Investigating the Maximum Electrical Demand of Arghandab and Shah Wali-kot Districts in Kandahar City

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Abstract

It is necessary to study the possibilities for the sale of electric power by considering the plans for development, the probable number of consumers, the power requirements of each type of load, the time at which loads might be required, the types of loads to be supplied, and various other factors that determine the total power that should be made available at the power station to cope with the need. The maximum power consumption demand of Arghandab and Shahwali-kot districts of Kandahar province has been assessed in this paper using the load survey method and computer-based for four seasons. In the spring season, the maximum demand, average load, and load factor of Arghandab and Shahwali-kot districts per home in a 24-hour period are 1450 W, 388 W, and 0.27 or 27%, respectively. For the summer season maximum demand, the average load and load factor are 1500 W, 636 W, and 0.42 or 42%, respectively. For the fall season maximum demand, the average load and load factor are 1250 W, 340.5 W, and 0.27 or 27%, respectively. And for winter season maximum demand, the average load and load factor are 1960 W, 465.5 W, and 0.24 or 24%, respectively.

Keyword: Energy consumption, Maximum demand, Average load and Load factor, Load Survey Method.

1. Introduction

Electricity is important to power all devices and, of course, all technology. If electricity did not exist and the process of its creation did not occur, there would be no technology and life would remain the same. Electricity is an important part of modern life and is important to the economy. People need electricity for lighting, heating and cooling, and for appliances, computers, machinery, and public transportation systems. In the past, people's lives were very simple. They lived in mud houses, which were able to avoid heat transfer through the envelope. And there was no need for active energy sources to cool and heat buildings in summer and winter, respectively. But now people are modernized and want to build their buildings with concrete and bricks, which have poor resistance to heat transfer through the building envelope. On the other hand, they need thermal comfort and light in all seasons. So, first necessary to find out the load requirements of the area where electricity is to be supplied. This depends on the nature of the area; the population of the town or village under consideration; the density of the population; the standard of living of the people in the locality; industrial development in the area; and the cost of electric power. The problem may be predicting the load requirement of a new township that is to be set up; the supply of electricity to a village for the first time; or the extension of the supply facilities to a growing city where electricity has been available for years and the need is continuously increasing owing to development. We calculate the same load based on the load survey method and supply electricity from the power station, which the building needs for cooling, heating, and lighting.

2. Material and Methods

The methodology that was followed consisted of two main steps, as illustrated in Figure 1.

The information related to this research that has been obtained from the field and other sources is as follows:

(1)The primary information has been obtained from the field through questionnaires and surveys, which are the load survey method Using this method, we reached the maximum demand for electricity consumption in the Arghandab and Shahwli Kot areas. First, we made a questionnaire, then we distributed the questionnaire to the people of the area, and in the questionnaire, different types of electricity consumers were mentioned.

(2) Secondary information has been obtained from various articles, books, and journals. These are among the secondary data, which include various administrative elements in this section.

