

Energy consumption measurement survey for commercial buildings in Japan - The existence of stand-by electricity

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1. SYNOPSIS

The energy consumption survey in office buildings reveals existence of huge stand-by electric load. This fact implies potentiality of energy saving in office buildings.

2. BACKGROUND OF SURVEY

Lack of Database on Energy Consumption in Commercial Sector in Japan

A number of surveys on energy consumption in the commercial sector in Japan have been conducted. However, detailed statistical database covering all business type in commercial sector is not yet built. Although energy consumption in office buildings accounting for about 20% of total energy consumed in the commercial sector can be grasped according to energy consumption reports for each building, the energy consumption data by type of end-use can not be obtained accurately. This present status implies necessity of detailed survey for database building.

3. MEASUREMENT SURVEY FOR OFFICE BUILDING

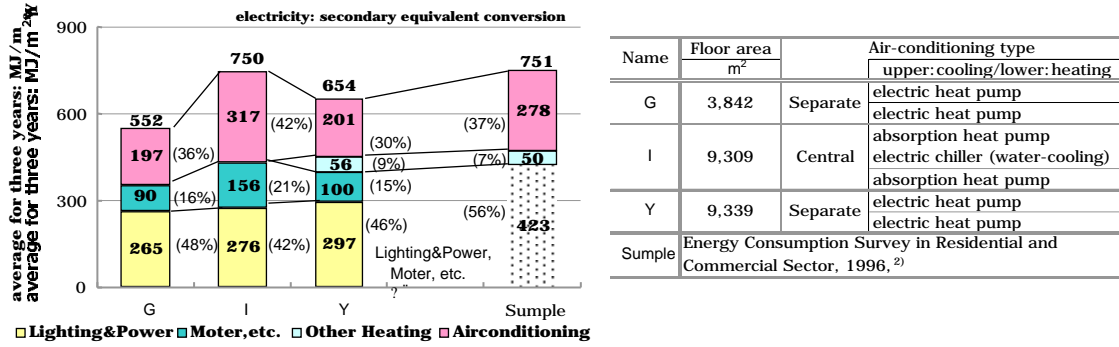
The measurement surveys and energy consumption report surveys have been conducted on three buildings from October 1999 to November 2000.

Energy Consumption in Survey Buildings

Figure 1 shows the energy consumption per floor space for three buildings (G, I and Y). The electricity consumption data was obtained from measurements and energy other than electricity from energy consumption reports. Almost identical amount of energy is consumed for power & lighting in each building (265~297MJ/m²Y), which accounts for about 45% of total energy consumption.

Similar amount of energy (200MJ/m²Y) is used for air-conditioning in building G and Y. Building I though consumes one and a half time as much energy for air-conditioning (317MJ/m²Y) as building G and Y. Air-conditioning energy consumption for building I accounts for 42% of the overall energy used in the building, while the corresponding numbers are 36% for G and 30% for Y. This large amount of energy consumption for air-conditioning in building I can be attributed to the utilisation of a central air -conditioning system which is difficult to control according to the different condition of each area.

Figure 1. Energy consumption per floor space in three buildings



4. NOCTURNAL ELECTRICITY CONSUMPTION FOR UNSPECIFIED END-USE IN OFFICE BUILDING

Measurement surveys revealed the existence of 20kW of electric load during nighttime. Figure 2 shows hourly electric load for power and lighting use (excluding emergency light) in building Y. This unspecified electric load can be regarded as stand-by power in office equipment.

Figure 2. Power & lighting Hourly Load Curve (Building Y)

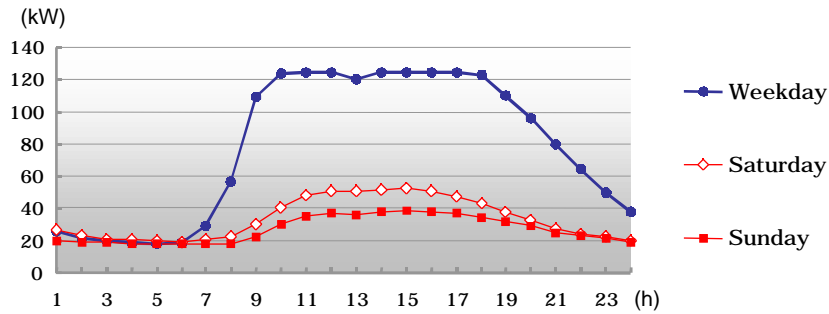
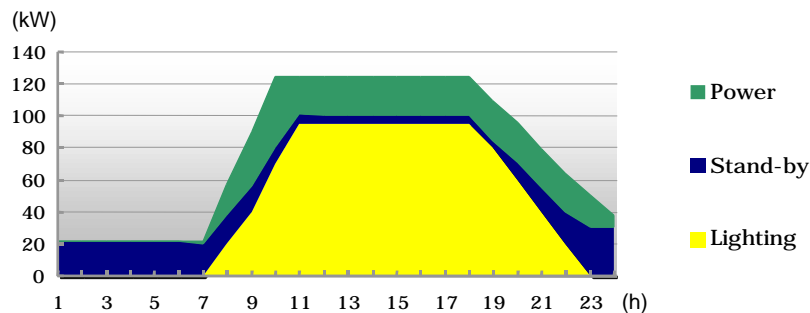


Figure 3 shows a thumbnail of stand-by power hourly load. Lighting load, can be presented as a trapezium in yellow, since lighting equipment does not generally contain stand-by power and lighting load rises sharply as the office opens and decreases gently as the office closes. On the other hand, stand-by load of OA equipment, presented as an area in blue, decreases gradually as office workers start their machine up when they come up to the office and then increases gently as they turn their machine off when they finish work.

Figure 3. Stand-by Hourly Load Curve Model (Building Y)



This model would make estimation on stand-by electricity consumption easier and more accurate. Simulation using this model and measurement survey results should be comparatively analysed hereafter. Accordingly, survey and database building for energy consumption in the commercial sector including office buildings are sine qua non to bring up potentiality in energy saving.

5. BIBLIOGRAPHY

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