

TOWARDS LOW-ENERGY OFFICE BUILDINGS IN SINGAPORE

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Introduction

Building energy saving potential has always been an interest to industry

The challenge is to really unlock the latent saving in the building asset.

Any performance below the benchmark would imply that improvement effort could be directed into the certain building system or element per se so as to help the building to attain the possible energy efficiency level.

A holistic approach, by means of a total building performance (TBP) process, could truly help to give your stakeholders' greater value.

A subject that is spoken since 1970s energy crisis.

Stocktaking of progress and development:

where are we now?

Are we in the right direction?

What is in the future for us?

What should we be doing?

Focus

Energy benchmark & classification

Designing towards low-energy office buildings

The energy benchmark and classification during use will add vital credibility to the predictions, that major energy savings and environmental benefits can be achieved in the building sector.

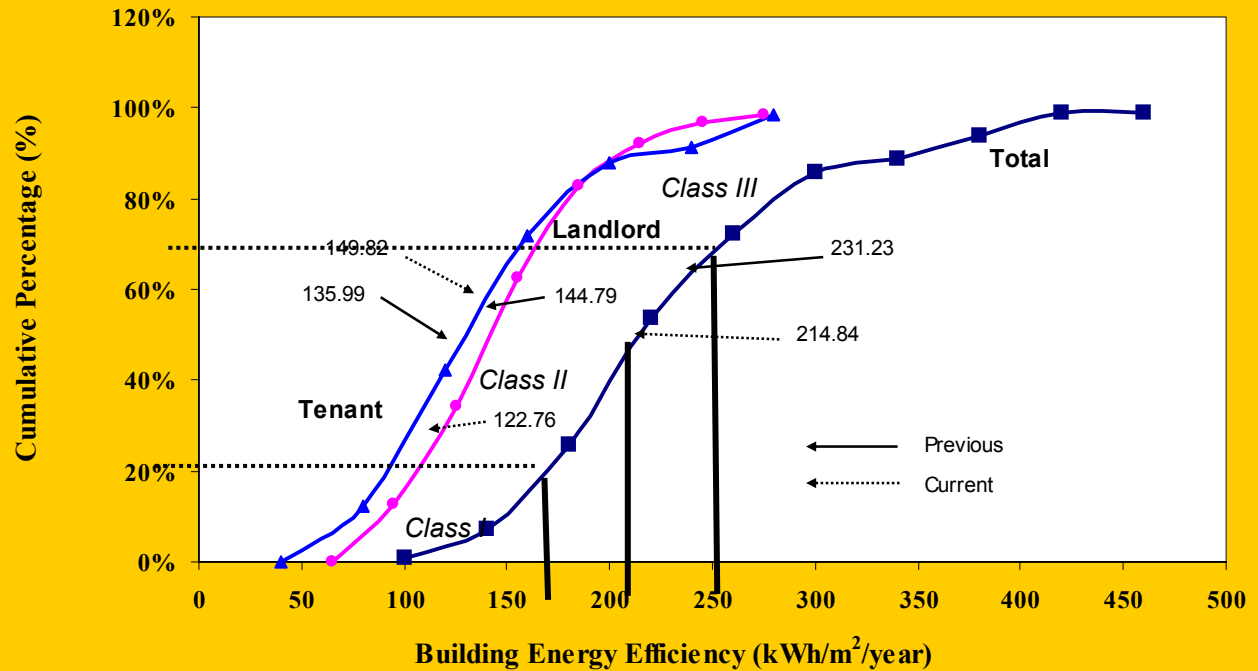
Demonstrate integration of the best energy efficiency measures, optimised towards achieving the overall best cost/effective solution.

A sustainable energy efficiency benchmark for office buildings has met considerable success at the joint CTBP-PREMAS energy project.