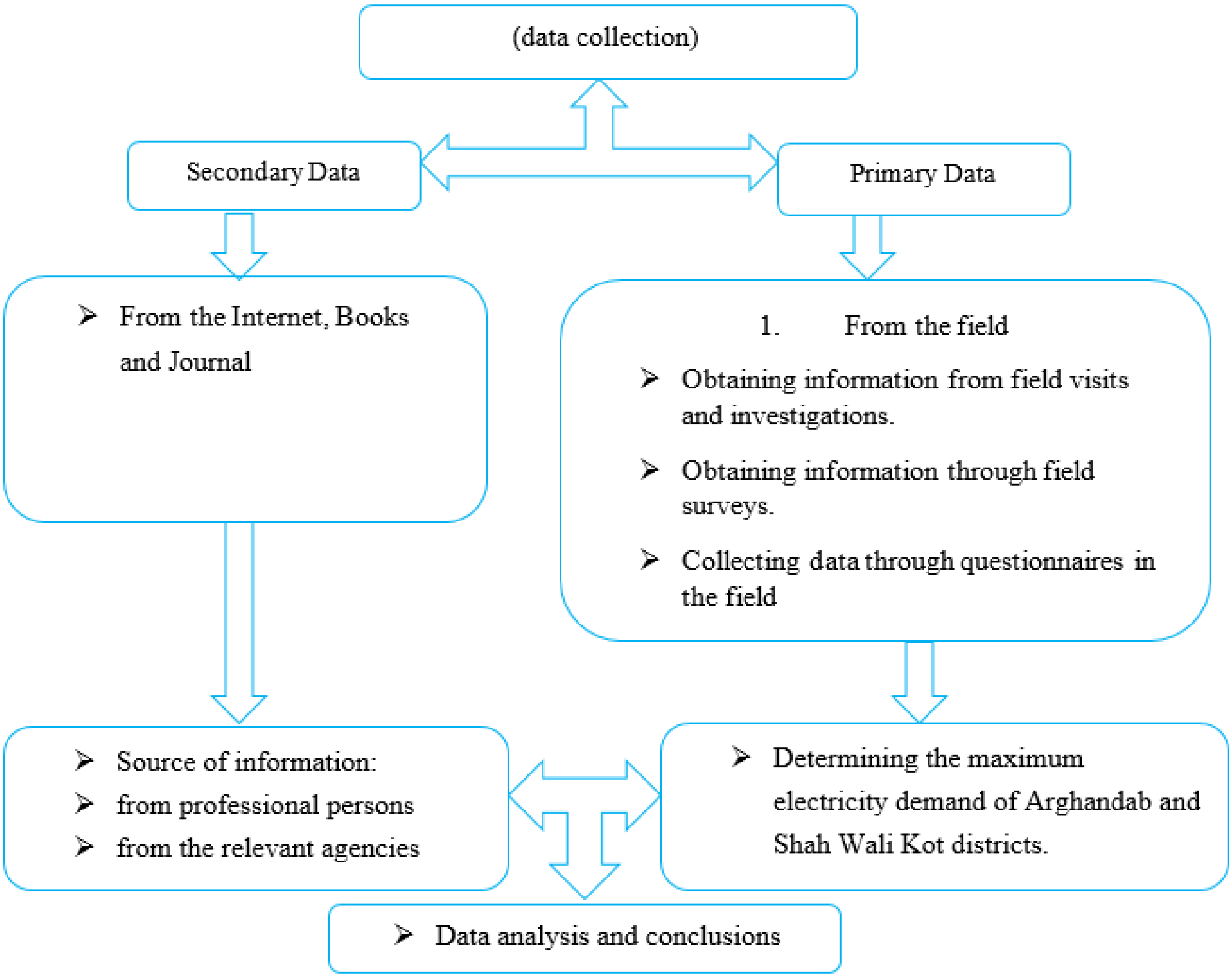

Figure (1): Steps involved in the collection of research papers.

3. Design considerations

This study was conducted in Kandahar province, Arghandab and Shahwali-kot districts, located between 31.700 longitude and 65.680 latitudes and 32.070 longitude and 66.140 latitudes, respectively. This district is divided into 38485 homes. The total population of these districts is 292888 people. The average population of each home is 8.92 people per home. The maximum demand, average load, and load factor are calculated for each of them in a 24-hour period. Table.1 shows the total number of homes, population, and average population per home for the Arghandab and Shahwali-kot districts.

Table. (1). Total home, population and average population per home for Aarghandab and Shahwali-kot districts.

No #	District Name	Total Number of Families or Households	Total Population	Average Size of a Family or Households
1	Arghandab	13738	92874	6.84
2	Shahwali-kot	24747	200014	9.84
3	Arghandab and Shahwali-kot	38485	292888	8.92

