Behind the energy-use figures

The BRANZ Building Energy End-use Study (BEES) recently examined the energy use of a group of randomly selected commercial buildings with some surprising results.

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COMPARING THE ENERGY use of different buildings is often done using energy use intensity (EUI) - the annual total energy purchased by that site, divided by the assigned floor area.

The EUI allows any load-driven variation to show up when comparing premises of different sizes - size usually being the largest determinant of energy-use differences between premises.

Expected energy use

Historical data indicates that the energy use of a typical New Zealand commercial building is 100-300 kWh/m²/yr. This is consistent with NZS 4220:1982 *Code of practice for energy conservation in non-residential buildings*, which specifies an energy consumption target of:

- 100 kWh/m²/yr for new office buildings
- 200 kWh/m²/yr for existing office buildings.

Some much higher or lower

However, the randomly selected buildings chosen for BEES show a much wider distribution of EUIs, with some much lower and some much higher than previously measured.

BEES analysed some of the highest and lowest EUI premises to determine the characteristics of these buildings that caused such low or high energy use per square metre. Six premises with anomalously low EUIs (under 50 kWh/m²) and five premises with anomalously high EUIs (over 300 kWh/m²) were analysed (see Figure 1).

Operational factors make the difference

Virtually all the differences in energy use can be explained by the operation of the premises.

Previous EUIs in the 100-250 kWh/m² range were generally from relatively large offices operating a consistent number of hours each week with relatively well controlled space conditions - temperature, illuminance and air quality.

The BEES buildings with anomalously low EUIs were smaller, occupied by fewer people for less hours and were poorly space conditioned.

The premises with anomalously high EUIs were invariably associated with food handling such as cooking and refrigeration - their high process loads caused the high energy use. Even some of the high EUI premises had poor space conditions.

Better refrigeration could save costs

Several high EUI premises had refrigeration systems operating for long hours to achieve the desired conditions (see Table 1). Causes may include poor control or poorly insulated storage areas. Refrigeration looks to offer opportunities for significant energy savings.

Overnight energy use also appeared to be higher than required, suggesting opportunities for improved energy efficiency, whether by improved controls or replacement with more efficient equipment.

These findings emphasise the importance of well running and suitable appliances.

Retail highest and lowest premises

Interestingly, the high and low EUI premises carried out retail activities - there were no office premises.

Offices are being looked at separately within BEES to understand their main energy drivers and the opportunities for energy efficiency measures. Analysis to further understand heating, ventilation and air-conditioning (HVAC) energy use of buildings will be released in a BEES report during 2013.

A previous BEES report (BRANZ Study Report 260/3) has already shown the opportunities for reducing lighting energy use in buildings. ◀

For more ▶ Download BRANZ Study Report 277/3 at www.branz.co.nz.

In short

- Energy use intensity (EUI) normalises the energy use of the premises by floor area to allow comparisons between different sized premises.
- The premises' operation was the greatest influence on EUI.
- The high and low EUI premises in BEES were retail, not offices.
- Poor space conditions were found in the low EUI premises and many of the high EUI premises.
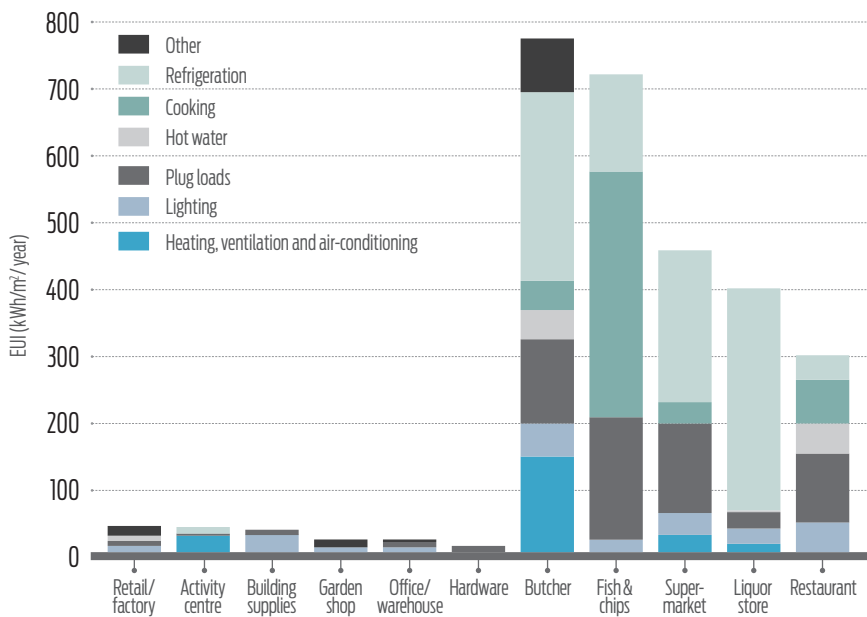

Figure 1: Energy use intensity by load type.

Table 1

REFRIGERATION LOADS

NAME	USE	REFRIGERATION EUI (kWh/m²)	HOURS OPERATING PER YEAR (FLH/year)	HOURS OPERATING PER DAY (FLH/day)
High 2	Liquor store	334	4,673	12.8
High 5	Butcher shop	285	4,632	12.7
High 3	Supermarket	228	5,819	15.9
High 4	Fish and chips	145	6,264	17.2
High 1	Restaurant	42	5,310	14.5
Low 5	Activity centre	10	2,917	8.0