CHAPTER 4

CONCLUSION

The conclusions of the analysis are presented in the following steps.

1. Graphs of daily consumption for each feeder and feeder combined.

For the separate analysis of each feeder, feeders 1 and 3, feeders 2 and 7 and feeders 6 and 8 appear to vibrate conversely. So, for better analysis we combined feeders (1+3), feeders (2+7) and feeders (6+8).

2. Summary of the numerical analysis of the daily consumption.

The distribution of all feeders combined are approximately symmetric and normal. Feeders (2+7) had the highest mean electricity uasge with 344,700 units/day. The maximum and minimum electricity usage was 455,600 and 244,600 units/day respectively. The lowest mean electricity usage was feeders (1+3) with 189,400 units/day. The maximum and minimum electricity usage was 231,300 and 150,000 units/day. In all feeders, the mean electricity usage was 762,200 units/day. The maximum and minimum electricity usage was 877,600 and 528,800 units/day respectively.

3. Comparison of the means of electricity usage between feeders and between days.

The variable Two-way Anova analysis shows that

3.1 The difference in mean electricity usage between feeders combined was significant (p- value=0).

3.2 The difference in mean electricity usage between days was significant (p- value=0).

4. Correlation analysis between feeders combined.

There are positive correlations between all feeders combined. The highest positive correlation occurs between feeders (1+3)-feeders (2+7) and the lowest positive correlation occur between feeders (1+3)-feeders (6+8) with values of 0.565 and 0.463 respectively.

5. Trend analysis of daily consumption.

Trend analysis of daily consumption showed that, for every feeders combined and all feeders, the usage increased from early in the year to peak in July and decreased again late in the year. In feeders (2+7) and (6+8), the electricity usage late in the year was similar to the usage early in the year. But in feeders (1+3) and all feeders, the electricity usage late in the year was greater than the usage earlier in the year.

The model for trend analysis of daily consumption are as follows.

5.1 Feeders (1+3)

$$y(t) = 1.64\text{x}10^5 + 368.9t - 0.9438t^2$$

The standard errors of the constant $1.64\text{x}10^5$ and the coefficient 368.9 and 0.9438 are1539, 19.29 and 0.05091 respectively. The efficiency of this model is 50.18 %.

5.2 Feeders (2+7)

$$y(t) = 3\text{x}10^5 + 686.6t - 1.813t^2$$

The standard errors of the constant $3\text{x}10^5$ and the coefficient 686.6 and 1.813 are 3294, 41.45 and 0.1094 respectively. The efficiency of this model is 43.46%.

5.3 Feeders (6+8)

$$y(t) = 1.787\text{x}10^5 + 784.7t - 2.111t^2$$

The standard errors of the constant $1.787\text{x}10^5$ and the coefficient 784.7 and 2.111 are 3965, 49.89 and 0.1316 respectively. The efficiency of this model is 41.53%.

5.4 All feeders

$$y(t) = 6.428\text{x}10^5 + 1840t - 4.868t^2$$

The standard errors of the constant $6.428\text{x}10^5$ and the coefficient 1840 and 4.868 are 5880, 73.99 and 0.1952 respectively. The efficiency of this model is 63.46%.

6. Comparison of the electricity usage between days.

6.1 Feeders (1+3)

The order of the days of the week from maximum to minimum electricity usage were.

Raw data: Tuesday, Saturday, Wednesday, Thursday, Friday, Sunday and Monday. The data were found not to be normally distributed and the p-value showed no significant differences at the 0.05 level of significance between each day's electricity usage.

Adjusted data: Saturday, Wednesday, Tuesday, Thursday, Friday, Sunday and Monday. The data were found to be normally distributed and the p-value showed significant differences at the 0.05 level of significance between each day's electricity usage.

6.2 Feeders (2+7)

The order of the days of the week from maximum to minimum electricity usage were.

Raw data: Wednesday, Thursday, Tuesday, Friday, Monday, Saturday and Sunday. The data were found not to be normally distributed and the p-value showed significant differences at the 0.05 level of significance between each day's electricity usage.