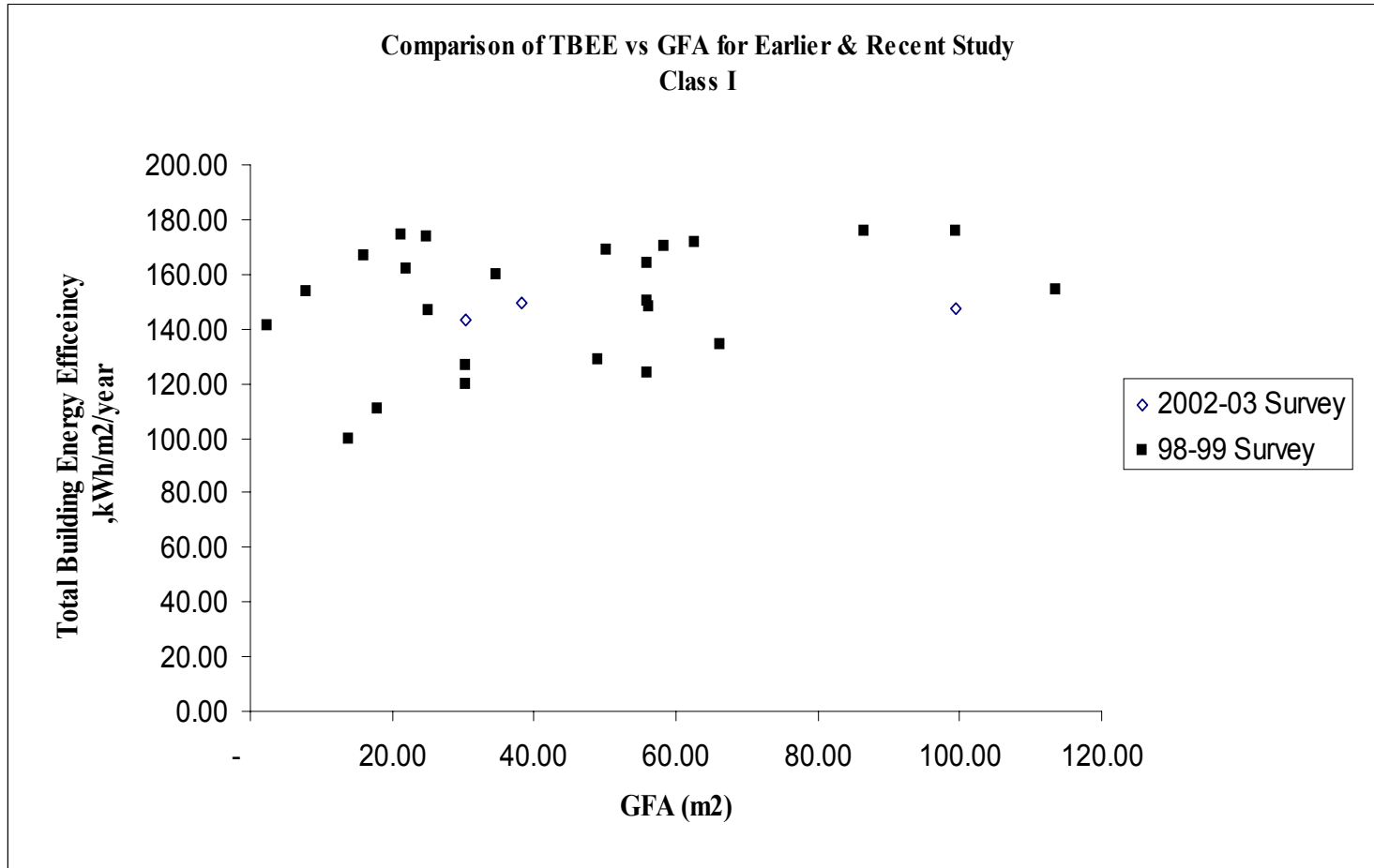
This energy benchmark classification allows the office building owners to know how their buildings will fare on comparison to the performance benchmark – not only at the whole building level, but the ability to profile the different energy-consuming equipments and space utilization type.

