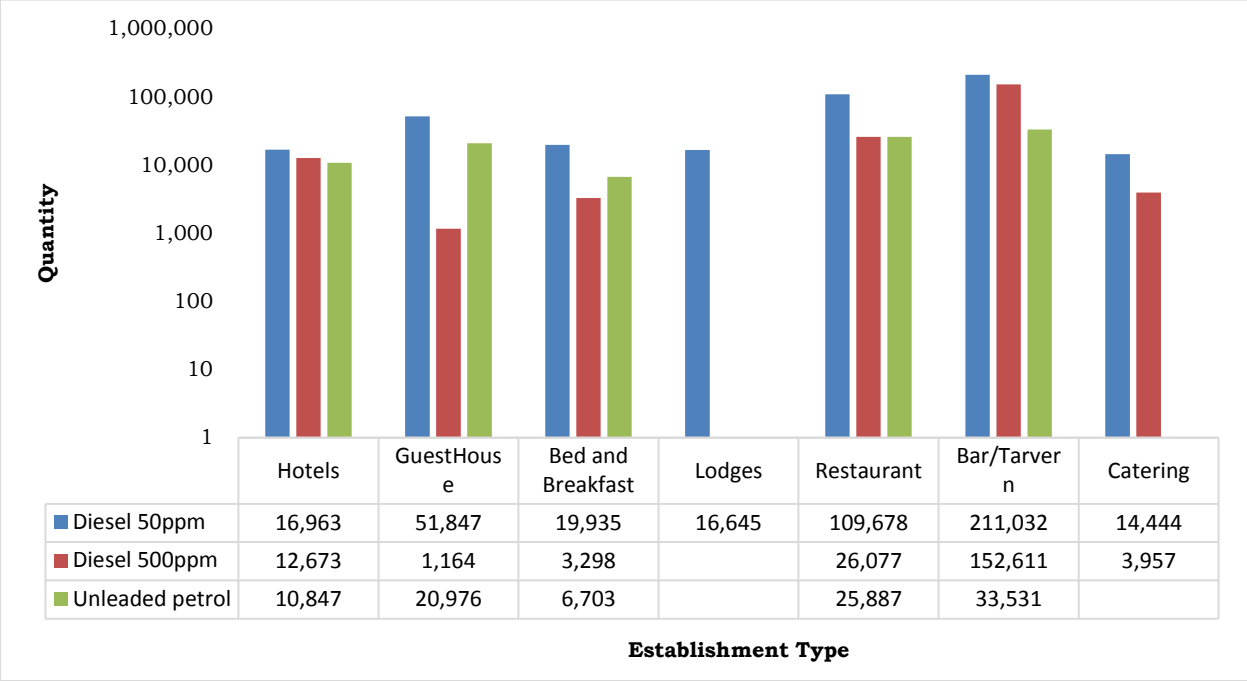
3.7.2.1 Fuel Used

Fuel is any substance which upon combustion produces a usable amount of energy, for example, diesel and unleaded petrol etc.

Figure 3.3 displays quantity of fuel type used and type of establishment. It can be observed that the greatest quantity of fuel used was Diesel 50ppm throughout all the establishment, followed by Diesel 500ppm except for Guesthouse, Lodges, Bed and

Breakfast. It is also observed that Bar/Tavern used the highest quantity of fuel across all types of fuel, thus, Diesel 50ppm (211,032 litres), Diesel 500 ppm (152,611 litres) and Unleaded petrol with 33,531 litres as opposed to other establishments. Lodges reported to have used Diesel 50ppm (16,645 litres) only. Catering used Diesel 50ppm and Unleaded petrol only (14,444 and 3,957 litres respectively).

Figure 3.3: Quantity of Fuel Type Used (litres) and Type of Establishment – 2017 SECS



	Hotels	GuestHouse	Bed and Breakfast	Lodges	Restaurant	Bar/Tarvern	Catering
Diesel 50ppm	16,963	51,847	19,935	16,645	109,678	211,032	14,444
Diesel 500ppm	12,673	1,164	3,298		26,077	152,611	3,957
Unleaded petrol	10,847	20,976	6,703		25,887	33,531	

3.8 Days of Operation per Week

Week Days of Operation means the total number of days during which the establishment provides services.
https://www.google.com/search?q=days+of+operation

Table 3.10 shows percentage distribution of establishment by days of operation per week. The table reveals that 73.4 percent of Bar/Tavern operated seven (7) days per week followed by Restaurant with 14.8 percent. It is also observed that 47.4 percent of Restaurant operated five (5) days followed by Catering with 44.7 percent. A similar pattern is observed for those operating six (6) days.

Table 3.10: Percentage Distribution of Establishments by Days of Operation per Week – 2017 SECS

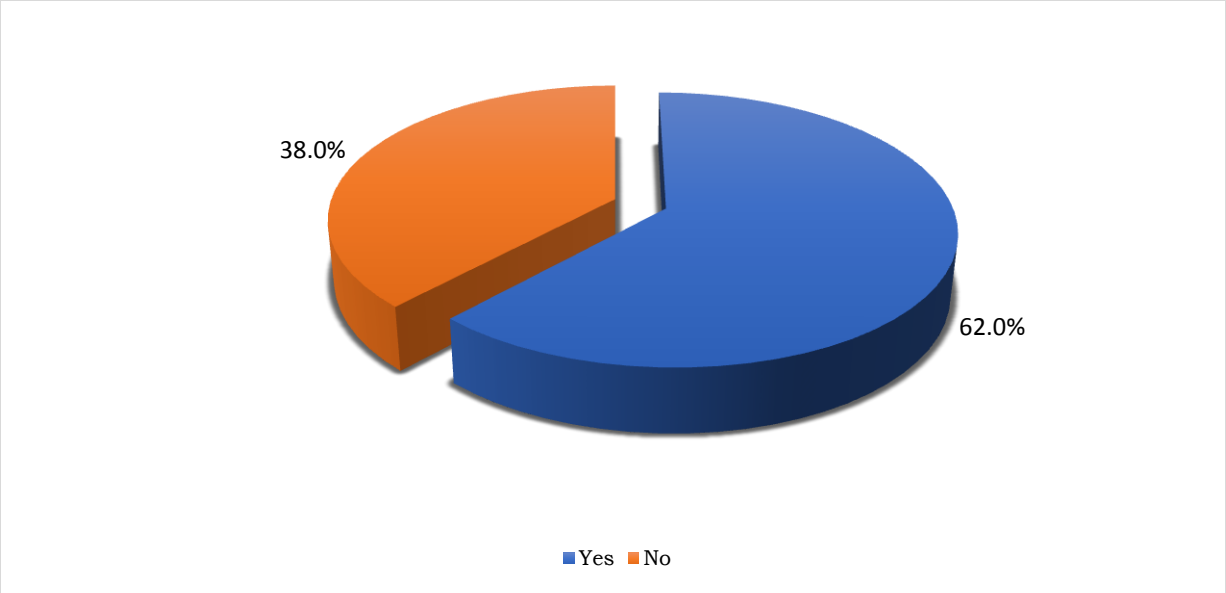
	Days of Operation		
Type of Establishment	**5**	**6**	**7**
Hotels	0.0	0.8	1.1
Guesthouse	0.0	9.4	4.6
Bed and Breakfast	5.3	1.5	2.4
Chalets	0.0	0.0	0.1
Lodges	0.0	3.8	1.8
Restaurant	47.4	46.9	14.8
Bar/Tavern	0.0	12.9	73.4
Catering	44.7	24.7	1.7
Other	2.6	0.0	0.1
Total %	**100.0**	**100.0**	**100.0**
Total (N)	**38**	**131**	**1006**

3.9 Independent Heating and Cooling Systems

A split system with an inverter (which adjusts compressor speed according to outside temperatures) can achieve 30% more operating efficiency than a conventional fixed speed model. Restaurant and other buildings with commercial kitchen may require space cooling even during winter, to remove the heat by food and kitchen equipment. https://www.energy.gov.au/households/heating-and-cooling

Percentage distribution of establishments using independent systems is demonstrated by figure 3.4. The figure portrays that the highest percentage (62.0 percent) of the establishments used independent systems.

Figure 3.4: Percentage Distribution of Establishments using Independent Systems – 2017 SECS



3.9.1 Electricity Consumption of Independent Systems

Electricity consumption is the quantity of electricity consumed over a certain period of time and is measured in kilowatt-hour (kWh). Energy consumption on the other hand refers to all the energy used to perform an action over a course of a year as measured in gigawatt hours (GWh). https://www.lawinsider.com/dictionary/electricity-consumption

Table 3.11 indicates energy in Tera Joules (TJ) and electricity consumed in kilo-watt hour (kWh) for heating and cooling by type of system. Split A/C Units with Inverter had the highest electricity consumption (181,488,227.82 kWh) for heating followed by Split A/C Units without Inverter (29,443,507.62 kWh). The category of Other (Fan heater) recorded the lowest consumption (5,299.10 kWh) for heating. Fans consumed less electricity with 163,181.26 kWh for cooling. Generally, more energy (877.45 TJ) was used for heating than cooling at 626.90 TJ.

Table 3.11: Energy (TJ) and Electricity (kWh) consumed for Heating and Cooling by Type of System – 2017 SECS

	Heating		Cooling	
Type of System/Appliance	**Electricity**	**Energy**	**Electricity**	**Energy**
Split A/C Units with Inverter	181,488,227.82	653.36	165,905,043.33	597.26
Split A/C Units without Inverter	29,443,507.62	106	8,069,697.99	29.05
Electric Oil Heater	19,215,914.38	69.18		
Electric Resistance Heater	13,583,458.77	48.9		
Fan			163,181.26	0.59
Other	5,299.10	0.02		
Total	**243,736,407.70**	**877.45**	**174,137,922.57**	**626.9**

Table 3.12 presents energy in Giga Joules (GJ) used for heating by type of system. It is noted that 'Other' types of systems (wood and coal stoves) used higher energy of 1,018.03 GJ while less energy was produced from Gas Heaters (130.03 GJ).

Table 3.12: Energy (GJ) used for Heating by Type of System – 2017 SECS

Type of System/Appliance	**Energy**
Paraffin Heater	261.06
Gas Heater	130.03
Other	1,018.03
Total	**1,409.11**

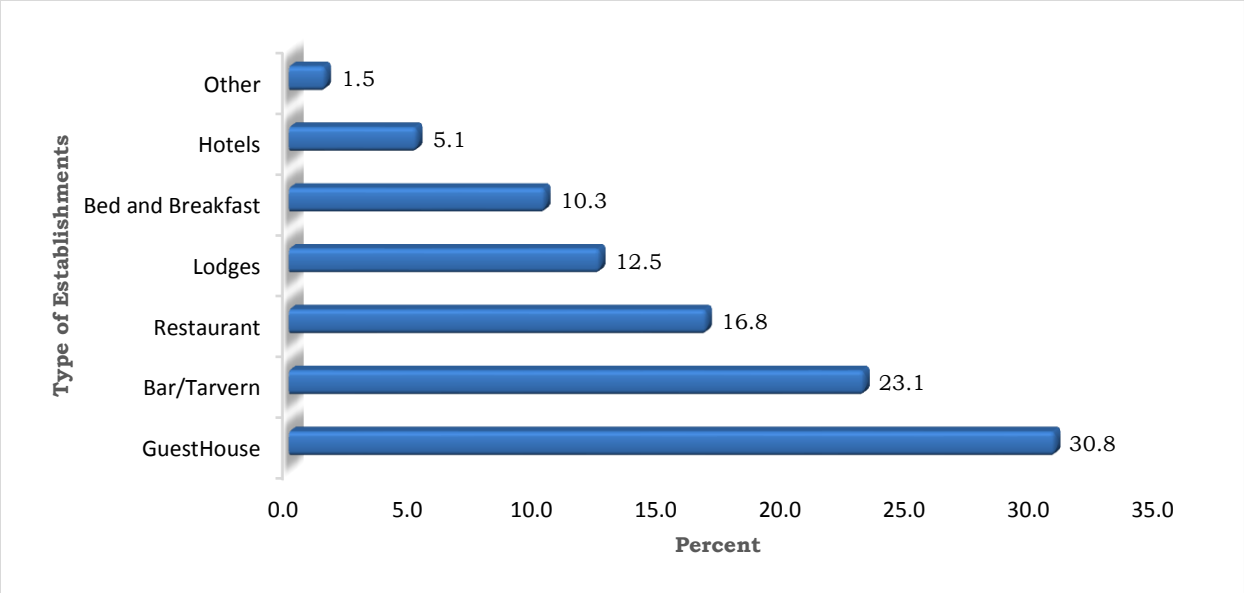
3.10 Lighting

Lighting refers to the process of illuminating a home, workplace, or street to make it livable through different technologies such as light bulbs, kerosene, charcoal burners or through daylighting. Access to lighting is important in ensuring a satisfactory quality of life for people and promoting economic development. https://energyeducation.ca/encyclopedia/Lighting

This section will focus on both light and motion sensors used by the establishments.

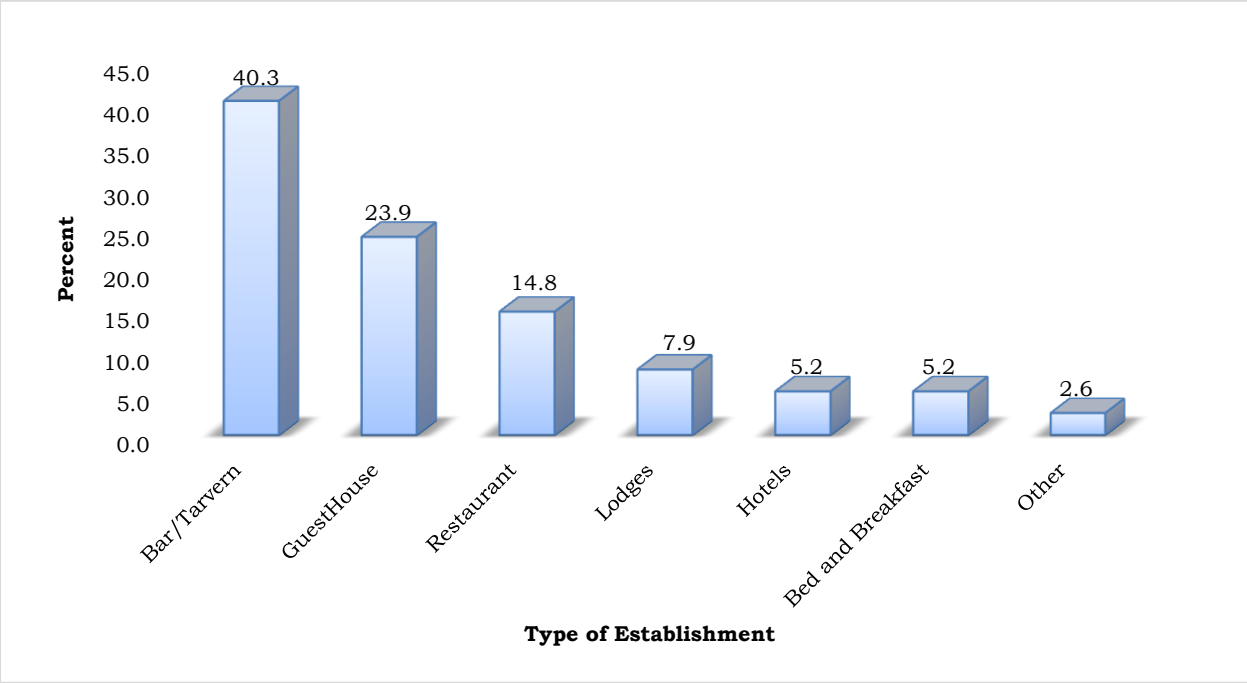
Figure 3.5 depicts the percentage distribution of establishments using light sensor by type. The highest percentage of light sensor usage by establishments was represented by Guesthouse with 30.8 percent. Bar/Tavern and Restaurants were second and third with 23.1 and 16.8 percent respectively. "Other" had the lowest percentage of 1.5.

Figure 3.5: Percentage Distribution of Type of Establishments using Light Sensor – 2017 SECS



Percentage distribution of type of establishment using motion sensor is displayed in figure 3.6. Motion sensors were highly used in Bar/Tavern and Guesthouse amounting to 40.3 and 23.9 percent respectively. "Other" had the lowest percentage of 2.6.

Figure 3.6: Percentage Distribution of Type of Establishment Using Motion Sensor – 2017 SECS



3.10.1 Light Bulbs

A bulb is an electric device that produces light when the electricity is passed through its terminals. It has two solid connection wires in the centre, with a thin wire attached between them. https://engineeringlearn.com/what-are-bulbs-6-types-of-light-bulbs-and-their-uses-explained-with-images/.

There are numerous light bulb types including incandescent, fluorescent, compact fluorescent, Light Emitting Diode (LED), halogen, and xenon. LED are the most energy efficient of all types of light bulbs. With lifespans that exceed those of most other bulbs and options that encompass a variety of colors as well as white, these bulbs offer the best bang for your buck. https://www.bobvila.com/articles/types-of-light-bulbs/

Furthermore, Teja, 2021 stated that the Incandescent bulbs are considered obsolete. Fluorescent bulbs on the other hand, despite being energy efficient than incandescent bulbs, are gradually being phased out due to use of toxic substances (Mercury) in them and also increased availability of LEDs.

Table 3.13 designates the percentage distribution of establishments by type of bulb. In general, the table shows that majority of establishments used Energy saver except Chalets and "Other". Catering and "Other" establishments that used Fluorescent bulbs accounted for 32.7 and 50.0 percent respectively.

Table 3.13: Percentage Distribution of Establishments by Type of Bulb – 2017 SECS

	Type of Bulb						
Type of Establishment	**Energy saver**	**Florescent**	**Incandescent**	**LED**	**Other**	**Total (%)**	**Total (N)**
Hotels	29.4	17.6	23.5	23.5	5.9	100	17
Guesthouse	38.7	23.5	14.3	17.6	5.9	100	119
Bed and Breakfast	37.0	15.2	26.1	17.4	4.3	100	46
Chalets	0.0	0.0	0.0	0.0	100.0	100	1
Lodges	39.0	36.6	17.1	7.3	0.0	100	41
Restaurant	37.8	18.1	18.1	21.8	4.1	100	386
Bar/Tavern	31.9	26.7	23.7	11.3	6.4	100	1,088
Catering	26.4	32.7	12.7	19.1	9.1	100	110
Other	0.0	50.0	0.0	50.0	0.0	100	2

3.10.2 Electricity Consumption of Bulbs

Figure 3.7 demonstrates electricity consumption (kWh) for lighting by type of bulb. Florescent Tube bulbs consumed a large amount of electricity (1,345.81 kWh) and Light Emitting Diode (LED) bulbs consumed less amount of 206.93 kWh.

Figure 3.7: Electricity Consumption (kWh) for Lighting by Type of Bulb – 2017 SECS

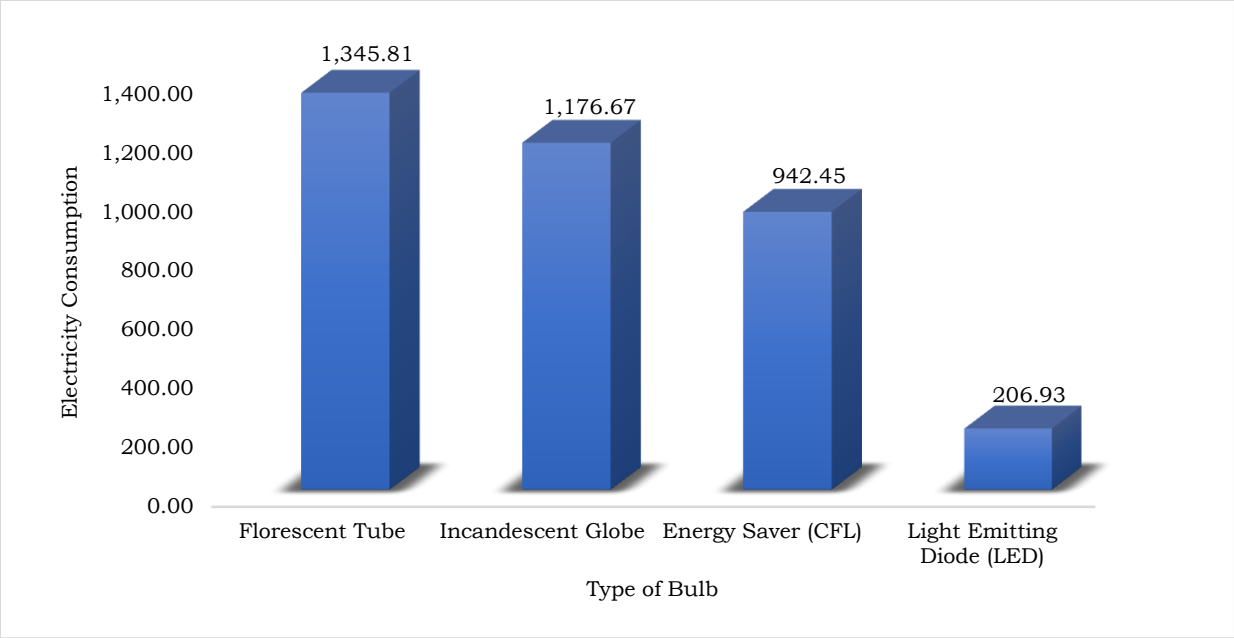


Table 3.14 presents energy in Mega Joules (MJ) for lighting using other forms of lighting by type. Paraffin lamp used more energy for lighting with 255,568.62 MJ followed by LPG lamp at 6,543.90 MJ. Solar Lantern lamp had the least amount of energy used amounting to 1.87 MJ.

Table 3.14: Energy (MJ) used for lighting using Other Forms of Lighting by Type of Lamp – 2017 SECS

Type of Lamp	Energy
Paraffin Lamp	255,568.62
Solar Lantern	1.87
Batter Lamp	17.86
LPG Lamp	6,543.90
Other	5,826.24
Total Energy (MJ)	**267,958.49**

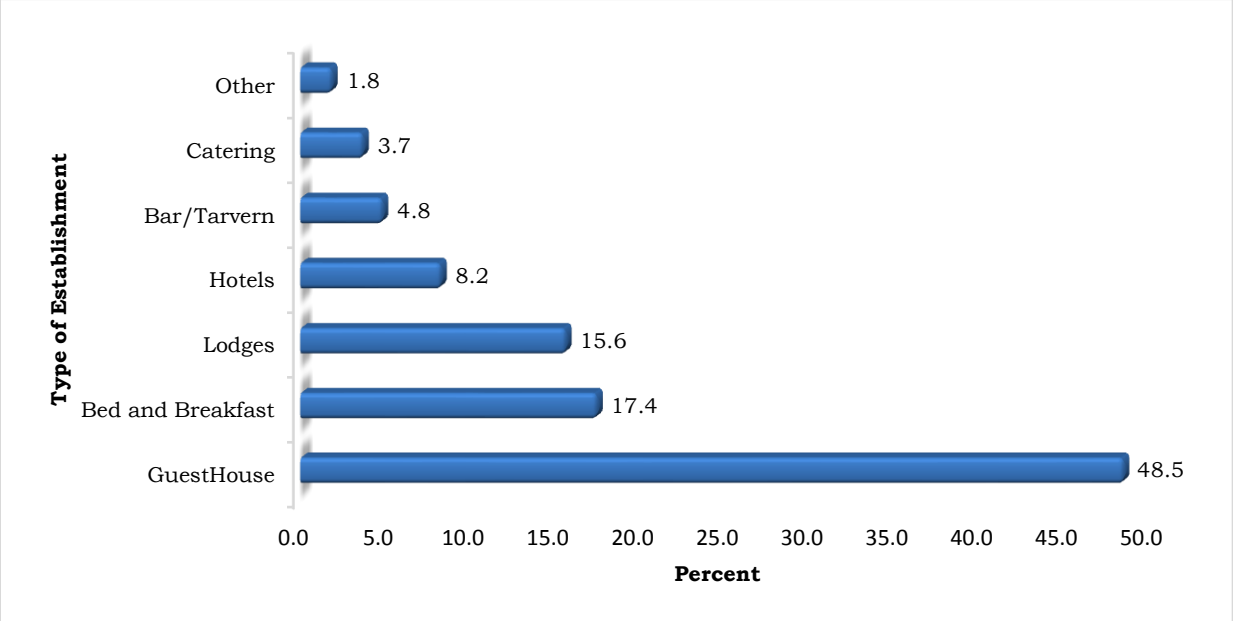
3.11 Laundry Equipment

Laundry Equipment means any equipment necessary for the operation of a coin-operated laundry, including washers, dryers, pressing or ironing machines and laundry bag dispensing machines. https://www.lawinsider.com/dictionary/laundry-equipment

Laundry equipment is mostly used in hospitality for washing, drying and ironing.

Percentage distribution of establishment using laundry equipment by type is illustrated in figure 3.8. Guesthouse, Bed and Breakfast as well as Lodges had the highest percentages of 48.5, 17.4 and 15.6 of laundry equipment usage respectively.

Figure 3.8: Percentage Distribution of Type of Establishment Using Laundry Equipment – 2017 SECS



3.11.1 Average Age of Laundry Equipment

Percentage distribution of establishment by type of laundry equipment and average age is presented in table 3.15. The table shows that all the laundry equipment had average age of 0 to 5 years with percentages over 80. For 6 to 10 category, Dryer and Washer Dryer recorded highest percentages of 16.7 and 11.8 respectively. Only Washer and Steaming Iron had an average age of 11 years and over.

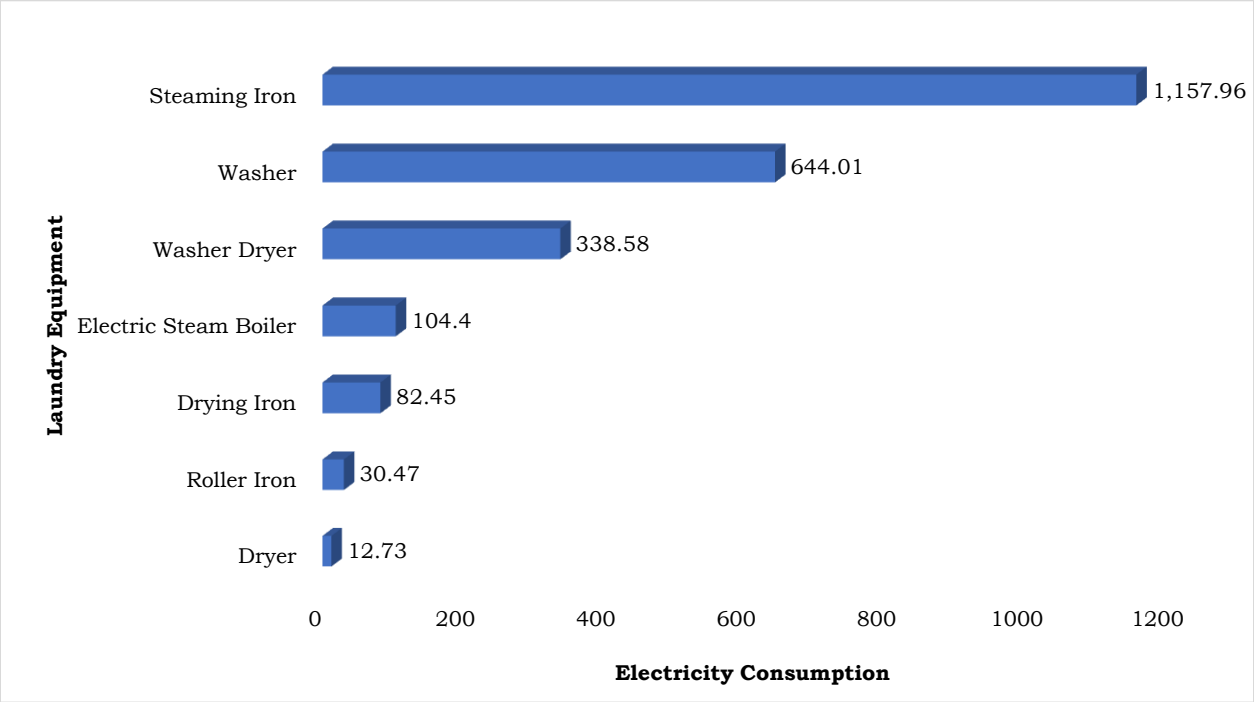
Table 3.15: Percentage Distribution of Establishment by Type of Laundry Equipment and Average Age – 2017 SECS

	Average Age				
Type of Equipment	**0-5**	**6-10**	**11+**	**Total (%)**	**Total (N)**
Washer	81.1	9.5	9.5	100.0	74
Washer Dryer	88.2	11.8	0.0	100.0	17
Dryer	83.3	16.7	0.0	100.0	6
Drying Iron	93.8	6.3	0.0	100.0	32
Roller Iron	100.0	0.0	0.0	100.0	2
Steaming Iron	91.7	3.6	4.8	100.0	84
Electric Steam Boiler	100.0	0.0	0.0	100.0	4
Total	**88.1**	**6.8**	**5.0**	**100.0**	**219**

3.11.2 Electricity Consumption of Laundry Equipment

Figure 3.9 displays electricity consumption (kWh) by type of laundry equipment. Steaming Iron (1,157.96 kWh) had the highest electricity consumption followed by Washer with 644.01 kWh. Dryer had the lowest consumption of 12.73 kWh.

Figure 3.9: Electricity Consumption (kWh) by Type of Laundry Equipment – 2017 SECS



3.12 Kitchen Equipment and Appliances

Kitchen appliances are essential for cooking, food storage, preparation, cleaning and safety. They are important because they help us cook our food the way we want. Some appliances are even special for specific tasks like bread maker without having to rise it yourself. There are different types of kitchen appliances, each with its own features and purposes such as ovens, microwaves, fryers, toaster etc. https://alrasub.com/what-are-the-importance-of-kitchen-appliances/

Percentage distribution of establishment using kitchen equipment is revealed in table 3.16. Restaurants had the highest percentage (43.9 percent) of kitchen equipment usage. Bar/Tavern were second with 20.6 percent and the least was Chalets by 0.2 percent.

Table 3.16: Percentage Distribution of Type of Establishment Using Kitchen Equipment – 2017 SECS

	Kitchen Equipment	
Type of Establishment	**Used**	**Not Used**
Hotels	2.9	0.0
Guesthouse	12.1	1.1
Bed and Breakfast	5.5	0.7
Chalets	0.2	0.0
Lodges	5.3	0.1
Restaurant	43.9	6.0
Bar/Tavern	20.6	88.4
Catering	9.1	3.7
Other	0.5	0.0
Total (%)	**100.0**	**100.0**
Total (N)	**419**	**756**

3.12.1 Average Age of Kitchen Equipment

Table 3.17 presents percentage distribution of kitchen equipment by type and average age. Majority of kitchen equipment with an average age of 0 to 5 years accounted for 60 percent and above. The table also shows that there were no records of Dishwashers aged 6 to 10 as well as 11 years and above. "Other" includes slow cooker, pizza maker, coffee maker etc.

Table 3.17: Percentage Distribution of Kitchen Equipment by Type and Average Age – 2017 SECS

	Average Age				
Type of Equipment	**0-5**	**6-10**	**11+**	**Total (%)**	**Total (N)**
Ovens	54.4	42.1	3.5	100.0	114
Fryers	61.3	31.2	7.5	100.0	186
Gridlers and grillers	78.7	17.0	4.3	100.0	47
Microwave	79.9	15.0	5.0	100.0	379
Toaster	72.7	20.0	7.3	100.0	110
Dishwasher	100.0	0.0	0.0	100.0	4
Stove	65.4	21.5	13.2	100.0	228
Air extractors	71.9	14.0	14.0	100.0	57
Other	39.7	48.9	11.5	100.0	131
Total	**67.0**	**25.0**	**8.0**	**100.0**	**1,256**

3.12.2 Electricity Consumption of Kitchen Equipment

Energy (GJ) and electricity (kWh) consumed by type of kitchen equipment is shown in table 3.18. Stove had the maximum consumption of electricity with 7,303.26 kWh and Air Extractor was second with 3,027.84 kWh. The equipment with the lowest consumption was Cooking Pots (147.29 kWh). The table further shows that overall energy used for kitchen equipment was 68.59 GJ.

Table 3.18: Energy (GJ) and Electricity (kWh) Consumed by Type of Kitchen Equipment – 2017 SECS

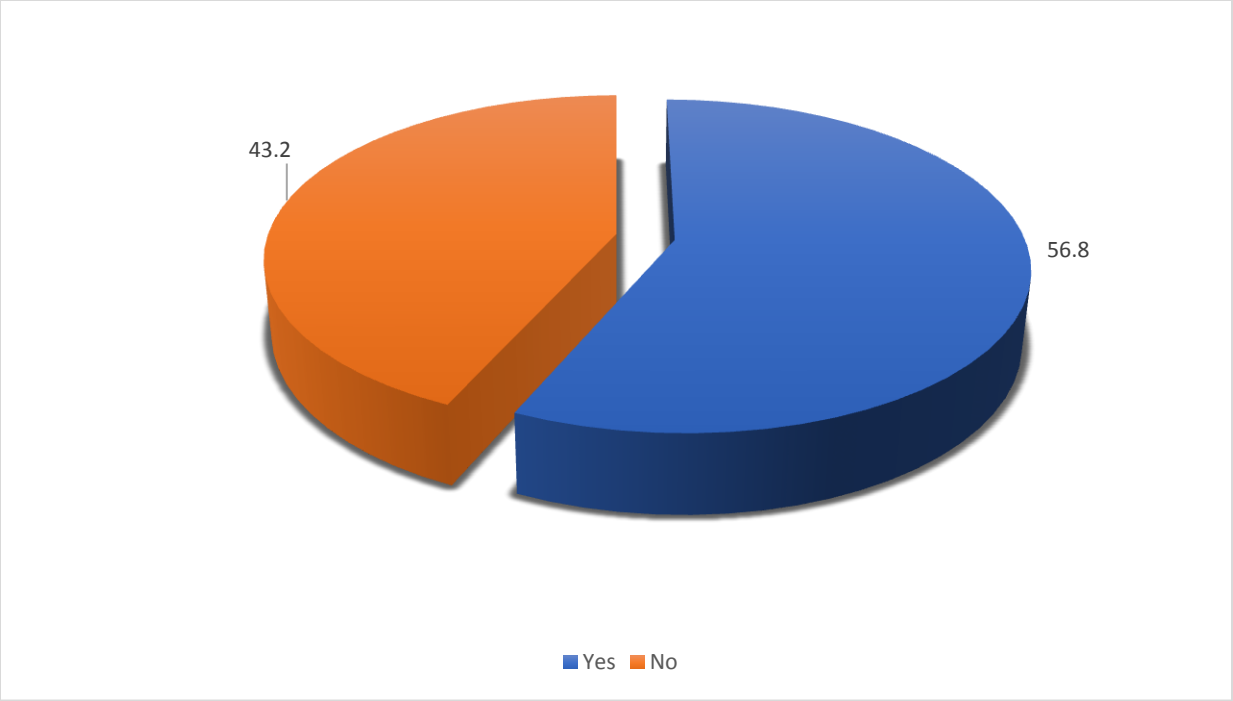
Type of Kitchen Equipment	Electricity	Energy
Ovens	1,670.73	6.01
Fryers	1,733.33	6.24
Gridlers and grillers	780.41	2.81
Cooking Pots	147.29	0.53
Microwave	2,182.96	7.86
Toaster	332.80	1.20
Dishwasher	133.53	0.48
Stove	7,303.26	26.29
Air extractors	3,027.84	10.90
Other	1,739.64	6.26
Total	**19,051.79**	**68.59**

3.13 Small Equipment

Office equipment is defined in terms of machinery, supplies and other paraphernalia that can be found in an office. It is essential and necessary, and should be available for every employee so they can work productively and efficiently**.** It helps in managing office-related work and makes your day-to-day tasks run smoothly (Teja, 2021). They include but not limited to desktops, monitors, laptops, printers, copiers, scanners etc.

Figure 3.10 portrays percentage distribution of establishment using small equipment. It is revealed by the figure that 56.8 percent of establishments had used small equipment and 43.2 percent did not.

Figure 3.10: Percentage Distribution of Establishment Using Small Equipment – 2017 SECS



3.13.1 Average Age of Small Equipment

Percentage distribution of establishments by type of equipment and average age is displayed in table 3.19. Laptops and Projectors with an average age of 0 to 5 years had the highest percentages of 86.5 and 84.6 respectively. The results show that there were no records on Projectors with an average age of 11 years and above.

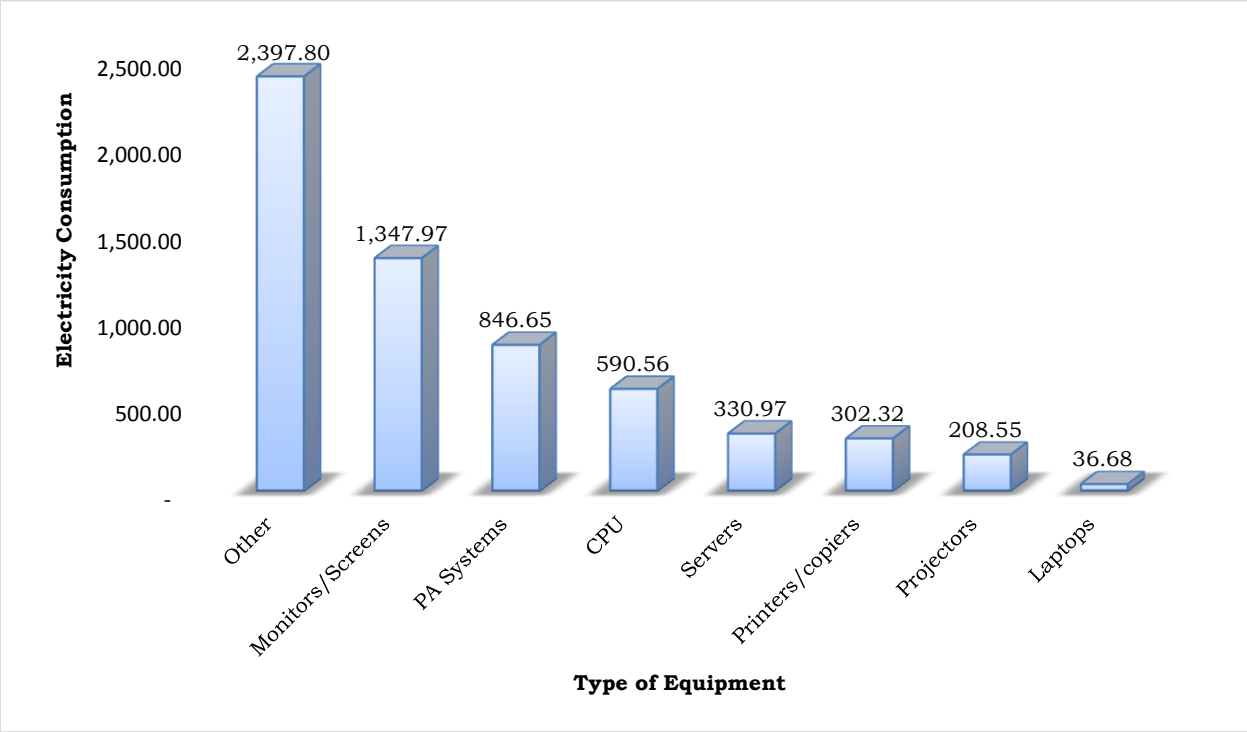
Table 3.19: Percentage Distribution of Establishments by Type of Equipment and Average Age – 2017 SECS

	Average Age				
Type of Equipment	**0 - 5**	**6 - 10**	**11+**	**Total (%)**	**Total (N)**
CPU	79.0	19.5	1.5	100	137
Monitors/Screens	65.1	29.3	5.6	100	334
Laptops	86.5	6.2	7.3	100	110
Servers	77.8	11.1	11.1	100	9
Printers/Copiers	52.3	37.6	10.1	100	100
Projector	84.6	15.4	0.0	100	13
PA Systems	57.0	32.9	10.1	100	186
Other	53.1	36.9	10.0	100	833

3.13.2 Electricity Consumption of Small Equipment

Figure 3.11 depicts electricity consumption (kWh) of small equipment by type. 'Other' (televisions, radios, rooters etc.) had the highest electricity consumption constituting 2,397.80 kWh. Monitors/Screens and PA Systems followed with 1,347.97 kWh and 846.65 kWh respectively. Laptops consumed the least amount of electricity with 36.68 kWh.

Figure 3.11: Electricity Consumption (kWh) of Small Equipment by Type – 2017 SECS

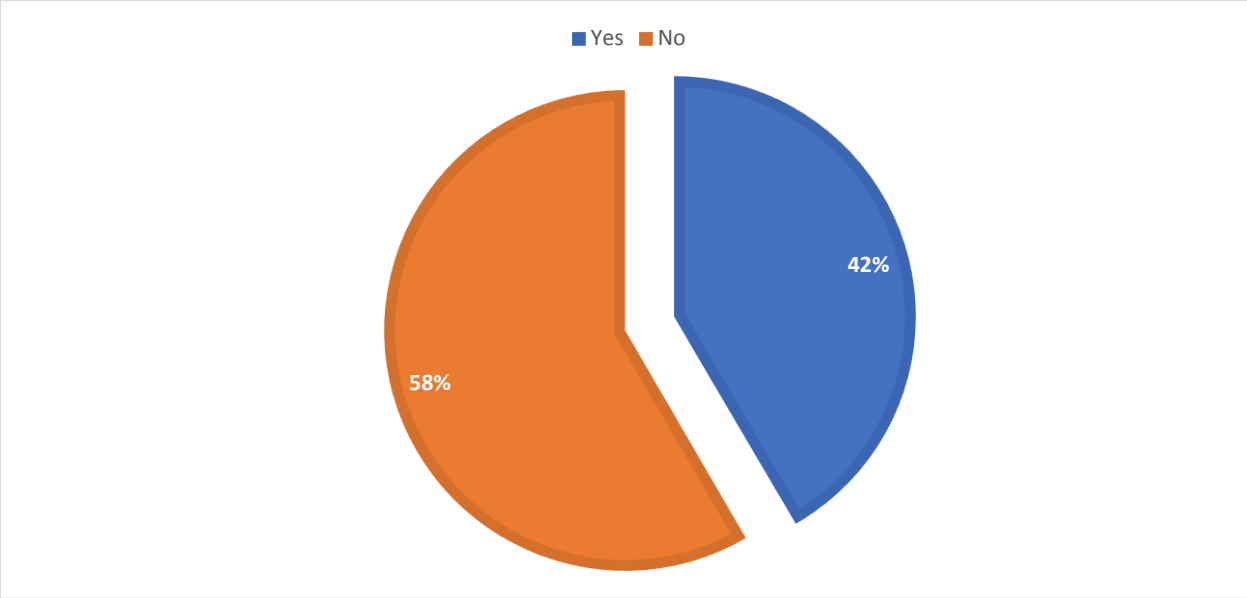


3.14 Cooking Facilities

Cooking facilities means equipment, devices or appliances that can be utilized to prepare a meal within a dwelling unit and includes a sink, counter-top, gas or electric range or stove, counter-top cooking unit, hot plate, arrangement of service lines which provide the energy source being used or intended to be used to service such facilities. https://www.lawinsider.com/dictionary/cooking-facilities.

Figure 3.12 illustrates percentage distribution of establishment with cooking facilities. With the reference of this figure, it is observed that the establishments which had cooking facilities constituted 42.0 percent while 58.0 percent did not have.