4. Result and discussion

The electrical maximum demand, average demand, and load factor of selected districts are calculated in four seasons, the maximum load is calculated with the help of the load survey method. we consider one home and calculate the maximum load, average load, and load factor for this home over a 24-hour period. Average load and load factor are calculated from equations (1) and (2) for all season which are explained as follows:

$$ALPh = \frac{\sum d}{24 \text{ hours}} \quad (1)$$

$$Load\ factor = \frac{\text{Average load}}{\text{Max demand}} \quad (2)$$

4.1. Spring season

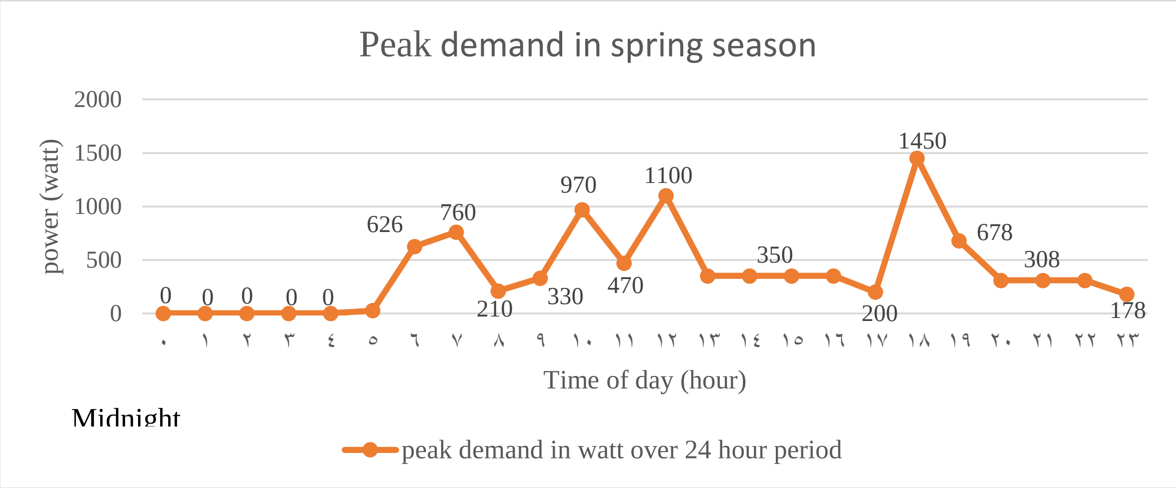

Fig. (2). Maximum load in spring season.

Table. (2). Maximum load, average load and load factor in spring season

No #	Name	Watt per hour
1	Maximum load	1450 W/h
2	Average load	388 W /h
3	Load factor	0.27 or 27%