Comparison of building energy efficiency between current and previous studies

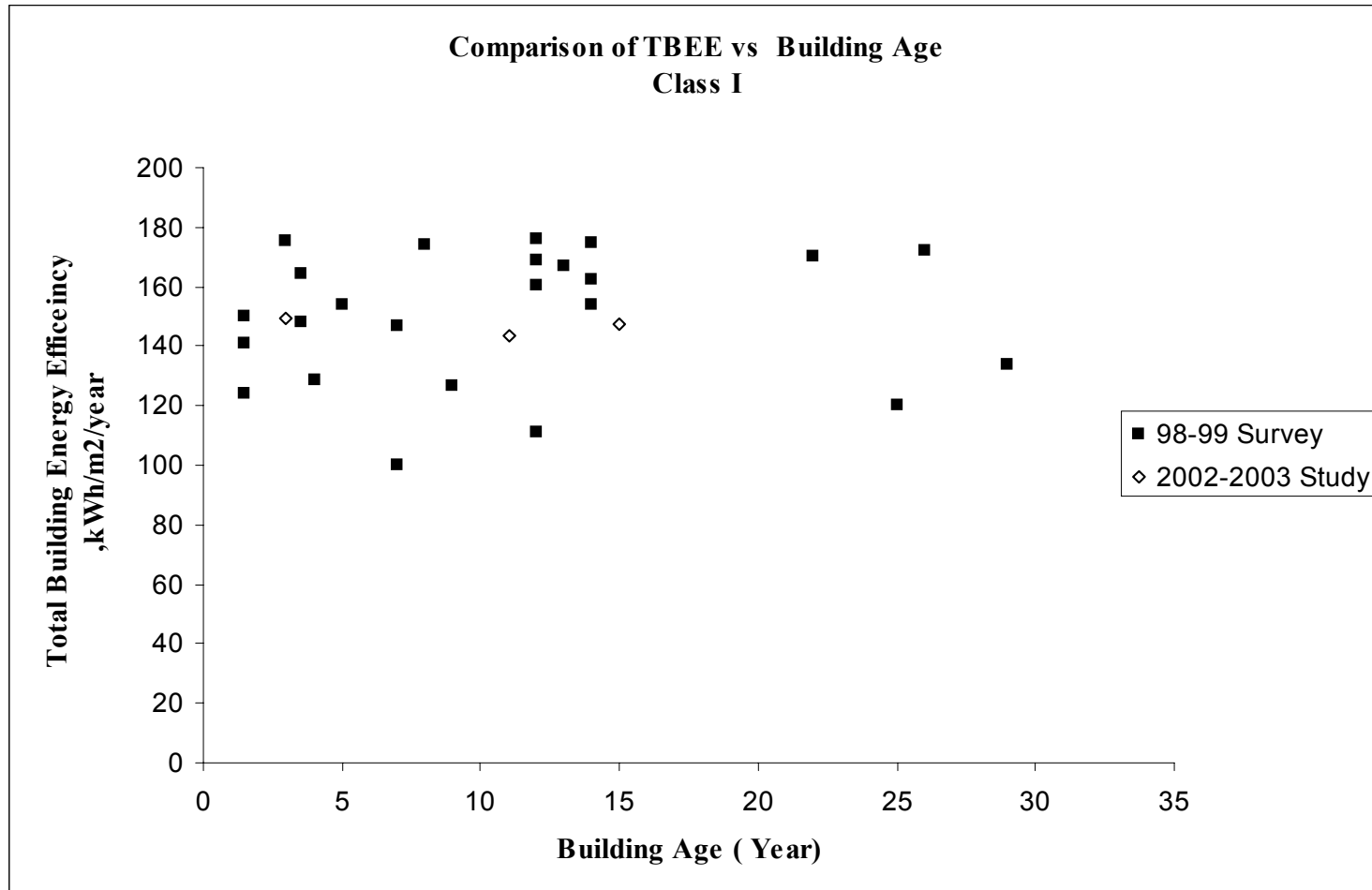