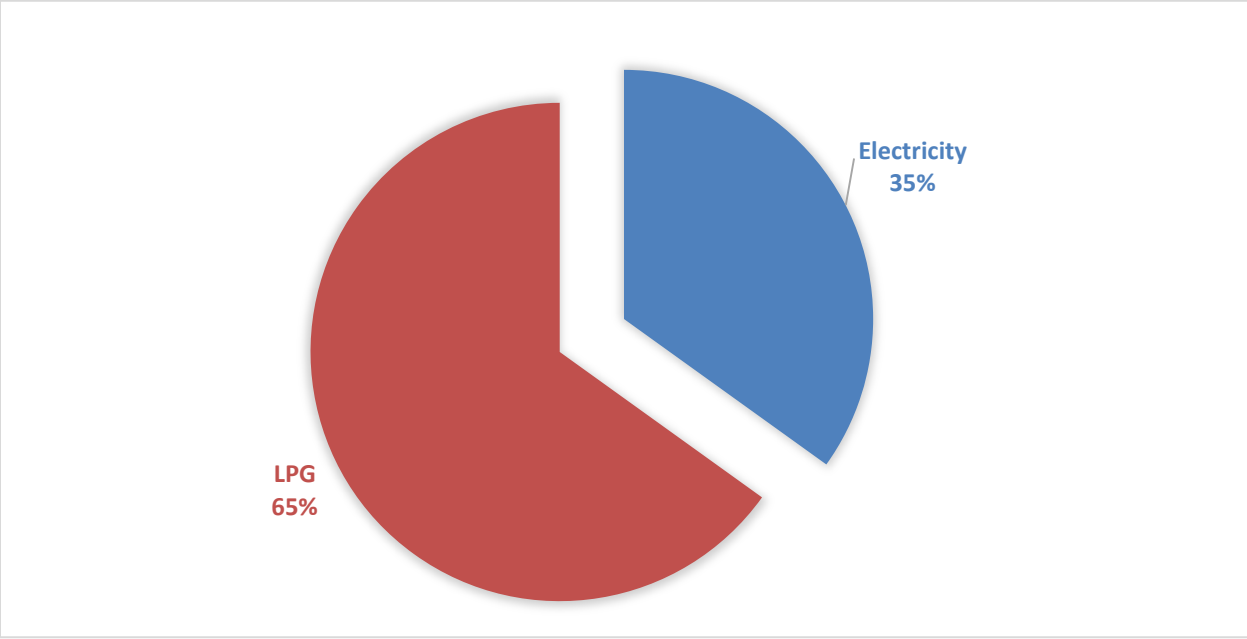
Figure 3.12: Percentage Distribution of Establishments with Cooking Facilities – 2017 SECS



3.14.1 Main Fuel Used for Cooking

Figure 3.13 demonstrates percentage distribution of establishment by main fuel used for cooking. The figure displays that 65.0 percent of establishments used Liquefied Petroleum Gas (LPG) as the main fuel for cooking while 35.0 percent used Electricity.

Figure 3.13: Percentage Distribution of Establishment by Main Fuel Used for Cooking – 2017 SECS

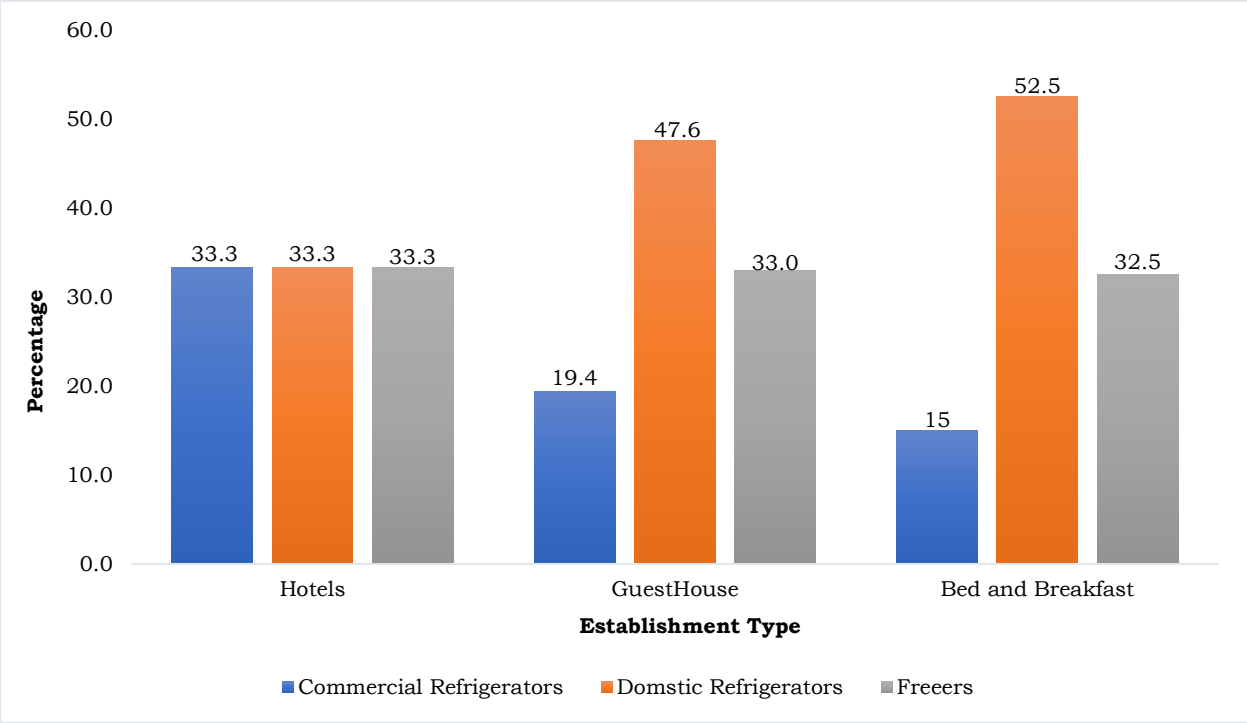


3.15 Refrigeration Equipment

Refrigeration is the process of removing heat from a body and cooling it to a lower temperature than the actual. Refrigerators are used for the refrigeration process. https://byjus.com/physics/refrigeration/

Figure 3.14 portrays percentage distribution of type of establishment by refrigeration equipment. Bed and Breakfast establishment mostly used Domestic refrigerators which accounted for 52.5 percent followed by Freezers with 32.5 percent. The usage of all refrigeration equipment was the same (33.3 percent) for Hotels.

Figure 3.14: Percentage Distributions of Type of Establishment by Refrigeration Equipment – 2017 SECS



3.16 Water Heating

Water heating is a thermodynamic process that uses an energy source to heat water above its initial temperature. Typical domestic uses of hot water include cooking, cleaning, bathing, and space heating. https://www.definitions.net/definition/water+heating

Table 3.20 presents percentage distribution of establishments using water heating equipment by district. It is observed that most (37.5 percent) establishments in Maseru district used water heating equipment followed by Leribe with 15.9 percent. The table further shows that establishments in Thaba Tseka were the least (2.1 percent) with regards to using water heating equipment.

Table 3.20: Percentage Distribution of Establishments Using Water Heating Equipment by District – 2017 SECS

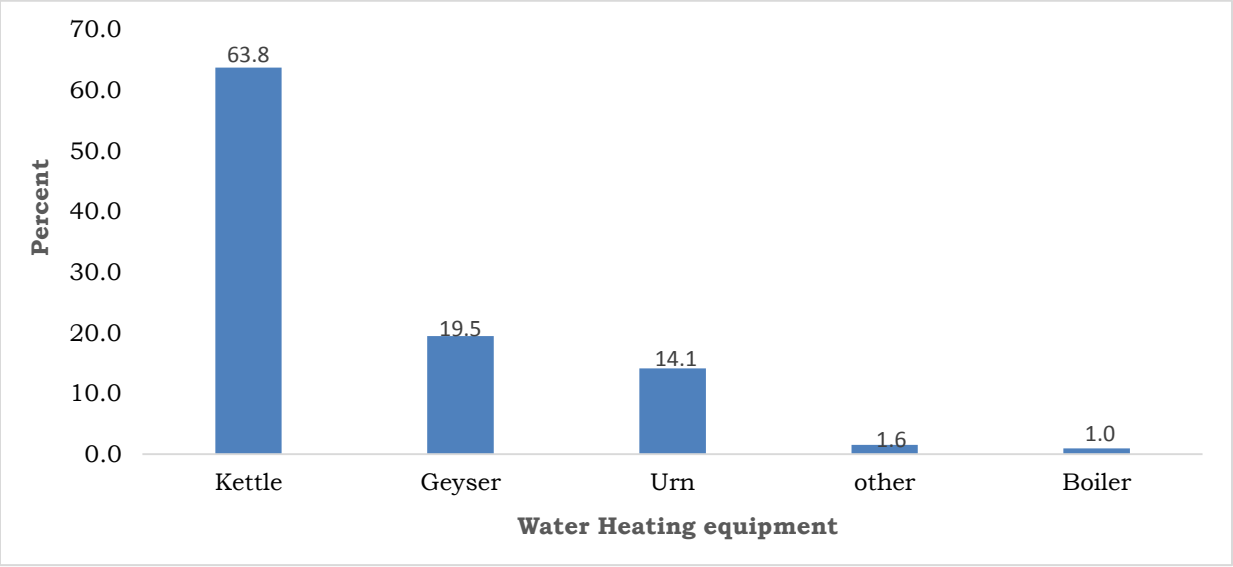
District	Water Heating	
	Used	Not Used
Botha-Bothe	4.1	3.3
Leribe	15.9	24.8
Berea	10.2	8.6
Maseru	37.5	20.3
Mafeteng	12.6	8.6
Mohale's Hoek	2.9	10.5
Quthing	6.9	6.1
Qacha's Nek	4.0	5.6
Mokhotlong	3.9	4.8
Thaba-Tseka	2.1	7.3
Total (%)	**100.0**	**100.0**
Total (N)	**555**	**619**

3.16.1 Water Heating Equipment

Water heating equipment include kettle, geyser, urn and other (element) for heating water.

Figure 3.15 illustrates the percentage distribution of establishments using water heating equipment by type. It is observed that a high percentage of the establishments (63.8 percent) used Kettle for water heating followed by Geyser with 19.5 percent.

Figure 3.15: Percentage Distribution of Establishments Using Water Heating Equipment-2017 SECS



3.17 Generator

Generator is a device that converts motive power into electric power for use in an external circuit. Sources of mechanical energy include steam turbines, gas turbines, water turbines, internal combustion engines, wind turbines and even hand cranks https://www.google.com

Table 3.21 shows percentage distribution of establishment by type and main use of generator. It is revealed by the table that Bar/Tavern had the greatest proportions across all categories of the main use of the generator with "Other" (86.3 percent), Powering Appliances (78.1 percent) and Lighting with 74.9 percent. Bed and Breakfast had the least percentages for Powering Appliances (1.5 percent) and Lighting (1.8 percent).

Table 3.21: Percentage Distribution of Establishments by Type and Main Use of Generator – 2017 SECS

	Main Use		
Type of Establishment	**Lighting**	**Powering Appliances**	**Other**
Hotels	0.0	3.0	0.0
Guesthouse	3.6	0.0	0.0
Bed and Breakfast	1.8	1.5	13.7
Lodges	11.4	0.0	0.0
Restaurant	8.3	17.3	0.0
Bar/Tavern	74.9	78.1	86.3
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**114**	**66**	**7**

CHAPTER 4: AGRICULTURE SECTOR

4.0 Introduction

The Agriculture sector comprises establishments primarily engaged in growing crops, raising animals, and harvesting fish and other animals from a farm, ranch, or their natural habitats. https://www.epa.gov/regulatory-information-sector/agriculture-sectors-crop-naics-111-and-animal-naics-112.

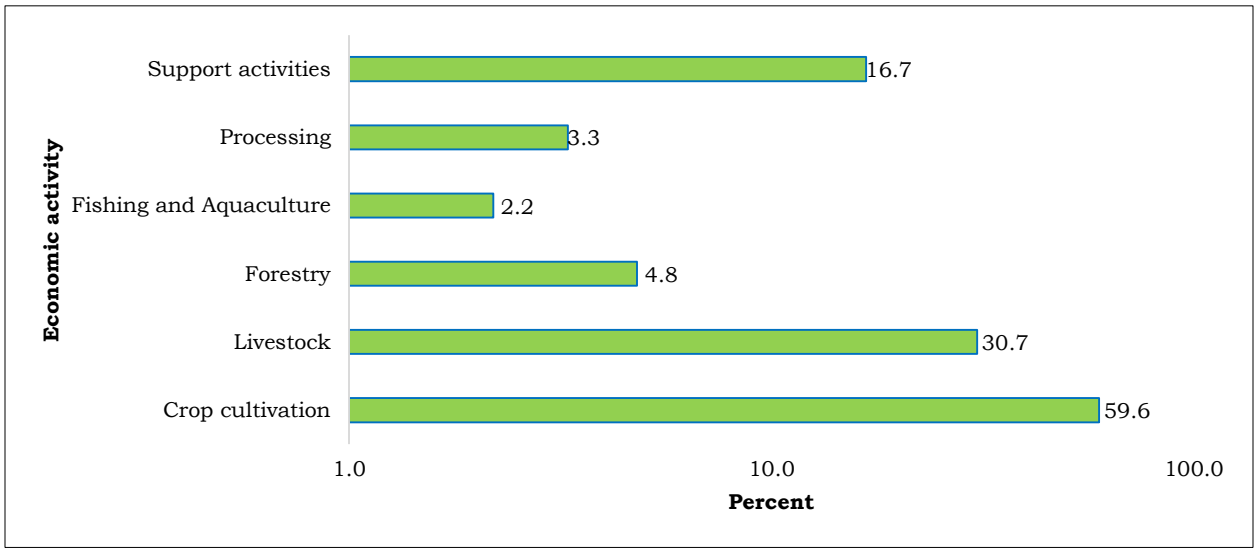
Energy is consumed directly by agriculture with the use of machinery (e.g. cultivation of fields with tractors) and the heating of livestock stables and greenhouses. Agriculture also uses energy indirectly, for the production of agrochemicals, farm machinery and buildings. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_energy_use#

4.1 Economic Activity

An economic activity takes place when resources such as capital goods, labour, manufacturing techniques or intermediary products are combined to produce specific goods or services. Thus, an economic activity is characterized by an input of resources, a production process and an output of products (goods or services). https://ec.europa.eu/eurostat/statistics explained/index. php?title=Glossary: Economic_activity.

Figure 4.1 depicts percentage distribution of agriculture facilities by economic activity. It is shown that most Agricultural facilities (59.6 percent) were involved in Crop cultivation followed by Livestock with 30.7 percent. Fishing and aquaculture contributed the least share of agriculture facilities (2.2 percent).

Figure 4.1: Percentage Distribution of Agriculture Facilities by Economic Activity - 2017 SECS



4.2 Ownership of Facilities

Agriculture facilities have different business structures which are set by farmers based on how they want to operate their farms. They can be owned by an individual who solely operates the farm, cooperatives, private companies as well as public companies.

Table 4.1 represents percentage distribution of facilities by ecological zone and ownership. It is observed that most Individuals that owned facilities (77.0 percent) were located in the lowlands and the least share of 0.9 percent in Senqu River Valley. It is further observed that all Private Companies (100.0 percent) were located in Lowlands.

Table 4.1: Percentage Distribution of Facilities by Ecological Zone and Ownership - 2017 SECS

	Ownership				
Ecological Zone	**Individual**	**Cooperative**	**Private Company**	**State Company**	**Total**
Lowlands	77.0	75.9	100.0	50.0	218
Foothills	6.3	9.7	0.0	3.3	21
Mountains	15.8	11.9	0.0	40.0	56
Senqu River Valley	0.9	2.5	0.0	6.7	8
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	
Total (N)	**115**	**119**	**10**	**60**	**304**

Table 4.2 depicts percentage share of facilities by ownership and economic activity. It is observed that most of the Crop cultivation facilities were owned by Individual and Cooperatives with 47.9 and 42.9 percent respectively. Fishing and Agriculture was owned by Cooperatives only.

Table 4.2: Percentage Share of Facilities by Ownership and Economic Activity - 2017 SECS

	Economic Activity						
Ownership	**Crop Cultivation**	**Livestock**	**Forestry**	**Fishing and Agriculture**	**Processing**	**Support Activities**	**Total**
Individual	47.9	28.9	20.6	0.0	50.0	0.0	115
Cooperative	42.9	48.9	63.5	100.0	50.0	8.9	119
Private Company	3.8	3.2	0.0	0.0	0.0	0.0	10
State Company	5.5	19.0	16.0	0.0	0.0	91.1	60
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	
Total (N)	**181.0**	**93.0**	**15.0**	**7.0**	**10.0**	**51.0**	**304.0**

4.3 Renewables and Waste

The agriculture sector is an important provider of biomass. The agricultural biomass resource can be used as a source of energy to produce heat, electricity and transport fuels. The agricultural sector also has a role to play to develop renewable energy consumption, including bioenergy. https://www.eubia.org/cms/wiki-biomass/biomass-resources/agriculture/

Percentage distribution of facilities by ecological zone and use of renewables and waste is displayed in figure 4.2. It is observed that most of agriculture facilities (45.3 percent) that use Renewables and Waste were located in the Mountains while the smaller share was located in Senqu River Valley with 6.0 percent.

Figure 4.2: Percentage Distribution of Facilities by Ecological Zone and Use of Renewables and Waste - 2017 SECS

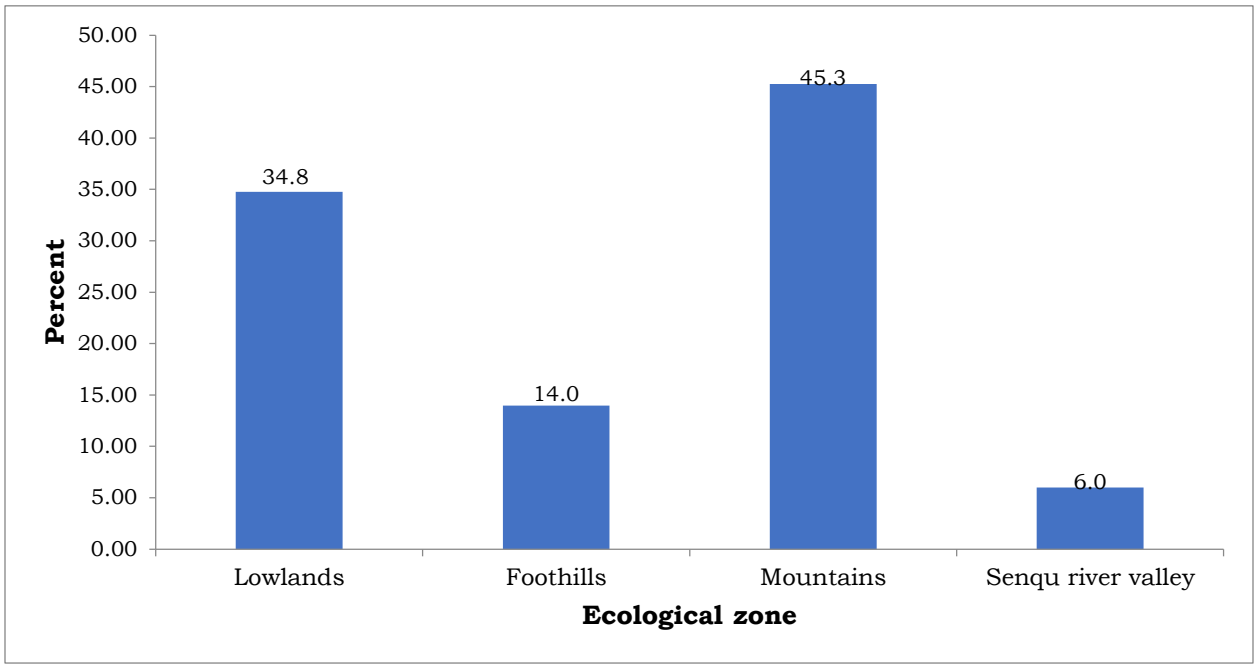


Table 4.3 shows percentage distribution of facilities by type of renewables and waste as well as main use. It is revealed that most facilities used Wood and other Waste mainly for Cooking followed by Space heating with 40.9 and 33.3 percent respectively. "Other" main use (such as melting wax) accounted for 2.1 percent which was the lowest.

Table 4.3: Percentage Distribution of Facilities by Type of Renewables and Waste and Main Use – 2017 SECS

	Renewable and Waste	
Main use of Renewables	**Wood and other Wastes**	**Other**
Space Heating	33.3	0
Cooking	40.9	100
Water Heating	23.7	0
Other	2.1	0
Total (%)	**100**	**100**
Total (N)	**48**	**3**

Table 4.4 presents quantity and energy of renewable and wastes used by type and ecological zones. The table unveils that, a maximum quantity (19,129.00kg) and energy (329.02GJ) of Wood and other Waste was used in the Lowlands followed by Mountains with 14,165.50kg resulting to 243.65GJ. Other type of renewable and wastes (1,700.00kg) resulting to (29.24GJ) was used only in the Mountains.

Table 4.4: Quantity and Energy of Renewable and Wastes used by Type and Ecological Zones - 2017 SECS

	Wood and Other Waste		Other	
Ecological Zone	**Quantity (kg)**	**Energy(GJ)**	**Quantity (kg)**	**Energy (GJ)**
Lowlands	19,129.00	329.02		
Foothills	6,610.00	113.69		
Mountains	14,165.50	243.65	1,700.00	29.24
Senqu River Valley	6,100.00	104.92		
Total	**46,004.50**	**791.28**	**1,700.00**	**29.24**

4.4 Solar Photovoltaic (PV)

Solar energy can be utilized in different sectors in Agriculture. Thermal energy can harness for utilization in drying, cooling, steam generation, etc. whereas electrical energy can be used in pumping water for irrigation, rural electrification and to operate various agricultural machineries https://www.biotecharticles.com/Applications-Article/Importance-of-Solar-Energy-in-Agriculture-

Table 4.5 displays percentage distribution of households connected to solar by ownership. It is observed that all facilities which had solar photovoltaic were owned by Cooperatives.

Table 4.5: Percentage Distribution of Facilities by Ownership and Use of Solar (PV)- 2017 SECS

	Solar Photovoltaic		
Ownership	**Used**	**Not used**	**Total (N)**
Individual	0.0	38.8	115
Cooperative	100.0	37.6	119
Private Company	0.0	3.3	10
State Company	0.0	20.3	60
Total (%)	**100**	**100**	
Total (N)	**8**	**296**	**304**

Table 4.6 exhibits quantity of electricity generated in kilowatt hour (kWh) by main use of solar. The table reveals that a total (5,694.15kWh) of electricity generated by solar (PV) was used. It also disposes that, a maximum (3,846.15kWh) of electricity generated by solar (PV) was used for Water Pumping and the least (1,848.00kWh) was used for Lighting.

Table 4.6: Quantity of Electricity Generated (kWh) by Main Use of Solar (PV) - 2017 SECS

Main Use	Electricity Generated
Lighting	1,848.00
Water Pumping	3,846.15
Total	**5,694.15**

4.5 Grid Electricity

Electrical power is used mostly for running electrical motors, for pumping water, dairy industry, cold storage, farm product processing, and cattle feed grinding (Makange, 2015).

Percentage distribution of facilities by use of grid electricity and district is demonstrated in figure 4.3. The largest percentage of facilities connected to grid electricity was reported in Leribe (30.2 percent) followed by Botha-Bothe with 14.6 percent. The connection percentages reported for Mohale's Hoek, Quthing and Mokhotlong districts was 3.6 percent each. No agriculture facilities in Qacha's Nek reported electricity connection.

Figure 4.3: Percentage Distribution of Facilities by Use of Grid Electricity and District - 2017 SECS

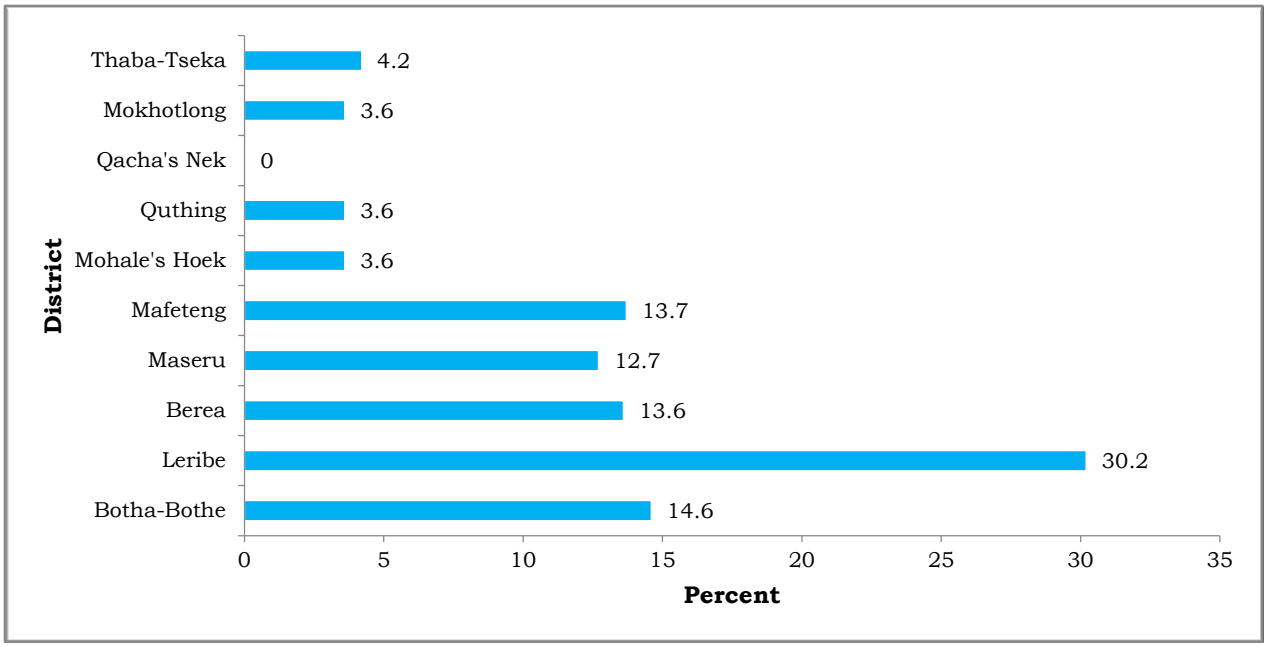


Table 4.7 presents the percentage distribution of facilities by amount paid and economic activity. The largest share of Crop cultivation facilities (44.4 percent) reported to have spent M3,500.00 and above to purchase electricity followed by those who spent from M500.00 to M1,999.99 (43.0 percent). Majority of Livestock production facilities (44.3 percent) spent M500.00 to M1,999.99. Most of Support activities (35.0 percent) spent from M2,000.00 to M3,499.99.

Table 4.7: Percentage Distribution of Facilities by Amount Paid and Economic Activity - 2017 SECS

	Economic Activity					
Amount Paid	**Crop cultivation**	**Livestock**	**Forestry**	**Processing**	**Support activities**	**Total**
< M500.00	12.6	12.0	0.0	0.0	14.6	4
M500.00 - M1999.99	43.0	44.3	100.0	50.0	19.7	22
M2000.00 - M3499.99	0.0	0.0	0.0	0.0	35.0	8
M3500.00+	44.4	43.8	0.0	50.0	30.7	20
Total (%)	**100**	**100**	**100**	**100**	**100**	
Total (N)	**18**	**28**	**2**	**4**	**23**	**55**

Table 4.8 presents percentage distribution of facilities by use of grid electricity and solar photovoltaic (solar PV). All facilities (100.0 percent) which reported to use Solar PV did not use Grid electricity. It is observed that 18.6 percent of facilities which did not use Solar PV reported to have used Grid electricity. No facilities reported to have used both Solar PV and Grid electricity.

Table 4.8: Percentage Distribution of Facilities by Use of Grid Electricity and Solar PV – 2017 SECS

	Solar Photovoltaic		
Grid Electricity	**Used**	**Not used**	**Total (N)**
Used	0.0	18.6	55
Not used	100.0	81.4	249
Total (%)	**100**	**100**	
Total (N)	**8**	**296**	**304**

Table 4.9 sets out the quantity of grid electricity used in kilowatt hour by ownership of facility. The table unveils the total quantity (16,808,778.65kWh) of electricity used in the Agriculture sector. It reveals that, State Companies used more electricity (16,583,897.43kWh) while Private Companies used less (4,375.00kWh).

Table 4.9: Quantity of Grid Electricity (kWh) Used by Ownership - 2017 SECS

Ownership	**Electricity Used**
Individual	84,029.54
Cooperative	136,476.67
Private Company	4,375.00
State Company	16,583,897.43
Total	**16,808,778.65**

4.5.1 Main Uses of Electricity

Agriculture facilities use energy directly as fuel or electricity for various reasons including water pumping (irrigation), machinery and equipment operation, to heat or cool buildings, and for lighting on the farm.

Table 4.10 conveys the total quantity of grid electricity used in kilowatt hour (kWh) by ownership of a facility and main use. The table displays that State Companies consumed more electricity (16,573,072.54) kWh) for Space heating followed by Cooperatives with 135,351.67 kWh used for lighting. It further shows that least electricity (1,125.00kWh) was used by Cooperatives for “Other”.

Table 4.10: Grid Electricity (kWh) Used by Ownership and Main Use - 2017 SECS

	Main Use						
Ownership	**Lighting**	**Pumping (irrigation)**	**Cooking**	**Space Heating**	**Milling**	**Other**	**Total**
Individual	0.00	62,510.16	0.00	5,250.00	3,331.88	12,937.50	84,029.54
Cooperative	135,351.67	0.00	0.00	0.00	0.00	1,125.00	136,476.67
Private Company	0.00	0.00	4,375.00	0.00	0.00	0.00	4,375.00
State Company	9,250.00	0.00	0.00	16,573,072.54	0.00	1,574.89	16,583,897.43
Total	**144,601.67**	**62,510.16**	**4,375.00**	**16,578,322.54**	**3,331.88**	**15,637.39**	**16,808,778.65**

4.6 Conventional Energies

Conventional sources of energy are the ones that are commonly used, and generally non-renewable sources of energy, which are being used since a long time. Examples of conventional sources of energy include oil, natural gas, coal, etc. Coal is an important contributor to power development. However, it deteriorates the environment by polluting air, water, and soil. It also pollutes the surrounding agricultural land that limits the production. https://www.researchgate.net/publication/261366522

LPG assists in providing heat for growing crops like Strawberries and Asparagus and heat for Poly tunnels to being an ideal fuel for crop drying. LPG is a clean, safe, and effective fuel source. When used for poultry, LPG-powered heaters isolate harmful products as well as minimizing water vapour and CO2 inside sheds. This helps keep litter dry, improve chick growth, and reduce the risk of common diseases such as Pododermititis. https://www.liquidgasuk.org/commercial/lpg-for-agriculture#

Table 4.11 shows percentage distribution of facilities by use of conventional energies and economic activity. It is studied that most facilities that used conventional energies were Support activities (49.2 percent) followed by Livestock with 40.0 percent. No facilities reported to have used Conventional energies in Fishing and Aquaculture.

Table 4.11: Percentage Share of Facilities by Use of Conventional Energies and Economic Activity – 2017 SECS

	Conventional Energies		
Economic Activity	**Used**	**Not used**	**Total**
Crop cultivation	19.3	73.9	181
Livestock	40.0	27.4	93
Forestry	2.9	5.5	15
Fishing and Aquaculture	0.0	3.0	7
Processing	6.3	2.2	10
Support activities	49.2	5.2	51
Total (%)	**100.0**	**100.0**	
Total (N)	**80**	**224**	**304**

Table 4.12 displays percentage distribution of facilities by type of conventional energies and main use. It is observed that majority (74.0 percent) of facilities used LPG as the main conventional energy for Space heating. It is further revealed that LPG was mostly used for Cooking with 88.2 percent. Paraffin was used more for "Other" uses (85.9 percent) which included Lighting.

Table 4.12: Percentage Distribution of Facilities by Type of Conventional Energies and Main Use – 2017 SECS

	Main Use		
Conventional Energies	**Space Heating**	**Cooking**	**Other**
Anthracite	17.2	0.0	0.0
Bituminous	11.7	0.0	14.1
Paraffin	17.2	23.5	85.9
LPG	74.0	88.2	21.1
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**51**	**17**	**14**

Table 4.13 indicates the quantity of conventional energies used by type and economic activity. The table shows that Livestock used more Paraffin (9,374.30 litres), releasing the energy of 356.22 GJ followed by Crop Cultivation with 5,884.80 litres, releasing 223.62 GJ. The table further reveals that Processing used least LPG (18.00 kg) releasing 0.81 GJ of energy.

Table 4.13: Quantity and Energy of Conventional Energies Used by Type and Economic Activity - 2017 SECS

	Economic Activity					
Type of Conventional Energies	**Crop cultivation**	**Livestock**	**Forestry**	**Processing**	**Support activities**	**Total**
Anthracite (kg)	0.00	0.00	0.00	160.00	3,677.00	3,837.00
Bituminous (kg)	0.00	1,800.00	0.00	0.00	1,660.00	3,460.00
Paraffin (l)	5,884.80	9,374.30	0.00	3,915.00	912.79	15,046.89
LPG (kg)	584.52	1,400.68	223.68	18.00	2,394.84	3,829.36
Energy (GJ)						
Anthracite	0.00	0.00	0.00	4.16	95.60	99.76
Bituminous	0.00	46.80	0.00	0.00	43.16	89.96
Paraffin	223.62	356.22	0.00	148.77	34.69	763.30
LPG	26.30	63.03	10.07	0.81	107.77	207.98

Table 4.14 indicates the percentage distribution of facilities by amount paid and type of conventional energies. The table reveals that 62.3 percent of the facilities paid M250.00 and above for Anthracite and only 11.3 percent paid less than M150.00. The table further shows that 95.8 percent of the facilities paid less than M150.00 for Paraffin and only 4.2 percent paid between (M150.00 and M199.00). It also highlights that 96.2 percent of the facilities paid M250.00 and above for LPG.

Table 4.14: Percentage Distribution of Facilities by Amount Paid (M) and Type of Conventional Energies - 2017 SECS

Type of Conventional Energies	Amount Paid				Total
	< M150.00	M150.00 - M199.00	M200.00 - M249.00	M250.00+	
Anthracite	11.3	0.0	26.4	62.3	100.0
Bituminous	33.3	0.0	0.0	66.7	100.0
Paraffin	95.8	4.2	0.0	0.0	100.0
LPG	0.0	3.8	0.0	96.2	100.0

4.7 Petroleum Products

Modern intensive agriculture requires much more energy input than traditional farming methods, since it relies on the use of fossil fuels for tillage, transportation and grain drying, for the manufacture of fertilizers, pesticides and equipment used as agricultural inputs, and for generating electricity used on farms (Frye, 1984).

Petroleum products are used to drive both motive power and stationery processing machinery. The more technically advanced and mechanically oriented an agricultural system, the more external energy is required.
https://na.unep.net/api/geas/articles/get

Table 4.15 displays the percentage distribution of facilities by economic activity and type of petroleum product used. Most of the facilities (46.6 percent) used Diesel 50ppm in Support activities. It is also observed that majority (66.4 percent) of the facilities used Diesel 500ppm for Livestock activities. The table further reveals that 86.9 percent of the facilities used Unleaded Petrol for Crop cultivation.

Table 4.15: Percentage Distribution of Facilities by Economic Activity and Type of Petroleum Product Used - 2017 SECS

Economic Activity	Petroleum Product		
	Diesel 50ppm	Diesel 500ppm	Unleaded petrol
Crop cultivation	26.3	25.2	86.9
Livestock	35.6	66.4	16.9
Forestry	0.0	0.0	3.1
Processing	4.2	16.8	3.1
Support activities	46.6	0.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**24**	**12**	**64**

Table 4.16 presents percentage distribution of facilities by type of petroleum product and main use. It is reported that majority of the facilities (50.8 percent) used Diesel 50ppm for Transportation followed by Pumping with 28.0 percent. The least share of facilities (4.2 percent) used Diesel 50ppm for Milling and "Other". It is further reported that most facilities used Diesel 500ppm (58.0 percent) for Pumping. Most facilities (55.4 percent) used Unleaded Petrol for Electricity Generation

Table 4.16: Percentage Distribution of Facilities by Type of Petroleum Product and Main Use - 2017 SECS

	Petroleum Product		
Main Use	**Diesel 50ppm**	**Diesel 500ppm**	**Unleaded Petrol**
Heating	8.5	0.0	0.0
Mobile Equipment	13.6	25.2	6.5
Pumping	28.0	58.0	38.4
Electricity Generation	8.5	0.0	55.4
Transport	50.8	8.4	6.2
Milling	4.2	16.8	1.6
Other	4.2	0.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**24**	**12**	**64**

Table 4.17 presents percentage distribution of facilities by ownership and type of petroleum product used. The greatest share of facilities that used Diesel 50ppm (46.6 percent) was owned by State Company. About 66.4 percent of facilities that used Diesel 500ppm were owned by Individual. Furthermore, 57.3 percent of the facilities that used Unleaded Petrol were owned by Cooperatives.

Table 4.17: Percentage Distribution of Facilities by Ownership and Type of Petroleum Product Used - 2017 SECS

	Petroleum Product		
Ownership	**Diesel 50ppm**	**Diesel 500ppm**	**Unleaded Petrol**
Individual	22.0	66.4	41.1
Cooperative	27.1	33.6	57.3
Private Company	4.2	0.0	1.6
State Company	46.6	0.0	0.0
Total (%)	**100.0**	**100.0**	**100.0**
Total (N)	**24**	**12**	**64**

4.8 Lubricants

Machine wear is a natural process that happens continuously as moving parts generate friction between them. However, when using the right lubricant, these moving parts will be fully protected and covered, which helps them stay moving for longer, reducing any potential wear and tear problems. The right lubrication for agricultural machinery can protect against corrosion https://www.compassfuels.co.uk/advantages-of-correct-lubrication-for-agricultural-machinery/.

Figure 4.4 demonstrates percentage distribution of facilities using lubricants by zone. It is observed that majority of facilities using lubricants (78.1 percent) were located in the Lowlands while the least share of facilities were in Senqu River Valley with 2.2 percent.

Figure 4.4: Percentage Distribution of Facilities Using Lubricants by Zone – 2017 SECS

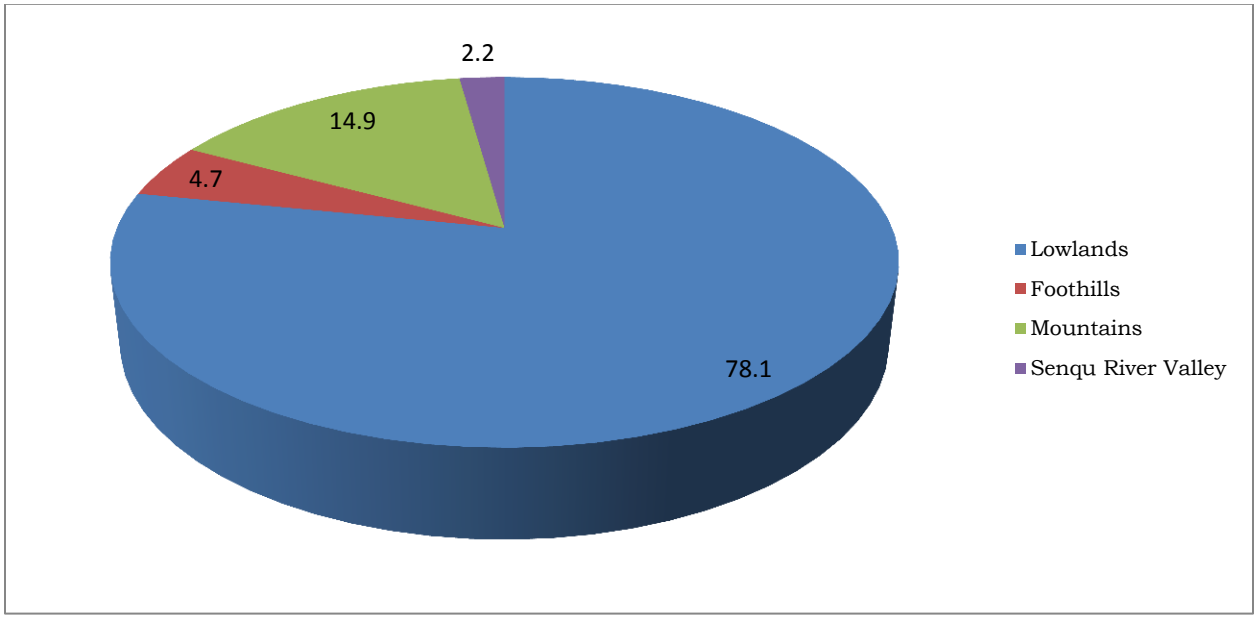


Table 4.18 reveals the quantity of lubricants used for operation and transportation by type. The table shows that Motor oil (4,078.04 litres) was mostly used followed by Heavy oil (195.00 litres). The least used lubricant was Transmission oil (6.00 litres). The table further highlights that all lubricants stated were used for Operation.

Table 4.18: Quantity of Lubricants Used for Operation and Transportation by Type - 2017 SECS

	Quantity		
Type of Lubricant	**Operation**	**Transportation**	**Total**
Grease (kg)	56.44	20.00	76.44
Brake fluid (l)	7.00	5.00	12.00
Motor oil (l)	3,954.44	123.60	4,078.04
Heavy oil (l)	155.00	40.00	195.00
Transmission oil (l)	6.00	0.00	6.00
Other (l)	20.00	0.00	20.00

4.9 Agriculture Operation

Agricultural production operations programs focus on the general planning, economics, labor, and capital to produce plant and animal products https://careerwise.minnstate.edu/education/major?id=0103

Table 4.19 presents percentage distribution of facilities by economic activity and days of operation per week. It is observed that most facilities involved in Livestock production (60.3 percent) reported to have operated 7 days per week and very few (1.1 percent) operated for 3 to 4 days. On the other hand, most facilities (93.4 percent) dealing with Support activities operated 5 days per week. Facilities engaged in Fishing and Aquaculture activities operated only for 6 days per week.

Table 4.19: Percentage Distribution of Facilities by Economic Activity and Days of Operation per week - 2017 SECS

Economic Activity	**Days of Operation**						
	3	**4**	**5**	**6**	**7**	**Total (%)**	**Total (N)**
Crop cultivation	0.6	1.4	15.8	39.4	42.9	**100.0**	**181**
Livestock	1.1	1.1	20.6	16.9	60.3	**100.0**	**92**
Forestry	0.0	17.8	6.9	68.5	6.9	**100.0**	**15**
Fishing and Aquaculture	0.0	0.0	0.0	100.0	0.0	**100.0**	**7**
Processing	10.0	0.0	30.0	30.0	30.0	**100.0**	**10**
Support activities	0.0	0.0	93.4	2.0	4.6	**100.0**	**51**

4.9.1 Working Hours

A person's Weekly Operating Hours are the total number of hours per week where the majority of workers are present. For example, if the majority of workers are in the building from 8:00 am - 6:00 pm M-F, then Weekly operating hours would be 50 (10 hrs * 5 days per week) https://energystar-mesa.force.com/How-do-I-determine-Weekly-Operating-Hours.

Table 4.20 presents the percentage distribution of facilities by hours of operation per day. The table indicates that 80.6 percent of facilities operated between 6 to 10 hours per day on Weekdays followed by 8.7 percent of facilities that operated between 1 to 5 hours. The table also conveys that about 34.9 percent of facilities operated between 1 to 5 hours on Weekends. Furthermore, 32.2 percent of facilities reported that there was no operation on Weekends.