Adjusted data: Thursday, Wednesday, Tuesday, Friday, Monday, Saturday and Sunday. The data were found to be normally distributed and the p-value showed significant differences at the 0.05 level of significance between each day's electricity usage.

6.3 Feeders (6+8)

The order of the days of the week from maximum to minimum electricity usage were.

Raw data: Thursday, Wednesday, Monday, Tuesday, Saturday, Friday and Sunday. The data were found to be normally distributed and the p-value showed no significant differences at the 0.05 level of significance between each day's electricity usage. The data from feeders (6+8) was found to be normally distributed. So, it is not necessary to check outliers and repeat the analysis.

6.4 All feeder

The order of the days of the week from maximum to minimum electricity usage were.

Raw data: Wednesday, Thursday, Tuesday, Friday, Monday, Saturday and Sunday. The data were found to be normally distributed and the p-value showed significant differences at the 0.05 level of significance between each day's electricity usage.The data from all feeders was found to be normally distributed. So, it is not necessary to check outliers and repeat the analysis.

7. Development of a model of electricity usage by time series.

The following models to forecast electricity usage were obtianed from the analysis.

7.1 Feeders (1+3)

Fitting a quadratic model.

$$y(t) = 1674 + 3.555t - 0.009678t^2$$

The efficiency of this model is 69.87%.

Fitting a time series model.

$$y(t) = 1893+138.9\cos(at-2.967)+56.93\cos(2at+1.6)+0.2589\cos(52at+2.712)$$

The efficiency of this model is 70.74%.

7.2 Feeders (2+7)

Fitting a quadratic model

$$y(t) = 3009 + 6.994t - 0.01893t^2$$

The efficiency of this model is 58.19%.

Fitting a time series model

$$y(t) = 3446+233.4\cos(at-3.003)+137.9\cos(2at+2.969)+1.764\cos(52at-2.592)$$

The efficiency of this model is 58.83%.

7.3 Feeders (6+8)

Fitting a quadratic model.

$$y(t) = 1727 + 8.628t - 0.02317t^2$$

The efficiency of this model is 65.54%.

Fitting a time series model.

$$y(t) = 2277+277\cos(at+3.037)+188.2\cos(2at-2.969)+2.578\cos(52at-2.85)$$

The efficiency of this model is 66.20%.

7.4 All feeders

Fitting a quadratic model.

$$y(t) = 6365 + 19.64t - 0.05279t^2$$

The efficiency of this model is 79.43%.

Fitting a time series model.

$$y(t) = 7610+655.1\cos(at-3.099)+337.7\cos(2at+2.998)+6.177\cos(52at-2.834)$$

The efficiency of this model is 79.47%.

From the analysis, the efficiencies of both models are similar. Using quadratic regression analysis it was found that, in of the models the electricity usage increased from early in the year to peak in July, and then decreased again later in the year. Using time series analysis it was found that, in all feeder models the electricity usage had two peaks in April and September. Being a fishing community, Pattani has a lot of number of fishing industries and using electricity to process fish. During September the fish population increases and so more fish are caught and processed. Pattani is classified as having a tropical wet climate. It is located on the east coast of the Southern region of Thailand on the Malay Peninsula. The hot season covers the months from January to May with April being the hottest month, according to national climate statistics. The use of air-conditions and fan may explain this increase in electricity usage in April. For each feeder combined, in feeder (6+8) which covers a high population density and a lot of industries areas, the peak of electricity usage in September more than peak in April. While, in feeder (2+7) the electricity usage peak are similar between April and September. But in feeder (1+3) which covers a low population density and the electricity usage is mostly for lighting areas, the electricity usage have one peak in April to May.

Recommendations

The results from the analyses in this report do not clearly demonstrate trends in electricity usage. In order to improve the predictive value of the analysis with respect to electricity usage, future studies should look to obtaining time series data for every hour over a period in excess of one year in each province of interest.