Building Energy Efficiency Ogive Curves

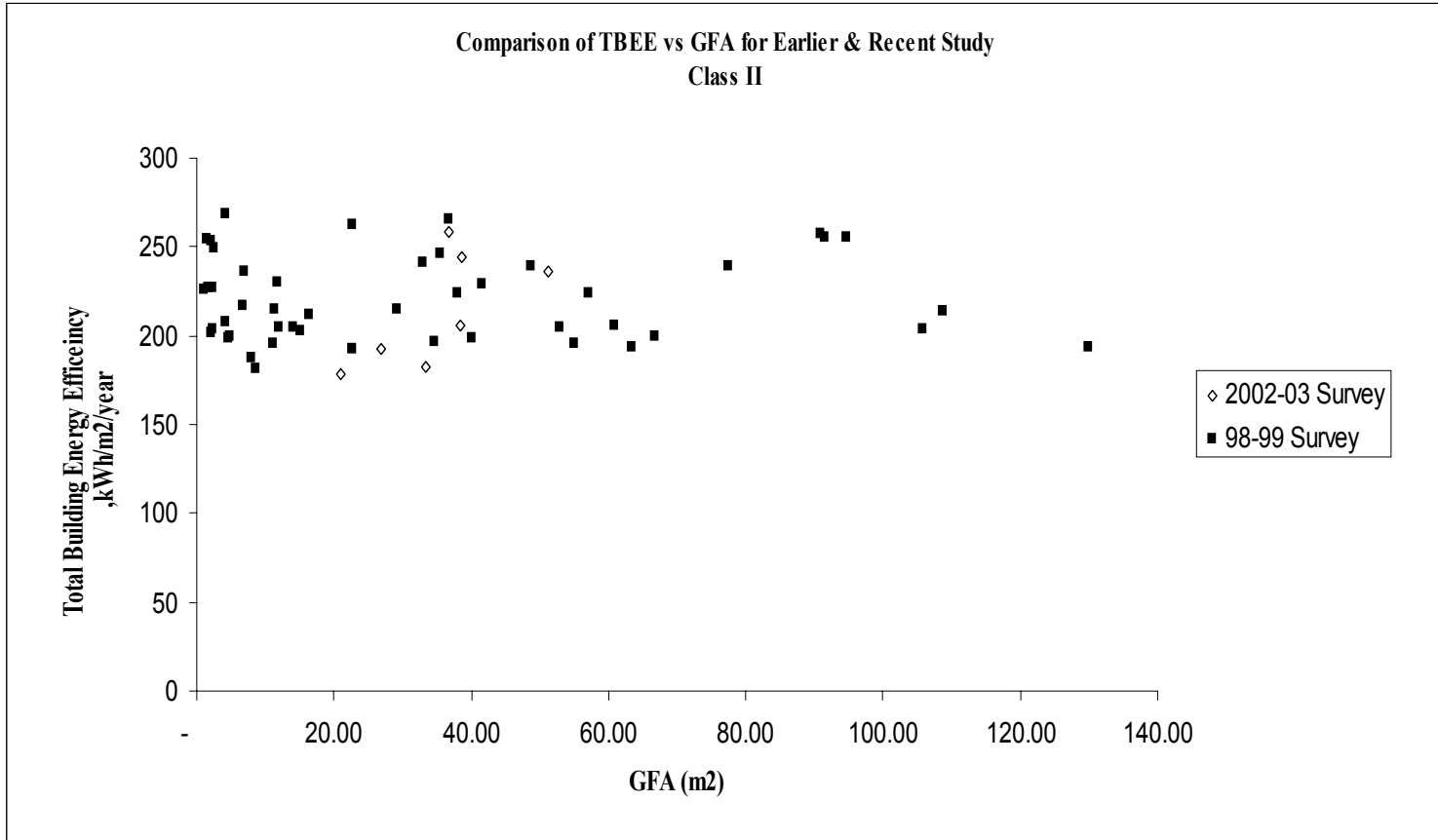