Table 4.20: Percentage Distribution of Facilities by Hours of Operation per day - 2017 SECS

Hours of Operation Per Day	Weekdays	Weekends
No Operation	0.0	32.2
1 - 5	8.7	34.9
6 - 10	80.6	25.2
11 - 15	6.4	4.2
16+	4.2	3.6
Total (%)	**100.0**	**100.0**
Total (N)	**304.0**	**304.0**

4.9.2 Buildings Occupied

Number of buildings in an Agriculture facility are occupied based on the type of entity and the size of operation. Some operations may require multiple buildings whilst other may require no buildings at all.

The table 4.21 presents the percentage distribution of facilities by number of buildings occupied and economic activity. Most facilities (39.7 percent) engaged in Crop cultivation occupied one building while the least number (1.7 percent) occupied 4 or more buildings. Facilities involved in Fishing and Aquaculture only occupied 2 buildings.

Table 4.21: Percentage Distribution of Facilities by Number of Buildings Occupied and Economic Activity – 2017 SECS

Total Number of Buildings	Economic Activity					
	Crop cultivation	Livestock	Forestry	Fishing and Agriculture	Processing	Support activities
No building	37.7	7.1	38.4	0.0	20.0	0.0
1	39.7	38.8	0.0	0.0	40.0	66.2
2	5.5	31.1	61.6	100.0	10.0	13.4
3	15.5	16.5	0.0	0.0	0.0	14.4
4+	1.7	6.4	0.0	0.0	30.0	5.9
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**
Total (N)	**181**	**93**	**15**	**7**	**10**	**51**

4.10 Independent Systems

There are many different types of independent systems world-wide but the report entails only that are available in the Agriculture sector in Lesotho. Some independent systems are used to heat or warm living rooms while others are used to remove heat from the enclosed space to achieve a more comfortable interior environment, and in some cases strictly controlling the humidity of internal air.

Figure 4.5 depicts percentage distribution of facilities by independent systems used. The figure illustrates that 23.3 percent of facilities used independent systems. The figure also reveals that 76.7 percent of facilities did not use independent systems.

Figure 4.5: Percentage Distribution of Facilities by Independent Systems - 2017 SECS

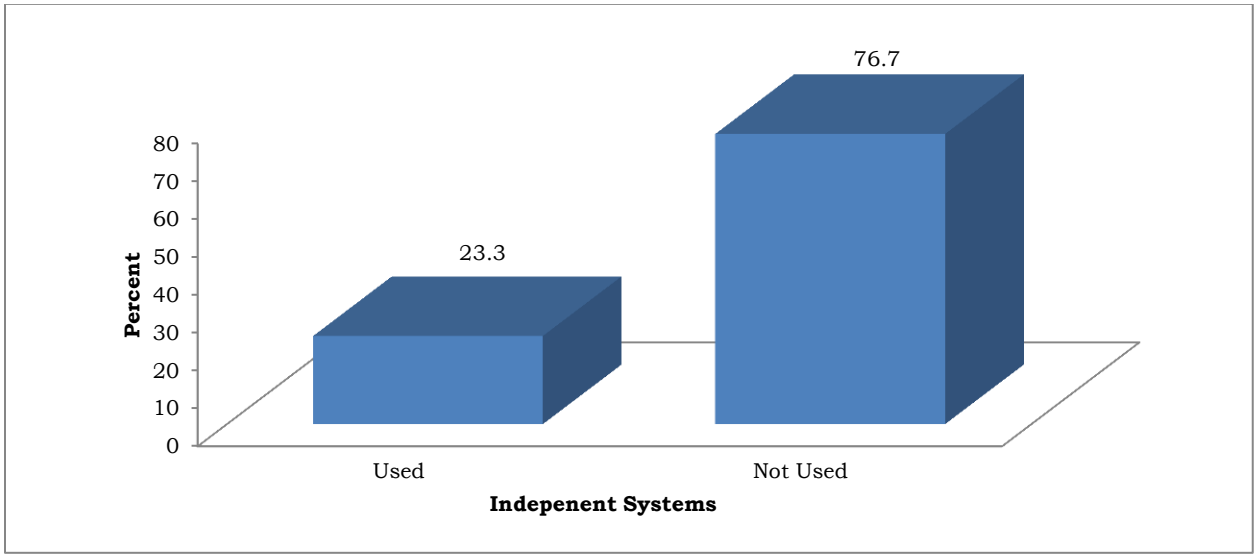


Table 4.22 conveys percentage distribution of facilities by type of independent systems or appliance. The table shows that 56.3 percent of the facilities used Gas Heater followed by 18.8 percent of facilities that used Electric Oil Heater. Only 4.7 percent of facilities used "Other".

Table 4.22: Percentage Distribution of Facilities by Type of Independent Systems/Appliance - 2017 SECS

Type of System	Percent
Electric Oil Heater	18.8
Electric Resistance Heater	12.5
Paraffin Heater	10.9
Gas Heater	56.3
Other	4.7
Total (%)	**100.0**
Total (N)	**64**

Table 4.23 displays total quantity of fuel consumed by type of independent systems. The table reveals that Wood Stove ("Other") used 3,600,000.00 kilogram of wood. It was also observed that Paraffin Heater used 34,166.40 litres of paraffin. The least quantity of fuel (1,008.00 kWh) was consumed by Fan Heater.

Table 4.23: Total Quantity of Fuel consumed by Type of Independent System - 2017 SECS

Type of System	Quantity
Electric Oil Heater (kWh)	7,895.28
Electric Resistance Heater (kWh)	8,044.80
Paraffin Heater (litres)	34,166.40
Gas Heater (kg)	278,107.00
Other	
Wood Stove (kg)	3,600,000.00
Fan Heater (kWh)	1,008.00

4.11 Control Sensors

Sensors are measuring devices that register ambient conditions such as brightness or motion. The lighting is adjusted when the lighting control system receives an impulse or a value above or below a predetermined level. A light sensor monitors light levels and enables the automatic control of light scenes depending on available daylight. Motion sensors register movement in the room and can be used, for example, in vacant offices to dim or switch off the light automatically in order to save power https://www.erco.com/en/guide/lighting-control/sensors-2611/.

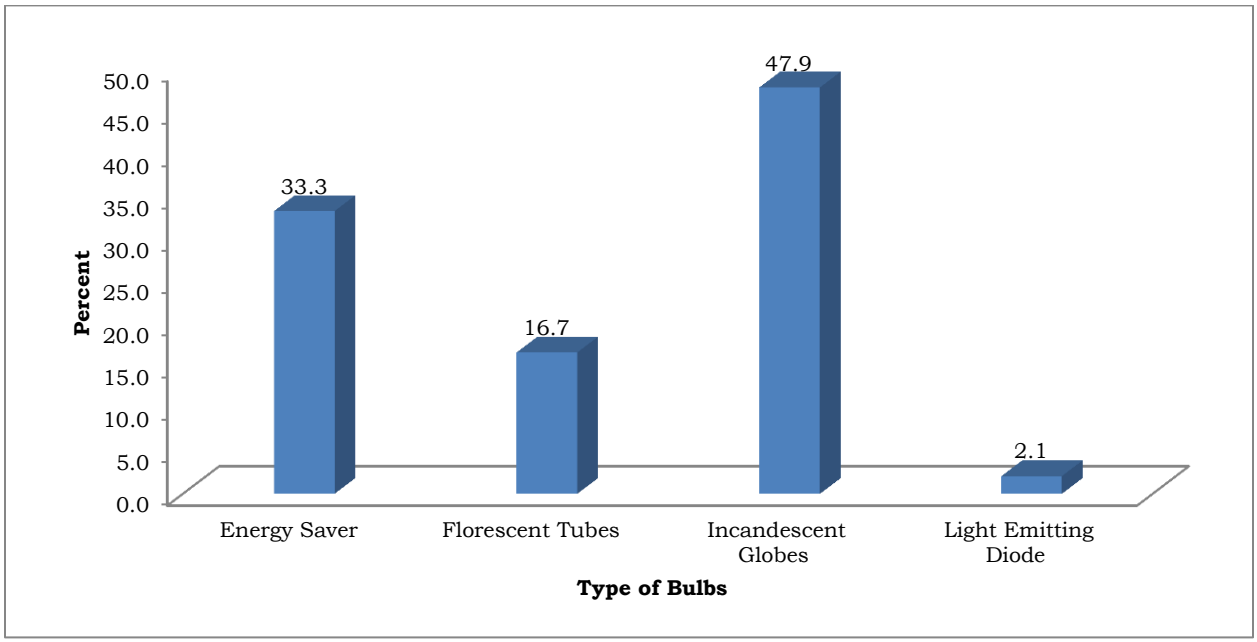
Table 4.24 presents the percentage number of facilities by light and motion sensor controls. The table conveys that 25.0 percent of facilities in the agriculture sector used Light Sensor controls and 75.0 percent did not use. The table also shows that facilities that used Motion Sensor controls accounted for 100 percent.

Table 4.24: Percentage Distribution of Facilities by Light and Motion Sensor Controls - 2017 SECS

Sensors' Usage	Light Sensor	Motion Sensor
Yes	25.0	100.0
No	75.0	0.0
Total (%)	**100.0**	**100.0**
Total (N)	**4**	**1**

Figure 4.6 depicts percentage distribution of facilities by type of bulbs used for lighting. The figure depicts that 33.3 percent of facilities used Energy Saver followed by Incandescent Globes with 47.9 percent. It was further observed that 2.1 percent of facilities used Light Emitting Diode.

Figure 4.6: Percentage Distribution of Facilities by Type of Bulbs used for Lighting - 2017 SECS

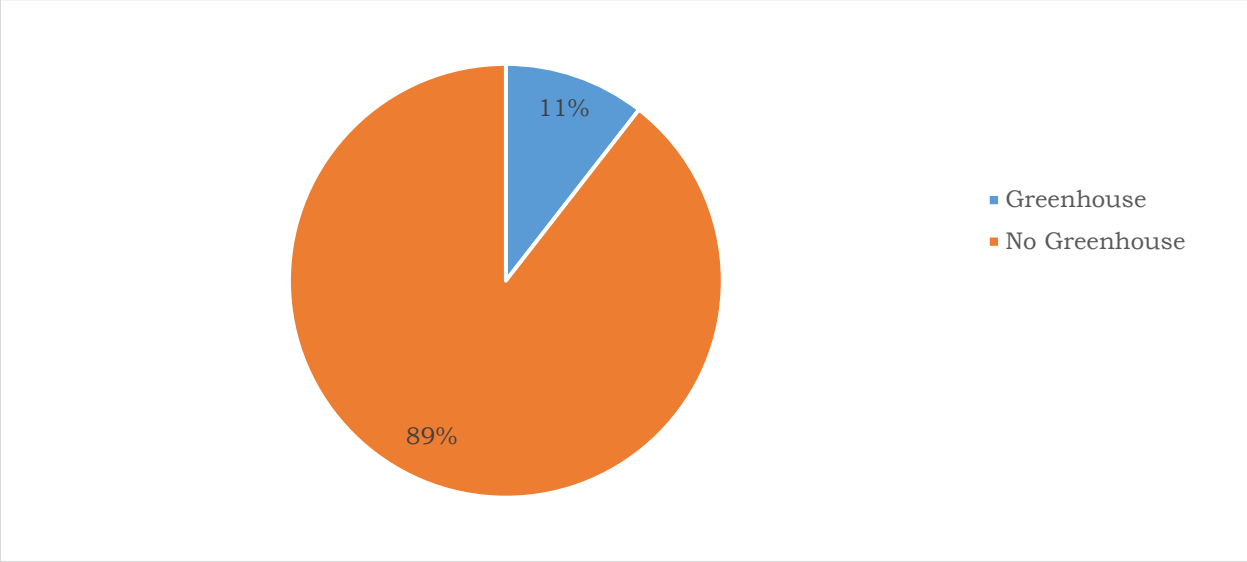


4.12 Greenhouses

A greenhouse is a structure with walls and roof made chiefly of transparent material, such as plastic, in which plants requiring regulated climatic conditions are grown. These structures range in size from small sheds to industrial-sized buildings. https://en.wikipedia.org/wiki/Greenhouse

Figure 4.7 portrays percentage share of agricultural establishments with greenhouse. According to the results illustrated by figure 4.7, 11.0 percent of the Agricultural Establishments had Greenhouses whereas 89.0 percent did not.

Figure 4.7: Percentage Share of Agricultural Establishments with Greenhouse – 2017 SECS

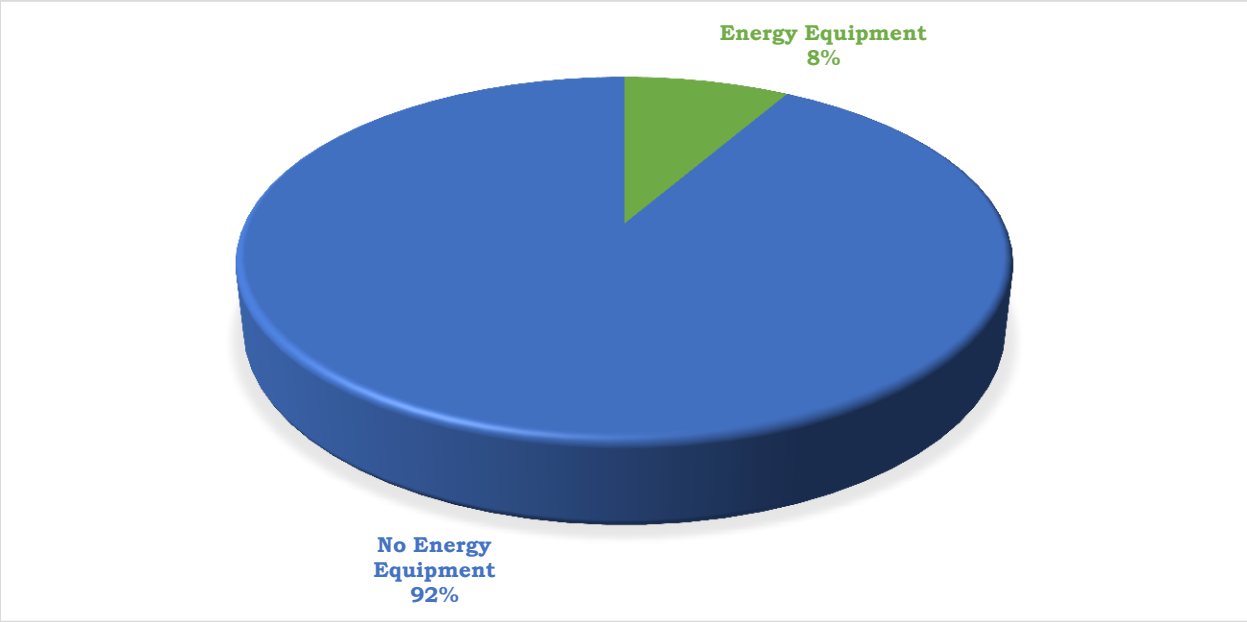


4.13 Greenhouse with Installed Energy Equipment

Greenhouses require energy to thrive. Most greenhouses require fans, water pumps and heating equipment for operation.

Percentage distribution of agricultural establishments with installed energy equipment is depicted in Figure 4.8. The results show that 8.0 percent of Agricultural Establishments with Greenhouse installed energy equipment and 92.0 percent did not.

Figure 4.8: Percentage Distribution of Agricultural Establishments with Installed Energy Equipment – 2017 SECS

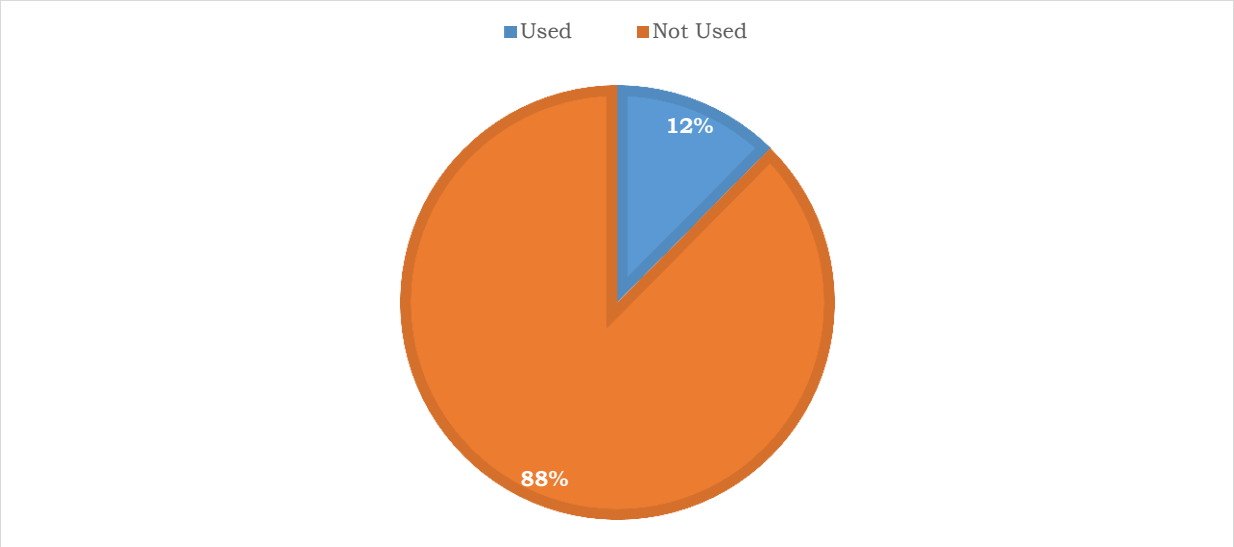


4.14 Generators

An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output.

Figure 4.9 provides information on percentage share of agricultural establishments using a Generator. Agricultural establishments without usage of the generator had the largest share (88.0 percent) while those that used a generator had the smallest share of 12.0 percent.

Figure 4.9: Percentage Share of Agricultural Establishments Using a Generator – 2017 SECS



4.14.1 Uses of Generators

Generators are often used as either backup power or even primary power for farming operations, as well as portable power for working on hard-to-reach locations. Barn, stable, or chicken coop heaters, fish farm air pumps, and irrigation systems are just a few farming and ranching devices that are commonly powered by generators. https://www.wpowerproducts.com/news/14-practical-uses-for-generators/

Figure 4.10 displays percentage distribution of the uses of a generator in agricultural sector. It is revealed that 60.0 percent of Agricultural Establishments used generators for Other (water pumping) purposes, 35.0 percent for Irrigation and 5.0 percent for Lighting Greenhouses.

Figure 4.10: Percentage Distribution of Uses of a Generator – 2017 SECS

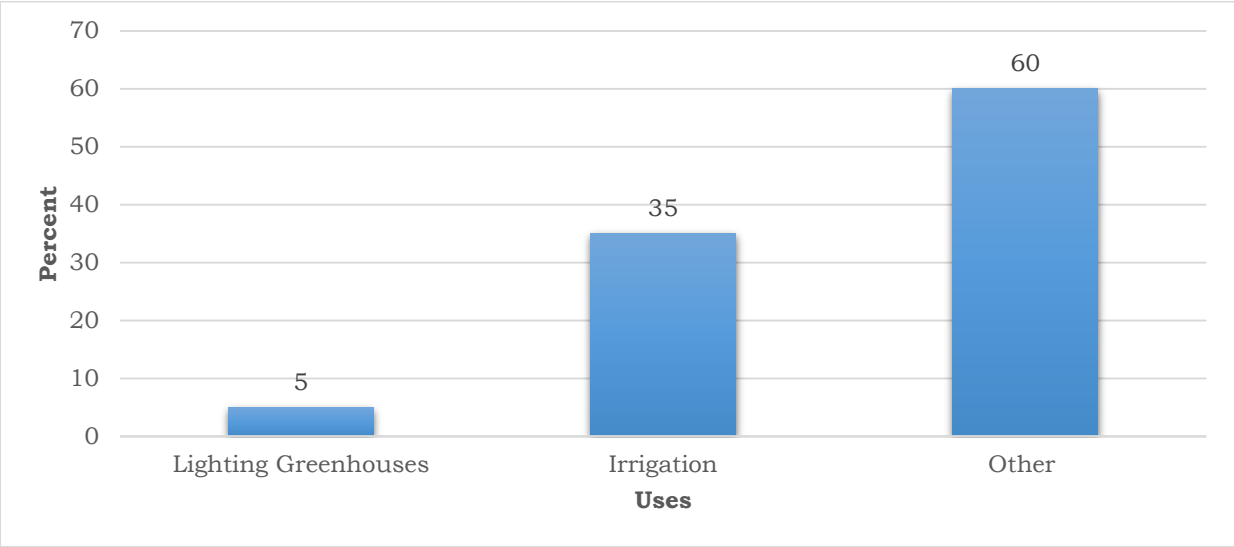


Table 4.25 indicates quantity of fuel used in generator in litres and agricultural use. The table shows that 8,555.70 litres of Unleaded petrol was used for Irrigation. About 160 litres of Diesel 50ppm was used for Other purposes. Total quantity of Diesel 500ppm used in Other Agricultural purposes was 7,704.00 litres.

Table 4.25: Quantity (L) of Fuel Used in Generator and Agricultural Use - 2017 SECS

Agricultural Uses	Diesel 50ppm	Diesel 500ppm	Unleaded Petrol	Total
Irrigation			8,555.70	8,555.70
Lighting Greenhouses	800.00			800.00
Other	160.00	7,704.00	2,877.00	10,741.00
Total	**960.00**	**7,704.00**	**11,432.70**	**20,096.70**

4.15 Transport

The discussions in this section refers to transport that was used for agricultural production purposes; transport used for animal and crop products.

Quantity used by type of vehicle and fuel type for agricultural purposes is presented in Table 4.26. It indicates that Diesel 50ppm used by Trucks constituted the highest quantity (31,600 litres) of fuel. Unleaded Petrol fuel used by Vans was the least quantity with 1,934.50 litres. The table further shows that a total of 17,475.80 litres of Diesel 500ppm was used in both Trucks and Vans.

Table 4.26: Quantity (L) used by Vehicle Type and Fuel Type for Agricultural Purposes - 2017 SECS

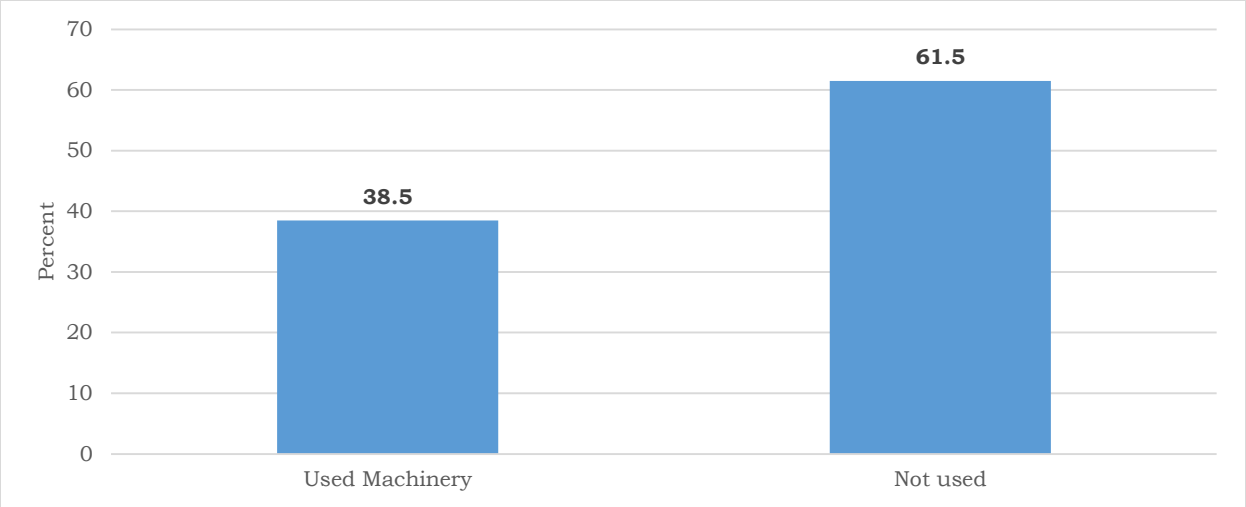
Vehicle Type	Diesel 50ppm	Diesel 500ppm	Unleaded petrol	Total
Van	11,844.42	6,375.80	1,934.50	20,154.72
Truck	31,600.00	11,100.00		42,700.00
Other			7,813.96	7,813.96
Total	**43,444.42**	**17,475.80**	**9,748.46**	**70,668.68**

4.16 Machinery in Crop Production

The modern farm machinery has upgraded the agricultural industry for the best. Some of the essential and most used machinery are Combine or Combine Harvester, Tractor Trailer and disc harrow.

Percentage distribution of agricultural establishments using agricultural machines for crop production is portrayed in figure 4.11. The Agricultural establishments using agricultural machinery for crop production constituted 38.5 percent and those who did not use totalled 61.5 percent.

Figure 4.11: Percentage Distribution of Agricultural Establishments using Agricultural Machines for Crop Production – 2017 SECS

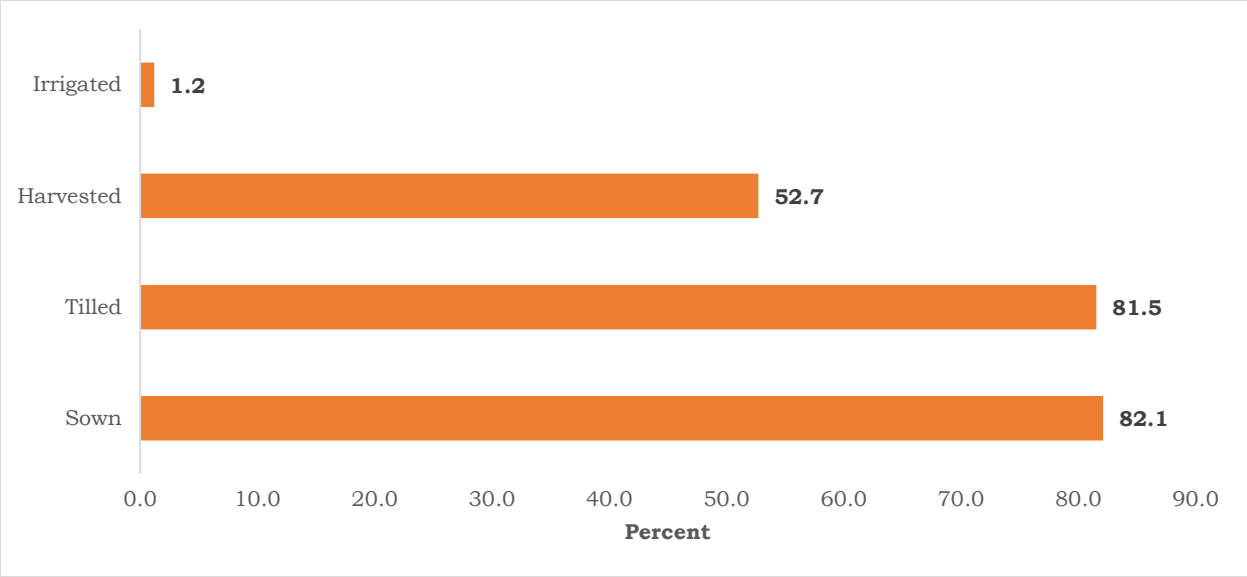


4.16.1 Mechanized Area

Mechanized agriculture is the process of using agricultural machinery to mechanize the work of agriculture, greatly increasing farm worker productivity. Powered machinery has replaced many farm jobs formerly carried out by manual labor or by working animals such as oxen, horses and mule. The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. The ongoing integration of machines since the Industrial Revolution however has allowed farming to become much less labor-intensive. Current mechanized agriculture includes the use of tractors, trucks, combine harvesters, countless types of farm implements, aero planes and helicopters (for aerial application), and other vehicles. https://ccsuniversity.ac.in/bridge-library/pdf/Lecture-1-Farm-Mechanization.pdf

Figure 4.12 displays percentage distribution of mechanized area. The latter includes sown, tilled, irrigated and harvested area. The figure reveals that 82.1 percent was Sown using machinery. It further shows that 81.5 percent was Tilled with the use of machinery and only 1.2 percent was Irrigated.

Figure 4.12: Percentage Distribution of Mechanized Area – 2017 SECS

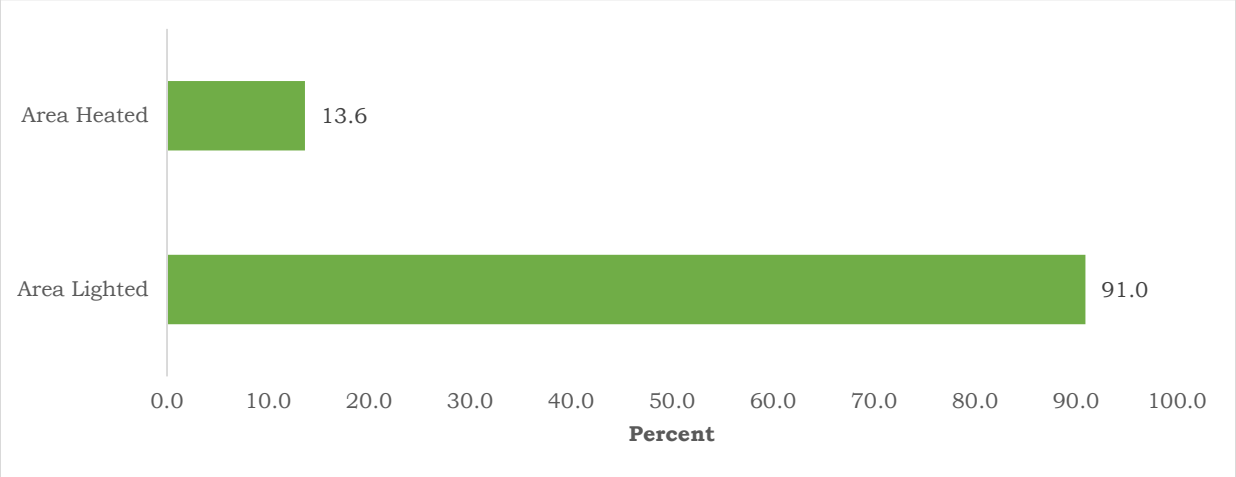


4.17 Breeding Area

Breeding is sexual reproduction that produces offspring, usually in animals or plants. It can only occur between a male and a female animal or plant. Breeding may refer to: Animal husbandry, through selected specimens such as dogs, horses, and rabbits. Breeding area is the place to which animals go to breed and the place may be equipped with energy emitting equipment. https://www.merriam-webster.com/dictionary/breeding%20ground

Figure 4.13 displays percentage distribution of heated and lighted breeding area. The figure reveals that 91.0 percent of the area was lighted. It also reveals that 13.6 percent of the breeding area was heated.

Figure 4.13: Percentage Distribution of Heated and Lighted Breeding Area – 2017 SECS



Agricultural equipment relates to the structures and devices used in farming or other agriculture. There are many types of such equipment, from hand tools and power tools to tractors and the countless kinds of farm implements that they tow or operate. https://en.wikipedia.org/wiki/Agricultural_machinery

Agricultural equipment in this section relates to Forestry, agricultural processing and other agricultural equipment.

Table 4.27 shows agricultural equipment by type and quantity. The table indicates that Solar Water Heaters in Agriculture sector consumed 25,615.36 kWh while Incubators consumed 8,418.00 kWh. There were 2,519.37 litres of Unleaded Petrol used to operate Chain saws consuming 3,569.28 kWh of energy. Mills in Agriculture sector used 419.71 litres of Diesel 500ppm.

Table 4.27: Agricultural Equipment by Type and Quantity (kWh and litres) by Type – 2017 SECS

Agricultural Equipment	Energy Consumption (kWh)	Diesel 500ppm (litres)	Unleaded Petrol (litres)
Chain saw	3,569.28		2,519.37
Food dryer	1,750.00		
Mill	480.00	419.71	
Cutters	375.00		
Honey making machine			5.00
Solar Water Heater	25,615.36		
Incubators	8,418.00		
Total	**40,207.64**	**419.71**	**2,524.37**

CHAPTER 5: GOVERNMENT SECTOR

5.0 Introduction

Government facilities and services are often the largest energy users within a country, and major purchasers of energy-using equipment. In every country there are important opportunities to improve energy efficiency in government facilities, operations, and public infrastructure and services. By focusing on government investment, procurement, and operating practices on energy-efficient buildings, products, and services, the public sector can create a strong, sustained, buyer-led shift in the market toward energy efficiency. https://pdf.usaid.gov/pdf_docs/PNADJ121.pd

Learning about energy usage in your state or local jurisdiction and similar jurisdictions can lead to more strategic energy decisions and can help communities plan for and achieve clean energy goals.https://www.energy.gov/eere/analysis/energy-analysis-data-and-tools-state-and-local-energy-planning

5.1 Government Employees

Government employee means any employee of the State, a county, city, town, village, or any other political subdivision or civil division of the State, or a county, city, town or village. "Government employee" shall also include any employee of a public authority, commission or public benefit corporation. Government employee and "employee" shall mean an employee, officer or elected official of a government employer who is entitled to receive pension or retiree healthcare benefits. https://www.lawinsider.com/dictionary/government-employee

Table 5.1 shows percentage distribution of employees by type of employment and sex. It is observed that 55.6 percent of permanent employees were females and 44.4 percent were males. It is further observed that 52.9 percent of Temporary employees were females and males (47.1 percent).

Table 5.1: Percentage Distribution of Employees by Type of Employment and Sex-2017 SECS

Employees	Permanent	Temporary
Females	55.6	52.9
Males	44.4	47.1
Total (%)	**100**	**100.0**
Total (N)	**9,293**	**5,835**

5.2 Electricity Generation

The electricity generation is discussed in terms of ownership and usage of back-up source of electricity with or without data loggers. The back-up source of electricity, are standby generators that could be connected or not connected to ones' home electrical panel. Generators run on fuel to keep ones' electricity on during an outage, usually diesel or gasoline. As a result, expenditure to maintain a steady fuel supply will be enormous.

Percentage distribution of departments by ownership of backup source is depicted on Figure 5.1. It is demonstrated that only 12.3 percent of departments had backup source of electricity while 87.7 percent did not.

Figure 5.1: Percentage Distribution of Departments by Ownership of Backup Source – 2017 SECS

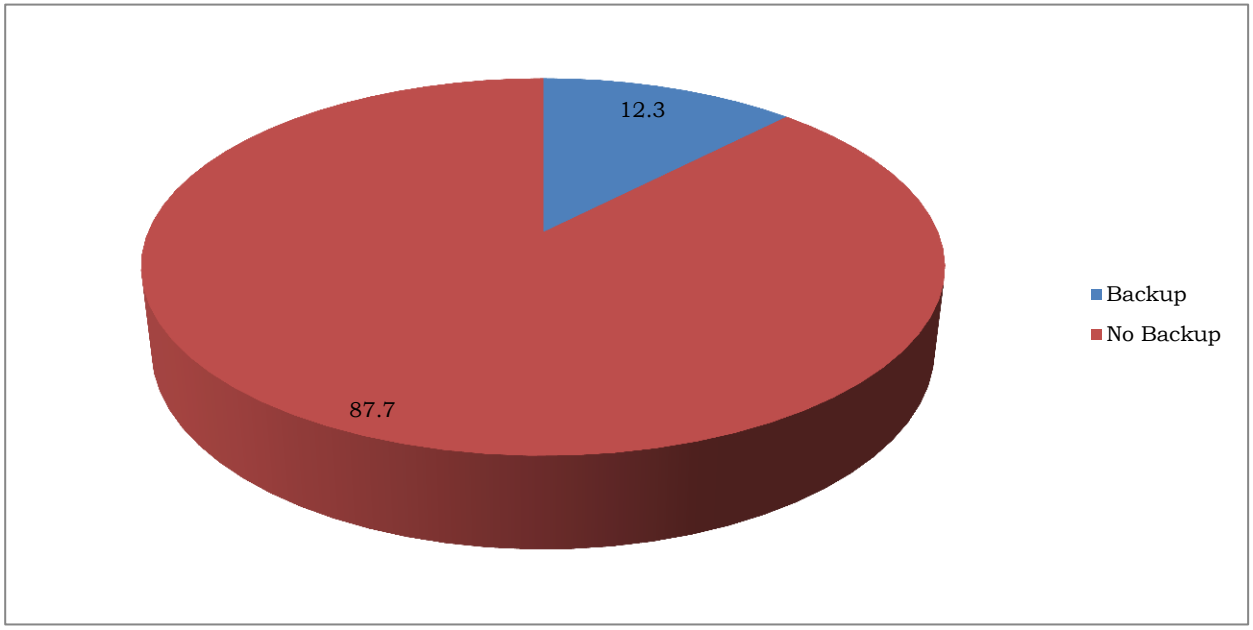
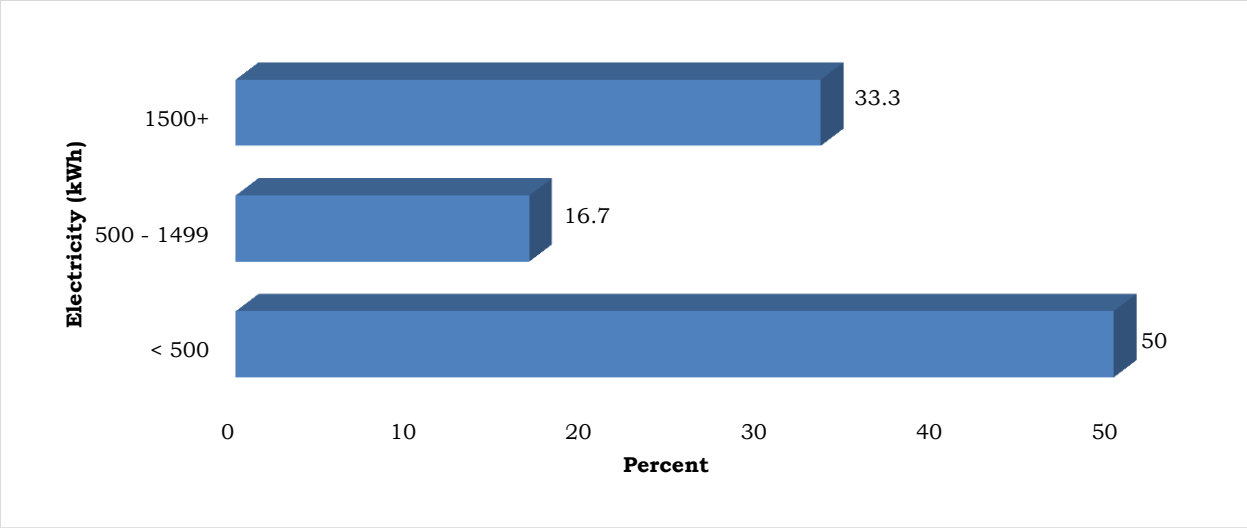


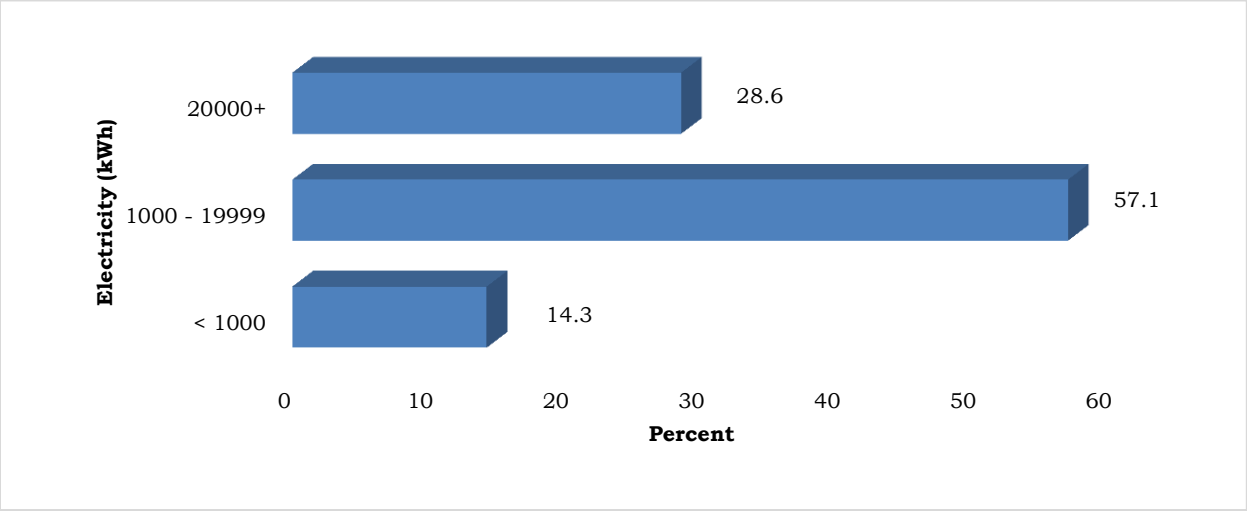
Figure 5.2 conveys percentage distribution of departments by electricity generated (kWh) using backup source with data loggers. The figure depicts that backup source with data loggers in most departments (50.0 percent) generated less than 500 kWh. It further shows that 33.3 percent of departments had backup source with data loggers which generated 1,500 kWh and more while only 16.7 percent generated between 500 kWh and 1,499 kWh.

Figure 5.2: Percentage Distribution of Departments by Electricity Generated (kWh) Using Backup with Data Loggers – 2017 SECS



Percentage distribution of departments by electricity (kWh) generated using backup source without data loggers is demonstrated in figure 5.3. It is observed that departments (57.1 percent) had backup source without data loggers which produced between 1,000 and 19,999 kWh. The results show that 14.3 percent of departments had backup source without data loggers that produced less than 1,000 kWh.

Figure 5.3: Percentage Distribution of Departments by Electricity (kWh) Generated Using Backup Source Without Data Loggers – 2017 SECS



5.3 Hard Coal Usage

The types of hard coal that are mostly consumed in the government sector are anthracite and bituminous. Hard Coal is mostly used for space heating and cooking.

The reasons behind lower consumption of hard coal are the energy shift towards natural gas and renewables for electricity production. It was also revealed that, hard coal production experienced a larger decrease than the consumption, leading to an increase in hard coal import dependency, consistently above 50% in the 2010s. https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220502-2

Percentage distribution of departments by hard coal usage is demonstrated in figure 5.4. The figure depicts that only 19.7 percent of departments used hard coal while 80.3 percent did not.

