Chapter 5

Conclusions and Future Research

5.1 Main Conclusions

Electricity demand characteristics analysis for Japan context is presented in this research. Regression-based seasonal models are proposed to reveal more detail demand characteristics for two major demand areas in Japan namely residential and commercial. The models are constructed to investigate how the implemented variables influence differently electricity demands under certain periods. As a mainly driver variables, meteorological parameters are used in models. Besides, existing holidays is also considered. Selecting proper variables especially for temperature functions is an important step in developing models for each season. Some options for models are calculated and assessed to find better models by using standard statistical tests including their validation. Regression equations of demand models are calculated by EViews 6.

The implementation of regression-based seasonal models are quite effective in the studied demand areas. Obtained regression coefficients and statistics provide specific information regarding direct link between applied variables and observed demands. Beside quite easy in constructing models, elimination of non-significance variables which can simplify related models gives another advantage such as reducing computational burden. From results, more information concerning characteristics of the demand areas can be revealed through the proposed models which are validated well. The function of variables in models to explain situation of the demands runs well. In residential area, the fitness degree of seasonal models (summer, autumn, winter, and spring model) are fairly good as indicated by obtained adjusted coefficient of determination $R^2$ values above 71%. Although characteristics are quite vary for each place and season, responses of residential demand in the three places to the driver variables show similar tendency generally. All implemented
variables have significance in the models excluding humidity $RHD$ in winter. Among meteorological variables, $CDD$ and $HDD$ influence highest demands for residential area in each season. The coefficient value for $CDD$ is relatively high under hot season periods, meanwhile for $HDD$ is under cold periods. Relating to holidays, demands in each season will decrease.

For commercial area, more detail demand characteristics can be derived by proposed half-year and seasonal models. It is obtained optimum $T_{ref}$ value related to demand may change by periods which tends to high under hot weather periods, and vice versa. The $R^2$ values which varies above 81% implying that variables affect commercial demand differently in each period. The applied variables can explain the demand optimally in hot rather than in cold weather. For base demand, it is relatively higher in cold than in hot season periods. Among meteorological parameters, $CDD$ and $HDD$ are the most significant variables. Next, holidays will cause demand decreases in all periods but in difference amount.

For characteristics comparison between areas, response of demands for residential and commercial areas to the same explanation variables tend to similair in the same season. Implemented variables not only have important contribution to demands, but also they have significance difference to both areas which vary in values generally. Thus, $CDD$, $HDD$, $RHD$, and / or $DH$ are essential load drivers in the studied demand place. The variables can explain better commercial demand than residential for each season. However, variables influence much residential demand rather than commercial demand as shown by coefficient values of models. An essential aspect in the characteristics comparison between areas, that is determining variables that have distinguishing power is considered. It is conducted by applying seasonal testing models as basis in examining variables in models for comparison analysis. As more information for each area can be revealed through the models, more completed and clearer characteristics comparison between areas can be achieved as expected.
5.2 Future Research

This section provides the opportunities for future research in this area as follows:

Firstly, as a demand driver, meteorological conditions are relatively different in each city (region) in Japan. Investigation demand characteristics for other different cities can be done for future research as an effort to find seasonal characteristics of Japanese electricity demand completely. Secondly, volume of electricity demand is possibly influenced by many kinds of explanation variables in one place including in Japan. As demand characteristics investigation presented in this research are mainly correlated by meteorological parameters, introducing other variables in the model such as demographic variables is visible for future study. Collection of additional variables data can be a challenge.