4.2. Summer season

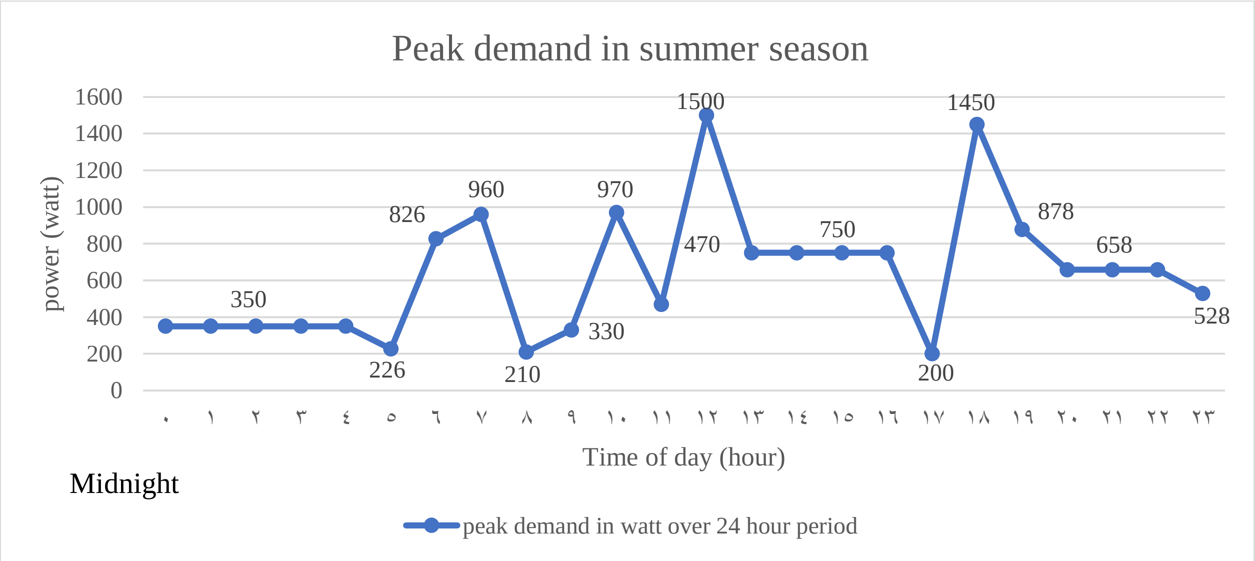

Fig. (3). Maximum load in summer season.

Table. (3). Maximum load, average load and load factor in summer season.

No #	Name	Watt per hour
1	Maximum load	1500 W/h
2	Average load	636 W /h
3	Load factor	0.42 or 42%

Academic Journal of Research and Scientific Publishing | Vol 4 | Issue 47
Publication Date: 05-03-2023 ISSN: 2706-6495

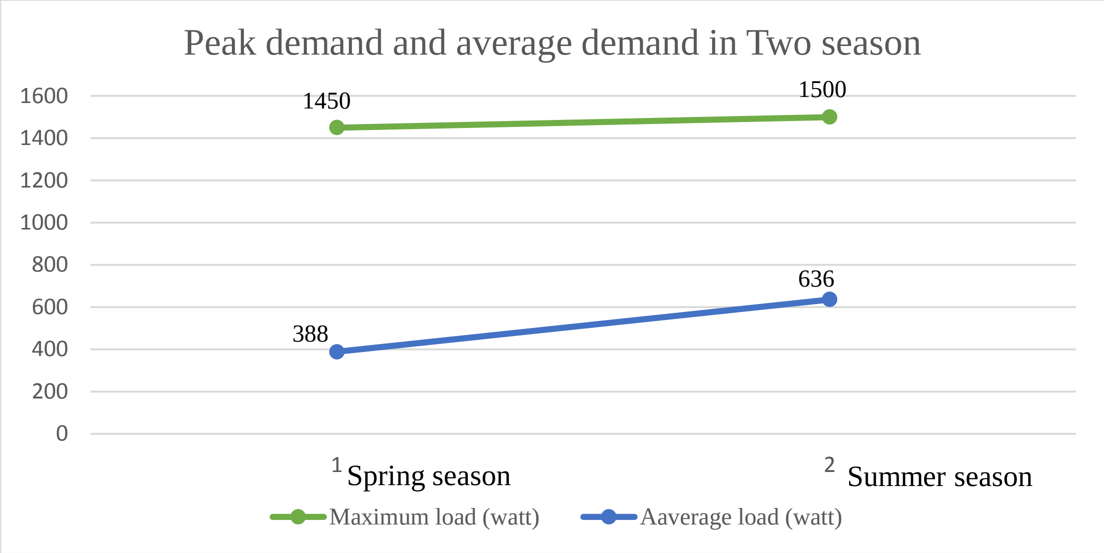

Fig. (4). Comparative representation of maximum load and average load in two seasons.

Table. (4). Comparative representation of maximum load, average load and load factor in two seasons.

No #	Name	Spring season	Summer season
1	Maximum load	1450 W/h	1500 W/h
2	Average load	388 W /h	636 W/h
3	Load factor	0.27 or 27%	0.42 or 42%