Figure 5.4: Percentage Distribution of Departments by Hard Coal Usage – 2017 SECS

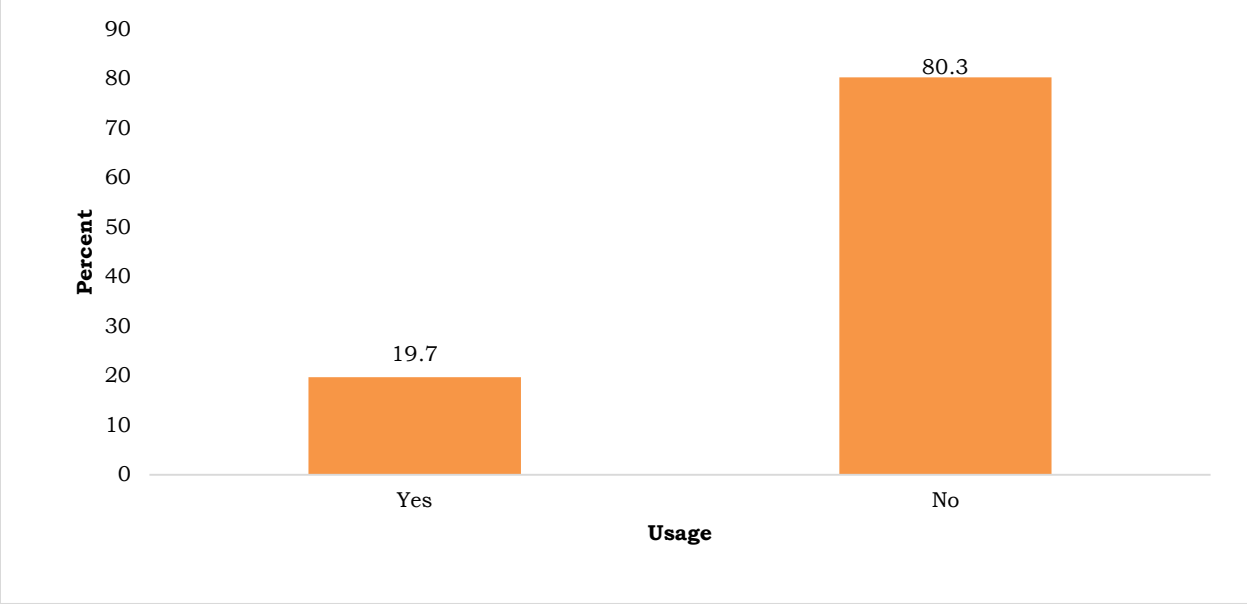
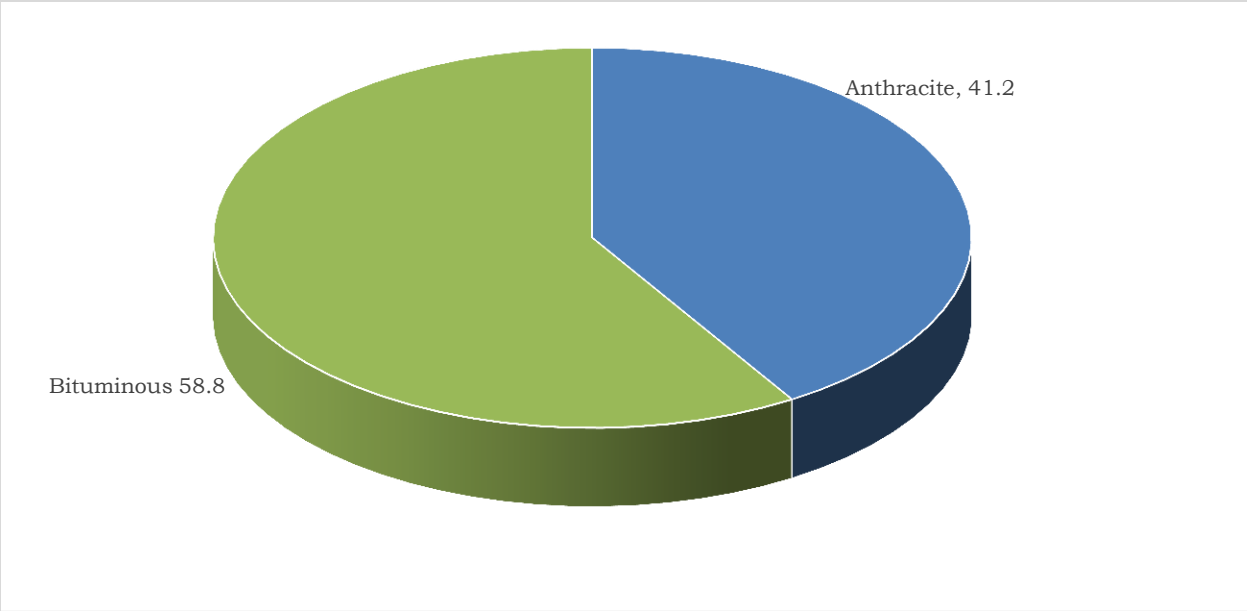


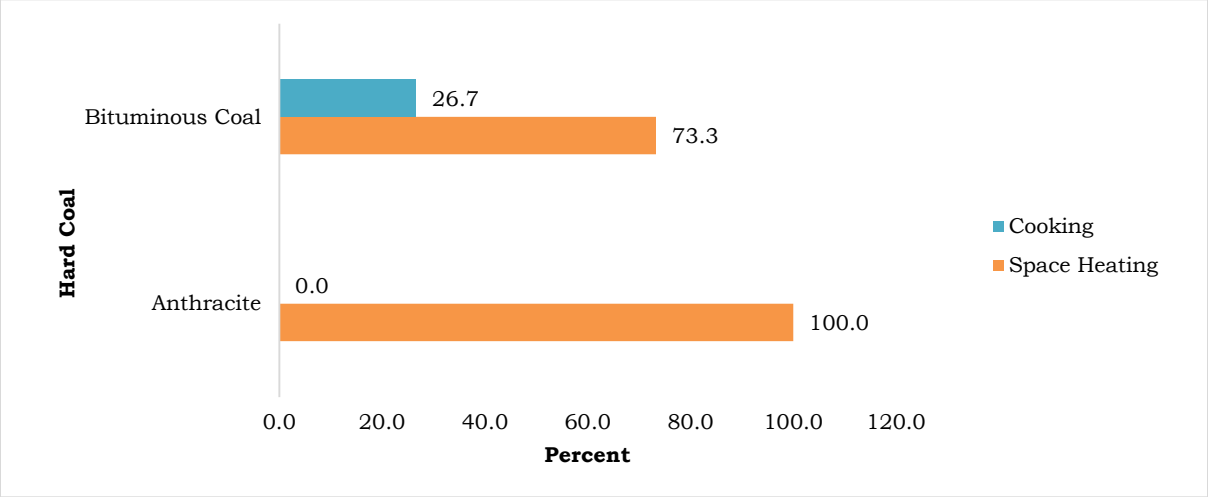
Figure 5.5 conveys percentage distribution of departments or ministries by type of hard coal. Bituminous (58.8 percent) was mostly used than anthracite (41.2 percent).

Figure 5.5: Percentage Distribution of Departments/Ministries by Type of Hard Coal – 2017 SECS



Percentage distribution of departments by type of hard coal and main use is demonstrated in figure 5.6. The figure reveals that both types of hard coal were mostly used for space heating. It is observed that anthracite (100.0 percent) was used for space heating only. Bituminous (73.3 percent) was used for space heating and 26.7 percent for cooking.

Figure 5.6: Percentage Distribution of Departments by Type of Hard Coal and Main Use – 2017 SECS



5.4 Renewables and Waste

Combustible renewables and waste comprise solid biomass, liquid biomass, biogas, industrial waste, and municipal waste, measured as a percentage of total energy use. Biomass is any plant matter used directly as fuel or converted into fuel, heat, or electricity. Biomass is common sources of renewable energy.https://www.indexmundi.com/facts/indicators/EG.USE.CRNW.ZS

Table 5.2 presents percentage distribution of departments by type of renewables and waste. It shows that 92.6 percent of departments used wood and other waste. It further exhibits that only 7.4 percent used charcoal.

Table 5.2: Percentage Distribution of Departments by Type of Renewables and Waste – 2017 SECS

Type of Renewable	Percent
Charcoal	7.4
Wood and Other Waste	92.6
Total (%)	**100.0**
Total (N)	**54**

Quantity, cost and energy of renewables and waste by type and main use is demonstrated in table 5.3. Charcoal (120.00 kg) produced 3.12 GJ that was used mainly for cooking. Wood and waste was used for both cooking (8,000.00 kg) and space heating (328,680.00 kg) that cost M23,200.00 and M64,386.00 respectively. The table further shows that resulted energy for wood and waste was mainly used for cooking (208.00 GJ) and space heating (8,545.68 GJ).

Table 5.3: Quantity, Cost and Energy of Renewables by Type and Main Use – 2017 SECS

	Type of Renewable					
Main Use	**Charcoal (kg)**	**Charcoal (M)**	**Charcoal (GJ)**	**Wood and Waste (kg)**	**Wood and Waste (M)**	**Wood and Waste (GJ)**
Cooking	120.00	1,200.00	3.12	8,000.00	23,200.00	208.00
Space heating	0.00	0.00	0.00	328,680.00	64,386.00	8,545.68
Total	**120.00**	**1,200.00**	3.12	**336,680.00**	**87,586.00**	8,753.68

5.5 Grid Electricity

The electrical grid is the electrical power system network comprised of the generating plant, the transmission lines, the substation, transformers, the distribution lines and the consumer.https://studentenergy.org/distribution/electrical-grid/. Grid electricity in the government sector is used for various reasons like space heating, space cooling, lighting, powering appliances and more.

Table 5.4 shows percentage distribution of departments by use of grid electricity. The table reveals that, 96.7 percent of departments used grid electricity while 3.3 percent did not.

Table 5.4: Percentage Distribution of Departments by Use of Grid Electricity – 2017 SECS

Grid Electricity	Percent
Used	96.7
Not Used	3.3
Total (%)	**100**
Total (N)	**241**

Table 5.5 illustrates percentage distribution of departments by connection to grid electricity and main use. The table shows that 48.5 percent of the departments used electricity for lighting and 43.3 percent used it for powering appliances. Only 8.2 percent of departments used electricity for space heating.

Table 5.5: Percentage Distribution of Departments by Connection and Main Use – 2017 SECS

Main Use	Grid Electricity
Space Heating	8.2
Lighting	48.5
Powering Appliances	43.3
Total (%)	**100.0**
Total (N)	**233**

Quantity and cost of electricity by main use is shown in table 5.6. The table reveals that, electricity for powering appliances (31,359,568.38kWh) cost M10,887,807.29. Electricity for space heating (5,116,638.29kWh) cost M5,575,241.41.

Table 5.6: Quantity (kWh) and Cost (M) of electricity by main use – 2017 SECS.

Main Use	Quantity (kWh)	Amount (M)
Space Heating	5,116,638.29	5,575,241.41
Lighting	12,408195.81	12,695369.12
Powering Appliances	31,359,568.38	10,887,807.29
Total	**48,884,402.48**	**29,158,417.82**

5.6 Occupancy

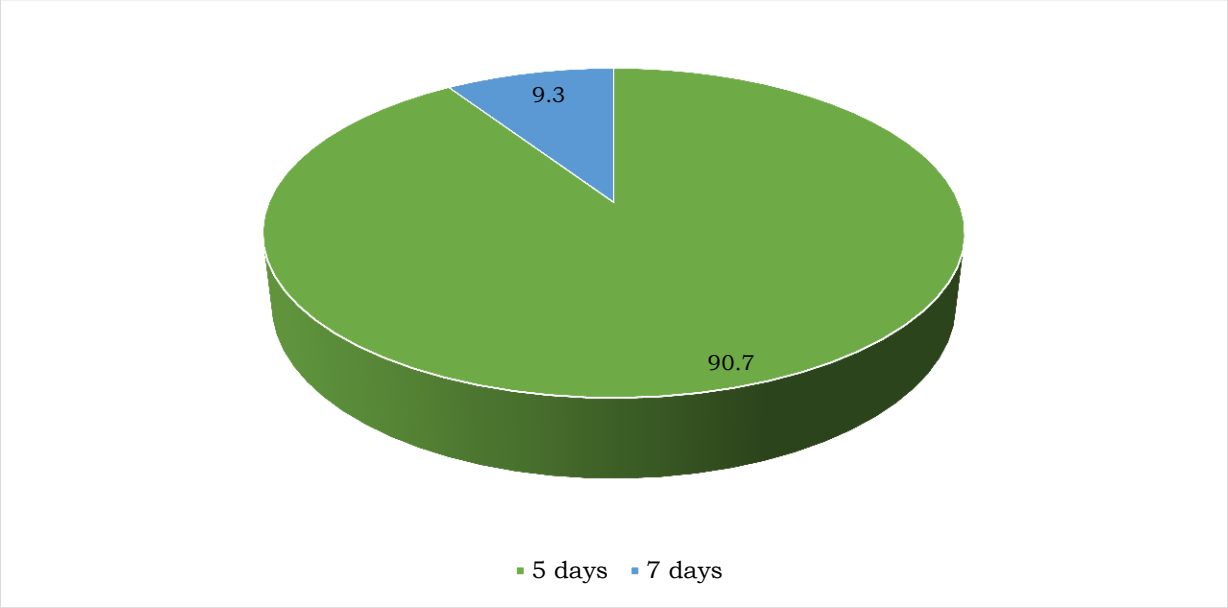
Occupancy is the act or state of living in or using a particular place. https://dictionary.cambridge.org/dictionary/english/occupancy. Government departments occupy different places which they either own or rent. Different work schedules are set for employees according to their positions and their type of work.

5.6.1 Days of Operation

A work schedule generally refers to the days per week and the hours per day that an employee is expected to be at their job. https://www.thebalancecareers.com/types-of-work-schedules-2064278

Figure 5.7 depicts percentage share of departments by days of operation per week. It is observed that majority of departments (90.7 percent) operated for 5 days a week and a smaller share (9.3 percent) operated 7 days a week.

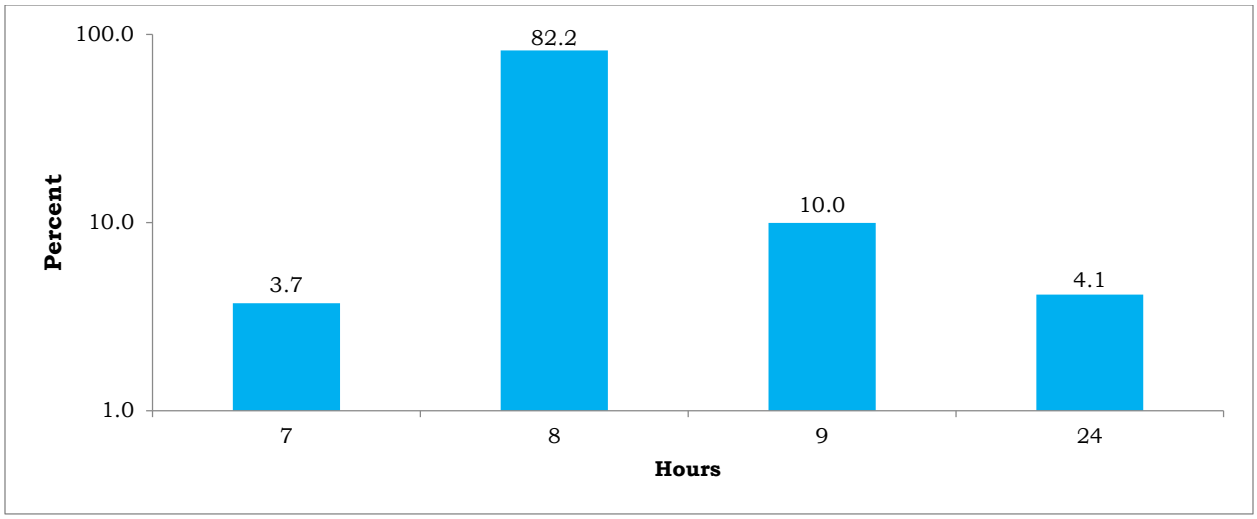
Figure 5.7: Percentage Share of Departments by Days of Operation per Week - 2017 SECS



Hours of Operation are the hours established by the employer to provide adequate service to the public and to fulfil the functions of the work unit. https://www.lawinsider.com/dictionary/hours-of-operation

Figure 5.8 illustrates percentage distribution of departments by hours of operation per day. It shows that most of the departments (82.2 percent) operated for 8 hours per day. About 10.0 percent of departments operated 9 hours a day. The figure further depicts that only 4.1 percent of the departments operated for 24 hours. The least share (3.7 percent) of departments operated 7 hours a day.

Figure 5.8: Percentage Distribution of Departments by Hours of Operation per Day – 2017 SECS



5.7 Usable area

A usable area is a fully-enclosed space that is available for the exclusive use of a building occupant for personnel, materials, furniture, fixtures and equipment. https://stevensonsystems.com/compendium/usable-area#:

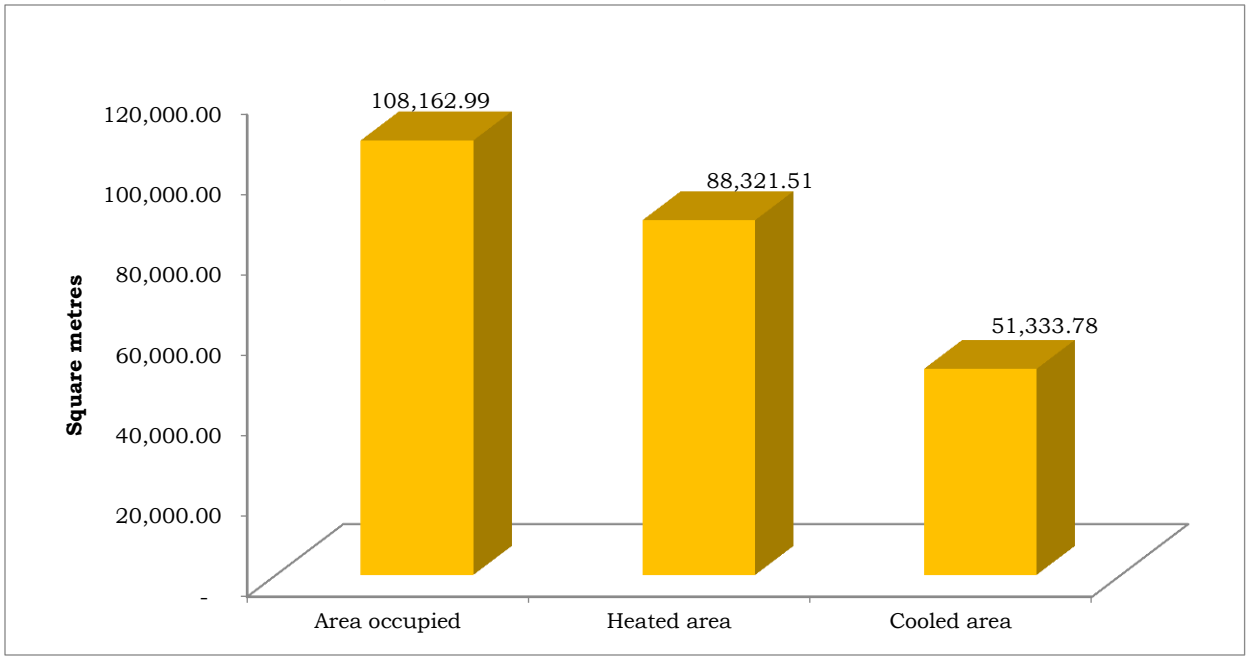
Table 5.7 presents the total area occupied by buildings and insulation in square meters (m^2). It is noted that the largest area was reported to have been insulated (105,762.40 m^2), while a smaller area covering 2,400.59 m^2 was not insulated.

Table 5.7: Total Area (m^2) Occupied by Buildings and Insulation – 2017 SECS

Insulation	Area
Insulated	105,762.40
Not Insulated	2,400.59
Total	**108,162.99**

Usable area of buildings in square meters is displayed in figure 5.9. It outlines that area occupied by government departments was 108,162.99m^2. Heated area was 88,321.51m^2 and cooled area was 51,333.78m^2.

Figure 5.9: Usable Area (m²) of Buildings - 2017 SECS



5.8 Central Heating/Cooling System

A central Heating or cooling system heats or cools your home by feeding heated or cooled air through your ductwork. Central cooling kicks off when a thermostat senses that the temperature in your home needs to be changed. The thermostat will alert your cooling unit that the temperature needs to drop, and all parts will work simultaneously to get your home to your desired temperature. https://www.trane.com/residential/en/buyers-guide/hvac-basics/how-does-a-central-heating-cooling-system-work/

Central heating systems can work in the same general way as central cooling systems by moving air around to change the temperature in your home. A central heating system provides warmth to the whole interior of a building (or portion of a building) from one point to multiple rooms. https://www.sciencedirect.com/topics/engineering/central-heating-system

Figure 5.10 demonstrates percentage distribution of departments by use of central heating or cooling system. It is observed that 3.1 percent of government departments used central heating or cooling system while 96.9 percent did not.

Figure 5.10: Percentage Distribution of Departments by Use of Central Heating or Cooling System - 2017 SECS

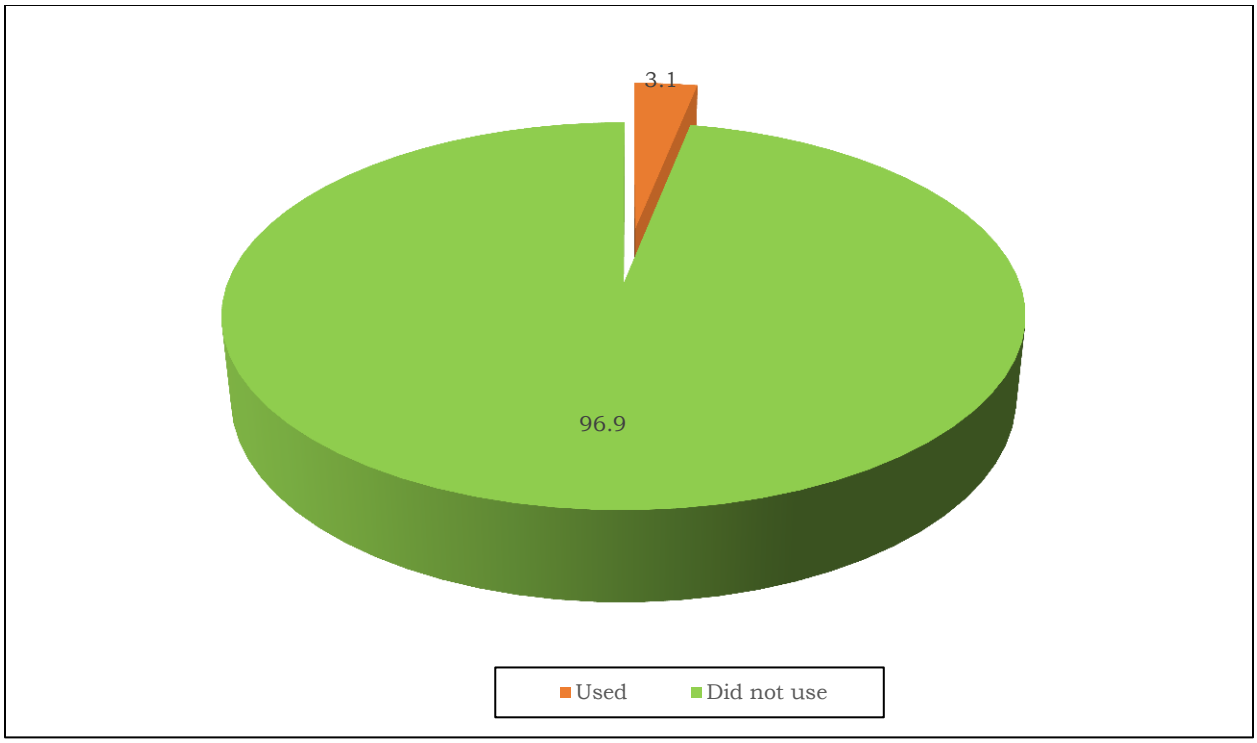


Table 5.8 represents number of annual hours and quantity of electricity used by type of central heating or cooling system and use. It is observed that Split systems were mostly used for heating, turned on for 2,520 hours while Chillers were used mostly for cooling with 2,400 hours switched on in a year. It is further observed that Chillers consumed more electricity for both space heating and space cooling with 275,126.40 kWh and 600,072.00 kWh respectively.

Table 5.8: Number of Annual Hours and Quantity of Electricity Used by Type of Central Heating or Cooling System and Use - 2017 SECS

	Annual Hours		Kilowatt-hours	
Type of system	**Heating**	**Cooling**	**Heating**	**Cooling**
Split System	2,520	1,176	2,318.40	811.44
Chillers	960	2,400	275,126.40	600,072.00
Total	**3,480.00**	**3,576.00**	**277,444.80**	**600,883.44**

5.9 Independent Heating/Cooling System

Space heater means any fixed or portable, liquid or gaseous fuel-fired, combustion unit used to heat air in a space, or used to heat air entering a space, for the purpose of maintaining an air temperature suitable for comfort, storage, or equipment operation. https://www.lawinsider.com/dictionary/space-heater

Independent heating or cooling systems are stand-alone space heaters working separately to either heat or cool the space.

Figure 5.11 depicts percentage distribution of departments by use of independent heating or cooling systems. It explains that majority of departments (95.2 percent) used Independent heating/cooling systems and 4.8 percent did not.

Figure 5.11: Percentage Distribution of Departments by Use of Independent Heating or Cooling Systems - 2017 SECS

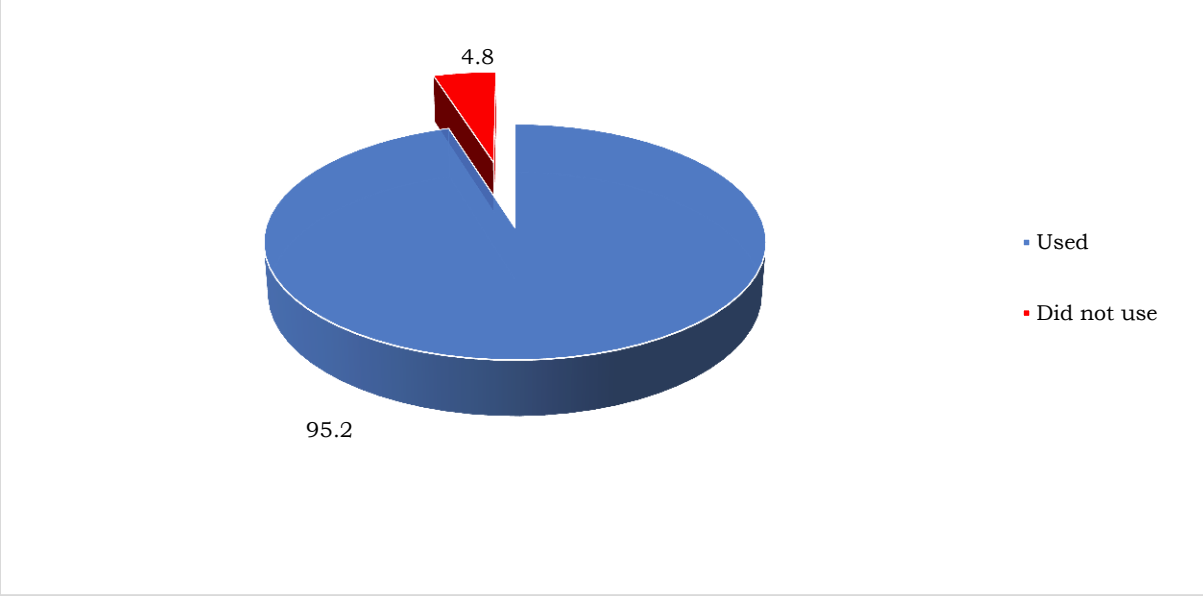
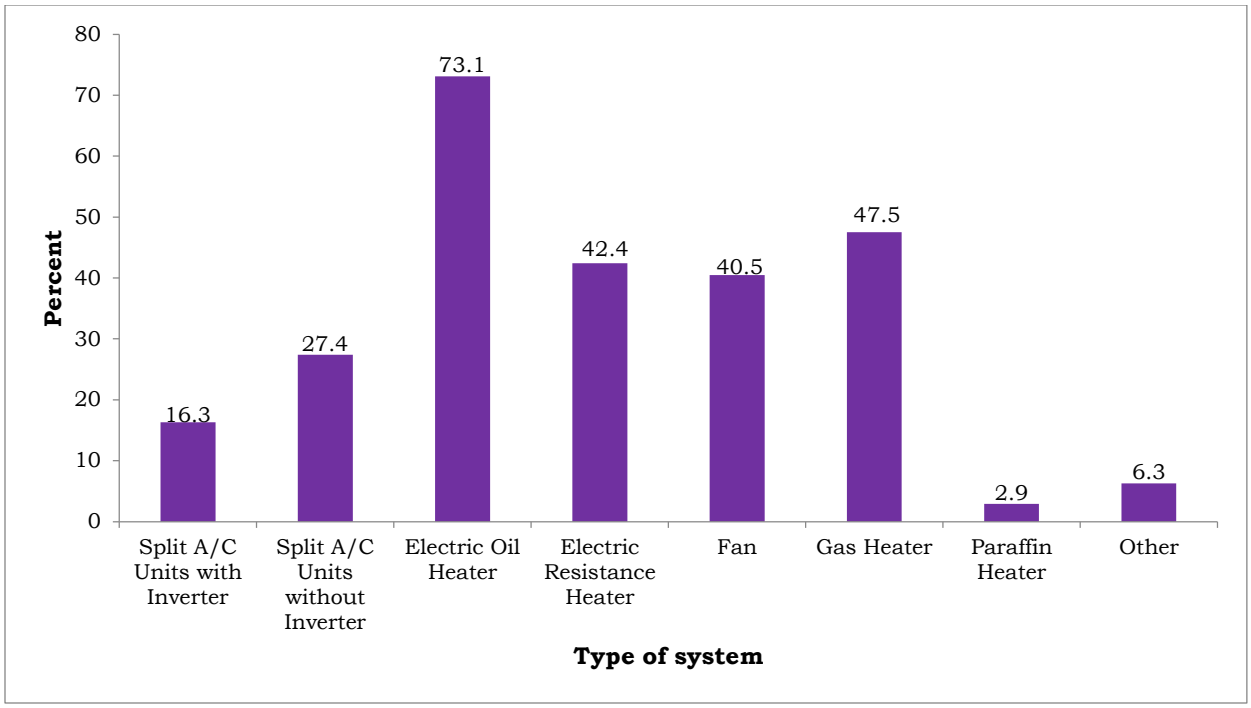


Figure 5.12 illustrates percentage distribution of departments by type of independent heating or cooling system used. Most of the departments reported to have used Electric Oil Heater constituting 73.1 percent followed by Gas Heater, Electric Resistance Heater and Fan with 47.5, 42.4 and 40.5 percent respectively. Paraffin heater was used by few departments with 2.9 percent. “Other” was used by 6.3 percent of departments and included systems like Fan Heater.

Figure 5.12: Percentage Distribution of Departments by Type of Independent Heating/ Cooling System Used - 2017 SECS



Quantity in Megawatt-hours (MWh) and energy (GJ) used by type of independent heating/cooling system and use is displayed in the table 5.9. Split Air conditioning (A/C) units without inverter were the most consuming systems for both space heating and cooling with 3,083.20MWh and 1,413.99MWh equivalent to 11,099.53GJ and 5090.38 GJ respectively.

It is studied that Electric oil heater also consumed more electricity for space heating (3,068.44MWh) equivalent to 11,046.37 GJ. The highest total consumption of electricity was that of Split A/C units without inverter (4,497.20MWh) releasing 16,189.91GJ followed by Electric oil heater (3,068.44 MWh). Fan was the least consuming system with 28.83MWh (103.80 GJ) for space cooling.

Table 5.9: Quantity and Energy used by Type of Independent Heating/Cooling System and Use – 2017 SECS

	Space Heating		Space Cooling		Total	
Type of System	**Quantity (MWh)**	**Energy (GJ)**	**Quantity (MWh)**	**Energy (GJ)**	**Quantity (MWh)**	**Energy (GJ)**
Split A/C Units with Inverter	409.09	1,472.73	353.99	1,274.35	763.08	2,747.08
Split A/C Units without Inverter	3,083.20	11,099.53	1,413.99	5,090.38	4,497.20	16,189.91
Electric Oil Heater	3,068.44	11,046.37	-	-	3,068.44	11,046.37
Electric Resistance Heater	1,226.80	4,416.49	-	-	1,226.80	4,416.49
Fan	-	-	28.83	103.80	28.83	103.80
Other	760.73	2,738.63	-	-	760.73	2,738.63

Table 5.10 illustrates quantity and energy used by type of independent heating system. Gas heater consumed 59.40 tonnes of gas and Paraffin heater used 2.67 kilolitres for space heating which released 2,672.91 GJ and 101.38 GJ of energy respectively.

Table 5.10: Quantity and Energy Used by Type of Independent Heating System – 2017 SECS

	Space Heating	
Type of System	**Quantity**	**Energy (GJ)**
Gas Heater	59.40	2,672.91
Paraffin Heater	2.67	101.38

5.10 Lighting

An electric light is a device that produces visible light from electric power. It is the most common form of artificial lighting and is essential to modern society, providing interior lighting for buildings and exterior light for evening and night-time activities https://en.wikipedia.org/wiki/Electric_light#:

Percentage distribution of departments with light sensors and motion sensors is displayed in figure 5.13. It explains that 9.3 percent of departments had light sensors while 90.7 percent did not have. It further highlights that 4.6 percent of departments had motion sensors while 95.4 percent did not.

Figure 5.13: Percentage Distribution of Departments with Light Sensors and Motion Sensors - 2017 SECS

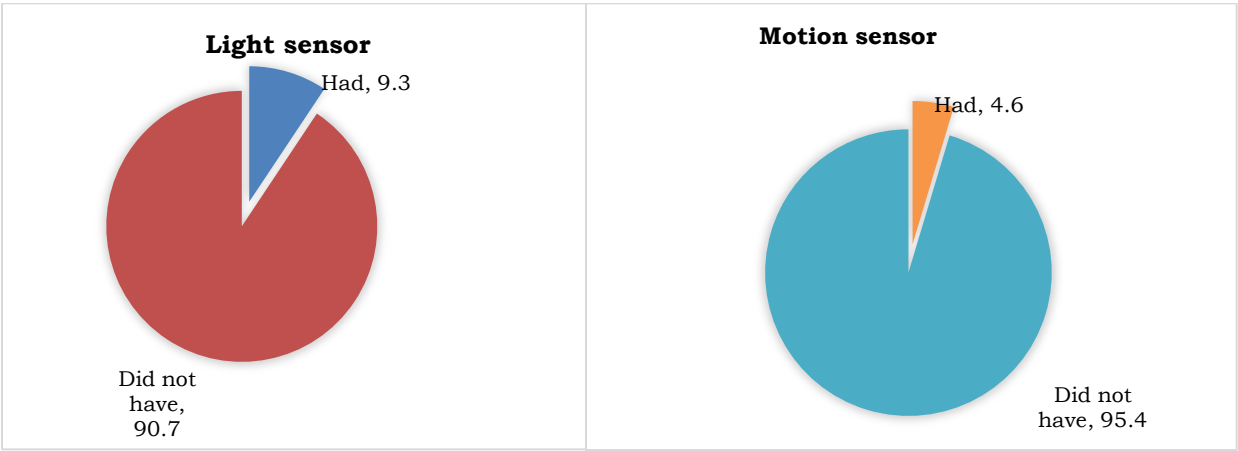


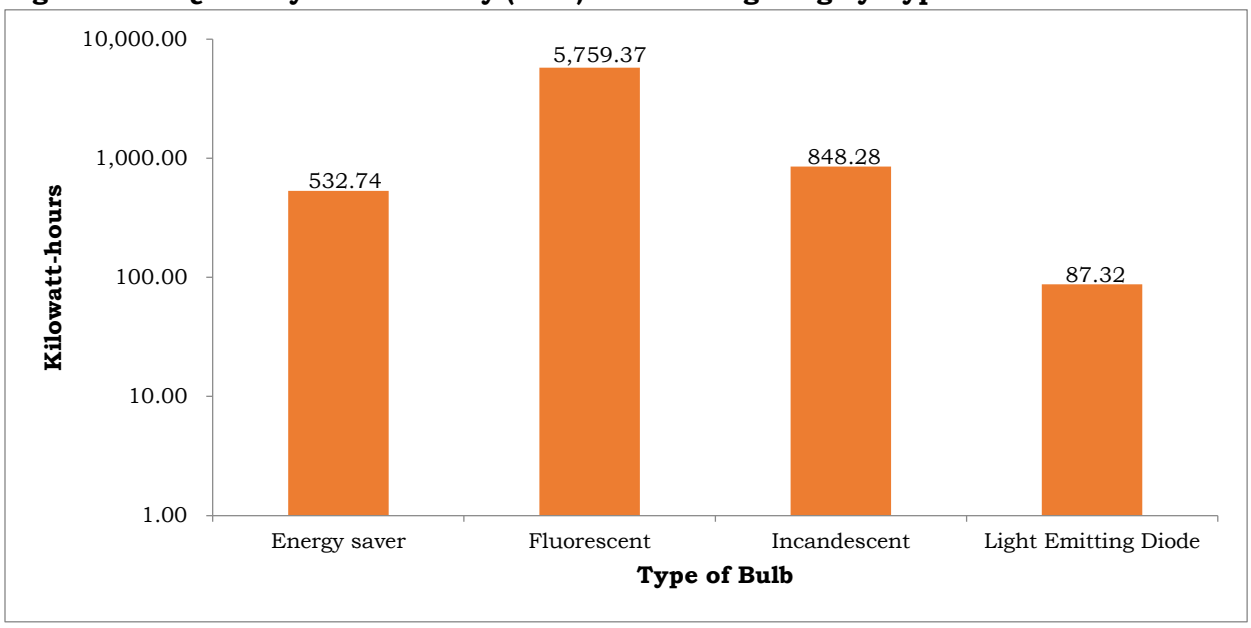
Table 5.11 represents the number of bulbs and average hours switched on per day by type. It is studied that the mostly used bulbs were Fluorescent tubes with a total number of 17,301 which were switched on 14.00 hours per day. The least used bulbs were Light Emitting Diode with a total of 324, switched on for 10.15 hours per day.

Table 5.11: Number of Bulbs and Average Hours Switched On per Day for Lighting by Type - 2017 SECS

Type of bulb	Number	Hours
Energy saver	2,518	10.29
Fluorescent tube	17,301	14.00
Incandescent bulb	1,040	10.47
Light Emitting Diode	324	10.15
Total	**21,183**	

Figure 5.14 portrays quantity of electricity used for lighting by type of bulb. The largest quantity of electricity was used by Fluorescent bulbs with 5,759.37 kWh. Light Emitting Diode consumed the smallest quantity (87.32 kWh).

Figure 5.14: Quantity of Electricity (kWh) Used for Lighting by Type of Bulb - 2017 SECS



5.11 Office Equipment

Office equipment means electronic products including, but not limited to, desktop computers, laptop computers, monitors, printers, scanners and so on.

Figure 5.15 demonstrates percentage distribution of Office equipment by type. The figure reveals that amongst office equipment used in government sector, Desktops and Printers constituted the highest percentage (24.0 percent) each. It is further shown that the usage of Servers recorded the lowest (2.0 percent).

Figure 5.15: Percentage Distribution of Office Equipment by Type- 2017 SECS

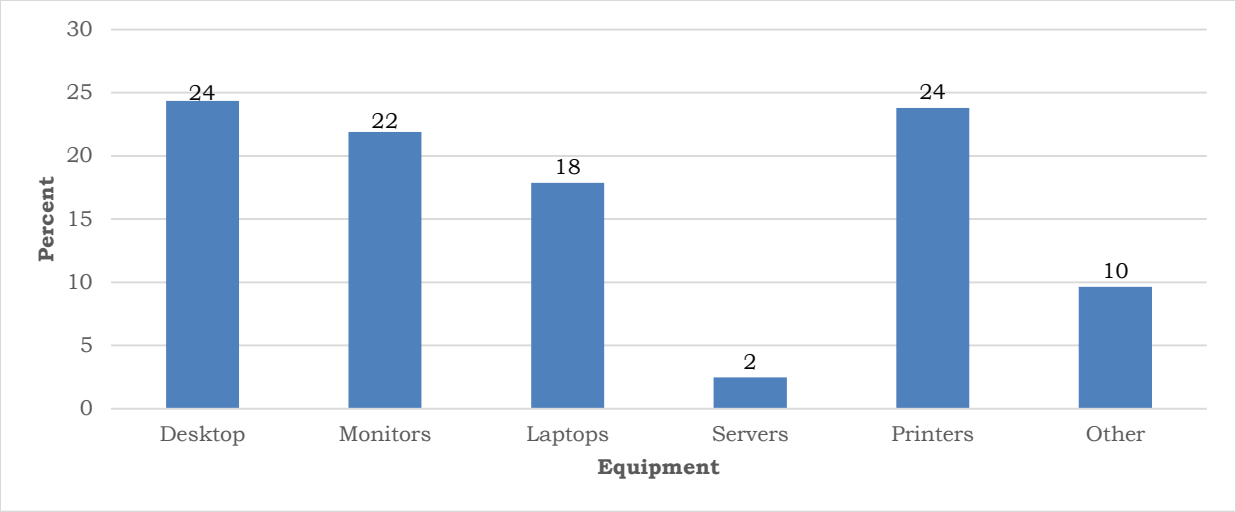


Table 5.12 presents type of office equipment by electricity consumption in kilowatt hours. Desktops consumed more electricity with 9,892.88 kWh followed by Monitors with 4,319.11 kWh. Printers consumed 3,528.69 kWh while Laptops consumed lowest with 453.16 kWh.

Table 5.12: Type of Office Equipment by Electricity Consumption (kWh) – 2017 SECS

Equipment	Electricity
Desktop	9,892.88
Monitor	4,319.11
Laptop	453.16
Servers	1,608.16
Printers	3,528.69
Other	2,107.30
Total	**21,909.29**

5.12 Household Appliances

A home appliance, also referred to as a domestic appliance, an electric appliance or a household appliance, is a machine which assists in household functions such as cooking, cleaning and food preservation. https://en.wikipedia.org/wiki/Home_appliance

Percentage distribution of household appliances by type is displayed in figure 5.16. Kettle was used by 49.0 percent of government institutions while 37.0 percent of them used microwaves. The figure demonstrates that only 1.0 percent of Government institutions used Stoves.

Figure 5.16: Percentage Distribution of Household Appliances by Type – 2017 SECS

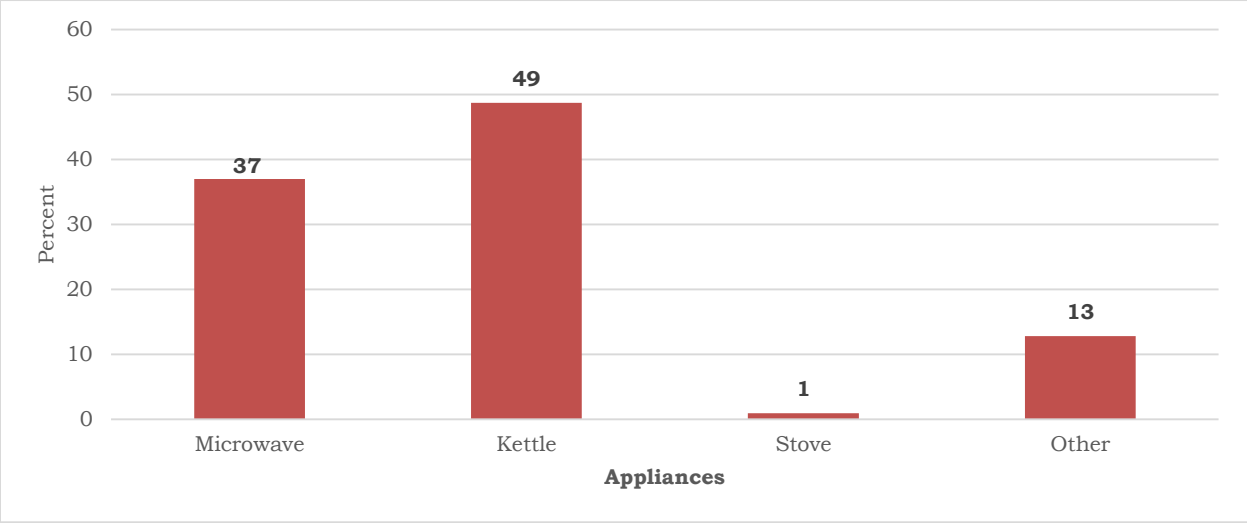


Table 5.13 shows type of household appliances by electricity consumption. "Other" (e.g. Urn, hoover) consumed highest electricity amounting to 3,960.56 kWh followed by Kettle with 2,832.15 kWh. Stove consumption was the lowest with 51.52 kWh.

