Investigation of the behavior of executors to optimize the evaluation of energy and indoor environment in buildings

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1. Background and objectives

Basic aspects to realize Zero Energy Buildings (ZEB: a building in which the net annual primary energy consumption is zero or approximately zero) include the elemental technologies, such as the improvement of the performance of outer shells and the use of facilities with advanced functions in addition to the reduction of internal heating (including the energy conservation of OA devices). Internal heating is given in the design of regular air-conditioning systems as the intensity per floor area. The conventional intensity is simply set with one meaning depending on the purpose of a given room; thus, it is not suitable for designs that take into account the energy conservation of OA devices. Hence, the design of air-conditioning systems to achieve ZEB requires a method to flexibly and reasonably set the amount of heat generated from OA devices.

The amount of heat generated from OA devices is affected by the maintenance status and how the devices are used; thus, it is likely to differ depending on business types even when devices are used for similar purposes. References about the actual uses of these devices are scarce, however, and the examination of methods to set the amount of heat generation requires the gathering and organization of fundamental information.

Therefore, this study investigates how OA devices are maintained and used in offices and prepares fundamental references to come up with a method to set the amount of heat generated from OA devices by taking into account the differences in the utilization behavior of users in different business types for the purpose of applying outcomes to air-conditioning systems aiming to achieve ZEB.

2. Outline of the investigation

In FY 2017, the author studied the literature and references to organize information concerning the maintenance status and utilization of OA devices. The author also conducted a survey about the maintenance status and categorized office spaces into three types ([1] clerical work, [2] research, professional, engineers, and [3] retail and sales) depending on business types where OA devices were used. The author then investigated the number of OA devices used, number of seats (desks) by business types, total floor area, and seat (desk) occupancy rate by hours (table 1). Twenty-six businesses responded to this study, and the author is now organizing the responses (figure 1).

3. Future perspective

The author is planning to analyze the correlation between the number of devices and individual elements (number of seats (desks), total floor area, and the component of business types which use office spaces) and organize the findings as a fundamental reference for examining methods to set the amount of heat generation.

Table 1. Outline of the investigation

Method of investigation	Distribution of survey forms by mail	
Number of surveys distributed (number of responses returned)	45 cases (26 cases)	
Investigated room	Office space ([1] clerical work, [2] research, professional, engineer, [3] retail and sales)	
Investigation category	Basic information	Name of company/organization, attribution of respondent, business type
	Information of the room	Number of seat (desks) by business types, total floor area, seat (desk) occupancy rate by hour
	Number of OA devices in the room	Multipurpose device, copy machine, scanner, fax, printer, shredder, telephone, desktop PC, laptop PC, PC monitor, desk lamp, projector, server, router, charger for tablets, charger for mobile phones, vending machine, coffee machine, tea server, water server, refrigerator, electric pot, electric kettle, microwave, television set, humidifier, air purifier, fan, electric heater

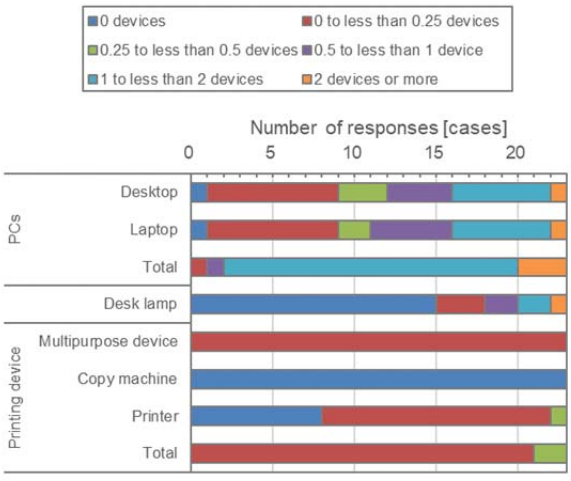

Figure 1. Number of OA devices per seat (desk) ([2] research, professional, engineering [23 cases])