4.3. Fall season

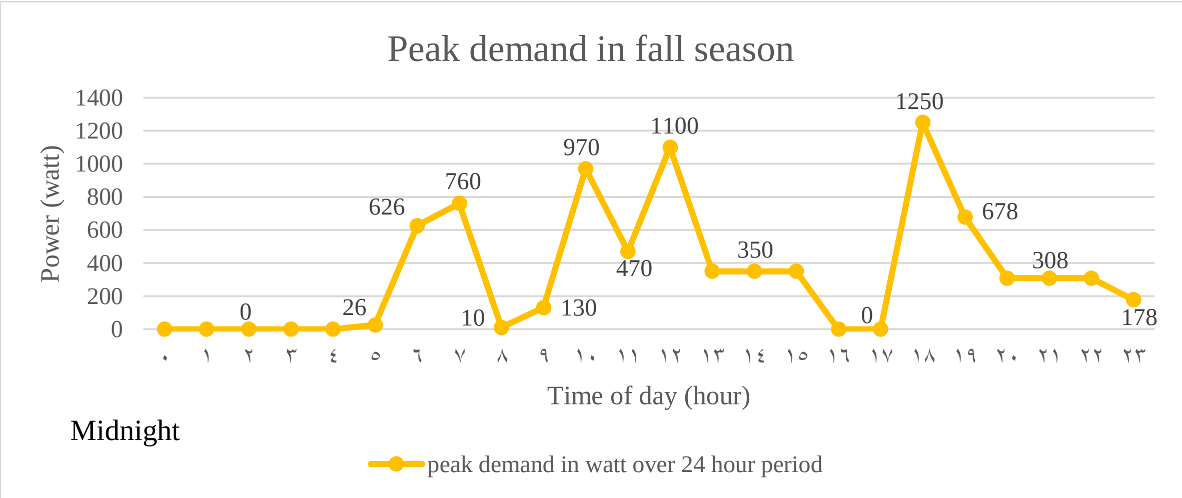

Fig. (5). Maximum load in fall season.

Table. (5). Maximum load, average load and load factor in fall season.

No #	Name	Watt per hour
1	Maximum load	1250 W/h
2	Average load	340.5 W /h
3	Load factor	0.27 or 27%

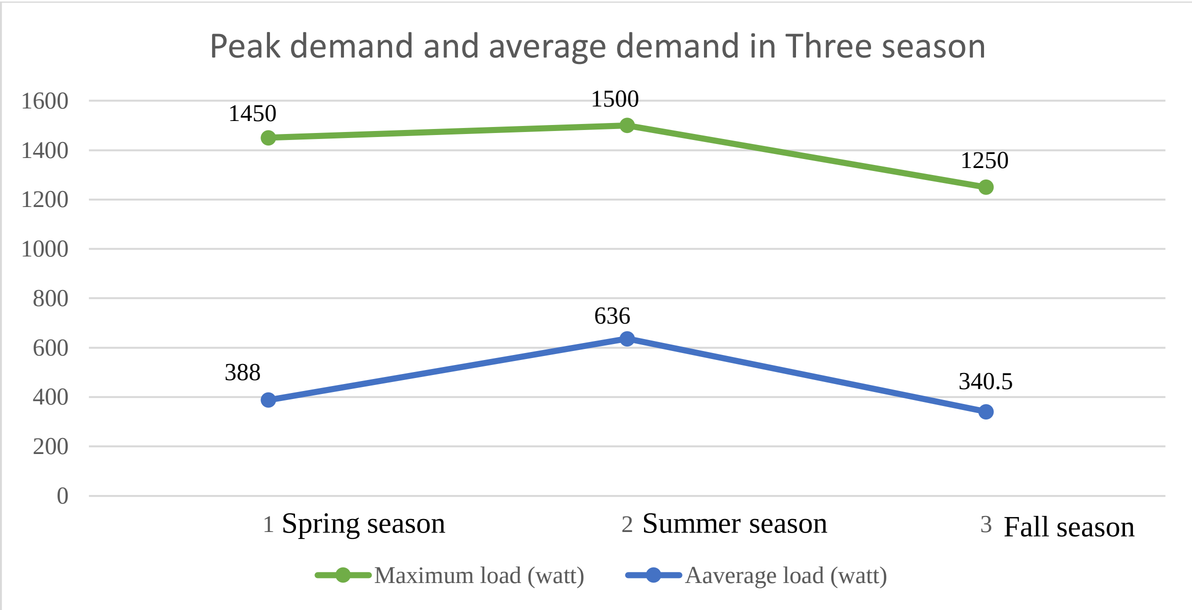

Fig. (6). Comparative representation of maximum load and average load in three seasons.