Table 5.13: Type of Household Appliances by Electricity Consumption (kWh) – 2017 SECS

Appliances	Electricity
Microwave	246.44
Kettle	2,832.15
Stove	51.52
Other	3,960.56
Total	**7,090.67**

5.13 Cooking Facilities

Kitchen facilities means commercial-grade kitchen items, including but not limited to, sinks, counters, ovens, griddles, grills, microwaves and dishwashers necessary to prepare and cook food served in a full-service restaurant. https://www.collinsdictionary.com/dictionary/english/cooking-facilities

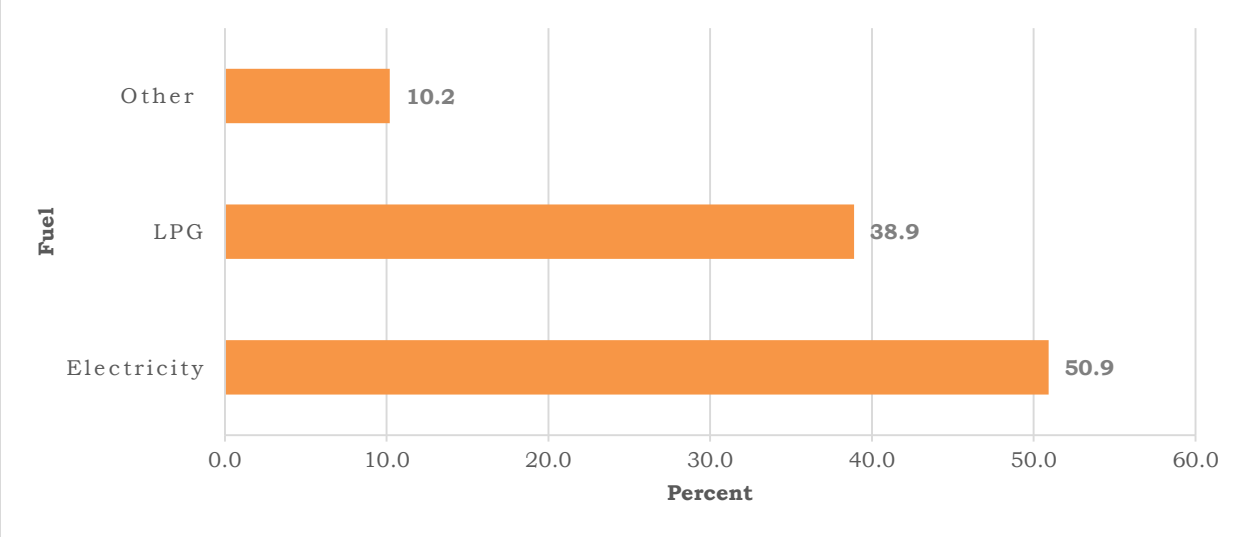
Table 5.14 indicates percentage distribution of government institutions by ownership and usage of cooking facility. It is shown in the table that 37.2 percent of government institutions had cooking facilities and 62.8 percent did not. The results further revealed that 40.2 percent of those institutions having cooking facilities used them.

Table 5.14: Percentage Distribution of Government Institutions by Ownership and Usage of Cooking Facility – 2017 SECS

Ownership	Had Cooking Facility	Used Cooking facility
Yes	37.2	40.2
No	62.8	59.8
Total (%)	**100.0**	**100.0**
Total (N)	**241.0**	**90.0**

Figure 5.17 portrays percentage distribution of government institutions by type of fuel used in cooking facilities. The figure shows that 50.9 percent of government institutions used Electricity in their kitchen facilities while 38.9 percent used Liquefied Petroleum Gas (LPG). "Other" type of fuel constituted 10.2 percent.

Figure 5.17: Percentage Distribution of Government Institutions by Type of Fuel Used in Cooking Facilities – 2017 SECS



5.14 Refrigeration

Refrigeration, or cooling process, is the removal of unwanted heat from a selected object, substance, or space and its transfer to another object, substance, or space. Removal of heat lowers the temperature and may be accomplished by use of ice, snow, chilled water or mechanical refrigeration. https://berg-group.com/engineered-solutions/the-science-behind-refrigeration/

Percentage distribution of government institutions with refrigeration is depicted in figure 5.18. The results demonstrate that 63.0 percent of government institutions had refrigerators as compared to 37.0 percent which did not.

Figure 5.18: Percentage Distribution of Government Institutions with Refrigeration – 2017 SECS

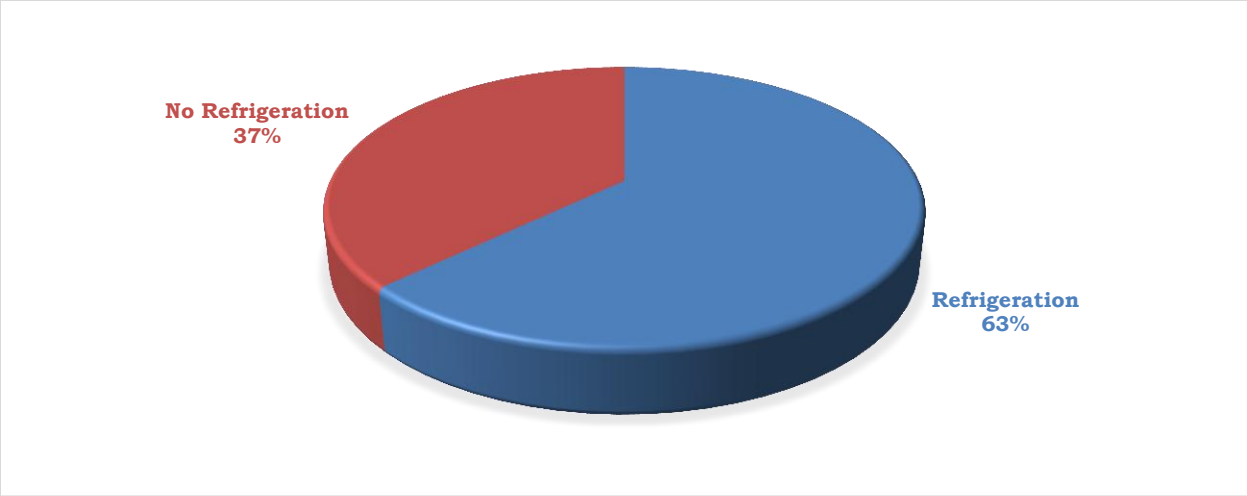


Table 5.15 illustrates type of refrigeration by number and electricity consumption in kilowatt hours. There was a total number of 388 for all refrigeration types, with 336 being for Refrigerators and 52 for Freezers. Electricity consumption for Refrigerators was 1,982.91 kWh while for Freezers was 1,790.33 kWh.

Table 5.15: Type of Refrigeration by Number and Electricity Consumption (kWh) – 2017 SECS

Refrigeration	Number	Electricity
Refrigerator	336	1,982.91
Freezer	52	1,790.33
Total	**388**	**3,773.24**

5.15 Generators

A generator is simply a device that moves a magnet near a wire to create a steady flow of electrons. One simple way to think about a generator is to imagine it acting like a pump pushing water through a pipe. Only instead of pushing water, a generator uses a magnet to push electrons along. A water pump moves a certain number of water molecules and applies a certain amount of pressure to them. In the same way, the magnet in a generator pushes a certain number of electrons along and applies a certain amount of "pressure" to the electrons. https://science.howstuffworks.com/electricity3.htm

Figure 5.19 displays percentage distribution of government institutions with Generators. According to the figure, 11.0 percent of government institutions used a Generator. It is further revealed that 89.0 percent of the institutions in Government sector did not use a generator.

Figure 5.19: Percentage distribution of Government Institutions with Generators – 2017 SECS,

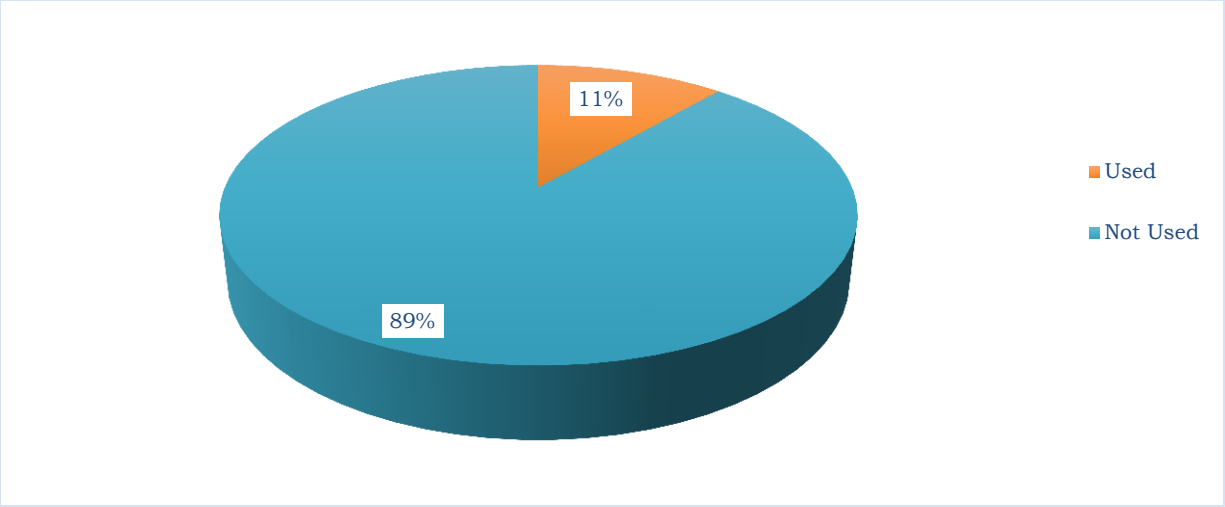


Table 5.16 presents main use of generators by electricity generated in kilowatt hours. Total electricity generated by generators in government sector was 526,107.06 kWh with 444,062.70 kWh used for Powering Appliances and 82,044.36 kWh for Lighting.

Table 5.16: Main use of Generators by Electricity Generated (kWh) – 2017 SECS

Main Use	Electricity
Lighting	82,044.36
Powering Appliances	444,062.70
Total	**526,107.06**

5.16 Freight Transport

Freight transport is the physical process of transporting commodities and merchandise goods and cargo. Freight transport can be defined as the stages and means rolled out when transporting goods. Stages include deployed logistics, conveyance or the resources used to reach the delivery destination. Its notable role has a direct influence on commercial trades within a country, or on an international scale. https://www.europeantransportation.com/what-is-freight-transportation

Quantity of fuel in litres by type of vehicle is demonstrated in figure 5.20. The results reflect that of all vehicles used by the government sector, "Other" used more fuel than all the types with 390,050.08 litres. Vans followed with 274,309.89 litres. The figure further revealed that Minivan vehicle used the smallest (141,302.58 litres) amount of fuel.

Figure 5.20: Quantity (litres) of Fuel by Type of Vehicle – 2017 SECS

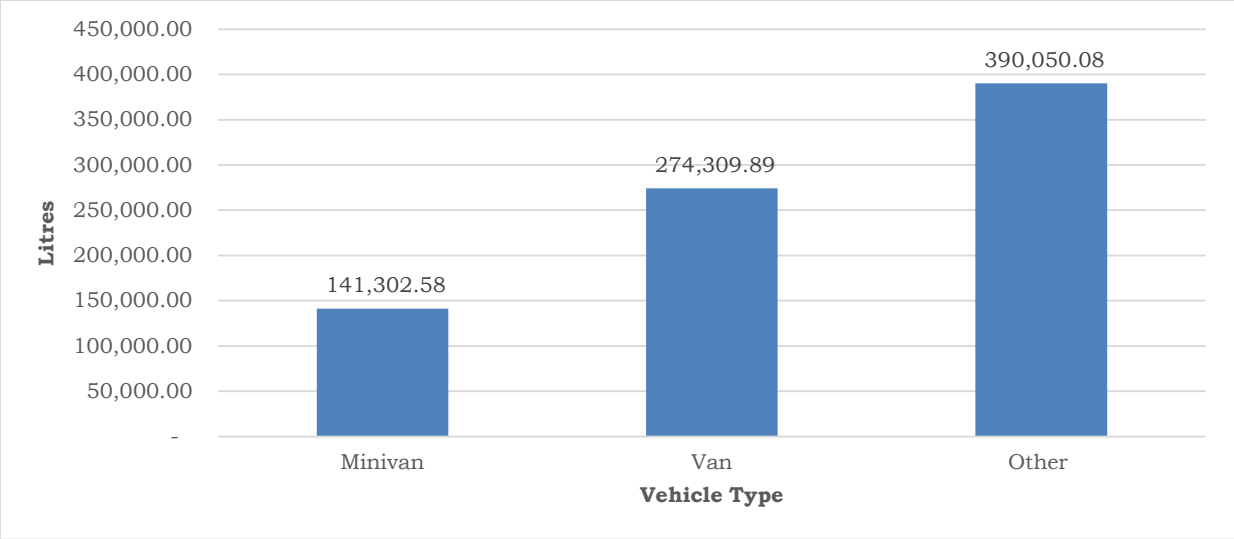


Table 5.17 shows type of fuel by quantity in litres. Total quantity of fuel used by freight transport was 805,662.54 litres. Unleaded petrol was mostly used fuel with quantity of 421,257.66 litres. Quantity of Diesel 500ppm and Diesel 50ppm was 250,543.35 and 133,861.54 litres respectively.

Table 5.17: Type of Fuel by Quantity (litres) – 2017 SECS

Fuel Type	Quantity
Diesel 50ppm	133,861.54
Diesel 500ppm	250,543.35
Unleaded petrol	421,257.66
Total	**805,662.54**

CHAPTER 6: EDUCATION

6.0 Introduction

This chapter provides a comprehensive look at energy use in the education sector. The sector consists of Early Childhood Care and Development (ECCD), primary, secondary, high school, tertiary, technical and vocational. Education sector is classified into two categories for purposes of this report;

(i) Below tertiary: this includes ECCD, primary, secondary and high school;
(ii) Higher learning institutions: this includes tertiary, technical and vocational.

The first part of this chapter describes the distribution and categories of schools across the country as well as employment status in school.

The second part of this chapter describes energy use in schools. Even though a large-scale electricity network has existed for more than a century, many primary schools and secondary schools have no electricity whatsoever and still resort to fossils and renewables for basic energy needs such as lighting.

6.1 Ownership of Institutions

This section reflects on how educational institutions are owned or operated. Lesotho educational institutions are either church owned, private owned, public owned or community owned. Public owned institutions are funded by the government while church owned institutions are mainly funded by the affiliated church and community. Private owned institutions usually rely on fees from families whose children attend the school for funding and they also receive government support.

Table 6.1 shows percentage distribution of type of below tertiary institutions by category. The table reveals that 73.0 percent of schools below tertiary were Church Owned, 11.0 percent were Public, and 10.3 percent were Private owned. The remaining percentage (5.7 percent) were reported to be Community owned schools.

Table 6.1 : Percentage Distribution of Type of Below Tertiary Institutions by Category – 2017 SECS

	Category				
Institution	**Church Owned**	**Private**	**Public**	**Community**	**Total (%)**
ECCD	12.6	54.1	9.1	24.2	**100**
Primary School	85.7	3.1	9.3	1.9	**100**
Secondary School	64.8	7.7	27.5	0.0	**100**
High School	73.9	0.0	18.9	7.3	**100**
Total (%)	**73.0**	**10.3**	**11.0**	**5.7**	**100**

Table 6.2 shows percentage distribution of types of higher learning institutions by category. The same pattern has been observed with higher education that a greater percentage of schools were Church Owned (43.3 percent), followed by Public owned schools (36.7 percent) and Private owned schools (13.3 percent). The least percentage was Community owned school with 6.7 percent.

Table 6.2: Percentage Distribution of Type of Higher Learning Institutions by Category – 2017 SECS

	Category				
Institution	**Church Owned**	**Private**	**Public**	**Community**	**Total (%)**
Tertiary	21.4	21.4	57.1	0.0	**100**
Technical	75.0	0.0	25.0	0.0	**100**
Vocational	58.3	8.3	16.7	16.7	**100**
Total (%)	**43.3**	**13.3**	**36.7**	**6.7**	**100**
Total (N)	**13**	**4**	**11**	**2**	**30**

6.2 Employment

Employment in institutions refers to individuals responsible for everyday operations of the school including but not limited to teachers, office secretary, cooks and school guards that have been directly hired by the institution.

Table 6.3 shows percentage distribution of type of employees by sex and below tertiary institution. The results indicate that there were more permanent and temporary female employees (69.9 percent and 57.0 percent respectively) in primary schools followed by high school with 20.8 percent permanent female employees and 36.1 percent temporary female employees. ECCD had the least female employees (5.4 percent permanent female employees and 3.8 percent temporary female employees). On the other hand, below tertiary institutions had more permanent male employees (52.2 percent) in primary school and more temporary male employees (49.7 percent) in high school. ECCD had the least permanent male employees and temporary male employees.

Table 6.3: Percentage Distribution of Type of Employees by Sex and Below Tertiary Institution – 2017 SECS

	Permanent		Temporary	
Institution	**Females**	**Males**	**Females**	**Males**
ECCD	5.4	1.3	3.8	1.4
Primary School	69.9	52.2	57.0	38.6
Secondary School	3.9	7.2	3.1	10.3
High School	20.8	39.3	36.1	49.7
Total (%)	**100**	**100**	**100**	**100**
Total (N)	**11901**	**5115**	**1219**	**893**

Table 6.4 shows the percentage distribution of type of employees by sex and higher learning institutions. Generally, higher learning institutions employed more females than males. This is reflected in tertiary which had 51.7 percent permanent female and 48.3 percent permanent males employees and 54.4 percent temporary females compared to 45.6 temporary males. Vocational also had more female employees with 63.3 percent and 73.7 percent permanent and temporary employees respectively. However, technical had more males than females with 67.7 percent and 100 percent permanent and temporary male employees respectively as opposed to 32.3 percent permanent female employees and no temporary female employees.

Table 6.4 : Percentage Distribution of Type of Employees by Sex and Higher Learning Institutions – 2017 SECS

	Permanent		Temporary	
Institution	**Females**	**Males**	**Females**	**Males**
Tertiary	51.7	48.3	54.4	45.6
Technical	32.3	67.7	0.0	100.0
Vocational	63.3	36.7	73.7	26.3
Total (%)	**51.3**	**48.7**	**54.2**	**45.8**
Total (N)	**955**	**905**	**200**	**169**

6.3 Enrolment

Student enrolment describes the number of students that were currently attending school.

Table 6.5 illustrates number of students by sex and category in below tertiary institutions. The proportion of female students (52.8 percent) below tertiary schools was higher than that of male students (47.2 percent).

Table 6.5: Number of Students by Sex and Category in Below Tertiary Institutions

Category	Female	Male
Church Owned	204,228	182,443
Private	16,722	16,249
Public	33,261	28773
Community	9,080	7,937
Total (%)	**52.8**	**47.2**
Total (N)	**263,291**	**235,402**

Table 6.6 presents number of students by category and sex in higher learning institutions. The same scenario was observed in higher education whereby the proportion of female students (61.2 percent) attending higher education was higher than that of male students (38.8 percent).

Table 6.6: Number of Students by Sex and Category in Higher Learning Institutions

Category	Female Students	Male Students
Church Owned	1,055	740
Private	3,396	2,524
Public	11,504	6,841
Community	64	69
Total (%)	**61.2**	**38.8**
Total (N)	**16,019**	**10,174**

6.4 Hard Coal

Hard coal refers to coal of gross calorific value less than 24MJ/kg on an ash-free but moist basis and with a mean random reflectance of vitrine of at least 0.6. (United Nations, 2017). There are different types of hard coal, however, this chapter will focus on two types only:

(i) Anthracite – has less than 10 per cent volatile matter, a high carbon content (about 86–98 percent carbon) and is non-agglomerating. It is mainly used for industrial and household heat raising.

(ii) Bituminous – has a higher volatile matter and lower carbon content than anthracite. They are used for industrial coking and heat raising and household heat raising.

Table 6.7 shows percentage distribution of hard coal by main use in below tertiary institutions. Hard coal was mostly used for Cooking (69.7 percent) followed by Space Heating with 22.6 percent. The table further shows that 85.1 percent and 14.9 percent of Anthracite was used for cooking and space heating respectively. Bituminous coal was used mostly for cooking (55.5 percent) followed by Space Heating with 29.6 percent.

Table 6.7: Percentage Distribution of Type of Hard Coal by Main Use in Below Tertiary Institutions – 2017 SECS

Hard Coal	Main Use			Total (%)	Total (N)
	Space Heating	Water Heating	Cooking		
Anthracite	14.9	0.0	85.1	**100**	**40.0**
Bituminous	29.6	14.9	55.5	**100**	**43.0**
Total (%)	**22.6**	**7.71**	**69.7**	**100**	**83.2**

Table 6.8 shows percentage distribution of hard coal by type and main use in higher learning institutions. The table indicates that most Hard Coal was used for Cooking (95.9 percent) followed by Space Heating with 4.1 percent. Anthracite was reported to have been used for Cooking only while 93.2 percent of Bituminous was used for Cooking. The least percent (6.8) of Bituminous was used for Space Heating.

Table 6.8: Percentage Distribution of Hard Coal by Type and Main Use in Higher Learning Institutions – 2017 SECS.

Hard Coal	Main Use		Total (%)	Total (N)
	Cooking	Space Heating		
Anthracite	100.0	0.0	**100**	**2.0**
Bituminous	93.2	6.8	**100**	**4.0**
Total (%)	**95.9**	**4.1**	**100**	**6.0**

Table 6.9 presents percentage distribution of institutions using hard coal by type. The majority of Tertiary institutions (88.9 percent) used Anthracite while the least (11.1 percent) used Bituminous coal. The table further shows that Technical Institutions used only Bituminous coal and Vocational Institutions used only Anthracite coal.

Table 6.9: Percentage Distribution of High Learning Institutions Using Hard Coal by Type – 2017 SECS

Institutions	Hard Coal		Total (%)	Total (N)
	Anthracite	Bituminous		
Tertiary	88.9	11.1	**100**	**3.0**
Technical	0.0	100.0	**100**	**2.0**
Vocational	100.0	0.0	**100**	**1.0**
Total (%)	**39.0**	**61.0**	**100**	**6.0**

Table 6.10 represents the quantity of Hard Coal used in Below Tertiary Institutions by type. Bituminous was the most used Hard Coal with 285,227kg followed by Anthracite with 142,367kg.

Table 6.10: Quantity (kg) of Hard Coal Used in Below Tertiary Institutions by Type

Hard Coal	Quantity
Anthracite	142,367.0
Bituminous	285,227.0
Total	**427,594.0**

6.5 Renewables and Waste

According to IEA, renewables and waste in this section refer to products which are produced and used for multiple purposes in the transformation and final consumption sectors such as wastes, fuelwood and charcoal.

Table 6.11 indicates percentage distribution of Institutions using Renewables and Waste by district in Below Tertiary Institutions. It is shown in the table that 48.9 percent of institutions used Renewables and Waste while 51.1 percent did not use. The results reveal that 94.0 percent of Below Tertiary Institutions in Qacha's Nek used

Renewables and Wastes as compared to 6.0 percent which did not use. In Mohale's Hoek district, 7.0 percent of Below Tertiary Institutions used Renewables and Wastes.

Table 6.11: Percentage Distribution of Institutions using Renewables and Wastes by District in Below Tertiary Institutions

District	Renewables and Waste	
	Used	Not used
Botha-Bothe	73.8	26.2
Leribe	42.6	57.4
Berea	63.0	37.0
Maseru	38.8	61.2
Mafeteng	50.1	49.9
Mohale's Hoek	7.0	93.0
Quthing	87.4	12.6
Qacha's Nek	94.0	6.0
Mokhotlong	50.5	49.5
Thaba-Tseka	10.3	89.7
Total (%)	**48.9**	**51.1**
Total (N)	**971**	**1016**

Figure 6.1 displays percentage distribution of Higher Learning Institutions using Renewables and Wastes. The figure reveals that 53.6 percent of higher learning institutions used Renewables and Wastes while 46.4 percent did not use.

Figure 6.1: Percentage Distribution of Higher Learning Institutions using Renewables and Wastes – 2017 SECS

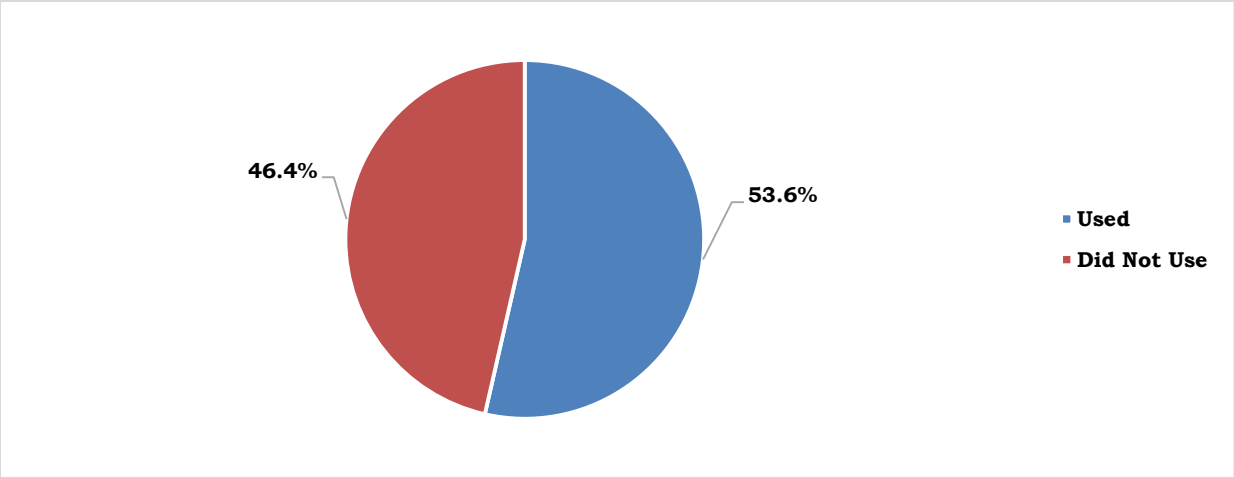


Table 6.12 shows quantity of renewables and waste used in below tertiary institutions. It is noted that below tertiary institutions mainly (9,789,947kg) used wood and other waste while 146,696kg was Other and 13,462kg was charcoal.

Table 6.12: Quantity (kg) of Renewables and Waste Used in Below Tertiary Institutions by Type – 2017 SECS

Renewable and Waste	Quantity
Charcoal	13,462
Wood and other waste	9,789,947
Other	146,696
Total	**9,950,105**

Table 6.13 shows amount spent on renewables and waste in below tertiary institutions. The table shows that M3,317,104.00 was spent on wood and other waste, M102,706.00 was spent on Other while M40,685.00 was spent on Charcoal.

Table 6.13: Amount (Maloti) Spent on Renewables and Waste in Below Tertiary Institutions by Type – 2017 SECS

Type	Amount
Charcoal	40,685.00
Wood and other waste	3,317,104.00
Other	102,706.00
Total	**3,460,495.00**

Table 6.14 illustrates percentage distribution of renewables and waste use by type of higher learning institutions. Of the total renewables and waste used in higher learning institutions, 86.7 percent was wood and other waste and 13.3 percent was charcoal.

Table 6.14: Percentage Distribution of Renewables and Waste Use by Type of Higher Learning Institution – 2017 SECS

Institution	Renewables and Waste		Total (%)
	Charcoal	Wood and other waste	
Tertiary	16.7	83.3	**100**
Technical	33.3	66.7	**100**
Vocational	0.00	100.0	**100**
Total (%)	**13.3**	**86.7**	**100**

6.6 Solar Photovoltaic (PV)

Table 6.15 shows the percentage distribution of below tertiary institutions using Solar PV by type. The results show that 3.7 percent of below tertiary institutions used solar PV, constituting 14.9 percent of high schools, 8.5 percent of secondary schools, 4.2 percent of ECCD and 1.5 percent of primary schools. On the other hand, 96.3 percent of below tertiary institutions did not use solar PV.

Table 6.15: Percentage Distributions of Below Tertiary Institutions Using Solar PV by Type – 2017 SECS

	Solar PV	
Type of Institution	**Used**	**Not Used**
ECCD	4.2	95.8
Primary School	1.5	98.5
Secondary School	8.5	91.5
High School	14.9	85.1
Total (%)	**3.7**	**96.3**
Total (N)	**73**	**1913**

Table 6.16 shows the percentage distribution of higher learning institutions using Solar PV by type. The table reveals that 10.7 percent of higher learning institutions used solar PV as opposed to the 89.3 percent that did not. In vocational institutions 16.7 percent used Solar PV while 83.3 percent did not. Technical institutions did not use solar PV at all.

Table 6.16: Percentage distributions of Higher Learning Institutions Using Solar PV by Type – 2017 SECS

	Solar PV	
Type of Institution	**Used**	**Not Used**
Tertiary	8.3	91.7
Technical	0.0	100.0
Vocational	16.7	83.3
Total (%)	**10.7**	**89.3**
Total (N)	**3**	**25**

Figure 6.2 portrays the number of solar panels used in below tertiary institutions. The figure reveals that High school had the largest number of solar panels (34) followed by Primary school with 21 solar panels. The least number was recorded in Secondary schools with 6 solar panels.

Figure 6.3 shows the number of solar panels used in higher learning institutions. It is shown that tertiary owned 1 solar panel and vocational owned 2 solar panels.

Figure 6.2: Number of Solar Panels Used in Below Tertiary Institutions

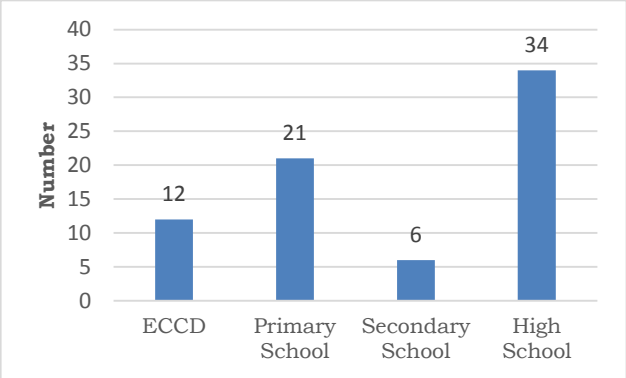
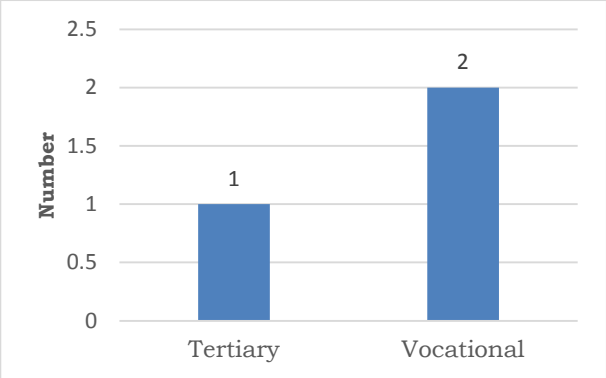


Figure 6.3: Number of Solar Panels Used in Higher Learning Institutions



6.7 Electricity

Electricity is an energy carrier with a very wide range of applications. It is used in almost all kinds of human activity ranging from industrial production, household use, agriculture, commerce for running machines, lighting and heating (Energy Statistics Manual, IEA Publications, 2010). There are different types of electricity connections such as solar electricity, grid electricity, to mention but a few. This section will however, focus on grid electricity. Grid electricity is an interconnected network for electricity delivery from producers to consumers. A network of synchronized power providers and consumers, that are connected by transmission and distribution lines and operated by one or more control centres What is Electric Grid | IGI Global (igi-global.com).

6.7.1 Grid Electricity Access

Grid access in this section refers to consumers that are connected to grid electricity and use it for cooking, powering appliances, refrigeration etc. This section reflects grid electricity access of below tertiary and higher learning institutions.

Figure 6.4 illustrates the percentage share of the higher learning institutions connected to grid electricity. This figure shows that 44.0 percent of Tertiary institutions and 41.0 percent of Vocational institutions were connected to grid-electricity. It further indicates that 15.0 percent of Technical institutions were connected to grid.

Figure 6.4: Percentage Share of Higher Learning Institutions Connected to Grid Electricity - 2017 SECS

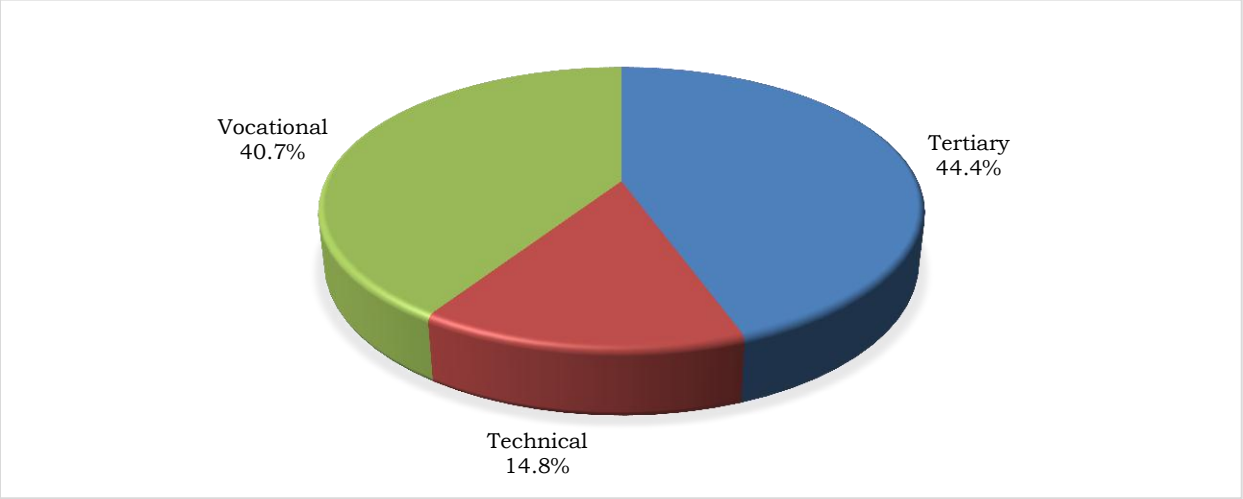


Table 6.17 shows the percentage distribution of institutions below tertiary connected to grid electricity by districts. It illustrates that 28.0 percent of the institutions in ten districts of Lesotho were using grid electricity while 72.0 percent were not. Berea (39.5 percent) and Maseru (32.5 percent) have the most institutions connected to electricity followed by Qacha's Nek (30.5 percent). Thaba-Tseka (88.7 percent) has most institutions not connected to grid electricity.

Table 6.17: Percentage Distribution of Below Tertiary Institutions Connected to Grid Electricity by Districts - 2017 SECS

	Grid Electricity	
District	**Used**	**Not Used**
Botha-Bothe	27.7	72.3
Leribe	29.2	70.8
Berea	39.2	60.8
Maseru	32.5	67.5
Mafeteng	30.0	70.0
Mohale`s Hoek	13.9	86.1
Quthing	32.5	67.5
Qacha`s Nek	30.5	69.5
Mokhotlong	17.6	82.4
Thaba-Tseka	11.3	88.7
Total (%)	**28.0**	**72.0**
Total N	**549**	**1438**

6.7.2 Electricity Consumption

This section reflects on the quantity of electricity consumed in higher learning and below tertiary institutions by main use.

Table 6.18 illustrates the quantity of electricity consumed by main use in Higher learning institutions. The table delineates that total electricity used by the institutions was 209,454,833.1kWh and major electricity consumption was recorded in lighting with 196,143,484.1kWh. The least electricity used was for Cooking with 15,375.00 kWh.

Table 6.18: Quantity (kWh) of Electricity Consumed in Institutions by Main Use

Main use	Electricity Consumed
Space Heating	50,101.4
Cooking	15,375.0
Lighting	196,143,484.1
Water Pumping	495,654.9
Powering Appliances	12,450,217.6
Other	300,000.0
Total	**209,454,833.1**

Table 6.19 below presents the amount of electricity consumed by main use in the institutions below tertiary. The results unfold that most of the institutions used electricity for powering appliances as they consumed 2,562,776.2 kWh followed by lighting 2,278,440.5 kWh. The least amount of electricity used was for Other (this entails sirens, computer lab equipment) with 5,659.2kWh.

Table 6.19: Amount (kWh) of Electricity Consumed in Below Tertiary by Main Use

Main Use	Electricity Consumed
Space Heating	708,226.0
Cooking	22,000.0
Lighting	2,278,440.5
Water Heating	326,376.2
Water Pumping	129,859.1
Powering Appliances	2,562,776.2
Other	5,659.2
Total (N)	**6,033,337.30**

6.8. Petroleum Products

The energy sector in Lesotho consists of three main sub-sectors petroleum, renewable energy and electricity. The petroleum products are defined as products obtained from crude oil, non-conventional oils or gases from oil and gas fields. They may be produced through the refining of conventional crude and non-conventional oils or during the

separation of natural gas from gases extracted from oil or gas fields (International Recommendations for Energy Statistics).

6.8.1 Petroleum Sub-Sector

This section focuses on petroleum sub-sector and will analyse the consumption of petroleum products used in the education sector. The petroleum products referred to are Diesel 50ppm, Diesel 500ppm, unleaded petrol, Paraffin, Acetylene and LPG.

Table 6.20 shows the percentage distribution of below tertiary institutions using petroleum products by district. Berea has the highest number of below tertiary institutions that used petroleum products with 75.9 percent followed by Qacha's Nek with 58.8 percent. Mohale's Hoek recorded the least percentage (10.7 percent).

Table 6.20: Percentage Distribution of Below Tertiary Institutions Using Petroleum Products by District – 2017 SECS.

District	Petroleum Product	
	Used	Not Used
Botha-Bothe	44.4	55.6
Leribe	26.5	73.5
Berea	75.9	24.1
Maseru	57.1	42.9
Mafeteng	56.7	43.3
Mohale's Hoek	10.7	89.3
Quthing	50.0	50.0
Qacha's Nek	58.8	41.2
Mokhotlong	27.8	72.2
Thaba-Tseka	33.3	66.7
Total (%)	**45.5**	**54.5**
Total (N)	**127**	**152**

Figure 6.5 displays percentage distribution of higher learning institutions using petroleum products. The figure shows that 89.3 percent of Higher Learning institutions used petroleum products while 10.7 percent did not use.

Figure 6.5: Percentage Distribution of Higher Learning Institutions Using Petroleum Products – 2017 SECS.

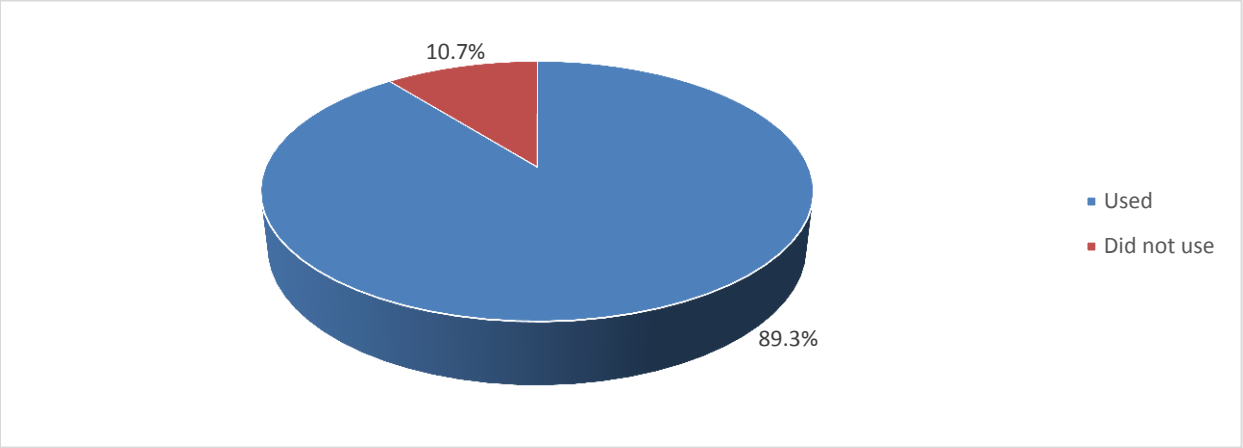


Table 6.21 presents the quantity of petroleum products used for operation by type in below tertiary institutions. Below tertiary institutions used 571,838.1Kg of LPG. Paraffin (105,428.6L) was mostly used followed by Diesel 500ppm (11,539.3L). The least petroleum products used was Diesel 50ppm with 589.0L.

Table 6.21: Quantity of Petroleum Products Used for Operation by Type in Below Tertiary Institutions

Type of Petroleum Products	Quantity
Diesel 50ppm (L)	589.0
Diesel 500ppm (L)	11,539.3
Unleaded petrol (L)	11,167.7
Paraffin (L)	105,428.6
LPG (Kg)	571,838.1

Table 6.22 indicates Quantity of Petroleum products used for operation by type in Higher Learning Institutions. It was observed that mostly used Petroleum product was Diesel 500ppm (8,769.9 litres) followed by Paraffin (2,813.1 litres). The least used petroleum product was Acetylene with 166.2kg.

Table 6.22 : Quantity of Petroleum Products Used for Operation by Type in Higher Learning Institutions

Type of Petroleum Product	Quantity
Diesel 50ppm (L)	8,769.9
Diesel 500ppm (L)	2,918.6
Unleaded petrol (L)	1,999.4
Paraffin (L)	2,813.1
Acetylene (kg)	166.2
LPG (Kg)	9,725.1

6.8.2 Lubricants

Lubricants are essential for the efficient functioning of any machine. They are used to reduce friction between moving parts, and also to reduce heat, dust, and wear and tear. Lubricants come in a variety of forms, such as oil, grease, and other specialized fluids, and can be used in a variety of applications. Either for transportation or operation such as lubricating a vehicle's engine to improve fuel efficiency and reduce friction, or for operating machines such as drills and saws etc. https://en.wikipedia.org/wiki/Lubricant.

Figure 6.6 displays percentage distribution of higher learning institutions using lubricants. The figure demonstrates that 41.7 percent of Vocational institutions used lubricates as opposed to 58.3 percent which did not use. It further reveals that 33.3 percent and 50.0 percent of Tertiary and Technical institutions used lubricants respectively.

Figure 6.6: Percentage Distribution of Higher Learning Institutions Using Lubricants – 2017 SECS

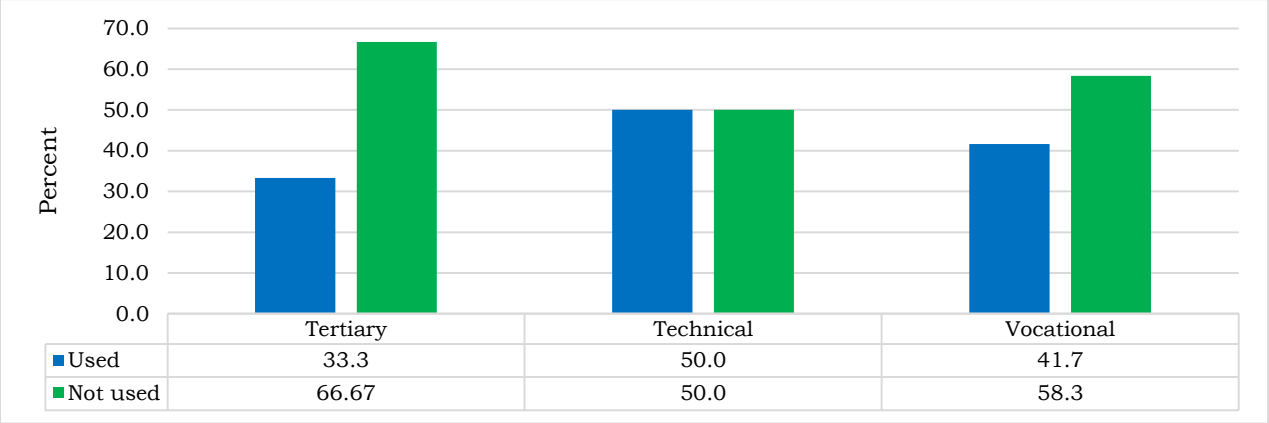


Table 6.23 presents quantity of Lubricants in below Tertiary Institutions used for Transport by category type. According to the table, Motor oil was used more in Secondary schools with 495 litres followed by High school with 218 litres. Brake fluid (79.9 litres) was used in High schools and 13.7kg of Grease was used in Primary schools.