Validity of
benchmark
values

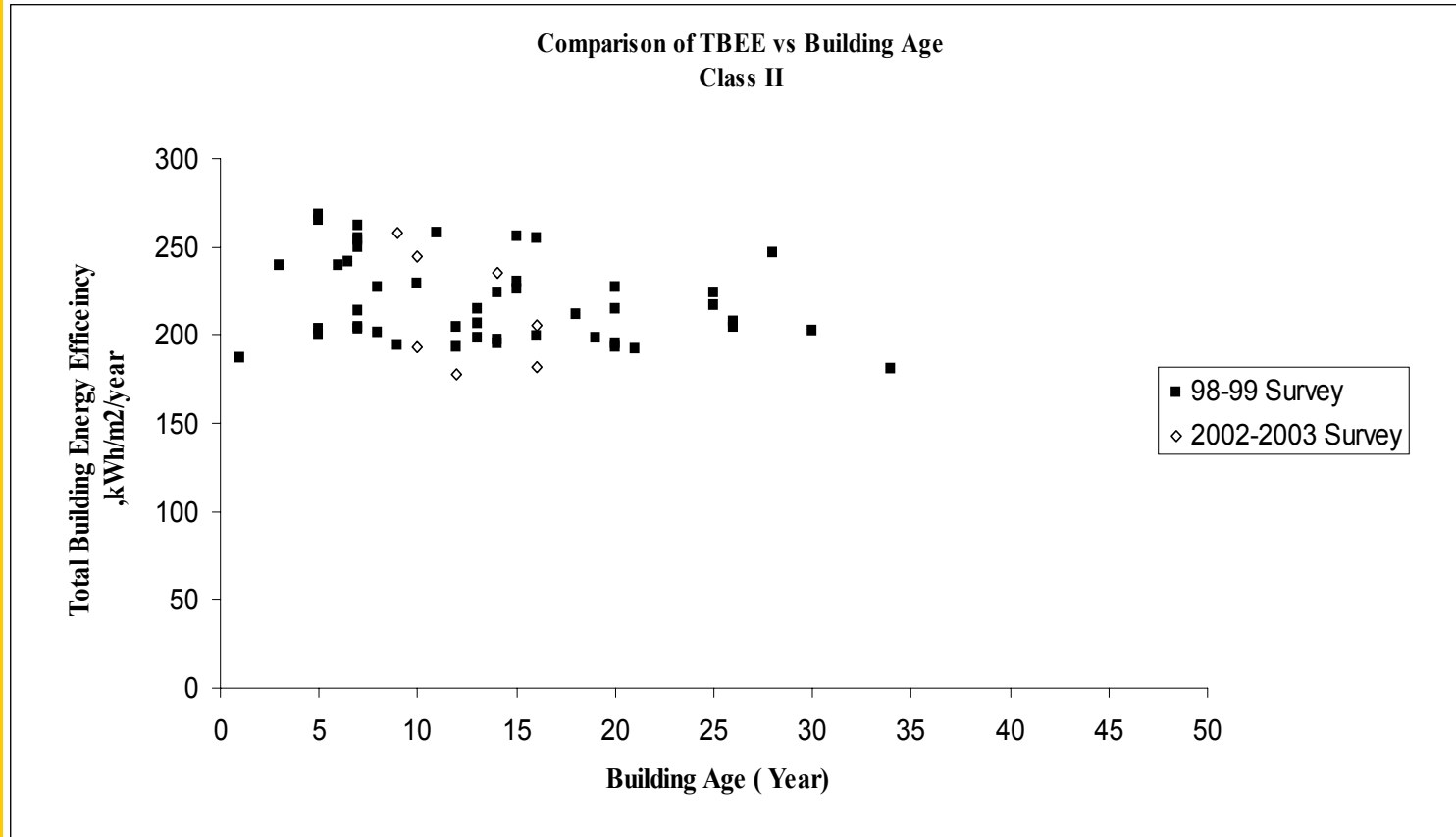


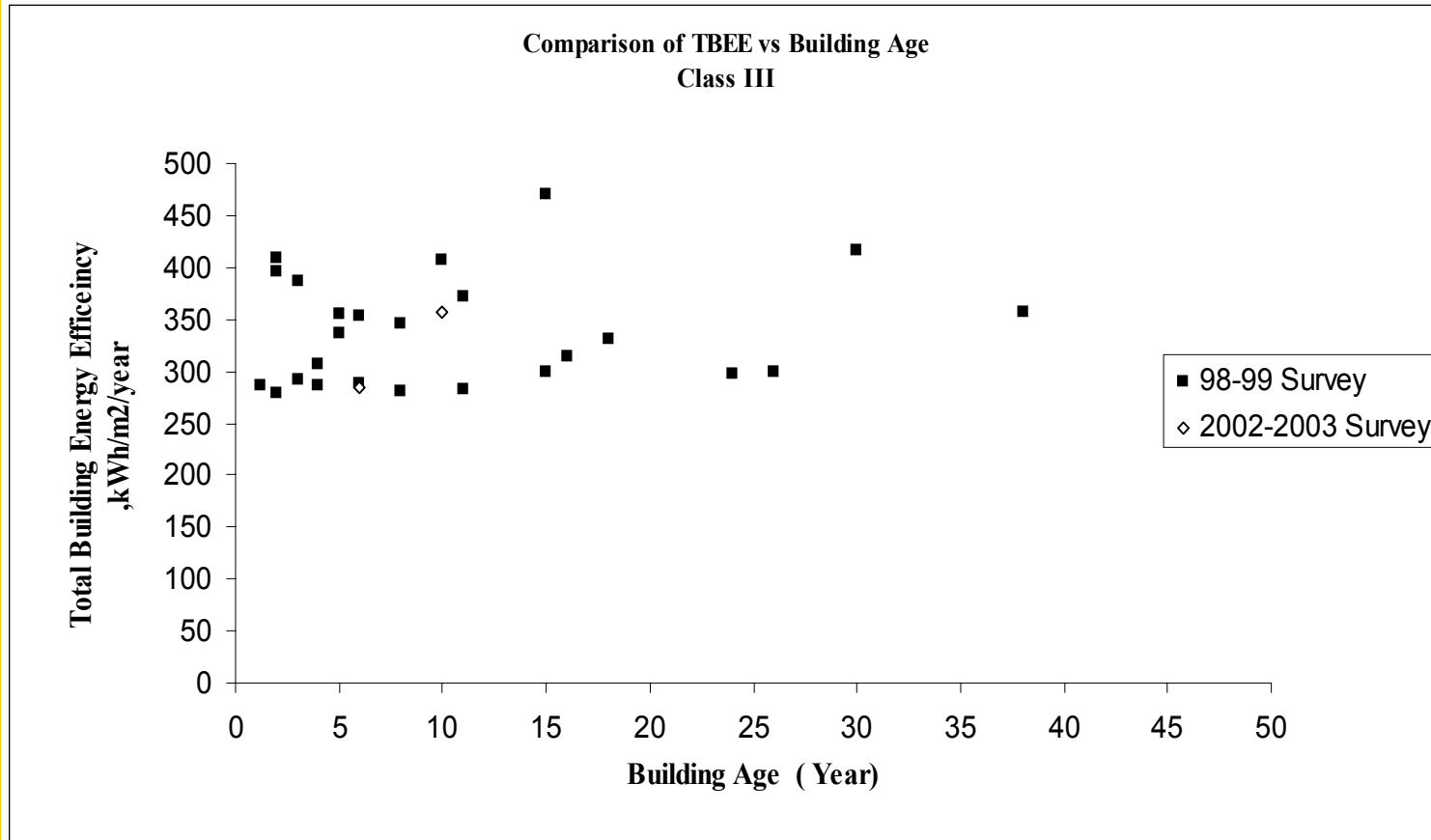