Table. (6). Comparative representation of maximum load, average load and load factor in three seasons.

No #	Name	Spring season	Summer season	Fall season
1	Maximum load	1450 W/h	1500 W/h	1250 W/h
2	Average load	388 W /h	636 W/h	340.5 W/h
3	Load factor	0.27 or 27%	0.42 or 42%	0.27 or 27%

4.4. Winter season

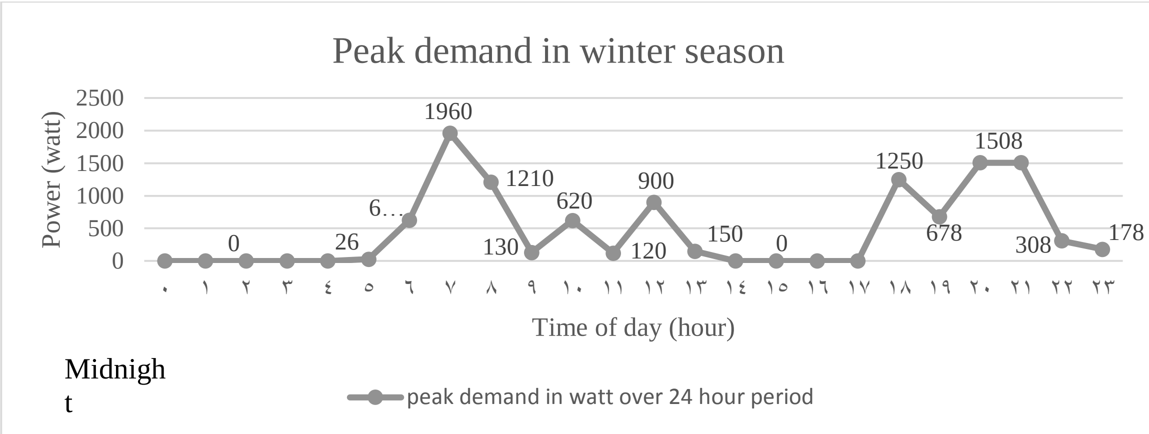

Fig. (7). Maximum load in winter season.

Table. (7). Maximum load, average load and load factor in winter season.

No #	Name	Watt per hour
1	Maximum load	1960 W/h
2	Average load	465.5 W /h
3	Load factor	0.24 or 24%

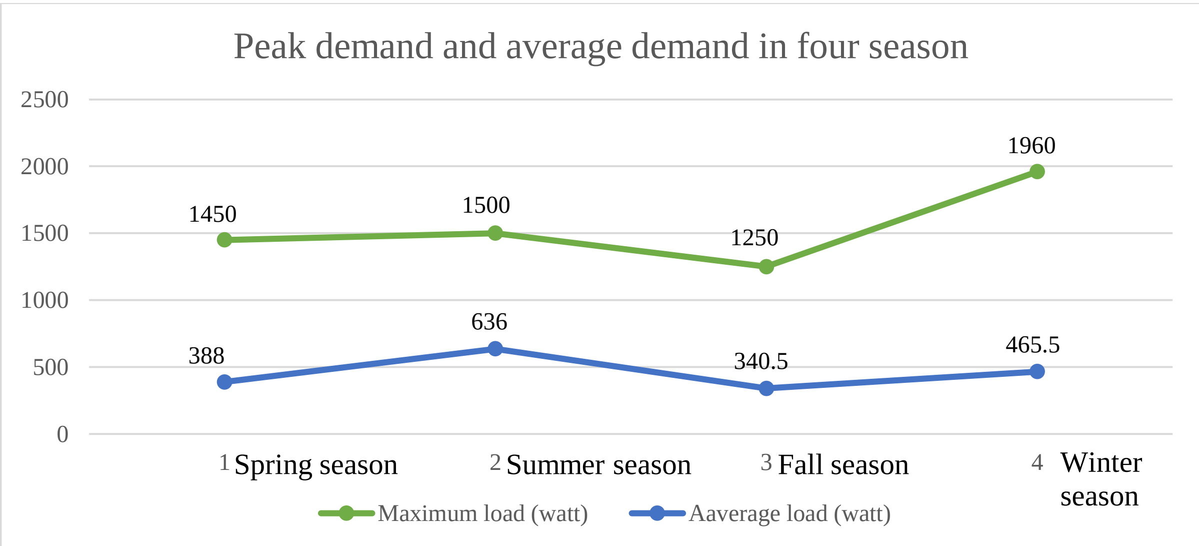

Fig. (8). Comparative representation of maximum load and average load in four seasons.