Table 6.23: Quantity of Lubricants in Below Tertiary Institutions Used for Transport by Category Type – 2017 SECS

	Lubricants			
Type of Category	**Grease (kg)**	**Brake Fluid (l)**	**Motor oil (l)**	**Other (l)**
Primary School	13.7	0.0	0.0	0.0
Secondary	11.0	60.0	495.0	0.0
High School	0.0	79.9	218.0	20.1
Total	**24.7**	**139.9**	**713**	**20.1**

Table 6.24 indicates quantity of Lubricants in higher learning institutions used for Transport by type. The table shows that 200.5 litres of Motor oil was used for transportation in higher learning institution as a lubricant. Grease (1kg) and "Other lubricants" (1litre) were also used Lubricants.

Table 6.24: Quantity of Lubricants in Higher Learning Institutions Used for Transport by Type – 2017 SECS

Type of Lubricants	Quantity
Grease (kg)	1.0
Brake Fluid (l)	5.4
Motor Oil (l)	200.5
Other (l)	1.0

Table 6.25 reveals Quantity of Lubricants in below Tertiary Institutions used for Operation by category type. It is shown from the table that Motor oil was mostly used in Primary school (102.92 liters) followed by High school (66.60 litres). "Other Lubricants" were used in ECCD and High school with 0.9 litres and 0.5 litres respectively.

Table 6.25: Quantity of Lubricants in Below Tertiary Institutions Used for Operation by Category Type – 2017 SECS

	Type of Lubricants			
Type of Category	**Grease (kg)**	**Brake Fluid (l)**	**Motor oil (l)**	**Other (l)**
ECCD	0.0	0.0	0.0	0.9
Primary School	84.8	67.0	102.92	0.0
Secondary school	11.0	0.0	66.0	0.0
High School	5.1	64	66.60	0.5
Total	**100.9**	**131**	**235.5**	**1.4**

6.9 Building Characteristics

This section defines features of a building, including its size and structural components. These characteristics can have a significant impact on the building's energy efficiency, comfort, and overall performance.

6.9.1 Insulation

Insulation is the use of non-conductors as a way of preventing heat losses, sound or electricity transfers.

Table 6.26 shows the percentage distribution of below tertiary institutions insulated by category type. In general, the results indicate that 57.0 percent used insulation, while 43.0 percent did not. The results further indicate that 77.5 percent of High school institutions used insulation. About 41.4 percent of ECCD institutions were insulated.

Table 6.26: Percentage Distribution of Below Tertiary Institutions Insulated by Category Type – 2017 SECS

	Insulation	
Type of Category	**Yes**	**No**
ECCD	41.4	58.6
Primary School	51.6	48.4
Secondary School	59.8	40.2
High School	77.5	22.5
Total (%)	**57.0**	**43.0**
Total (N)	**4,485**	**3,415**

Table 6.27 shows percentage distribution of Higher Learning institutions insulated by category type. According to the table, all tertiary institutes (100.0 percent) were insulated. It further reveals that 75.6 percent and 87.2 percent of technical and vocational institutions respectively were insulated.

Table 6.27: Percentage Distribution of Higher Learning Institutions Insulated by Category Type – 2017 SECS

	Insulation	
Type of Category	**Yes**	**No**
Tertiary	100.0	0.0
Technical	75.6	24.4
Vocational	87.2	12.8
Total (%)	**90.6**	**9.4**
Total (N)	**192**	**20**

6.9.2 Area Heated and Cooled

Area occupied in this section refers to the total areas used by the institution such as classrooms, offices and kitchen but this excludes corridors and restrooms. Area heated or cooled refers to the area where heating and cooling is done in the institution.

Table 6.28 presents total area occupied, heated and cooled in below tertiary institutions. Primary schools occupied the largest area 589,472.0m^2 followed by High schools with 264,205.9m^2. The least area (58,498.8m^2) was occupied by ECCD. The total area heated in below tertiary institutions was 152,311.5m^2 while the total area cooled was 651.9 m^2.

Table 6.28: Total Area (m^2) Occupied, Heated and Cooled in Below Tertiary Institutions – 2017 SECS

	Area		
Type of Category	**Occupied**	**Heated**	**Cooled**
ECCD	58,498.8	14,236.6	0.00
Primary School	589,472.0	85,641.4	0.00

Secondary School	60,725.7	15,955.5	0.00
High School	264,205.9	36,478.0	651.9
Total (N)	**972,902.4**	**152,311.5**	**651.9**

Table 6.29 presents the total area occupied, heated and cooled in Higher Learning Institutions by category type. The total area occupied by Higher Learning Institutions was 128,083.6 m². Tertiary institutions heated the largest (67,731.2m²) area while Technical institutions heated the least area (909.6m²) Cooled area was reported for Tertiary institutions with a total of 18,943.2m².

Table 6.29: Total Area (m²) Occupied, Heated and Cooled in Higher Learning Institutions by Category Type

	Area		
Type of Category	**Occupied**	**Heated**	**Cooled**
Tertiary	111,565.6	67,731.2	18,943.2
Technical	7,916.0	909.6	0.0
Vocational	8,602.0	1,809.2	0.0
Total (N)	**128,083.6**	**70,450.0**	**18,943.2**

6.10 Central Heating/Cooling System

A central heating system or cooling system is a component of heating, ventilation and air conditioning systems, which can both cool and warm interior spaces.

A central heating system has a furnace that converts fuel or electricity to heat. The heat is circulated through the building either by fans forcing heated air through ducts, circulation of low-pressure steam to radiators in each heated room, or pumps that circulate hot water through room radiators. Primary energy sources may be fuels like coal or wood, oil, kerosene, natural gas, or electricity Central heating - Wikipedia.

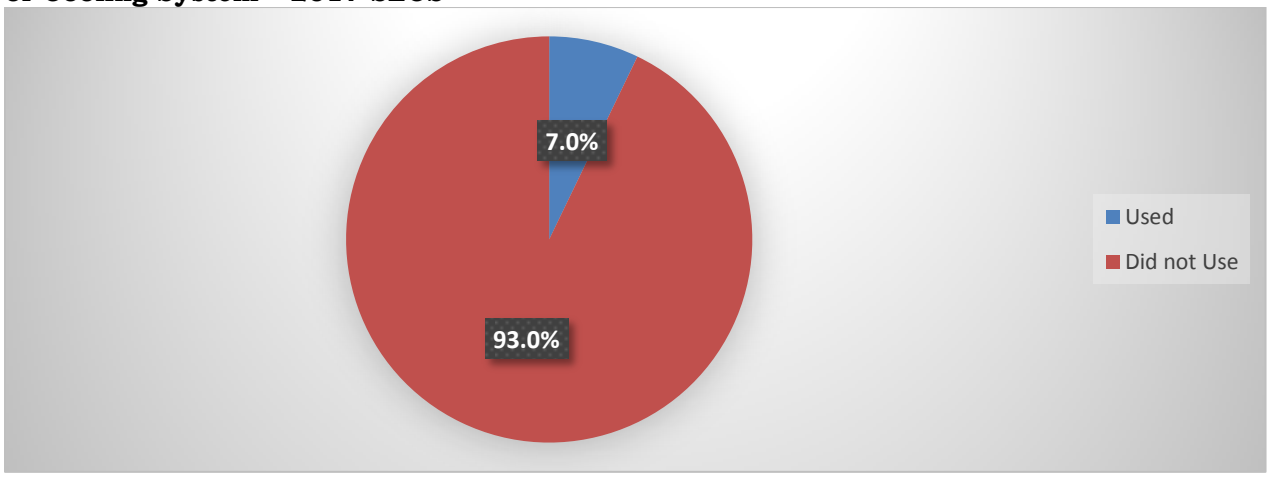
Table 6.30 shows quantity of electricity consumed by the Central Heating and Cooling system in Higher Learning Institutions by type. Electric Resistance used more electricity for Central heating with 568,160.00kWh followed by Split system with inverter (350,544.00kWh). For Central Cooling, Heat pump and Air furnace consumed 69,463.4kWh and 1,344.00kWh respectively.

Table 6.30: Quantity of Electricity (kWh) Consumed by Central Heating and Cooling Systems in Higher Learning Institutions by Type – 2017 SECS

Type of System	**Electricity Consumed**	
	Heating	**Cooling**
Air Furnace	672.0	1,344.0
Heat Pump	37,305.6	69,463.4
Electric Resistance	568,160.0	0.0
Split System with Inverter	350,544.0	419,328.0
Total	**956,681.6**	**490,135.4**

Figure 6.7 outlines the percentage share of Higher Learning institutions using central heating or cooling systems. The figure illustrates that 7.0 percent of higher learning institutions used central heating or cooling system while 93.0 percent did not use.

Figure 6.7: Percentage Distribution of Higher Learning Institutions Using Central Heating or Cooling System – 2017 SECS



6.11 Independent Heating/Cooling Systems

Independent heating or cooling systems refers to the systems that generate heat or cool air by transforming the chemical energy in fuel into thermal energy and transferring that energy into air which then gets delivered throughout the building. Heat Pump Systems | Department of Energy.

This section illustrates the usage of independent heating or cooling system, energy source used and energy consumed by the independent heating or cooling systems in the Higher Learning and below tertiary institutions.

Table 6.31 below represents the percentage distribution of institutions using independent heating or cooling systems in Higher Learning Institutions by type. The table illustrates that 89.0 percent of the Higher Learning institutions used independent heating or cooling systems while 11.0 percent did not. About 75.0 percent of Vocational Institutions used independent Cooling or Heating System as opposed to 25.0 percent which did not.

Table 6.31: Percentage Distribution of Higher Learning Institutions Using Independent Heating or Cooling System by Type – 2017 SECS

	Independent Heating or Cooling System	
Type of Institutions	**Used**	**Not Used**
Tertiary	100.0	0.0
Technical	100.0	0.0
Vocational	75.0	25.0
Total (%)	**89.0**	**11.0**
Total (N)	**24**	**3**

Table 6.32 shows the percentage distribution of below tertiary institutions using independent heating or cooling system by type. In general, the table illustrates that 27.0 percent of below tertiary institutions used independent heating or cooling systems while 73.0 percent did not use. High School Institutions recorded 76.1 percent of Independent Heating or Cooling System usage and 14.0 percent of Primary School Institutions used Independent Heating or Cooling System.

Table 6.32: Percentage Distribution of Below Tertiary Institutions Using Independent Heating or Cooling System by Type – 2017 SECS

	Independent Systems	
Type of Institution	**Used**	**Not Used**
ECCD	48.6	51.4
Primary School	14.0	86.0
Secondary School	40.8	59.2
High School	76.1	23.9
Total (%)	**27.0**	**73.0**
Total (N)	**53,788**	**144194**

Table 6.33 illustrates percentage distribution of higher learning institutions using independent heating or cooling system by type and energy source. The table shows that 97.5 percent of Higher Learning institutions used electricity systems for heating or cooling while 2.0 percent used Paraffin and 0.8 percent used Gas.

Table 6.33: Percentage Distribution of Higher Learning Institutions Using Independent Heating or Cooling System by Type and Energy Source -2017 SECS

Type of System	**Energy Source**		
	Electricity	**Gas**	**Paraffin**
Split A/C Units with Inverter	3.4	0.0	0.0
Split A/C Units without Inverter	20.2	0.0	0.0
Electric Oil Heater	22.7	0.0	0.0
Electric Resistance Heater	26.9	0.0	0.0
Paraffin Heater	0.0	0.0	100.0
Gas Heater	0.0	100.0	0.0
Fan	4.2	0.0	0.0
Other	22.7	0.0	0.0
Total (%)	**97.5**	**0.8**	**2.0**
Total (N)	**119.0**	**1.0**	**1.6**

Table 6.34 illustrates the percentage share of below tertiary institutions using heating or cooling system by type and energy source. The table indicates that Paraffin (61.3 percent) was the most used energy source followed by electricity (37.5 percent). Gas (1.3 percent) was the least used energy source.

Table 6.34: Percentage Share of Below Tertiary Institutions Using Independent Heating or Cooling System by Type and Energy Source – 2017 SECS

Type of System	Energy Source		
	Electricity	Gas	Paraffin
Split A/C Units with Inverter	1.3	0.0	0.0
Split A/C Units without Inverter	1.9	0.0	0.0
Electric Oil Heater	16.5	0.0	0.0
Electric Resistance Heater	17.8	0.0	0.0
Paraffin Heater	0.0	0.0	60.0
Gas Heater	0.0	1.3	0.0
Fan	0.0	0.0	0.0
Other	0.0	0.0	1.2
Total (%)	**37.5**	**1.3**	**61.3**

Table 6.35 delineates the quantity of energy consumed in higher learning institutions by type of heating or cooling systems. The table shows that Electric Oil Heater consumption was 67,834,563.9 kWh while Paraffin Heater consumed 258,620.0 litres and Gas Heater consumed 1,113,448.5 kg.

Table 6. 35: Quantity of Energy Consumed in Higher Learning Institutions by Type of Heating or Cooling System – 2017 SECS

Type of System	Energy Consumed		
	Heating	Cooling	Units
Split A/C Units with Inverter	453,034.2	474,888.2	KWh
Split A/C Units without Inverter	5438527.4	2096147	KWh
Electric Oil Heater	67,834,563.9		KWh
Electric Resistance Heater	3,941,750.8		KWh
Paraffin Heater	258,620.0		L
Gas Heater	1,113,448.5		KG
Fan		598,507.8	KWh

Table 6.36 portrays the quantity of energy consumed in below tertiary institutions by type of heating or cooling system. The table reveals that Gas Heater consumption was 553,995.7 kg, Paraffin Heater consumption was 3,252,177.7 litres. The Electric Oil Heater consumed more energy with 266,153,440.5kWh followed by Electric Resistance Heater with 21,053,059.9kWh.

Table 6.36: Quantity of Energy Consumed in Below Tertiary Institutions by Type of Heating or Cooling System - 2017 SECS

	Energy Consumed		
Type of System	**Heating**	**Cooling**	**Units**
Split A/C Units with Inverter	7,245.3	3,396.3	KWh
Split A/C Units without Inverter	13,860.0		KWh
Electric Oil Heater	266,153,440.5		KWh
Electric Resistance Heater	21,053,059.9		KWh
Paraffin Heater	3,252,177.7		L
Gas Heater	553,995.7		KG
Fan		36,780.9	KWh
Other (wall heater)	12,889.5		KWh

6.12 Lighting (Grid Electricity)

Lighting refers to deliberate use of light to achieve practical or visual effects https://www.slideshare.net/jaitasarkar/lightning-outdoor-and-specialized. Lighting includes the use of artificial light sources like lamps and bulbs. Lighting can be done manually or by motion sensor and light sensors. Motion sensor light refers to a light that is **activated by** physical movement around them while Light sensors are a type of photodetector that detect light.

This section reflects on the use of grid electricity lighting in educational institutions and focuses on the following types of bulbs.

- Energy Saver Bulb: these use less electricity to emit the same amount of light as a traditional bulb.
- Florescent Tubes: a glass tube which radiates light when phosphor on its inside surface is made to fluoresce by ultraviolet radiation from mercury vapor.
- Incandescent bulb: a glass and metal device that produces light when a thin wire filament glows with illumination as it is heated by an electrical current passing through it.
- Light-Emitting Diode (LED) bulb: a semiconductor bulb that emits light when an electric current flows through it.
- Other – This represents a mercury vapor bulb. Light Bulb Types: How to Choose the Best Light Bulbs (lowes.com)

6.12.1 Light Sensors

Table 6.37 shows percentage distribution of below tertiary institutions with light sensors. The results indicate that 19.7 percent of below tertiary institutions had light sensors and 80.3 percent did not have light sensors. Light sensors (66.7 percent) were

mostly used in secondary school followed by high school (35.3 percent). ECCD did not use light sensors.

Table 6. 37: Percentage Distribution of Below Tertiary Institutions with Light Sensors – 2017 SECS

Type of Institutions	Light Sensors	No Light Sensors	Total
ECCD	0.0	100.0	100.0
Primary School	6.8	92.9	100.0
Secondary School	66.7	33.3	100.0
High School	35.3	64.7	100,0
Total (%)	**19.7**	**80.3**	**100.0**
Total (N)	**109**	**444**	**554**

Table 6.38 shows percentage distribution of Higher Learning institutions with light sensors. The results indicate that 30.8 percent of Higher Learning institutions had light sensors while 69.2 percent did not have. About 75.0 percent of technical schools used light sensors and only 36.4 percent of tertiary institutions used light sensors.

Table 6.38: Percentage Distribution of Higher Learning Institutions With Light Sensors

Institutions	With	Without	Total (%)
Tertiary	36.4	63.6	100
Technical	75.0	25.0	100
Vocational	9.1	90.9	100
Total (%)	**30.8**	**69.2**	**100**
Total (N)	**8**	**18**	**25**

6.12.2 Motion Sensor

Figure 6.8 presents the percentage distribution of below tertiary institutions with motion sensors. The results show that 97.6 percent of below tertiary institutions did not have motion sensors and 2.4 percent had motion sensors.

Figure 6.8: Percentage Distribution of Below Tertiary Institutions With motion -2017 SECS

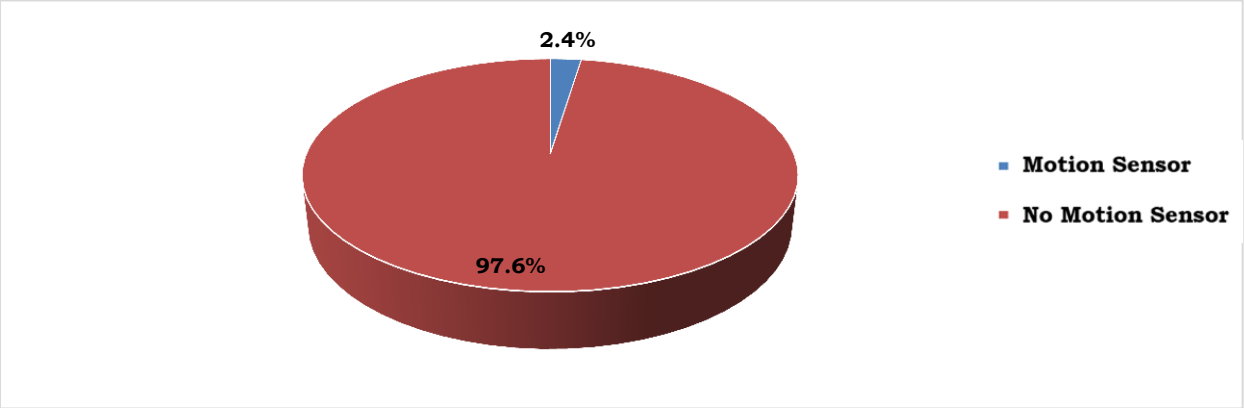
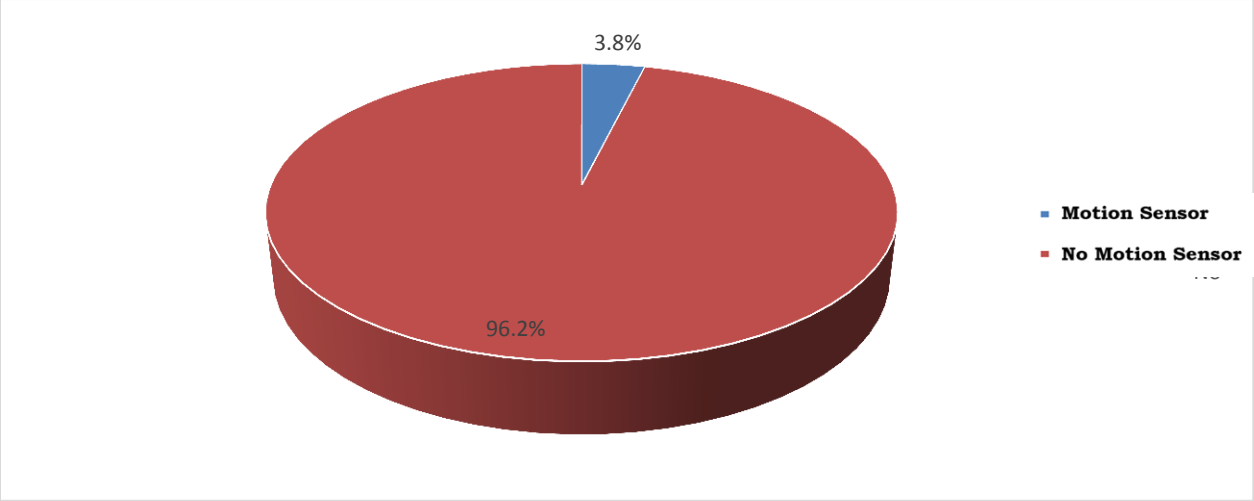


Figure 6.9 presents the percentage distribution of Higher Learning institutions with motion sensors. The results indicate that 3.8 percent of Higher Learning institutions had motion sensor and 96.2 percent did not have motion sensors.

Figure 6.9: Percentage Distribution of Higher Learning Institutions With Motion Sensors – 2017 SECS



6.12.3 Light Bulb

Table 6.39 presents percentage distribution of light bulbs used in below tertiary institutions. The results indicate that Florescent tubes were mostly used with 43.0 percent, followed by Energy Saver with 27.7 percent. LED was the least used bulb with 6.1 percent.

Table 6.39: PPercentage Distribution of Type of Bulbs Used in Below Tertiary Institutions – 2017 SECS

	Types of bulbs			
Institution	**Energy Saver**	**Florescent**	**Incandescent**	**LED**
ECCD	39.2	29.4	17.6	15.7
Primary School	27.0	42.4	30.6	0.0
Secondary School	21.2	43.9	21.2	13.6
High School	28.0	45.6	16.9	9.4
Total (%)	**27.7**	**43.0**	**23.3**	**6.1**
Total (N)	**209**	**324**	**176**	**46**

Table 6.40 presents percentage distribution of light bulbs used by type in Higher Learning institutions. The results indicate that Florescent tubes were mostly used with 82.3 percent, followed by Energy saver with 11.9 percent. Energy saver (12.0 percent) was mostly used in tertiary institutions followed by vocational institutions (9.8 percent). Halogen (0.2 percent) was only used in tertiary institutions. Florescent tubes were mostly used in technical institutions (93.6 percent) followed by tertiary institutions (82.3 percent).

Table 6.40: Percentage Distribution of Light Bulbs Used by Type in Higher Learning Institutions – 2017 SECS

	Types of Bulbs					
Institution	**Energy saver**	**Florescent**	**Incandescent**	**LED**	**Halogen**	**Other**
Tertiary	12.0	82.3	1.4	4.1	0.2	0.1
Technical	1.4	93.6	4.6	0.5	0.0	0.0
Vocational	9.8	79.2	9.8	1.2	0.0	0.0
Total (%)	**11.9**	**82.3**	**1.5**	**4.0**	**0.2**	**0.1**
Total (N)	**3,325.0**	**23,092.0**	**434.0**	**1,131.0**	**54.0**	**20.0**

6.12.4 Energy Consumed

Table 6.41 presents the amount of electricity consumed by type of light bulbs in Higher Learning institutions by district. The results show that Higher Learning institutions in Maseru consumed more energy across types of bulbs with Florescent consuming more energy (10535.8kWh), energy saver (6826.0kWh), Incandescent (319.8kWh), LED (496.1), Halogen (100.4kWh) and Other (80.0 kWh).

Table 6.41: Amount of Electricity (kWh) Consumed by Type of Light Bulbs in Higher Learning Institutions by District – 2017 SECS

	Types of Bulbs					
District	**Energy Saver**	**Florescent**	**Incandescent**	**LED**	**Halogen**	**Other**
Botha-Bothe	0.0	0.0	0.0	0.0	0.0	0.0
Leribe	5.8	45.6	12.2	0.1	0.0	0.0
Berea	1.8	36.9	0.6	0.0	0.0	0.0
Maseru	6,826.0	10,535.8	319.8	496.1	100.4	80.0
Mafeteng	0.0	0.0	0.0	0.0	0.0	0.0
Mohale's Hoek	0.5	41.0	2.5	0.3	0.0	0.0
Quthing	0.2	52.5	0.0	0.0	0.0	0.0
Qacha's Nek	0.0	0.0	0.0	0.0	0.0	0.0
Mokhotlong	0.0	0.1	0.0	0.0	0.0	0.0
Thaba-Tseka	0.0	0.0	0.0	0.0	0.0	0.0
Total (N)	**6,834.4**	**10,711.9**	**335.2**	**496.5**	**100.4**	**80.0**

6.13 Lighting (Solar Electricity)

As described in section 6.12, lighting in this section also refers, however, the section reflects on use of solar electricity lighting in educational institutions.

6.13.1 Motion Sensor

Table 6.42 displays the percentage distribution of Higher Learning institutions with light and motion sensor. It is evident from the table that 30.8 percent of higher learning institutions had light sensors while 69.2 percent did not. The higher learning institutions (3.8 percent) had motion sensors while 96.2 did not. Light sensors (75.0 percent) and motion sensors (25.0 percent) were mostly used in technical institutions.

Tertiary institutions which used light sensors accounted for 36.4 percent and none used motions sensors, the same is observed with vocational (9.1 percent) which used only light sensors.

Table 6.42: Percentage Distribution of Higher Learning Institutions with Light and Motion Sensors

	Light Sensor Control		Motion Sensor Control	
Institution	**Yes**	**No**	**Yes**	**No**
Tertiary	36.4	63.6	0.0	100.0
Technical	75.0	25.0	25.0	75.0
Vocational	9.1	90.9	0.0	100.0
Total (%)	**30.8**	**69.2**	**3.8**	**96.2**
Total (N)	**8**	**18**	**1**	**25**

Table 6.43 displays the percentage distribution of below tertiary institutions with light and motion sensors. The results show that 18.6 percent of below tertiary institutions used light sensor and 3.2 percent of below tertiary institutions used motion sensors. About 67.4 percent of secondary schools used light sensors while 32.6 percent did not and 6.8 percent of primary schools used light sensors while 93.2 percent did not. Motion sensors were only used in high schools with 44.8 percent.

Table 6.43: Percentage Distribution of Below Tertiary Institutions with Light and Motion Sensors – 2017 SECS

	Light Sensor Control		Motion Sensor Control	
Institution	**Yes**	**No**	**Yes**	**No**
ECCD	0.0	100.0	0.0	100.0
Primary School	6.8	93.2	0.0	100.0
Secondary School	67.4	32.6	0.0	100.0
High School	31.2	68.8	44.8	55.2
Total (%)	**18.6**	**81.4**	**3.2**	**96.8**
Total (N)	**103**	**451**	**13**	**398**

Table 6.44 shows the percentage distribution of light bulbs used by type in below tertiary institutions. Florescent tubes (45.7 percent) were mostly used in below tertiary institutions followed by Energy Saver (31.3 percent) and LED (23.1 percent). Energy saver is mostly used in High school with 42.7 percent followed by primary school with 32.5 percent. Secondary schools only use florescent tubes.

Table 6. 44: Percentage Distribution of Light Bulbs Used by Type in Below Tertiary Institutions – 2017 SECS

	Used Type			
Institutions	**Energy Saver**	**Fluorescent Tube**	**LED**	**Total (%)**
Primary School	32.5	53.0	14.5	**100**
Secondary School	0.0	100.0	0.0	**100**
High School	42.7	16.9	40.4	**100**
Total (%)	**31.3**	**45.7**	**23.1**	**100**
Total (N)	**65**	**95**	**48**	**208**

Table 6.45 depicts the amount of electricity consumed by type of light bulb in below tertiary institutions. Florescent consumed the most electricity with 14.3kWh, followed by energy saver with 1.9kWh.

Table 6.45: Amount of Electricity (kWh) Consumed by Type of Light Bulb in Below Tertiary Institutions – 2017 SECS.

Bulb Type	Electricity
Energy Saver	1.9
LED	0.5
Florescent	14.3
Incandescent	0.0
Other	0.0
Total	**16.63**

6.14 Office Equipment

Office equipment is defined as any office electronic device owned, leased, or operated by or for the benefit of schools which can create, send, receive, store and/or otherwise use electronic information, materials and/or communications including but not limited to, computers, servers, printers, scanners, fax machines, telephones, and portable electronic devices (PEDs) Office Supplies: Are They an Asset or an Expense? (fool.com).

Figure 6.10 shows the percentage distribution of office equipment by type in below tertiary institutions. On average, desktops and printers were the most used with a percentage of 30.3 followed by monitors (21.8 percent). Laptops were the least used office equipment with 8.4 percent.

Figure 6.10: Percentage Distribution of Office Equipment by Type in Below Tertiary Institutions – 2017 SECS

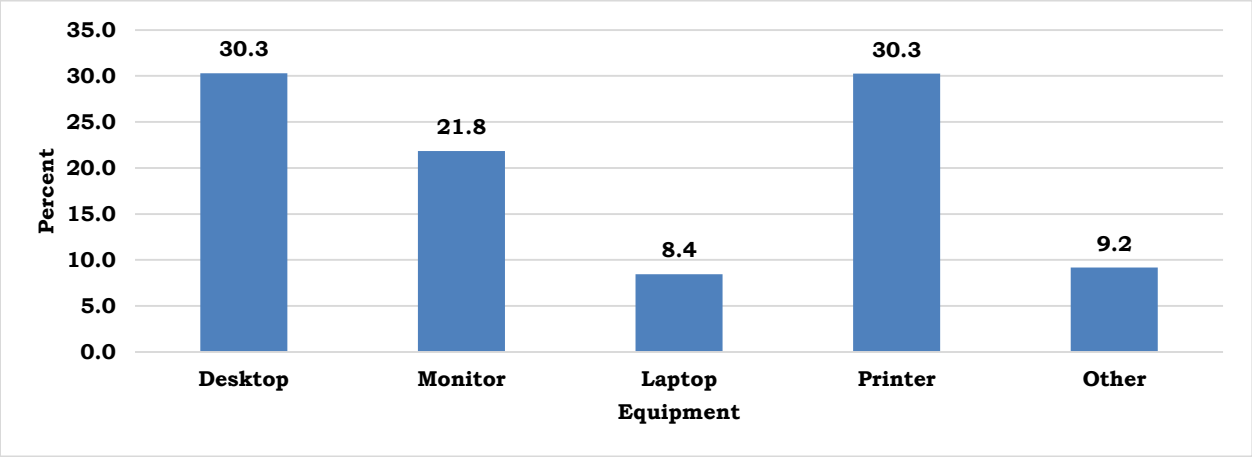


Figure 6.11 depicts the graphical presentation of the percentage distribution of office equipment by type in higher learning institutions. Desktops were the most used at

25.5 percent followed by printers (23.5 percent). Laptops and Servers were the least used office equipment with 12.7 and 5.9 percent respectively.

Figure 6.11: Percentage Distribution of Office Equipment by Type in Higher Learning Institutions – 2017 SECS

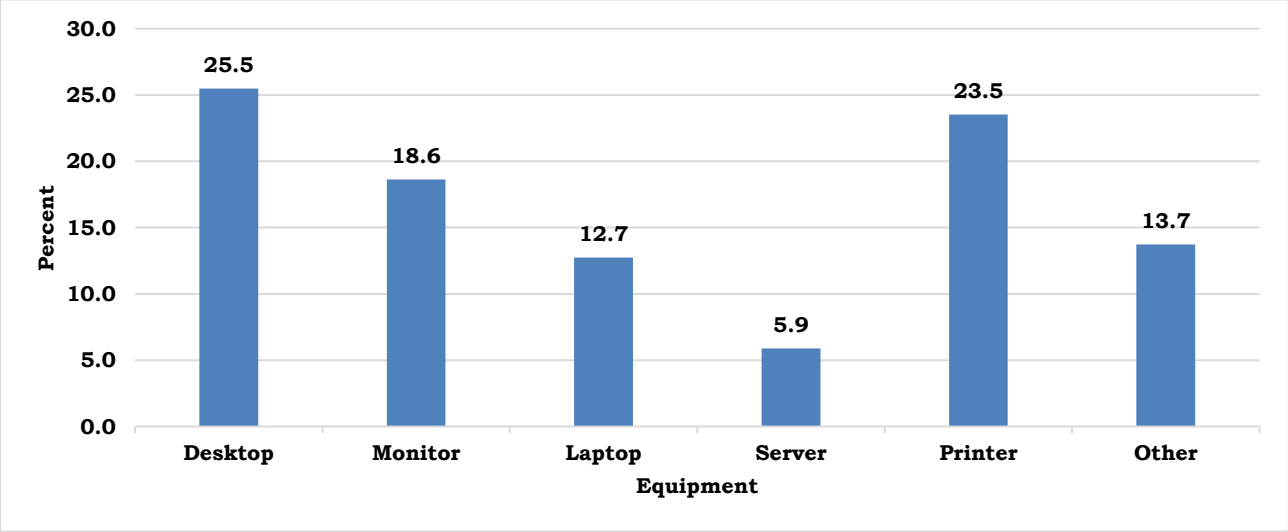


Table 6.46 shows electricity consumed by type of office equipment in below tertiary institutions. Desktops had the highest consumption of 7,820.8 kWh followed by monitors with 3,470.8 kWh. Laptops (129.4kwh) consumed the least electricity.

Table 6. 46: Electricity (kWh) Consumed by Type of Office Equipment in Below Tertiary Institutions – 2017 SECS

Type of Equipment	Electricity
Desktops	7,820.8
Monitors	3,470.8
Laptops	129.4
Printers	2,706.6
Other	404.8
Total	**14,532.4**

Table 6.47 shows electricity consumed by type of office equipment in higher learning institutions. Desktops consumed 6,295.8 kWh, monitors (7,058.9kWh) and printers (1585.8kWh). Servers and Laptops consumed less electricity with 528.6kWh and 309.1kWh respectively.

Table 6.47: Electricity (kWh) Consumed by Type of Office Equipment in Higher Learning Institutions – 2017 SECS

Type of Equipment	Electricity
Desktops	6,295.8
Monitors	7,058.9
Laptops	309.1
Servers	528.6
Printers	1,585.8
Workshop Equipment	1,510.4
Other	2,767.2
Total	**20,055.8**

6.15 Household Appliances

Household appliances are machines used to assist in household functions and this section focuses on those that only use electricity to operate.

6.15.1 Electricity Consumption

Energy consumption refers to the amount of energy used and this varies by equipment type. This section compares different household appliances by the amount of energy used by such appliances for various institutions.

Table 6.48 shows the amount of electricity consumed by type of household appliances in below tertiary institutions. Kettle consumed more electricity with 163.3kWh followed by Microwave with 105.7kWh. The least amount of electricity was consumed by Water dispenser (26.4kWh).

Table 6.48: Amount of Electricity (kWh) Consumed by Type of Household Appliances in Below Tertiary Institutions – 2017 SECS

Type of appliance	Electricity
Microwave	105.7
Kettle	163.3
Stove	49.7
Water dispenser	26.4
Urn	153.7
Total	**269.0**

Table 6.49 shows the amount of electricity consumed by type of household appliances in Higher Learning Institutions. The table shows that Water Dispenser consumed 8,016.2kWh. On the other hand stove consumed 1165.8kWh, kettle 248.2kWh and URN consumed least energy with 6.4kWh.

Table 6.49: Amount of Electricity (kWh) Consumed by Type of Household Appliances in Higher Learning Institutions – 2017 SECS

Type of appliance	Electricity
Stove	1165.8
Microwave	81.7
Kettle	248.2
Water Dispenser	8016.2
URN	6.4
Oven	25.1
Hand-dryer	23.7
Iron	8.4
Total	**9575.4**

6.16 Cooking facilities

Cooking facilities refer to a dwelling unit that can be used to prepare a meal and is equipped with sink, stove, cabinet, etc. This section excluded kitchen facilities without a stove as it was considered not to be used for the intended purpose, which is cooking.

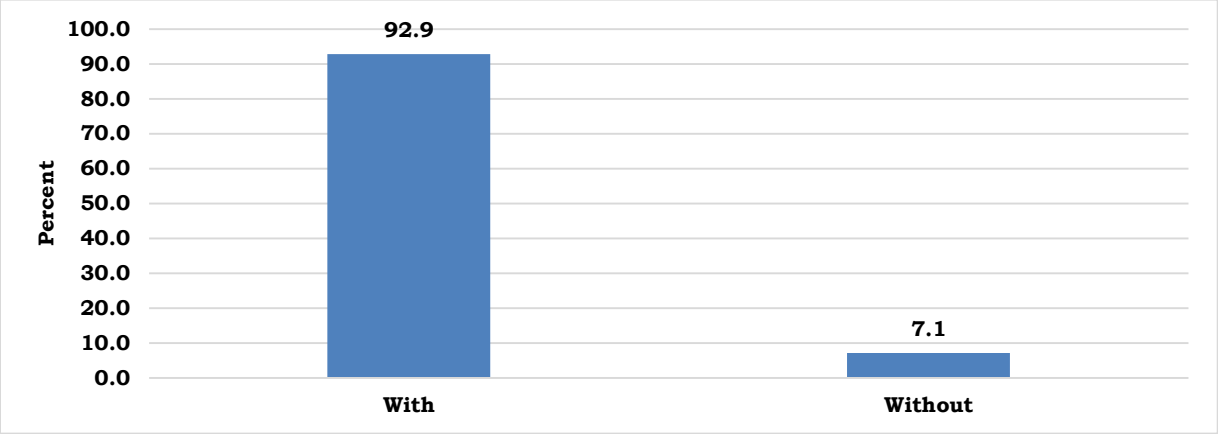
Table 6.50 presents the percentage distribution of below tertiary institutions by type with cooking facilities. In general, the results show that 62.0 percent of below tertiary institutions had cooking facilities while 38.0 percent did not. About 93.0 percent of secondary schools owned a cooking facility while only 7.0 percent did not. The table further illustrates that 43.1 percent of ECCD owned a cooking facility while 56.9 percent did not.

Table 6.50: Percentage Distribution of Below Tertiary Institutions by Type With Cooking Facilities – 2017 SECS

Type of Institution	Ownership	
	With	Without
ECCD	43.1	56.9
Primary School	62.7	37.2
Secondary School	93.0	7.0
High School	71.5	28.5
Total (%)	**62.0**	**38.0**
Total (N)	**1,232**	**755**

Figure 6.12 presents the percentage distribution of Higher Learning institutions with cooking facilities. The figure depicts that 92.9 percent of Higher Learning institutions had cooking facilities and 7.1 percent did not have.

Figure 6.12: Percentage Distribution of Higher Learning Institutions with Cooking Facilities – 2017 SECS



6.16.1 Fuel Used for Cooking

Table 6.51 presents the percentage distribution of below tertiary institutions by type and main fuel used for cooking. The results show that below tertiary used wood (77.0 percent) for cooking more than the rest of the fuels. Electricity was the least used fuel with 3.0 percent. Wood fuel was mostly used by Secondary school with 92.4 percent, followed by Primary school with 88.4 percent and it was least used by ECCD. Electricity was only used by Primary School (1.1 percent) and High school (13.0 percent). LPG was mostly used by ECCD (65.9 percent) followed by High school (23.6 percent).

Table 6.51: Percentage Distribution of Below Tertiary Institutions by Type and Main Fuel Used for Cooking – 2017 SECS

	Main fuel used			
Type of Institution	**Electricity**	**LPG**	**Wood**	**Other**
ECCD	0.0	65.9	34.1	0.0
Primary School	1.1	6.8	88.4	3.8
Secondary School	0.0	7.6	92.4	0.0
High School	13.0	23.6	55.9	7.5
Total (%)	**3.0**	**17.0**	**77.0**	**4.0**
Total (N)	**28**	**167**	**755**	**36**

Table 6.52 presents the percentage distribution of higher Learning institutions by type and main fuel used for cooking. The results indicate that mostly used fuel was LPG with 44.0 percent followed by electricity with 40.0 percent. Wood fuel was only used by Technical institutions (25.0 percent) and vocational institutions (8.3 percent). About 66.7 percent of Tertiary institutions used electricity while technical and vocational only accounted for 25.0 percent each.

Table 6. 52: Percentage Distribution of Higher Learning Institutions by Type and Main Fuel Used for Cooking – 2017 SECS

	Main fuel used			
Type of Institutions	**Electricity**	**LPG**	**Wood**	**Other**
Tertiary	66.7	11.1	0.0	22.2
Technical	25.0	50.0	25.0	0.0
Vocational	25.0	66.7	8.3	0.0
Total (%)	**40.0**	**44.0**	**8.0**	**8.0**
Total	**10**	**11**	**2**	**2**

6.17 Refrigeration

Refrigeration is a process of cooling or freezing for purposes of preserving. The machines or equipment referred to in this section to undertake the process are refrigerators, freezers and cold-rooms.

Figure 6.13 portrays the percentage distribution of below tertiary institutions with refrigeration equipment for food. The figure reflects that 91.4 percent of Below Tertiary Institutions did not own Refrigeration equipment for food and 8.6 percent owned.

Figure 6.13: Percentage Distribution of Below Tertiary Institutions with Refrigeration Equipment for Food – 2017 SECS

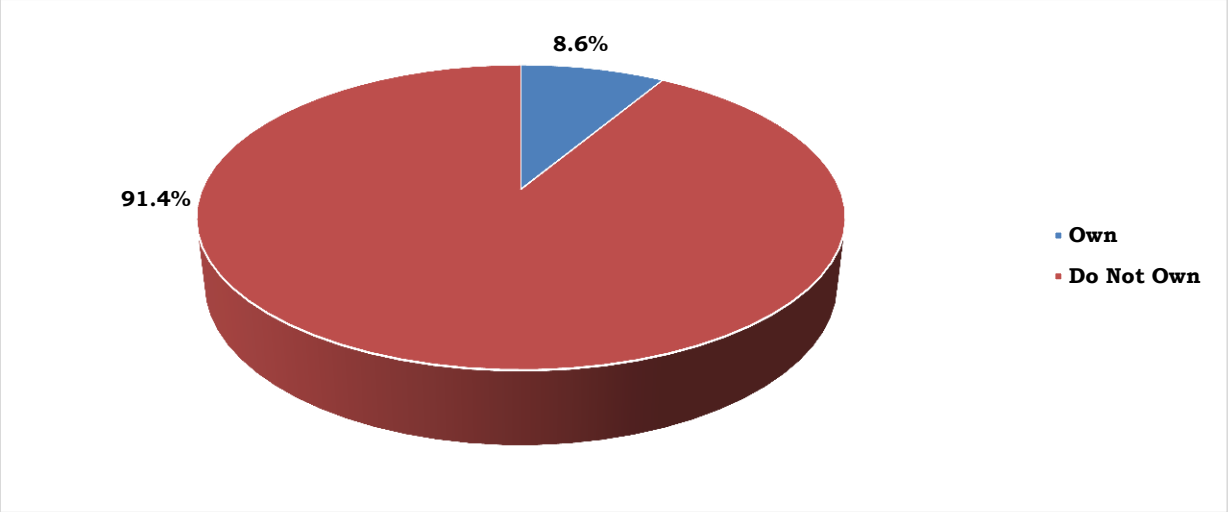


Figure 6.14 presents the percentage distribution of higher learning institutions with refrigeration equipment for food. It is evident from the figure that 89.0 percent of higher learning institutions owned refrigeration equipment while 11.0 percent did not own.