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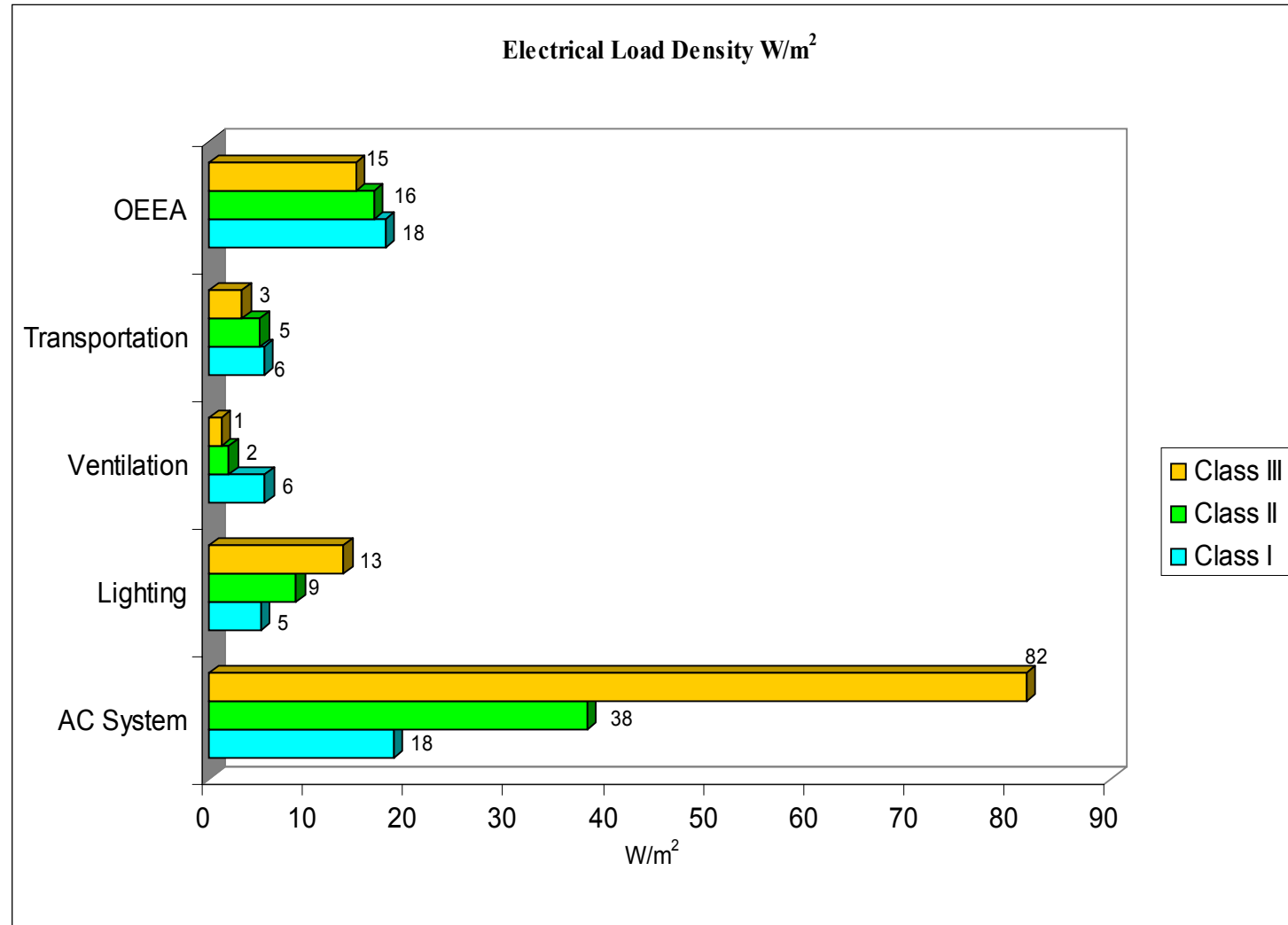