Table. (8). Comparative representation of maximum load, average load and load factor in four seasons.

No #	Name	Spring season	Summer season	Fall season	Winter season
1	Maximum load	1450 W/h	1500 W/h	1250 W/h	1960 W/h
2	Average load	388 W /h	636 W/h	340.5 W/h	465.5 W/h
3	Load factor	0.27 or 27%	0.42 or 42%	0.27 or 27%	0.24 or 24%

4.5. Annual Maximum demand, average load, load factor, and energy consumption of Arghandab and Shahwali-kot distracts.

In this step, the annual maximum demand, average load, load factor, and energy consumption are calculated with the help of data from the load survey method and formula of load for Arghandab and Shahwali-kot districts. Table.9 displays the average of maximum load, an average of average load, and load factor for a home in selected districts during the spring, summer, fall, and winter seasons. Table.10 shows the total number of families or households, total population, and average size of a family or households for the Arghandab and Shahwali-kot districts. Table.11 shows the total annual maximum demand, average load, and annual energy consumption for Arghandab and Shahwali-kot districts.

Table. (9). Average of maximum demand, average of average load and average of load factor in spring, summer, fall, and winter season for a home of selected districts.

No #	Name	Spring season	Summer season	Fall season	Winter season	Average of max, average load and load factor
1	Maximum load	1450 W/h	1500 W/h	1250 W/h	1960 W/h	1540 W/h
2	Average load	388 W /h	636 W/h	340.5 W/h	465.5 W/h	457.5 W/h
3	Load factor	0.27 or 27%	0.42 or 42%	0.27 or 27%	0.24 or 24%	0.3 or 3%

Table. (10). Total Number of Families or Households, Total Population, and Average Size of a Family or Households at Arghandab and Shahwali-kot districts.

No #	District Name	Total Number of Families or Households	Total Population	Average Size of a Family or Households
1	Arghandab	13738	92874	6.84
2	Shahwali-kot	24747	200014	9.84
3	Arghandab and Shahwali-kot	38485	292888	8.92

Table. (11). Total annual maximum demand, average load and annual energy consumption for Arghandab and Shahwali-kot districts.

No #	District Name	Total Number of Families or Households	Total Population	Average Size of a Family or Households	Average power consumption (MW)	Peak demand (MW)	Annual energy consumption (MWh)
1	Arghandab	13738	92874	6.84	6.29	20.92	55080.35
2	Shahwali-kot	24747	200014	9.84	11.33	37.69	99219.2
3	Arghandab and Shahwali-kot	38485	292888	8.92	17.61	58.62	144299.5

4. Conclusion

With the completion of this research, it was clear that the home energy consumption of the Arghandab and Shahwali-kot districts season by season. In the spring season, the maximum demand and average load for a home in this season were 1450 W/h and 388 W/h, respectively. In the summer season, the maximum demand and average load for a home in this season were 1500 W/h and 636 W/h, respectively.

In the fall season, the maximum demand and average load for a home were 1250 W/h and 340.5 W/h, respectively. In the winter season, the maximum demand and average load for a home were 1960 W/h and 465 W/h, respectively. And the annual energy consumption, maximum load, average load, and load factor for all households in Arghandab and Shahwali-kot districts at this time were 144299.5 MWh, 58.62 MW, 17.61 MW, and 0.3 or 30%, respectively.

Data Availability

Requests for access to these data should be made to the corresponding author via e-mail address: zainullahserat777@gmail.com

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Publication Date: 05-03-2023 ISSN: 2706-6495

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