Figure 6.14: Percentage Distribution of Higher Learning Institutions With Refrigeration Equipment for Food – 2017 SECS

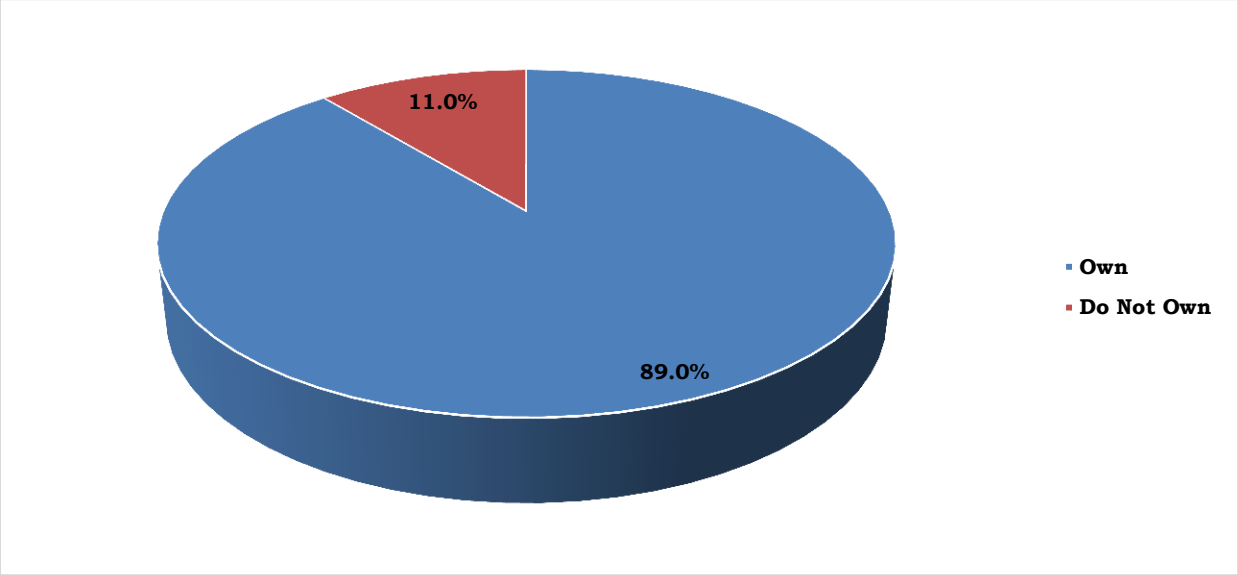


Table 6.53 presents the amount of electricity consumed by type of refrigeration equipment in below tertiary institutions. Freezers consumed 3,877.5kWh of electricity while refrigerators consumed 999.0kWh.

Table 6.53: Amount of Electricity (kWh) Consumed by Type of Refrigeration in Below Tertiary Institutions – 2017 SECS`

Type of Refrigeration	Electricity
Refrigerators	999.0
Freezers	3,877.5
Total	**4,876.5**

Table 6.54 shows the amount of electricity consumed by type of refrigeration equipment in Higher Learning institutions. Refrigerators consumed more (1103.3kWh) electricity followed by Freezers (338.5kWh). The least consumption was by Cold rooms with 272.9kWh.

Table 6.54: Amount of Electricity (kWh) Consumed by Type of Refrigeration in Higher Learning Institution – 2017 SECS

Type of Refrigeration	Electricity
Refrigerators	1,103.3
Freezers	338.5
Cold rooms	272.9
Total	**1,714.7**

6.18 Solar Water Heating

A solar water heater is a system that uses sunlight to heat water. It typically consists of solar collectors, which absorb energy from the sun and transfer it to a heat transfer fluid, such as water or antifreeze, that circulates through the system. The heated fluid is then used to heat water that is stored in a tank, which can be used for domestic hot water or space heating. https://www.energy.gov/energysaver/water-heating/solar-water-heaters.

6.18.1 Solar Electricity

Table 6.55 shows the amount of electricity generated by solar water heaters in below tertiary and Higher Learning institutions. Technical institutes generated the highest amount of electricity recorded at 25,368.0kWh followed by Secondary schools with 25,200.0kWh. Vocational generated the least electricity with 817.5 kWh.

Table 6.55: Amount of Electricity (kWh) Generated by Solar Water Heaters in Higher Learning Institutions – 2017 SECS

Institution	Electricity
Secondary School	25,200.0
Tertiary	19,160.0
Technical	25,368.0
Vocational	817.5

6.19 Generators

A generator converts mechanical energy into electrical energy. It is used in a wide range of applications, including powering equipment, power plants, wind turbines, hydroelectric dams, and portable generators for use in remote locations How Generators Work: Explaining The Conversion Of Mechanical Energy To Electrical Energy | Dr Bakst Magnetics. However, in this section a generator was mostly for powering appliances as a main or back-up source.

Table 6.56 shows the quantity of fuel used by type to operate a generator in both institutions. Below Tertiary institutions consumed 5603.9 litres of Diesel 50ppm, 961.5 litres of Diesel 500ppm and 511.1 litres of Unleaded petrol to operate generator. Higher Learning institutions only used Unleaded petrol (7833.5 litres).

Table 6.56: Quantity (Litres) of Fuel Used by Type to Operate a Generator in Both Institutions – 2017 SECS

Institutions	Fuel		
	Diesel 50ppm	Diesel 500ppm	Unleaded petrol
Below Tertiary	5603.9	961.5	511.1
Higher Learning	0	0	7833.5

6.19.1 Generator Electricity

Table 6.57 shows the amount of electricity generated by generator in below tertiary institutions. High schools generated the highest amount of electricity recorded at 5,386,099.7kWh followed by secondary schools with 44,700.0kWh. Total electricity generated by generator in below tertiary institutions was 5,432,193.6kWh.

Table 6. 57: Amount of Electricity (kWh) Generated by Generator in Below Tertiary Institutions – 2017 SECS.

Institution	Electricity
ECCD	0.0
Primary School	1,393.9
Secondary School	44,700.0
High School	5,386,099.7
Total	**5,432,193.6**

Table 6.58 shows the amount of electricity generated by generators in higher learning institutions. Technical institutions generated the highest (25,368.0kWh) amount of electricity by generators. Tertiary institutions followed with 15,600.0kWh and vocational institutions were the least with 817.5kWh.

Table 6.58: Amount of Electricity (kWh) Generated by Generator in Higher Learning Institutions – 2017 SECS

Type of Institution	Electricity
Tertiary	15,600.0
Technical	25,368.0
Vocational	817.5
Total	**41,785.5**

6.20 Transport

Transport for official or passenger in this section refers to the means of transportation used to transport everything related to schools e.g. staff, school equipment and school property, from one place to another for official purposes.

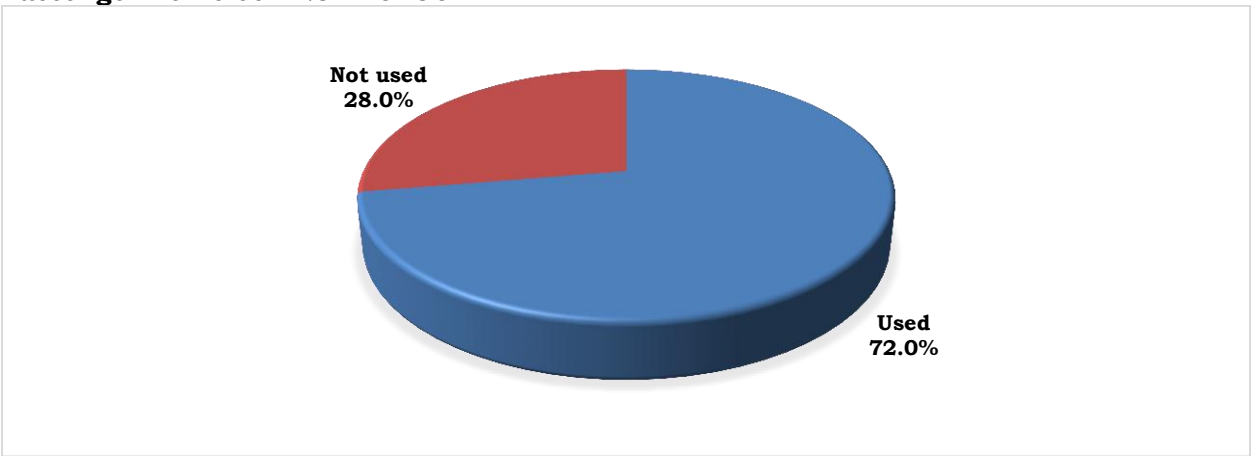
Table 6.59 shows the percentage distribution of below tertiary institutions using official or passenger vehicles by district. Below Tertiary institutions (10.8 percent) used passenger or official vehicles while 89.2 percent did not. Berea (26.7 percent) had the largest percentage of institutions that used official or passenger transport followed by Maseru with 15.0 percent.

Table 6.59: Ppercentage Distribution of Below Tertiary Institutions Using Official or Passenger Vehicles by District – 2017 SECS

District	Used	Not Use
Botha-Bothe	8.5	91.5
Leribe	10.4	89.6
Berea	26.7	73.3
Maseru	15.0	85.0
Mafeteng	0.0	100.0
Mohale'sHoek	7.1	92.9
Quthing	4.8	95.2
Qacha's Nek	12.8	87.2
Mokhotlong	7.8	92.2
Thaba-Tseka	4.7	95.3
Total (%)	**10.8**	**89.2**
Total (N)	**215**	**1,772**

Figure 6.15 shows the percentage distribution of higher learning institutions using official or passenger vehicles. Higher Learning institutions (72.0 percent) used official or passenger transport while 28.0 percent did not use.

Figure 6.15: Percentage Distribution of Higher Learning Institutions Using Official or Passenger Vehicles – 2017 SECS



6.21 Additional Information

This section focuses on the plans and constraints of institutions to install new equipment or upgrade the already existing equipment to more efficient equipment.

6.21.1 Upgrade

Upgrade means raising something to a higher standard than it was before with the intention of attaining better results. This section discusses plans to upgrade to more efficient equipment.

Table 6.60 presents the percentage distribution of below tertiary institutions by type with upgrading plans. Below tertiary institutions reported 'Fit a ceiling' as a major plan (12.6 percent) followed by 'PV system' (12.3 percent). ECCD had 'Fit a ceiling' (17.8 percent) as the major plan for upgrading and did not have any plan to 'replace windows'. Primary schools had 'PV system' (12.4 percent) as a major plan to upgrade followed by 'fit a ceiling' (12.0 percent).

Table 6.60: Percentage Distribution of Below Tertiary Institutions by Type with Upgrading Plans – 2017 SECS

	Plans								
Type of Institutions	**CFL**	**LED**	**Motion Sensor**	**SWH**	**PV System**	**Insulate Walls**	**Replace Windows**	**Fit a ceiling**	**None**
ECCD	4.4	6.7	4.4	4.4	11.1	6.7	0.0	17.8	44.4
Primary	9.3	9.1	9.1	9.8	12.4	9.1	8.4	12.0	20.8
Secondary	4.5	4.5	4.5	13.6	22.7	9.1	9.1	13.6	18.2
High School	13.1	13.1	9.1	8.1	10.1	8.1	8.1	13.1	17.2
Total (%)	**9.4**	**9.4**	**8.6**	**9.2**	**12.3**	**8.8**	**7.8**	**12.6**	**21.9**

Table 6.61 shows the percentage distribution of Higher Learning institutions with upgrade plans. The results reveal that switching to CFL and LED light bulbs were the major plans with 16.2 percent both. These were followed by fitting a ceiling with 13.2 percent. Tertiary had 'Solar Water Heater (SWH)' at 20.6 percent as the major plan for upgrading and 'Insulate walls' (2.9 percent) as the least. Technical institutions had 'fit ceiling' (25.0 percent) and 'Motion sensor' (25.0 percent) as major plans for upgrading and did not have any plan to upgrade to 'PV system'.

Table 6. 61: Percentage Distribution of Higher Learning Institutions by Type With Upgrading plans – 2017 SECS

	Plans								
Institutions	**CFL**	**LED**	**Motion Sensor**	**SWH**	**PV System**	**Insulate Walls**	**Replace Windows**	**Fit Ceiling**	**None**
Tertiary	11.8	17.6	5.9	20.6	17.6	2.9	8.8	8.8	5.9
Technical	12.5	12.5	25.0	0.0	0.0	12.5	0.0	25.0	12.5
Vocational	23.1	15.4	0.0	3.8	3.8	11.5	7.7	15.4	19.2
Total (%)	**16.2**	**16.2**	**5.9**	**11.8**	**10.3**	**7.4**	**7.4**	**13.2**	**11.8**
Total (N)	**11**	**11**	**4**	**8**	**7**	**5**	**5**	**9**	**8**

6.21.2 Constraints

Constraints mean a restriction to achieve something. And here we focus on restrictions to upgrade to more efficient equipment.

Table 6.62 shows the percentage distribution of below tertiary institutions by constraints and upgrade. Below tertiary institutions (31.3 percent, 31.5 percent and 29.4 percent) reported "no electricity" as the major constraint for fitting CFL, LED and motion sensor, respectively. About 20.8 percent reported 'High Purchasing Cost' as a constraint against insulating walls.

Table 6.62: Percentage Distribution of Below Tertiary Institutions by Constraints and Upgrade – 2017 SECS

	Upgrades							
Constraints	**CFL**	**Fit ceiling**	**Insulate walls**	**LED**	**Motion sensor**	**PV**	**Replace Windows**	**SWH**
Insufficient Budget	3.7	16.7	19.1	4.1	5.2	17.3	18.8	15.1
Rented	9.5	14.3	14.3	9.5	9.5	14.3	14.3	14.3
No Electricity	31.3	0.2	0.9	31.5	29.4	2.4	0.4	3.9
High purchasing costs	1.1	11.2	20.8	1.1	6.7	15.2	21.3	22.5
Already have	28.2	43.7	1.9	12.6	6.8	2.9	2.9	1.0
Other	6.7	6.9	15.8	10.3	11.1	13.3	18.1	17.8
Total (%)	**12.7**	**11.4**	**12.8**	**12.8**	**13.0**	**11.5**	**13.2**	**12.6**

Table 6.63 shows the percentage distribution of Higher Learning institutions by constraints and upgrade. Higher Learning institutions (24.4 percent and 14.6 percent) reported 'Already Have' CFL and LED, respectively. Furthermore, 37.5 percent of Higher Learning institutions reported 'High Purchasing Cost' as a major constraint for wall insulation.

Table 6.63: Percentage Distribution of Higher Learning Institutions by Constraints and Upgrade -2017 SECS

	Upgrades							
Constraints	**CFL**	**LED**	**Motion Sensor**	**SWH**	**PV**	**Wall Insulation**	**Window**	**Fitting Ceiling**
Insufficient Budget	4.6	4.6	18.5	18.5	18.5	13.8	16.9	4.6
Rented	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
No Electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High purchasing costs	0.0	12.5	25.0	12.5	12.5	37.5	0.0	0.0
Already have	24.4	14.6	4.9	7.3	4.9	7.3	2.4	34.1
Other	7.1	14.3	16.7	7.1	14.3	14.3	23.8	2.4
Total (%)	**16.9**	**9.6**	**13.6**	**11.3**	**12.4**	**12.4**	**13.0**	**10.7**
Total (N)	**17**	**17**	**23**	**19**	**21**	**22**	**23**	**18**

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ANNEX

HEALTH QUESTIONNAIRE

Section A

Identification

District					
Constituency					
	Name of Institution				
	Physical Address				
Type of institution (tick)	Public hospital				
	Private hospital				
	Public clinic				
	Private clinic				
	CHAL Hospital				
	CHAL Clinic				
Number of employees in 2017	Permanent		Female		
			Male		
	Temporary		Female		
			Male		

Section B

Total Energy Consumption

B1. Did the institution consume Hard Coal in 2017?

If coded 2, skip to B3

1. Yes
2. No ☐

B2. How much Hard Coal did the institution consume in 2017?

	Product (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Use: (Multiple response)** 1. Space Heating 2. Water heating 3. Steaming 4. Cooking 5. Other(specify) ..... (d)
1.	Anthracite			
2.	Bituminous coal			
3.	Other (specify).....			

B3. Did the institution consume Renewables & Wastes in 2017?

If coded 2, skip to B5

1. Yes
2. No

B4. How much Renewables & Wastes were used in 2017? (exclude solar electricity)

	Type of Renewable & Waste (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Use: (multiple answer)** 1. Space Heating 2. Cooking 3. Water Heating 4. Other (Specify) ..... (d)
1.	Charcoal			
2.	Wood and other wastes			
3.	Other (specify).....			

B5. Did the institution have solar photovoltaic (PV) system in 2017?

If coded 2, skip to B7

1. Yes
2. No

B6. How many solar panels did the system have in 2017?

NOTE: for panels with the same wattage, write the number of such panels and capacity of only one panel. For solar panels with same capacity but different annual hours record them separately. Panels should be functional in the period covered by the survey (2017)

	Number of panels (a)	**Capacity of Panel (Watts)** (b)	**Annual hours** (c)	**Use: (multiple answer)** 1. Space Heating 2. Water Heating 3. Lighting 4. Other (Specify) (d)
1.				
2.				
3.				

B7. Was the institution connected to grid electricity in 2017?

If coded 2, skip to B9

1. Yes
2. No

B8. How much Electricity (Grid) did the institution use in 2017?

How was electricity obtained: (a)	**Amount Paid (Maloti)** (b)	**Electricity used (KWh)** (c)	**Use: (multiple response)** 1. Space Heating 2. Space Cooling 3. Lighting 4. Cooking 5. Water Heating 6. Powering Appliances 7. Other (Specify) (d)
1. Purchased			
2. Included in Rent			

B9. Did the institution use Petroleum products for operation in 2017?

If coded 2, skip to B11

1. Yes
2. No

B10. How much Petroleum was used for operation in 2017?

Product (a)	**Quantity used for operation activities (litres or kg)** (b)	**Amount paid for operation activities (Maloti)** (c)	**Use for operation activities:** (Multiple response) 1. Space heating 2. Lighting 3. Cooking 4. Water Heating 5. Powering Appliances 6. Other (specify) (d)
Diesel 50ppm			
Diesel 500ppm			
Lead replacement petrol (LRP)			
Unleaded petrol			
Paraffin			
Acetylene (kg)			
LPG (kg)			
Heavy oil			

B11. Did the institution use Lubricants in 2017?

If coded 2, skip to Section C

1. Yes
2. No

B12. How much Lubricants were used in 2017?

Product (a)	**Amount paid (Maloti)** (b)	**Quantity used for transportation (kg or litres)** (c)	**Quantity used for Operation (kg or litres)** (d)
Grease (kg)			
Brake Fluid			
Motor oil			
Other (specify) ……			

Section C

C1. Occupancy (working hours)

Days of operation per week ☐

Hours of operation per day; Week days ☐

Weekends ☐

Number of patient rooms ☐

Average of occupied beds ☐

C2. The Institution: Tick appropriately

1. Covers one whole building ☐
2. Covers part of the building ☐
3. Covers more than one building ☐
4. Is in the multi-storey building with other services. ☐

C3. If coded 3, how many _____

C4. Building characteristics

Fill in the following table for the building(s)

Construction period 1. Before 1966 2. 1966- 1975 3. 1976- 1985 4. 1986- 1995 5. 1996-2005 6. 2006- 2015 7. After 2015 88. Don't Know (a)	**Was the building insulated?** 1. Yes 2. No (b)	**Main Wall Material** 1. Cane/Tree trunk 2. Stick and Mud 3. Masonite 4. Stone with mud 5. Burnt mud bricks 6. Mud bricks/Makoete 7. Stone with cement 8. Advanced stone 9. Sand/concrete blocks 10. Advanced burnt brick 11 Corrugated iron/metal sheet 12 Other (Specify)..... (c)	**Total Area Occupied (mSq)** (d)	**Heated Area (mSq)** (e)	**Cooled Area (mSq)** (f)

Section D

Offices, medical wards, patient rooms, equipment

Space Heating/Cooling equipment

Central Air-conditioning System

D1. Did the institution use Central Air-conditioning System in 2017?

If coded 2, skip to D2

1. Yes
2. No

D2. Which systems were in operation in 2017?

Type of System (a)	**Energy source** 1. Electricity 2.Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of units** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Heat Pumps								
Absorption coolers								
Other (specify)…								

Central Heating/Cooling System

D3. Did the institution use Central Heating/Cooling System(s) in 2017?

If coded 2, skip to D3

1. Yes
2. No

D4. Which central heating/cooling systems were in operation in 2017?

Central Heating System (a)	**Energy source** 1.Electricity 2.Diesel 3.Coal 4. Other (b)	**Heating** **Annual hours** (c)	**Cooling** **Annual hours** (d)	**Number of units** (e)	**Heating Capacity** (f)	**Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Water circulation								
Steam boiler								
Heat pumps								
Air furnace								
Solar heating								
Electric resistance								

Independent heating/cooling systems

D5. Did the institution use Independent/ cooling System(s) in 2017?

If coded 2, skip to D4

1. Yes
2. No

D6. Which of the following systems were in operation in 2017?

Type of System (a)	**Energy sources** 1. **Electricity** 2. **Other (specify)** (b)	**Used for Heating** **Annual hours** (c)	**Used for cooling** **Annual hours** (d)	**Number of units** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Split A/C units with inverter								
Split A/C units without inverter								
Electric oil heater								
Electric resistance heater								
Other (specify)…								

Lighting

D7. Were there light sensor (daylight switch) controls for operating the lighting in service areas (staircases, toilets etc.) in 2017?

1. Yes
2. No

D8. Were there motion sensor controls for operating the lighting in service areas (staircases, toilets etc.)?

1. Yes
2. No

D9. What type of light bulbs (for grid) were fitted in 2017?
(in offices, medical wards, patient rooms, in corridors, toilets and external areas) *For those coded 3 in* ***Section B8*** *column D*

Type (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

D10. What type of light bulbs were connected to solar electricity in 2017? *For those coded 3 in* ***Section B6*** *column D*

Type (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

Medical Equipment

Diagnostic Equipment

D11. Did the institution use Diagnostic Equipment(s) in 2017?

If coded 2, skip to D13

1. Yes ☐
2. No

D12. Which diagnostic equipment was used in 2017?

Equipment (a)	**Number** (b)	**Average Age (years)** 1. 0-5 2. 6-10 3. 10+ (c)	**Average minutes of use per day** (d)
X ray			
Ultra sound			
Other (specify)			

Sterilization equipment

D13. Did the institution use Sterilization Equipment(s) in 2017?

If coded 2, skip to D15

1. Yes
2. No

D14. Which sterilization equipment was used in 2017?

Equipment (a)	**Number** (b)	**Average Age (years)** 1. 0-5 2. 6-10 3. 10+ (c)	**Capacity (watts)** (d)	**Minutes of use per day** (e)
Ovens				
Washing machine for medical equipment				
Washing machine for bed linen				
Dish washer for dishes & utensils				
Other (specify)				

Refrigeration Equipment

D15. Was there refrigerating equipment for medical use?

If coded 2, skip to D17

1. Yes
2. No

D16. Which of the following refrigeration equipment were used in 2017?

Type (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litres)** (d)	**Minutes per day** (e)
Laboratory fridges				
Freezers				
Blood plasma freezers				
Other (specify)				

Cold room equipment

D17. Did the facility have cold room equipment in 2017?

If coded 2 skip to small equipment

1. Yes
2. No

D18. Which of the following cold room equipment were used in 2017?

Type (a)	**Number** (b)	**Capacity(watts)** (c)	**Minutes per day** (d)
Cold rooms			
Mortuary cold rooms			

Small Equipment

D19. Did the facility use any small equipment in 2017?

If coded 2, skip to D21

1. Yes
2. No

D20. Which equipment was in operation in 2017?

Appliance (a)	**Number** (b)	**Age (years)** 1. 0-5 2. 6-10 3. 10+ (c)	**Capacity (watts)** (d)	**Average minutes of use per day** (f)
Desktops				
Monitors/Screens				
Laptops				
Servers				
Printers/copiers				
Other (specify).....				

Household appliances

D21. Did the facility have any household appliances in 2017?

If coded 2, skip to D23

1. Yes
2. No

D22. Which of the following appliances were in operation in 2017?

Appliance (a)	**Number** (b)	**Average Age (years)** 1. 0-5 2. 6-10 3. 10+ (c)	**Capacity (watts)** (d)	**Average minutes of use per day** (e)
Microwave				
Kettle				
Stove				
Other (specify) …….				

Cooking

D23. Were there cooking facilities in the establishment in 2017?

1. Yes
2. No

D24. If yes which was the main fuel used for cooking: *Tick appropriately*

Electricity	
LPG	
Wood	
Coal	

Refrigeration

D25. Was there refrigeration equipment for food?

If coded 2, skip to Solar water heater

1. Yes
2. No

D26. Which refrigeration equipment was in use in the facility in 2017?

Type (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litres)** (d)	**Minutes per day** (e)
Refrigerators				
Freezers				

Section E

Solar water heating

E1. Did the institution have a solar water heater in 2017?

If no skip to generators

1. Yes
2. No

E2. How many solar water heaters were used in 2017?

	Number of Solar Water heating systems (a)	**Capacity (litres)** (b)	**Year system Installed** (c)	**Functionality** 1.Yes 2. No (d)	**Aperture Area** (e)
1.					
2.					
3.					

Section F

Generators

F1. Did the facility use generators in 2017?

If no, skip to section E

1. Yes
2. No

F2. How many generators did the facility use in 2017?

	Number of Generators (a)	**Capacity (kVA)** (b)	**Age (years)** 00 for less than a year (c)	**Energy source** 1. Diesel 50ppm 2. Diesel 500ppm 3. Lead Replacement Petrol (LRP) 4. Unleaded petrol (d)	**Use (multiple answer)** 1. Lighting 2. Powering appliances (e)	**Operation Annual hours** (f)
1.						
2.						
3.						

Section G

Transport with official vehicles

G1. Which vehicle types did the establishment use in 2017?

Vehicle type 1.Ambulance 2.Taxi/Minibus 3.Van 4.Sedan (a)	**Number of units** (b)	**Capacity (vehicle weight)** (c)	**Distance Km travelled (average)** (d)	**Fuel used** 1. Diesel 50 ppm 2. Diesel 500 ppm 3. Lead Replacement Petrol (LRP) Unleaded petrol (e)	Litres consumed (f)	**Amount spent (Maloti)** (g)

Section H

Additional information

H1. Are there plans to upgrade the existing or install new equipment?
Replacing one or various units by other units with the same characteristics (energy source and power).

1. Yes 2. No

If coded 2, go to H2

1. Replace the light bulbs: 1(a) with CFL ☐ 1(b). With LED ☐ 2. Motion sensor ☐

3. Install a Solar Water Heater ☐ 4. Install a PV system ☐ 5. Insulate the walls ☐

6. Replace the windows ☐ 7. Fit a ceiling ☐

For those coded 2 in H1

H2. What are the constraints against upgrading the existing or installing new equipment? Tick appropriately (*Multiple response*)

Plans (a)		**Constraints**						
		Insufficient budget (b)	**Rented** (c)	**No Electricity** (d)	**High Purchasing Costs** (e)	**High Installation/ labour costs** (f)	**Don't know about these technologies** (g)	**Other (Specify) .....** (h)
Replace light bulbs	CFL							
	LED							
Motion sensor								
Install a Solar Water Heater								
Install a PV system								
Insulate walls								
Replace the windows								
Fit a ceiling								

ACCOMMODATION AND FOOD SERVICES SECTOR QUESTIONNAIRE

Section A

Identification

District				
Constituency				
Name of Establishment				
Physical Address				
Type of Establishment	Hotels			
	Suite			
	Motels			
	Guesthouses			
	Bed and Breakfast			
	Chalets			
	Youth Hostels			
	Lodges			
	Housekeeping Cottages and Cabins			
	Restaurant			
	Bar/tavern			
	Catering			
Rating	1. One Star 2. Two Star 3. Three Star 4. Four Star 5. Five Star 6. None 7. Not Applicable			
Number of employees in 2017	Permanent		Female	
			Male	
	Temporary		Female	
			Male	

Section B

Electricity Generation

B1. Did the establishment have a back-up source of electricity in 2017?
If coded2, skip to Section C

1. Yes
2. No

B2. Did the backup have data loggers?
If coded 2, skip to B4

1. Yes
2. No

B3. What was the back-up source of electricity with data loggers?

Source: 1. Generator 2. Solar **3.** Other (Specify **(a)**	**Number** **(b)**	**Capacity** (kVA/watts) **(c)**	**Generated Power** **(d)**	**Unit** 1. MWh 2. KWh 3. GJ 4. MBtu **(e)**

B4. What was the back-up source of electricity without data loggers?

Source 1. Generator 2. Solar 3. Other (Specify**)** …… **(a)**	**Number** **(b)**	**Capacity** **(c)**	**Time in hours** **(Average)** **(d)**	**Total energy generated in kWh** **(e)**

Section C

Total energy consumption

C1. Did the establishment consume Hard Coal in 2017?
If coded 2, skip to C3

1. Yes
2. No

C2. How much Hard Coal did the establishment consume in 2017? ***Write "Not used" for types which were not used.***

	Product **(a)**	**Amount Used (Kg)** **(b)**	**Amount Paid (Maloti)** **(c)**	**Main Use** 6. Space Heating 7. Water heating 8. Cooking 9. Other(specify) **(d)**	**Other Uses (multiple response)** 1. Space Heating 2. Water heating 3. Cooking 4. Other(specify) 5. None **(e)**
1.	Anthracite				
2.	Bituminous coal				
3.	Other (specify)				

C3. Did the establishment consume Renewables & Wastes in 2017?
If coded 2, skip to C5

1. Yes
2. No

C4. How much Renewables & Wastes were used in 2017? ***Write "Not used" for types which were not used.***

	Type of Renewable & Waste (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Main Use:** 1. Space Heating 2. Water Heating 3. Cooking 4. Other(Specify) 5. (d)	**Other Uses: (multiple response)** 1. Space Heating 2. Water Heating 3. Cooking 4. Other(Specify) 5. None (e)
1.	Charcoal				
2.	Wood and other wastes				
3.	Other (Specify)				

Solar electricity

C5. Did the establishment have solar photovoltaic (PV) system in 2017?
If coded 2, skip to C7

1. Yes
2. No

C6. How many solar panels were used in 2017 to produce electricity?

NOTE: for panels with the same wattage, write the number of such panels and capacity of only one panel. For solar panels with same capacity but different annual hours, record them separately. Panels should be functional in the period covered by the survey (2017).

	Number of panels (a)	**Capacity of Panels (Watts)** (b)	**Annual Hours** (c)	**Main Use** 1. Water Heating 2. Cooking 3. Lighting 4. Water pumping 5. Other (Specify) (d)	**Other Uses: (multiple response)** 1. Water Heating 2. Cooking 3. Lighting 4. Water pumping 5. Other (Specify) 6. None (e)
1.					
2.					
3.					

Grid Electricity

C7. Was the establishment connected to grid electricity in 2017?
If coded 2, skip to C9

1. Yes
2. No

C8. How much electricity (Grid) did the establishment use in 2017?

How was electricity obtained (a)	**Amount Paid (Maloti)** (b)	**Electricity used in units (KWh)** (c)	**Main Use:** 1. Space Heating 2. Space Cooling 3. Water Heating 4. Cooking 5. Lighting 6. Powering appliances 7. Sauna 8. Water Fountain Pumping 9. Pool cleaning 10. Water Pumping 11. Other(Specify) ……. (d)	**Other Uses: (multiple response)** 1. Space Heating 2. Space Cooling 3. Water heating 4. Cooking 5. Lighting 6. Powering appliances 7. Sauna 8. Water Fountain Pumping 9. Pool cleaning 10. Water Pumping 11. Other(Specify) 12. None (e)
Purchased				
Included in Rent				

Petroleum

C9. Did the establishment use petroleum products in 2017?
If coded 2, skip to C11

1. Yes
2. No

C10. How much Petroleum was used in 2017? ***Write "Not used" for types which were not used.***

Product **(a)**	**Quantity used for operation activities (litres or kg)** **(b)**	**Amount paid for operation activities (Maloti)** **(c)**	**Quantity used for transportation (litres)** **(d)**	**Amount paid for transportation (Maloti)** **(e)**	**Main Use:** 1. Space Heating 2. Water Heating 3. Cooking 4. Lighting 5. Generator 6. Transportation 7. Other (Specify **(f)**	**Other Uses: (multiple response)** 1. Space Heating 2. Water Heating 3. Cooking 4. Lighting 5. Generator 6. Transportation 7. Other (Specify 8. None **(g)**
Diesel 50ppm						
Diesel 500ppm						
Unleaded petrol						
Paraffin						
Acetylene (kg)						
LPG (kg)						

C11. Did the establishment use lubricants in 2017?
If coded 2, skip to Section D

1. Yes
2. No

C12. How much lubricants were used in 2017? ***Write "Not used" for types which were not used.***

Product **(a)**	**Amount paid (Maloti)** **(b)**	**Quantity used for transportation (kg or litres)** **(c)**	**Quantity used for operation (kg or litres)** **(d)**
Grease (kg)			
Brake Fluid			
Motor oil			
Heavy Oil			
Other (specify) ……			

Section D

D1. Occupancy (working hours)

Days of operation per week	
Hours of operation per day	
Number of rooms	
Average of occupied rooms	
Average of occupied beds	

The Establishment:

- Covers one whole building ☐
- Covers part of the building ☐
- Covers more than one building ☐

how many? _____

- Is in the multi-storey building with other services. ☐

Building characteristics

D2. Fill in the following table for the building(s).

Construction period 1 Before 1966 2 1966- 1975 1. 1976- 1985 2. 1986- 1995 3. 1996-2005 4. 2006- 2015 5. After 2015 6. Don't Know **(a)**	Was the building insulated? 3. Yes 4. No **(b)**	**Main Wall Material** 1 Cane/Tree trunk 2 Stick and Mud 3 Masonite 4 Stone with mud 5 Burnt mud bricks 6 Mud bricks/ Makoete 7 Stone with cement 8 Advanced stone 9 Sand/concrete blocks 10 Advanced burnt brick 13 Corrugated iron/metal sheet 14 Other (Specify)..... **(c)**	**Total Area *Occupied?* (mSq*)*** **(d)**	**Heated Area (mSq)** **(e)**	**Cooled Area (mSq)** **(f)**

Section E

Central Air-conditioning System

E1. Did the establishment use central air-conditioning systems in 2017?
If coded 2, skip to E3

1. Yes
2. No

E2. Which of the following systems were in operation in 2017?

Type of System 1.Heat Pumps 2.Absorption coolers 3.Other (Specify) **(a)**	**Energy source** 1. Electricity 2. LPG 3.Other (specify) **(b)**	**Used for Heating** Annual hours **(c)**	**Used for cooling** Annual hours **(d)**	**Number of units** **(e)**	**Heating capacity** **(f)**	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr **(g)**	**Cooling Capacity** **(h)**	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr **(i)**

Central Heating/Cooling System

E3. Did the Establishment use Central Heating /Cooling Systems in 2017?
If coded 2, skip to E5

1. Yes
2. No

E4. Which of the following systems were in operation in 2017?

Central Heating/Cooling Systems 1. Water Circulation 2. Steam Boiler 3. Heat Pumps 4. Forced Air furnace 5. Solar Heating 6. Electric Resistance 7. Split system 8. Packaged Air Conditioners 9. Chillers **(a)**	**Energy source** 1.Electricity 2.Diesel 3.Coal 4.Other (specify) **(b)**	**Used for Heating** Annual hours **(c)**	**Used for Cooling** Annual hours **(d)**	**Number of units** **(e)**	**Heating Capacity** **(f)**	**Heating Capacity Units** 1. kVA 2. kW 3.kcal/hr 4.BTU/hr **(g)**	**Cooling Capacity** **(h)**	**Cooling Capacity Units** 1. kVA 2. kW 3. kcal/hr 4.BTU/hr **(i)**

Independent heating/cooling systems

E5. Did the Establishment use Independent Heating /Cooling Systems in 2017?

If coded 2, skip to section F

1. Yes
2. No

E6. Which of the following systems or appliances was in operation in 2017?

Type of Systems/ appliances (a)	**Energy sources** 3. Electricity 4. LPG 5. Paraffin 6. Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of systems** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)	**Type of refrigerant /gas** (j)	**Quantity of refrigerant (Grams)** (k)
Split A/C units with inverter										
Split A/C units without inverter										
Electric oil heater										
Electric resistance heater										
Fans										

Gas Heater										
Paraffin Heater										
Other (specify) …										

SECTION F

Lighting

F1. Were there light sensor controls (day-light switch) for operating the lighting in service areas (staircases, toilets etc.) in 2017?

1. Yes
2. No

F2. Were there motion sensors controls for operating the lighting in service areas (staircases, toilets etc.) in 2017?

1. Yes
2. No

F3. What types of light bulbs were fitted in 2017(for grid)? *Give number of lights in offices, in corridors, toilets and external areas.* ***For those coded 5 in C8 Column D or E***

Type 1. Energy saver (CFL) 2. Fluorescent 3. LED 4. Incandescent **(a)**	**Number** **(b)**	**Capacity (W)** **(c)**	**Average minutes switched on per day** **(d)**

F4. What types of light bulbs were connected to solar electricity in 2017? ***For those coded 3 in C6 column D or E*** *(Those who use solar for lighting)*

Type 1. Energy saver (CFL) 2. Fluorescent 3. LED 4. Incandescent **(a)**	**Number** **(b)**	**Capacity (W)** **(c)**	**Average minutes switched on per day** **(d)**

F5. Were there any other forms of lighting used by the establishment in 2017?

If coded 2, skip to Section G

1. Yes
2. No

F6. What type of lamp did the establishment use in 2017?

Type 1. Paraffin Lamp 2. Solar Lantern 3. Battery Lamp 4. LPG Lamp 5. Other (Specify)…. **(a)**	**Capacity (Watts)** **(b)**	**Number** **(c)**	**Average Minutes Used per Day** **(d)**	**Source of Energy** 1. Battery 2. Paraffin 3. LPG 4. Solar 5. Other (Specify) ….. **(e)**	**Quantity Used (kg/litres)** **(f)**

SECTION G

Irrigation System

G1. Did the establishment use irrigation system powered by energy in 2017?
If coded 2 skip to G3

1. Yes
2. No

G2. How many irrigation systems did the establishment use in 2017?

	Number **(a)**	**Capacity (kVA or kW)** **(b)**	**Type of energy source used** 1. Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol 4. Electricity 5. Solar 6. Other (specify) **(c)**	**Quantity of energy source used (units)** **(d)**	**Operation time** Annual hours **(e)**
1					
2					
3					
4					

Laundry Equipment

G3. Did the establishment use laundry equipment in 2017?

If coded 2 skip to G5

1. Yes
2. No ☐

G4. Which of the following laundry equipment were used in 2017?

Equipment 1. Washer 2. Washer-Dryer 3. Dryers 4. Drying Iron 5. Roller Iron 6. Steaming Iron 7. Electric steam boiler 8. Pressing machine 9. Other (specify) **(a)**	**Number** **(b)**	**Average Age (years)** 4. 0-5 5. 6-10 6. 11+ **(c)**	**Capacity (watts)** **(d)**	**Capacity (kg)** **(e)**	**Minutes of use per day** **(f)**

Kitchen Equipment and Appliances

G5. Did the establishment use kitchen equipment and / or appliances in 2017?

If coded 2 skip to G7

1. Yes
2. No ☐

G6. Which of the following kitchen equipment and/or appliances were in operation in 2017?

Equipment 1. Ovens 2. Boiling table 3. Fryers 4. Griddlers and grillers 5. Cooking pots 6. Microwave 7. Toaster 8. Dishwasher 9. Stove 10. Air extractor 11. Other (specify)	**Number**	**Average Age (years)** 4. 0-5 5. 6-10 6. 11+	**Capacity (watts)**	**Average minutes of use per day**
(a)	**(b)**	**(c)**	**(d)**	**(e)**

Small Equipment

G7. Did the establishment use any small equipment in 2017?

If coded 2, skip to G9

1. Yes
2. No

G8. Which of the following equipment was in operation in 2017?

Equipment 1. CPU 2. Monitors/Screens 3. Laptops 4. Servers 5. Printers/copiers 6. Projector 7. PA system 8. Other (specify)…… **(a)**	**Number** **(b)**	**Average Age (years)** 4. 0-5 5. 6-10 6. 11+ **(c)**	**Capacity (watts)** **(d)**	**Average minutes of use per day** **(e)**

Special rooms (Cold Room and Sauna) equipment

G9. Did the establishment have special rooms in 2017?
If coded 2, skip to G11

1. Yes
2. No

G10. Which of the following special rooms were used in 2017?

Type 1. Cold room 2. Freezer room 3. Sauna **(a)**	**Number** **(b)**	**Capacity (wattage)** **(c)**	**Average minutes of use per day** **(d)**	**Type of refrigerant/gas** **(e)**	**Quantity of refrigerant/gas (grams)** **(f)**

Cooking and food refrigeration

G11. Were there cooking facilities in the establishment in 2017?
If coded 2, skip to G14

1. Yes
2. No

G12. Have you used cooking facilities for cooking?
If coded 2, skip to G14

1. Yes
2. No

G13. If yes which was the main source of energy used for cooking? *(Code the appropriate source)*

1. Electricity

2. LPG

3. Wood

4. Other (specify)

Refrigeration

G14. Was there refrigeration equipment for food in 2017?
If coded 2, skip to G16

1. Yes
2. No

G15. Which refrigeration equipment was in use in the establishment in 2017?

Type 1. Commercial Refrigerators 2. Domestic Refrigerators 3. Freezers (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litres)** (d)	**Average minutes of switched on per day** (e)	**Type of refrigerant/gas** (f)	**Quantity of refrigerant in grams** (g)

Water heating

G16. Did the establishment use any water heating equipment in 2017?
If coded 2, skip to G18

1. Yes
2. No

G17. Which water heating equipment was used in 2017?

Type 1.Geyser 2. Kettle 3. Urn 4. Boiler 5. Other (Specify)…… (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes of use per day** (d)

Solar water heating

G18. Did the establishment have a solar water heating system in 2017?
If coded 2, skip to G20

1. Yes
2. No

G19. How many solar water-heating systems did the establishment have in 2017?

	Number of heating systems (a)	**Capacity (litres)** (b)	**Year system was Installed** (c)	**Functionality** 1. Yes 2. No (d)	**Aperture Area** (e)
1.					
2.					
3.					

Generator

G20. Did the establishment use a generator in 2017?
If coded 2, skip to Section H

1. Yes
2. No

G21. How many generators did the establishment use in 2017?

	Number of Generators	**Capacity (kVA/KW)**	**Age (years)**	**Energy source used** 1.Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol	**Quantity used (litres)**	**Main use:** 3. Space Heating 4. Space Cooling 5. Water Heating 6. Cooking 7. Lighting 8. Powering appliances 9. Sauna 10. Water Fountain Pumping 11. Pool cleaning 12. Other (Specify)	**Other Uses: (multiple response)** 1. Space Heating 2. Space Cooling 3. Water Heating 4. Cooking 5. Lighting 6. Powering appliances 7. Sauna 8. Water Fountain Pumping 9. Pool cleaning 10. Other (Specify)	**Operation** Annual hours
	(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**
1.								
2.								
3.								