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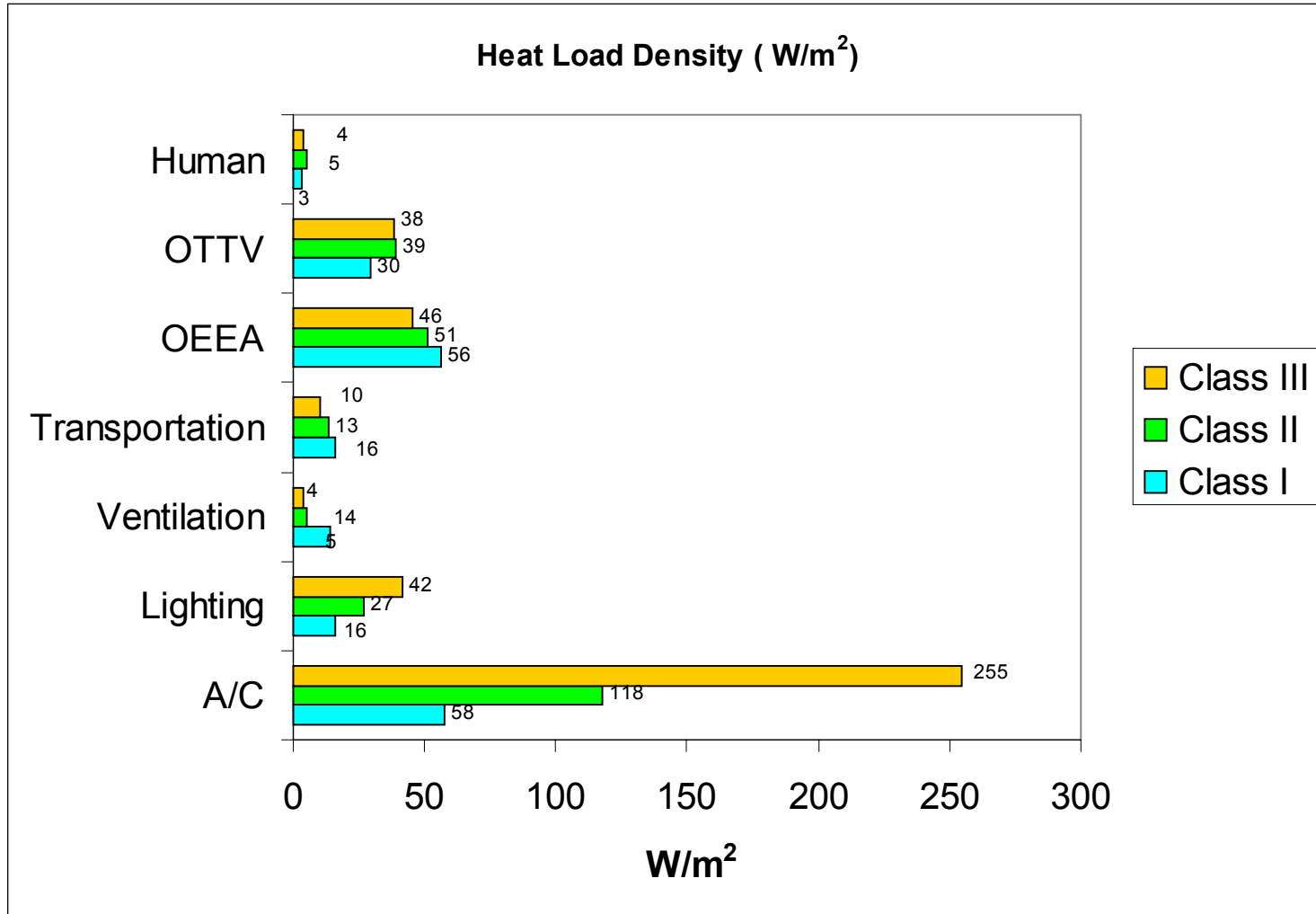