Section H

Transport

H1. Did the establishment use freight and transport in 2017?

If coded 2, skip to Section I

1. Yes
2. No

H2. Which of the following freight and transport did the establishment use in 2017.

Vehicle type 1. Sedan 2. Taxi/Mini-Bus 3. Van 4. Bus 5. Truck 6. Shuttle 7. Other (specify)	**Number**	**Capacity** (weight for freight & number of passengers for transport)	**Distance** Km travelled (average)	**Fuel used**		
				Type of fuel 4. Diesel 50 ppm 5. Diesel 500 ppm 6. Unleaded petrol	**Amount consumed** (litres)	**Amount spent** (maloti)
(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**

Section I

Additional information

Waste Management

I1. Which of the following waste type does the establishment have?

Type 1. Food 2. Bottle 3. Plastic 4. Paper 5. Can 6.Mixture (specify) **(a)**	**Quantity Generated** 1. 10Litre 2. 20Litre 3. Green Bin 4. Black Bin 5.Other (specify) **(b)**	**Number** **(c)**	**How often collected** 1. Daily 2. Weekly 3. Fortnight 4. Monthly **(d)**	**Method of Collection** 1.MCC 2.Sub-contracted by MCC 3.Individual/ Company contracted 4.Own collection **(e)**	**Method of Disposal** 1. Burn 2. Dumping Site 3. Recycling 4. Reuse **(f)**

E-waste

I2. Which of the following waste type does the establishment have?

Type 1. TV 2. Computer/Laptop 3. Photocopier 3. Tablet 4. Heater 5. Kettle 6. Iron 7. Other (specify) **(a)**	**Number** **(b)**	**How often collected** 1. Annually 2. After two years **(c)**	**Method of Collection** 1.Department of Environment 2.Sub-contracted by MCC 3. Individual/ Company contracted 4.Own collection **(d)**	**Method of Disposal** 1. Dumping Site 2. Recycling **(e)**

I3. Are there plans to upgrade the existing or install new equipment?
Replacing one or various units by other units with the same characteristics (energy source and power).

1. Yes
2. No ☐

If coded 2, go to I4

1. Replace the light bulbs: 1(a) with CFL ☐ 1(b). With LED ☐ 2. Motion sensor ☐
3. Light sensor ☐ 4. Install Solar water heater ☐ 5. Install PV system ☐
6. Insulate the walls ☐ 7. Replace the windows ☐ 8. Fit a ceiling ☐ 9. Fit the carpet ☐
10. Use key switch ☐

Constraints

For those coded 2 in I3

I4. What are the constraints against upgrading the existing or installing new equipment? ***Multiple response***

Plans		Constraints				
		Insufficient budget	**Rented**	**No electricity**	**Already have**	**Other (Specify)**
Replace the light bulbs:	CFL					
	LED					
Motion sensor						
Light sensor						
Install a SWH						
Install a PV system						
Insulate the walls						
Replace the windows						
Fit the ceiling						
Fit the carpet						
Use key switch						

AGRICULTURE SECTOR QUESTIONNAIRE

Section A
Identification

District			
Constituency			
Community council			
Zone			
Village			
Name of Establishment			

Economic activities (tick) [ISIC classification]	*Crop cultivation* [ISIC Groups 011-013, 015-016 except for class 0162]	
	Livestock [ISIC Groups 014-015 or Class 0162]	
	Forestry [ISIC Division 02]	
	Fishing and Aquaculture [ISIC Division 031,032]	
	Processing	
Ownership (tick)	*Individual*	
	Cooperative	
	Private company	
	State company	

	Type of employment	Total number	*Sex*	*Salaried*	*Waged*	*Volunteer*	*Payment in kind*
Number of employees in 2017	Permanent		Female				
			Male				
	Temporary		Female				
			Male				
	Contract		Female				
			Male				

Section B

Total energy consumed

B1. Did the facility/household consume Renewables & Wastes in 2017?
If coded 2, skip to B3

1. Yes
2. No

B2. How much Renewables & Wastes were used in 2017? ***Write "Not used" for types which were not***

Type of Renewable & Waste (a)	**Amount paid (Maloti)** (b)	**Amount Used (Kg)** (c)	**Main Use:** 1. Space Heating 2. Cooking 3. Water Heating 4. Other (specify)..... (d)	**Other Uses: (multiple responses)** 1. Space Heating 2. Cooking 3. Water Heating 4. Other (specify)..... 5. None (e)
Charcoal				
Wood				
Pellet				
Other (Specify)				

B3. Did the facility/household have solar photovoltaic (PV) system in 2017?
If coded 2, skip to B5

1. Yes
2. No

B4. How many solar panels were used in 2017 to produce electricity?

	Number of panels (a)	**Annual Hours** (b)	**Capacity of Panels (Watts)** (c)	**Main Use:** 1. Water Heating 2. Cooking 3. Lighting 4. Water Pumping 5. Space Heating 6. Milling 7. Other (specify)..... ..... (d)	**Other Use: (multiple response)** 6. Water Heating 7. Cooking 8. Lighting 9. Water Pumping 10. Space Heating 11. Milling 12. Other (Specify)..... 13. None (e)
1.					
2.					
3.					
4					

B5. Was the facility/household connected to grid electricity in 2017?
If coded 2, skip to B7

1. Yes
2. No

B6. How much electricity (Grid) did the facility/household use in 2017?

Amount Paid (Maloti) (a)	**Electricity used in units (KWh)** (b)	**Main Use:** (c) 1. Lighting 2. Pumping (irrigation) 3. Cooking 4. Cooling 5. Space Heating 6. Water heating 7. Milling 8. Other (specify).....	**Other Uses: (multiple response)** (d) 1. Lighting 2. Pumping (irrigation) 3. Cooking 4. Cooling 5. Space Heating 6. Water heating 7. Milling 8. Other (specify)..... 9. None

B7. Did the facility/household consume any conventional energy in 2017?
If coded, skip to B9

1. Yes
2. No

B8. How much conventional energy did the facility/household consume in 2017? ***Write "Not used" for types which were not***

Product (a)	**Amount paid (Maloti)** (b)	**Amount Used (kg/l)** (c)	**Main Use:** (d) 1. Space Heating 2. Cooking 3. Water Heating 4. Other (specify).....	**Other Uses: (multiple response)** (e) 1. Space Heating 2. Cooking 3. Water Heating 4. Other (specify)..... 5. None
Anthracite				
Bituminous coal				
Paraffin				
Acetylene				
LPG				
Other (Specify)				

B9. Did the facility/household use petroleum products in 2017?
If coded 2, skip to B11

1. Yes
2. No ☐

B10. How much petroleum fuels were used in 2017? ***Write "Not used" for types which were not***

Product **(a)**	**Amount paid (Maloti)** **(b)**	**Quantity used for all uses except mobile equipment** **(in Unit)** **(c)**	**Quantity used for mobile agricultural equipment** **(in Unit)** **(d)**	**Quantity used for other mobile equipment** **for freight transport (in Unit)** **(e)**	**Main Use:** 1. Heating 2. Mobile Equipment 3. Pumping 4. Electricity Generation 5. Transport 6. Milling **7.** Other(Specify)…… **(f)**	**Other Uses: (multiple response)** 1. Heating 2. Mobile Equipment 3. Pumping 4. Electricity Generation 5. Transport 6. Milling 7. Other(Specify)…… 8. None **(g)**
Diesel 50ppm						
Diesel 500ppm						
Unleaded petrol						

B11. Did the facility/household use lubricants in 2017?
If coded 2, skip to Section C

1. Yes
2. No ☐

B12. How much lubricants were used in 2017? ***Write "Not used" for types which were not***

Product **(a)**	**Amount paid (Maloti)** **(b)**	**Quantity used for operation (kg/litres)** **(c)**	**Quantity used for transportation (kg/litres)** **(d)**
Grease			
Brake Fluid			
Motor oil			
Heavy Oil			
Other (specify).....			

Section C

C1. Occupancy (working hours)

Days of operation per week ☐

Hours of operation per day; week days ☐

weekends ☐

The facility/household: ***tick appropriate box***

1. Covers one whole building/structure; ☐
2. Covers part of the building ☐
3. Covers more than one building ☐

how many?_____

4. Is in the multi-storey building with other services ☐

Building Characteristics

C2. Fill in the following table for the building/structure (s) occupied in 2017.

Construction period 7. Before 1966 8. 1966- 1975 9. 1976- 1985 10. 1986- 1995 11. 1996-2005 12. 2006- 2015 13. After 2015 14. Don't Know **(a)**	Does the building have roof? 1.Yes 2.No **(b)**	Does the building/structure have insulation? 1. Yes 2. No **(c)**	Did the building/structure use lighting? 1.Yes 2.No **(d)**	**Structure Use:** 1. Poultry Rearing 2. Sheep and Goat Kraal 3. Cow kraal 4. Office 5. Shop 6. Butchery 7. Stall 8. Pigsty 9. Other (Specify)… **(e)**	**Main Wall Material** 1. Stone 2. Cane/Tree trunk 3. Stick and Mud 4. Masonite 5. Stone with mud 6. Burnt mud bricks 7. Mud bricks/ Makoete 8. Stone with cement 9. Advanced stone 10. Sand/concreet blocks 11. Advanced burnt brick 12. Corrugated iron/metal sheet 13. Other (Specify)…… …….. **(f)**	**Total Area *Occupied*(mSq*)*** **(g)**	**Heated Area (mSq)** **(h)**	**Cooled Area (mSq)** **(i)**

Section D

Central Heating/Cooling System

D1. Did the facility/household use Central Heating/Cooling System in 2017?
If coded 2, skip to D3

1. Yes
2. No ☐

D2. Which Central Heating/Cooling Systems was in use in 2017?

Central Heating/Cooling Systems 10. Water Circulation 11. Steam Boiler 12. Heat Pumps 13. Forced Air furnace 14. Electric Resistance 15. Split system 16. Packaged Air Conditioners 17. Ductless mini-split system **(a)**	**Energy source** 1.Electricity 2.Diesel 3.Coal 4.Solar Heating 5.Other (specify) **(b)**	**Used for Heating** Annual hours **(c)**	**Used for Cooling** Annual hours **(d)**	**Number of units** **(e)**	**Heating Capacity** **(f)**	**Heating Capacity Units** 1. kVA 2. kW 3. kcal/hr 4.BTU/hr **(g)**	**Cooling Capacity** **(h)**	**Cooling Capacity Units** 1. kVA 2. kW 3. Kcal/hr 4. BTU/hr **(i)**

Independent heating/cooling systems and appliances

D3. Did the facility/household use Independent heating/cooling System(s) or appliances in 2017?
If coded 2, skip to Section E

3. Yes
4. No ☐

D4. Which of the following systems/appliances were in operation in 2017? ***Write "Not used" for types which were not used.***

Type of Systems/ appliances (a)	**Energy sources** 7. Electricity 8. LPG 9. Paraffin 10. Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of systems** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)	**Type of refrigerant/gas** (j)	**Quantity of refrigerant (Grams)** (k)
Split A/C units with inverter										
Split A/C units without inverter										
Electric oil heater										
Electric resistance heater										
Fans										

Gas Heater										
Paraffin Heater										
Other (specify)…										

Section E

Lighting

E1. Are there light sensor controls for operating the lighting in service areas (staircases, toilets etc.)?

Yes ☐ ☐

E2. Are there motion sensors controls for operating the lighting in service areas (staircases, toilets etc.)?

Yes ☐ ☐

E3. What types of light bulbs (for grid) were fitted in 2017?(in offices, in corridors, toilets and external areas etc.)***For those coded 3 in B8 column D or E***

Type 5. Energy saver (CFL) 6. Fluorescent 7. Incandescent 8. LED 9. Other (specify) **(a)**	**Number** **(b)**	**Capacity (Watts)** **(c)**	**Average minutes switched on per day** **(d)**

E4. What types of light bulbs (for solar) were fitted in 2017?(in offices, in corridors, toilets and external areas etc.) ***For those coded 3 in B4column D or E***

Type 1. Energy saver (CFL) 2. Fluorescent 3. Incandescent 4. LED 5. Other (specify) **(a)**	**Number** **(b)**	**Capacity (W)** **(c)**	**Average minutes switched on per day** **(d)**

E5. Were there any other forms of lighting used by the facility /household?
If coded 2, skip to Section F

3. Yes ☐
4. No

E6. What type of lamp did the facility/ household use in 2017?

Type 6. Paraffin Lamp 7. Solar Lantern 8. Battery Lamp 9. LPG Lamp 10. Other (Specify)…. **(a)**	**Number** **(b)**	**Capacity (Watts)** **(c)**	**Average Minutes Used per Day** **(d)**	**Source of Energy** 6. Battery 7. Paraffin 8. LPG 9. Solar 10. Electricity 11. Other (Specify) ….. **(e)**	**Quantity Used (kg/litres)** **(f)**

Section F

Office Equipment

F1. Did the facility/household have any office equipment in 2017?
If coded 2, skip to F3

1. Yes ☐
2. No

F2. Which of the following equipment was in operation in 2017?

Equipment 1. CPU 2. Monitor/Screens 3. Laptops 4. Servers 5. Printer/Copiers 6. Other (Specify) **(a)**	**Number** **(b)**	**Average Age (years)** 1. 0-5 2. 6-10 3. 11+ **(c)**	**Capacity (Watts)** **(d)**	**Average Minutes of use per day** **(e)**

F3. Did the facility/household use any electrical appliances in 2017?
If coded 2, skip to Section G

1. Yes
2. No

F4. Which of the following appliances were used in 2017?

Appliance 1. Microwave 2. Kettle 3. Stove 4. Other (Specify) (a)	**Number** (b)	**Average Age(years)** 1. 0-5 2. 6-10 3. 11+ (c)	**Capacity(Watts)** (d)	**Average Minutes of use per day** (e)

F5. Did the facility/household use refrigeration equipment in 2017?
If coded 2, skip to Section G

1. Yes
2. No

F6. Which refrigeration equipment was in use in the facility/household in 2017?

Type 4. Commercial Refrigerators 5. Domestic Refrigerators 6. Freezers (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litres)** (d)	**Average minutes of switched on per day** (e)	**Type of refrigerant/gas** (f)	**Quantity of refrigerant in grams (g)** (g)

Section G

Mobile Agricultural Equipment

G1. Did the facility/household use Mobile Agriculture Equipment in 2017?
If coded 2, skip to Section H

1. Yes
2. No

G2. Which of the following equipment was used for agricultural purposes in 2017?

Equipment 1. Tractors 2. Combines 3. Balers 4. Agricultural mowers 5. Sprayers 6. Tillers 7. Swathes 8. Planter 9. Harvester 10. Other agricultural equipment (specify) **(a)**	**Number** **(b)**	**Capacity (kW / kg or HP)** **(c)**		**Type of fuel used** 1.Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol **(d)**	**Quantity Used in Litres** **(e)**	**Operation type (multiple responses)** 1. Tillage 2. Sowing/planting 3. Harvesting 4. Spreading (fertilizers, pesticides) 5. Disking 6. winnowing 7. Other (specify) **(f)**	**Operation time (including travelling)** Annual hours **(g)**

Section H

Irrigation Pumps

H1. Did the facility/household use Irrigation Pumps in 2017?
If coded 2, skip to Section I

1. Yes ☐
2. No

H2. How many irrigation pumps were used in 2017?

Number (a)	**Capacity (kVA or kW)** (b)	**Energy source/ Fuel Type** (c) 1. Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol 4. Electricity 5. Solar	**Operation time** (d) Annual hours	**Quantity of Fuel Used** (e) **(Units)**

H3. How much water was used in irrigation in 2017 in average [ ] per month in litres?

Section I

Greenhouses

I1. Did the facility/household have greenhouses in 2017?
If coded 2, skip to section J

1. Yes
2. No

[ ]

I2. Was there any energy consumed in the greenhouses in 2017?
If coded 2 skip to section J

1. Yes
2. No

[ ]

I3. How many greenhouses did the facility/household have in 2017?

Number of greenhouses (a)	**Main Crop types** (b)	**Total Area (ha)** (c)	**Is it heated?** (d) 1. Yes 2. No	**Is it cooled?** (f) 1. Yes 2. No	**Is it lighted?** (g) 1. Yes 2. No

I4. Which of the following heating/cooling/ventilation equipment was used for greenhouses in 2017?

Systems: 1. Forced air unit heaters 2. Convention heaters 3. Radiant heaters 4. Steam boiler 5. Oil heater 6. Hot water boiler 7. Paraffin Heater 8. Paola 6. Powered fan 7. Other (specify) **(a)**	**Number of units** **(b)**	**Capacity (KVA or kW)** **(c)**	**Use:** **(multiple response)** 1. Heating 2. Ventilation 3. Cooling 4. Other (specify) **(d)**	**Energy Used** 1. Coal 2. Wood 3. Paraffin 4. LPG 5. Electricity 6. Other (specify)) **(e)**	**Quantity Used** **(Specify Unit)** **(f)**	**Operation time** Annual hours **(g)**

Section J

Livestock Breeding Areas Equipped with Energy System

J1. Did the facility/household have livestock breeding areas equipped with energy system?
If coded 2, skip to section K

1. Yes
2. No

J2. Which of the following energy systems were used in the breeding areas 2017?

Heating/cooling systems 1.Air-to-air heat pumps 2. Boiler 3. Electrical oil heater 4.Electric resistance heater 5. Wood stove 6. Paraffin heater 7. Gas heater 8. Air conditioner 9. Other (specify) **(a)**	**Number of units** **(b)**	**Capacity (KVA or kW)** **(c)**	**Use:** (multiple answer) 1. Heating 2. Ventilation 3. Cooling 4. Other (specify) **(d)**	**Energy Used** 1. Coal 2. Wood 3. Paraffin 4. LPG 5. Electricity 6. Diesel 50ppm 7. Diesel 500ppm **(e)**	**Operation time for Heating** Annual Hours **(f)**	**Operation time for Cooling** Annual Hours **(g)**

Section K

Forestry Equipment

K1. Did the facility/household use Forestry Equipment in 2017?
If coded 2, skip toK3

1. Yes
2. No

K2. Which of the following forestry equipment was used in 2017?

Equipment 1. Skidders 2. Wheeled Feller Bunchers 3. Tracked Feller Bunchers 4. Forwarders 5. Wheeled Harvesters 6. Tracked Harvesters 7. Swing Machines 8. Knuckleboom Loaders 9. Chain Saw 10. Other equipment	**Number of units**	**Mobility of Equipment** 1.Mobile 2. Non-mobile	**Capacity (kW or HP)**	**Type of fuel /Energy source** 1.Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol 4. Electricity	**Quantity of fuel used (Specify units)**	**Operation time (including travelling)** Annual Hours
(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**

Agricultural Processing

K3. Did the facility/household use agricultural processing equipment in 2017?
If coded 2, skip to section L

1. Yes
2. No

K4. Which of the following equipment was used for agricultural processing in 2017?

Equipment 1. Food dryer 2. Mill 3. Cutters 4. Other (Specify) **(a)**	**Number of units** **(b)**	**Capacity (kW or HP)** **(c)**	**Type of fuel/energy source used** 1. Coal 2. Wood 3. Paraffin 4. LPG 5. Electricity 6. Diesel 50ppm 7. Diesel 500ppm 8. Unleaded petrol **(d)**	**Quantity of fuel/energy source used** **(e)**	**Operation time** Annual Hours **(f)**

Section L

Generators

L1. Did the facility/household use generators in 2017?
If coded 2, skip to section M

1. Yes
2. No

L2. How many generators did the facility/household use in 2017?

Number (a)	**Capacity** (kW/kVA) (b)	**Type of fuel used** 1.Diesel 50ppm 2. Diesel 500ppm 3. Unleaded petrol (c)	**Quantity of fuel used** (d)	**Agricultural use**: (multiple response) 1.Irrigation 2.Heating greenhouses 3. Lighting greenhouses 4. Heating for livestock 5. Lighting for livestock 6. Other (specify) (e)	**Operation time** Annual hours (f)

Section M

Solar Photovoltaic energy

M1. Did the facility/household use solar photovoltaic for agricultural uses in 2017?
If coded 2, skip to section N

1. Yes
2. No

M2. How many panels did the system have in 2017?

	Number of panels (a)	**Capacity of panels (Watts)** (b)	**Annual hours** (c)	**Agricultural use: (multiple response)** 1.Irrigation (pumping) 2. Lighting greenhouses 3. Water heating 4. Food drying 5. Other (specify) (d)
1				
2				
3				
4				

Section N

Other equipment

N1. Did the facility/household use other equipment for operation in 2017?
If coded 2, skip to section O

1. Yes
2. No

N2. Which of the following equipment was used for operation in 2017?

Equipment 1. Incubators 2. Milk Cooler 3. Grinding Mills 4. Silage cutting and blowing 5. Hoist 6. Power Sow 7. Other (Specify) **(a)**	**Number** **(b)**	**Capacity (kVA/kW)** **(c)**	**Operation hours:** Annual hours **(d)**

Section O

Transport of agricultural, forest products and livestock

O1. Did the facility/household own transport for agricultural purposes in 2017?
If coded 2, skip to section P

1. Yes
2. No

O2. Which vehicle type was used for agricultural purposes **excluding** marketing in 2017?

Vehicle type 1.Van 2. Truck 3.Mini trucks 4. Tractor 5.Other (specify) **(a)**	**Distance** Km travelled **(b)**	**Fuel used**		
		1. Diesel 50 ppm 2. Diesel 500 ppm 3. Unleaded petrol **(c)**	Amount spent (maloti) **(d)**	Litres consumed **(e)**

O3. Which type of vehicle was used to transport animal products in the farm in 2017?

Vehicle type 1.Van 2. Truck 3.Mini trucks 4. Tractor 5.Other (specify) **(a)**	**Animal products** 1 Milk 2.Meat 3.Wool 4.Mohair 5.Other (Specify) **(b)**	**Quantity (Litres/ kg)** **(c)**	**Distance travelled to market in km** **(d)**	**Type of fuel** 1. Unleaded 2. Diesel 50 ppm 3. Diesel 500 ppm **(e)**	**Amount of fuel (litres)** **(f)**

O4. Which type of vehicle was used to transport crop products in the farm in 2017?

Vehicle type 1.Van 2. Truck 3.Mini trucks 4. Tractor 5.Other (specify) **(a)**	**Crops (Multiple response)** 1Maize 2.Wheat 3.Sorghum 4.Beans 5.Peas 6. Potatoes 6.Vegetables **(b)**	**Quantity in kg** **(c)**	**Distance travelled to harvest(to and from fields to home)in km** **(d)**	**Type of fuel.** 1.Unleaded 2.Diesel 50 ppm 3.Diesel 500 ppm **(e)**	**Amount of fuel** **(f)**	**Distance travelled to market after harvest(to and from market)in km** **(g)**	**Type of fuel** 1.Unleaded 2.Diesel 50 ppm 3.Diesel 500 ppm **(h)**	**Amount of Fuel** **(i)**

Section P

Additional information

P1. Was the facility/household involved in crop production in 2017?
If coded 2, skip to P6

1. Yes
2. No

P2. What was the total cultivated area in 2017? _____ (hectares)

Mechanized cultivated area

P3. Did the facility/household use machinery for crop production in 2017?
If coded 2, skip to P6

1. Yes
2. No

P4. For each crop production using machinery fill in the table:

	Crop type (a)	Area used (ha) (b)	Total annual production (kg) (c)	Mechanized area (ha)					
				Tilled (d)	Sown (e)	Irrigated (f)	Harvested (g)	Other	
								ha (h)	Specify operation (i)
1									
2									
3									
4									
5									
6									
7									

(If there was 100% mechanization, skip p5)

P5. What are the reasons of not having 100% mechanized area? ***Please tick (multiple response).***

☐ Without connection to the electricity

☐ Difficult access to energy products

☐ Limitations due to the geography

☐ Small activity dedicated to own use

☐ Affordability

☐ Other (please specify)

P6. Did the facility/household have livestock in 2017?
If coded 2, end of interview

1. Yes
2. No

P7. Total number of animals

Animals	**Number**
Cattle	
Sheep	
Goats	
Pigs	
Chicken***(improved 50+)***	
Other Poultry ***specify.....***	

P8. What is the total livestock breeding area? _____ (hectares)

P9. Heated/cooled/lighted livestock breeding area

	Livestock type **(a)**	**Total area** (mSq) **(b)**	**Area heated** (mSq) **(c)**	**Area cooled** (mSq) **(d)**	**Area lighted** (mSq) **(e)**
1					
2					
3					
4					
5					
6					

GOVERNMENT SECTOR QUESTIONNARE

Section A
Identification

District				
Constituency				
Name of Ministry/Department				
Physical Address				
Number of employees in 2017	Permanent		Female	
			Male	
	Temporary		Female	
			Male	

Section B
Total energy consumption

B1. Did the department consume Hard coal in 2017?
If coded 2, skip to B3
1. Yes
2. No

B2. How much Hard Coal did the department consume in 2017?

	Product (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Use:(multiple response)** 1. Space Heating 2. Other (Specify) ……. (d)
1.	Anthracite			
2.	Bituminous coal			
3.	Other (Specify) ……			

B3. Did the department consume Renewables and Waste in 2017?
If coded 2, skip to B5
1. Yes
2. No

B4. How much Renewables and Waste did the Department consume in 2017?

	Type of Renewable & Waste (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Use:(multiple response)** 6. Space Heating 7. Water Heating 8. Other (Specify) ..... (d)
1.	Charcoal			
2.	Wood and other wastes			
3.	Other (Specify)			

B5. Did the department have solar photovoltaic (PV) system in 2017?

If coded 2, skip to B7

1. Yes
2. No

B6. How many solar Panels did the system have in 2017? *Note: For panels with the same wattage, write the number of such panels and capacity of ONLY one solar panel. Panels should be functional for the period covered by the survey (Year 2017)*

	Number of Panels (a)	**Capacity of Panel (watts)** (b)	**Annual Hours** (c)	**Use: (multiple response)** 1. Space Heating 2. Water Heating 3. Lighting 4. Other (Specify) (d)
1.				
2.				
3.				

B7. Was the department connected to grid electricity in 2017?

If coded 2, skip to B9

3. Yes
4. No

B8. How much electricity (Grid) did the institution use in 2017?

How was electricity obtained (a)	**Amount Paid (Maloti)** (b)	**Electricity used in units (KWh)** (c)	**Use: (multiple response)** 12. Space Heating 13. Space Cooling 14. Lighting 15. Other (d)
Purchased			
Included in Rent			

Section C

Occupancy (working hours)

C1. Days of operation per week

C2. Hours of operation per day

C3. The Institution:

1. Covers one whole building ❒
2. Covers part of the building ❒
3. Covers more than one building ❒
4. Is in the multi-storey building with other services ❒

If coded 3, how many? _____

Building characteristics

C4. Fill in the following table for the building (s).

Construction period 1.Before 1966 2.1966- 1975 3.1976- 1985 4.1986- 1995 5.1996-2005 6. 2006- 2015 7. After 2015 88. Don't know (a)	**Was the building insulated?** 5. Yes 6. No (b)	**Main Wall Material** 1.Masonite 2.Burnt mud bricks 3.Stone with cement 4.Advanced stone 5.Sand/concrete blocks 6.Advanced burnt brick 7.Corrugated iron/metal sheet 8.Other (Specify)..... (c)	**Total Area *Occupied* (mSq*)*** (d)	**Heated Area (mSq)** (e)	**Cooled Area (mSq)** (f)

Section D
Offices equipment

D1. Did the Department use Central Heating /Cooling Systems in 2017?

If coded 2 skip to D3

3. Yes
4. No ☐

D2. Which of the following systems were in operation in 2017?

Central Heating/Cooling Systems (a)	**Energy source** 1.Electricity 2.Diesel 3.Coal 4.Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for Cooling** Annual hours (d)	**Number of units** (e)	**Heating Capacity** (f)	**Heating Capacity Units** 1. kVA 2. kW 3. kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1. kVA 2. kW 3. kcal/hr 4. BTU/hr (i)
Water Circulation								
Steam Boiler								
Heat Pumps								
Forced Air furnace								
Solar Heating								
Electric Resistance								
Split system								
Packaged Air Conditioners								
Ductless mini-split system								

Independent heating/cooling systems

D3. Did the Department use Independent Heating /Cooling Systems in 2017?

If coded 2 skip to D5

1. Yes
2. No

D4. Which of the following systems were in operation in 2017?

Type of System (a)	**Energy sources** 11. Electricity 12. Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of units** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Split A/C units with inverter								
Split A/C units without inverter								
Electric oil heater								
Electric resistance heater								
Other (specify)…								

Lighting

D5. Were there light sensor controls (day-light switch) for operating the lighting in service areas (staircases, toilets etc.) in 2017?

3. Yes
4. No

D6. Were there motion sensors controls for operating the lighting in service areas (staircases, toilets etc.) in 2017?

3. Yes ☐
4. No

D7. What types of light bulbs were fitted in 2017(for grid)? *Give number of lights in offices, in corridors, toilets and external areas.* For those coded 3 in B8 Column D

Type (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

For those coded 3 in B6 column D (those who use solar for lighting)

D8. What types of light bulbs were connected to solar electricity in 2017?

Type (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

Small Equipment

D9. Did the department use any small equipment in 2017?

If coded 2, skip to D11

3. Yes
4. No

D10.Which of the following equipment were in operation in 2017?

Equipment (a)	**Number** (b)	**Average Age (years)** 7. 0-5 8. 6-10 9. 10+ (c)	**Capacity (watts)** (d)	**Average minutes of use per day** (e)
Desktops				
Monitors/Screens				
Laptops				
Servers				
Printers/copiers				
Other (specify).....				

D11.Did the department have household appliances?
If coded 2, skip to D13

3. Yes
4. No

D12. Which of the following household appliances were in operation in 2017?

Equipment (a)	**Number** (b)	**Average Age (years)** 7. 0-5 8. 6-10 9. 10+ (c)	**Capacity (watts)** (d)	**Average minutes of use per day** (e)
Microwave				
Kettle				
Stove				
Other (specify) ……				

Cooking

D13. Were there cooking facilities in the building?

If coded 2 skip to D15

1. Yes
2. No

D14. If yes which was the main fuel used for cooking:

Electricity

LPG

Wood

Other (specify) …

Refrigeration

D15. Were there refrigerating equipment for food in 2017?

If coded 2, skip to D17

1. Yes
2. No

D16. Which refrigeration equipment was in use in 2017?

Type (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litres)** (d)	**Minutes per day** (e)
Refrigerators				
Freezers				

Solar water heating

D17. Did the department have a solar water heating system in 2017?

If coded 2, skip to D19

1. Yes
2. No

D18. How many solar water heating systems did the department have in 2017?

	Number of heating systems (a)	**Capacity (Litres)** (b)	**Year when system was Installed** (c)	**Functionality** 1. Yes 2. No (d)	**Aperture Area** (e)
1.					
2.					
3.					
4.					
5.					

D19. Did the department use a generator in 2017?

*If coded 2, skip to **Section E***

3. Yes
4. No

D20. How many generators did the department use in 2017?

	Number of Generators (a)	**Capacity (kVA)** (b)	**Age (years)** 00 for less than a year (c)	**Energy source** 1. Diesel 50ppm 2. Diesel 500ppm 3. Lead Replacement Petrol (LRP) 4. Unleaded petrol (d)	**Final use (multiple answer)** 13. Lighting 14. Powering appliances (e)	**Operation** Annual hours (f)
1.						
2.						
3.						

Section E

Additional information

E1. Are there plans to upgrade the existing or install new equipment?

- Replacing one or various units by other units with the same characteristics (energy source and power). 1. Yes2. No

If coded 2, go to the E2

1. Replace the light bulbs: 1(a) with CFL ☐ 1(b). With LED ☐ 2. Motion sensor ☐

3. Light sensor ☐ 4. Install Solar water heater ☐ 5. Install PV system ☐

Constraints

For those coded 2 in E1.

E2. What are the constraints against upgrading the existing or installing new equipment?
Multiple response

Plans		Constraints				
		Insufficient budget	Rented	No electricity	Already have	Other (Specify)
Replace the light bulbs:	CFL					
	LED					
Motion sensor						
Light sensor						
Install a SWH						
Install a PV system						

EDUCATION QUESTIONNARE

Section A

Identification

District				
Constituency				
Name of Institution				
Physical Address				
Category				1. Church owned 2. Private 3. Public
Type of institution	ECCD			
	Primary School			
	Secondary School			
	High School			
	Tertiary			
	Technical School			
	Vocational School			
Number of employees in 2017	Permanent		Female	
			Male	
	Temporary		Female	
			Male	
Students	Number of students		Female	
			Male	

Section B

Total Energy Consumption

B1. Did the institution consume Hard Coal in 2017?

If coded 2, skip to B3

1. Yes
2. No

B2. How much Hard Coal did the institution consume in 2017?

	Product (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Main Use:** 3. Space Heating 4. Water Heating 5. Steaming 6. Cooking 7. Other(Specify) (d)
1.	Anthracite			
2.	Bituminous coal			
3.	Other (Specify)			

B3. Did the institution consume Renewables & Wastes in 2017?

If coded 2, skip to B5

1. Yes
2. No

B4. How much Renewables & Wastes were used in 2017?

	Type of Renewable & Waste (a)	**Amount Used (Kg)** (b)	**Amount Paid (Maloti)** (c)	**Main Use:** 9. Space Heating 10. Water Heating 11. Cooking 12. Other(Specify) (d)
1.	Charcoal			
2.	Wood and other wastes			
3.	Other (Specify)			

B5. Did the institution have solar photovoltaic (PV) system in 2017?
If coded 2, skip to B7

1. Yes
2. No

B6. How many solar panels were used in 2017 to produce electricity?

NOTE: for panels with the same wattage, write the number of such panels and capacity of only one panel. For solar panels with same capacity but different annual hours, record them separately. Panels should be functional in the period covered by the survey (2017).

	Number of panels (a)	**Capacity of Panels (Watts)** (b)	**Annual Hours** (c)	**Use: (multiple response)** 14. Water Heating 15. Cooking 16. Lighting 17. Water pumping 18. Other (Specify) (d)
1.				
2.				
3.				

B7. Was the institution connected to grid electricity in 2017?
If coded 2, skip to B9

1. Yes
2. No

B8. How much electricity (Grid) did the institution use in 2017?

Amount Paid (Maloti) (a)	**Electricity used in units (KWh)** (b)	**Use: (multiple response)** 16. Space Heating 17. Space Cooling 18. Cooking 19. Lighting 20. Water pumping 21. Powering appliances 22. Other(Specify) (c)

B9. Did the institution use Petroleum products in 2017?
If coded 2, skip to B11

1. Yes
2. No

B10. How much Petroleum was used for operation in 2017?

Petroleum Products (a)	**Quantity used for operation (Litres/kg)** (b)	**Amount paid (Maloti)** (c)	**Use (multiple response)** 1. Space heating 2. Cooking 3. Lighting 4. Water heating 5. Powering appliances 6. Other (specify (d)
Diesel 50ppm			
Diesel 500ppm			
Lead Replacement Petrol (LRP)			
Unleaded Petrol			
Paraffin			
Acetylene (kg)			
LPG (kg)			
Heavy oil			

B11. Did the institution use Lubricants in 2017?
If coded 2, skip to Section C

1. Yes ☐
2. No

B12. How much Lubricants were used in 2017?

Product (a)	**Amount paid (Maloti)** (b)	**Quantity used for transportation** (kg or Litres) (c)	**Quantity used for Operation** (kg or litres) (d)
Grease (Kg)			
Brake Fluid			
Motor oil			
Other (specify).....			

Section C

C1. Occupancy (working hours)

Starting Month: _____ Ending Month___

Days of operation per week		
Hours of operation per day;	week days	
	weekends	

The Institution: *tick appropriate box*

5. Covers one whole building; ☐
6. Covers part of the building ☐
7. Covers more than one building ☐
8. Is in the multi-storey building with other services ☐

If coded 3, how many? _____

C2. Building characteristics

Fill in the following table for the building(s).

Construction period 1. Before 1966 2. 1966- 1975 3. 1976- 1985 4. 1986- 1995 5. 1996-2005 6. 2006- 2015 7. After 2015 88. Don't Know (a)	**Use of buildings** 1. Classroom and teaching uses 2. Boarding 3. School hall 4. Kitchen 5. Other (Specify) (b)	**Was the building insulated?** 7. Yes 8. No (c)	**Main Wall Material** 1 Stick and Mud 2 Masonite 3 Stone with mud 4 Burnt mud bricks 5 Mud bricks/ Makoete 6 Stone with cement 7 Advanced stone 8 Sand/concrete blocks 9 Advanced burnt brick 15 Corrugated iron/metal sheet 16 Other (Specify)..... (d)	**Total Area occupied (mSq)** (e)	**Heated Area (mSq)** (f)	**Cooled Area (mSq)** (g)

Section D

Office equipment

Space Heating/Cooling equipment

Central Air-conditioning System

D1. Did the institution use central air-conditioning system in 2017?
If coded 2, skip to D3

1. Yes

2. No

D2**.** Which of the following systems were in operation in 2017?

Type of System (a)	**Energy source** 1. Electricity 2.Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of units** (e)	**Heating capacity** (f)	**Heating Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Cooling Capacity Units** 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Heat Pumps								
Absorption coolers								
Other (specify)…								

Central Heating/Cooling System

D3. Did the institution use central heating/cooling system in 2017?
If coded 2, skip to D5

1. Yes ☐
2. No

D4. Which of the following systems were in operation in 2017?

System Heating System (a)	Energy source 1.Electricity 2. Diesel 3.Coal 4.Other (specify) (b)	Used for Heating Annual hours (c)	Used for cooling Annual hours (d)	Number of units (e)	Heating capacity (f)	Heating Capacity Units 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (g)	Cooling Capacity (h)	Capacity Units 1.kVA 2.kW 3.kcal/hr 4.BTU/hr (i)
Water circulation								
Steam boiler								
Heat pumps								
Air furnace								
Solar heating								
Electric resistance								

Independent heating/cooling systems

D5. Did the institution use independent heating/cooling system in 2017?
If no, skip to D7

1. Yes
2. No

D6. Which of the following systems were in operation in 2017?

Type of System (a)	**Energy sources** 13. Electricity 14. Other (specify) (b)	**Used for Heating** Annual hours (c)	**Used for cooling** Annual hours (d)	**Number of units** (e)	**Heating Capacity** (f)	**Heating Capacity Units** 1.kWA 2.kw 3. kcal/hr 4.BTU/hr (g)	**Cooling Capacity** (h)	**Units** 1.kWA 2.kw 3. kcal/hr 4.BTU/hr (i)
Split A/C units with inverter								
Split A/C units without inverter								
Electric oil heater								
Electric resistance heater								
Other (specify)…								

Lighting

D7. Were there light sensor controls for operating the lighting in service areas (staircases, toilets etc.)?

1. Yes
2. No

D8. Were there motion sensors controls for operating the lighting in service areas (staircases, toilets etc.?)

1. Yes
2. No

D9. What type of light bulbs were fitted (for grid) in 2017? (in offices, classrooms, corridors, toilets and external areas)

Type of bulb (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

D10. What type of light bulbs were connected to solar electricity?
for those coded 3 in B6 column (d)

Type of bulb (a)	**Number** (b)	**Capacity (W)** (c)	**Average minutes switched on per day** (d)
Energy saver (CFL)			
Incandescent			
Fluorescent			
LED			
Other (specify)			

Small Equipment

D11. Did the institution use any small equipment?
If coded 2, skip to D13

1. Yes
2. No

D12. Which of the following equipment were in operation in 2017?

Equipment (a)	**Number** (b)	**Average Age (years)** 1. 0-5 2. 6-10 3. 10+ (c)	**Capacity (watts)** (d)	**Minutes of use per day** (e)
Desktops				
Monitors/Screens				
Laptops				
Servers				
Printers/copiers				
Household appliances (microwaves etc.)				
Other (specify)				

Household appliances

D13. Does the facility have any household appliances?
If coded 2, skip to D14

1. Yes ☐
2. No

D14. Which of the following appliance were in operation in 2017?

Appliance (a)	**Number** (b)	**Average Age (years)** 4. 0-5 5. 6-10 6. 10+ (c)	**Capacity (watts)** (d)	**Minutes of use per day** (e)
Microwave				
Kettle				
Stove				
Other (Specify).....				

Cooking

D15. Were there cooking facilities in the institution in 2017?

If coded 2, skip to D17

1. Yes
2. No

D16. If yes which was the main fuel used for cooking:

Electricity	
LPG	
Wood	
Coal	

Refrigeration

D17. Was there Refrigeration equipment for food?

If coded 2, skip to D19

1. Yes
2. No

Refrigeration equipment

D18. Which refrigeration equipment was in use in 2017?

Type (a)	**Number** (b)	**Capacity (wattage)** (c)	**Capacity (litters)** (d)	**Minutes per day** (e)
Refrigerators				
Freezers				

Solar water heating

D19. Did the institution have a solar water heater in 2017?
If coded 2, skip to D21

1. Yes ☐
2. No

D20. How many solar water heaters did the institution have in 2017?

	Number of Solar Water heating systems (a)	**Capacity (litres)** (b)	**Year when system was Installed** (c)	**Functionality** 1.Yes 2. No (d)	**Aperture Area** (e)
1.					
2.					
3.					

Generators

D21**.** Did the institution have a generator in 2017?
If no skip to section E

1. Yes ☐
2. No

D22. How many generators did the institution have in 2017?

	Number of Generators (a)	**Capacity (KVA)** (b)	**Age (years)** *00 for less than one year* (c)	**Energy source** 1. Diesel 50ppm 2. Diesel 500ppm 3. Lead replacement petrol (LRP) 4.Unleaded petrol (d)	**Final use (multiple response)** 1. Lighting 2. Powering appliances (e)	**Operation Annual hours** (f)
1.						
2.						
3.						
4.						
5.						

Section E

E1. Did the institution use official/passenger vehicle in 2017?
If coded 2, skip to section F

1. Yes
2. No

E2**.** What type of official/passenger vehicle did the institution use in 2017?

Vehicle type 1.Van 2.Taxi/minibus 3.Bus 4.Sedan (a)	**Number of units** (b)	**Capacity (vehicle weight)** (c)	**Distance** **Km travelled** (d)	**Fuel used**		**Amount spent (maloti)** (g)
				4. Diesel 50 ppm 5. Diesel 500 ppm 6. Lead replacement petrol 7. Unleaded petrol (e)	Litres consumed (f)	

Section F

Additional information

Are there any plans to upgrade the existing or install new equipment?

F1. Replacing one or various units by other units with the same characteristics (energy source and power).

1. Yes 2. No

If coded 2, go to F2

1. Replace the light bulbs: 1(a) with CFL ☐ 1(b). With LED ☐ 2. Motion sensor ☐

3. Install a Solar Water Heater ☐ 4. Install a PV system ☐ 5. Insulate the walls ☐

6. Replace the windows ☐ 7. Fit a ceiling ☐

Constraints

For those coded 2 in F1

F2. What are the constraints against upgrading the existing or installing new equipment(s)? Tick appropriately. ***Multiple response***

Plans		**Constraints**					
		Insufficient budget	**Rented**	**No electricity**	**High purchasing costs**	**Already have**	**Other (specify)**
Replace light bulbs	CFL						
	LED						
Motion sensor							
Install a Solar Water Heater							
Install a PV system							
Insulate walls							
Replace the windows							
Fit a ceiling							