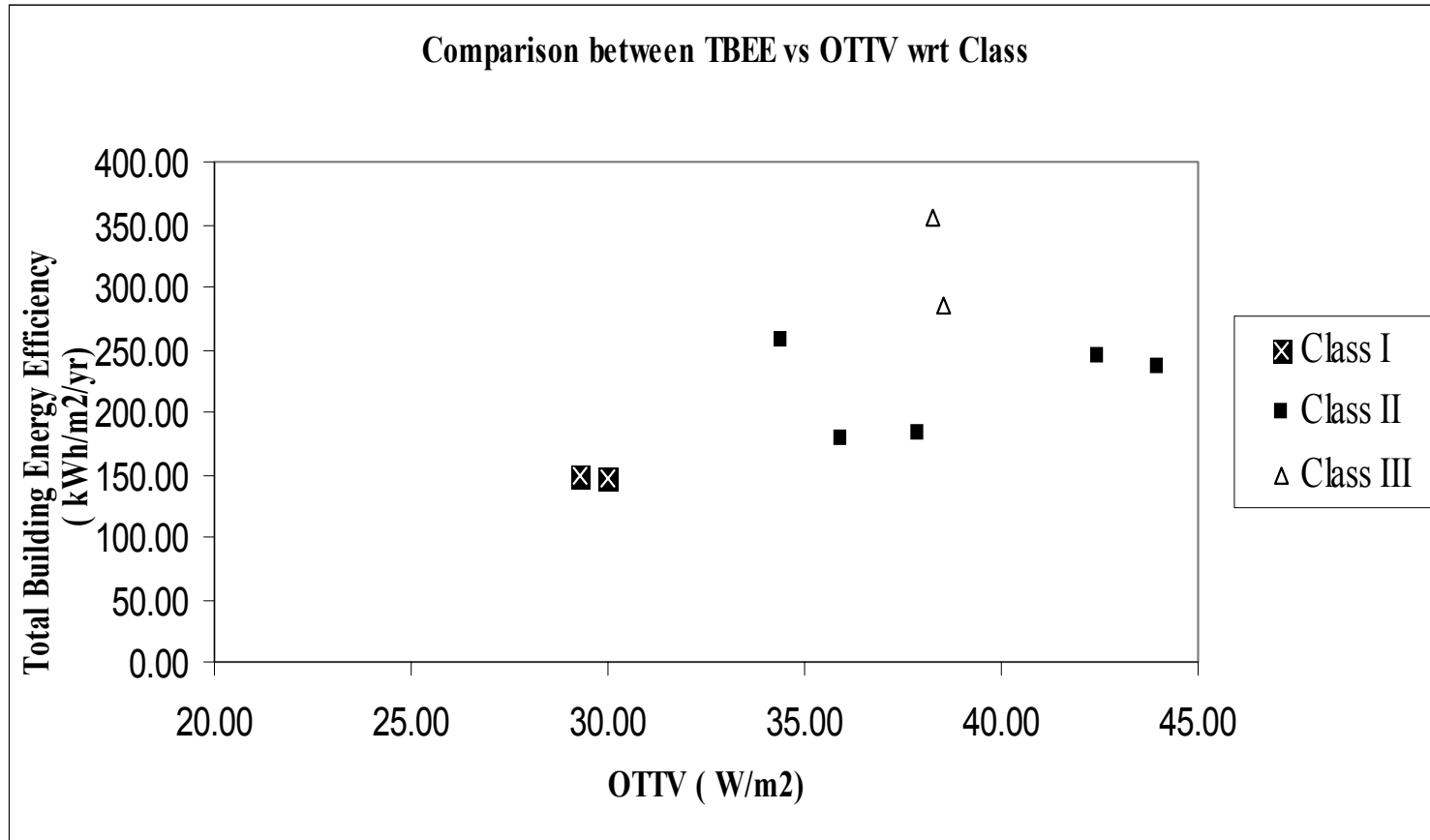
Profiling
electrical load
density



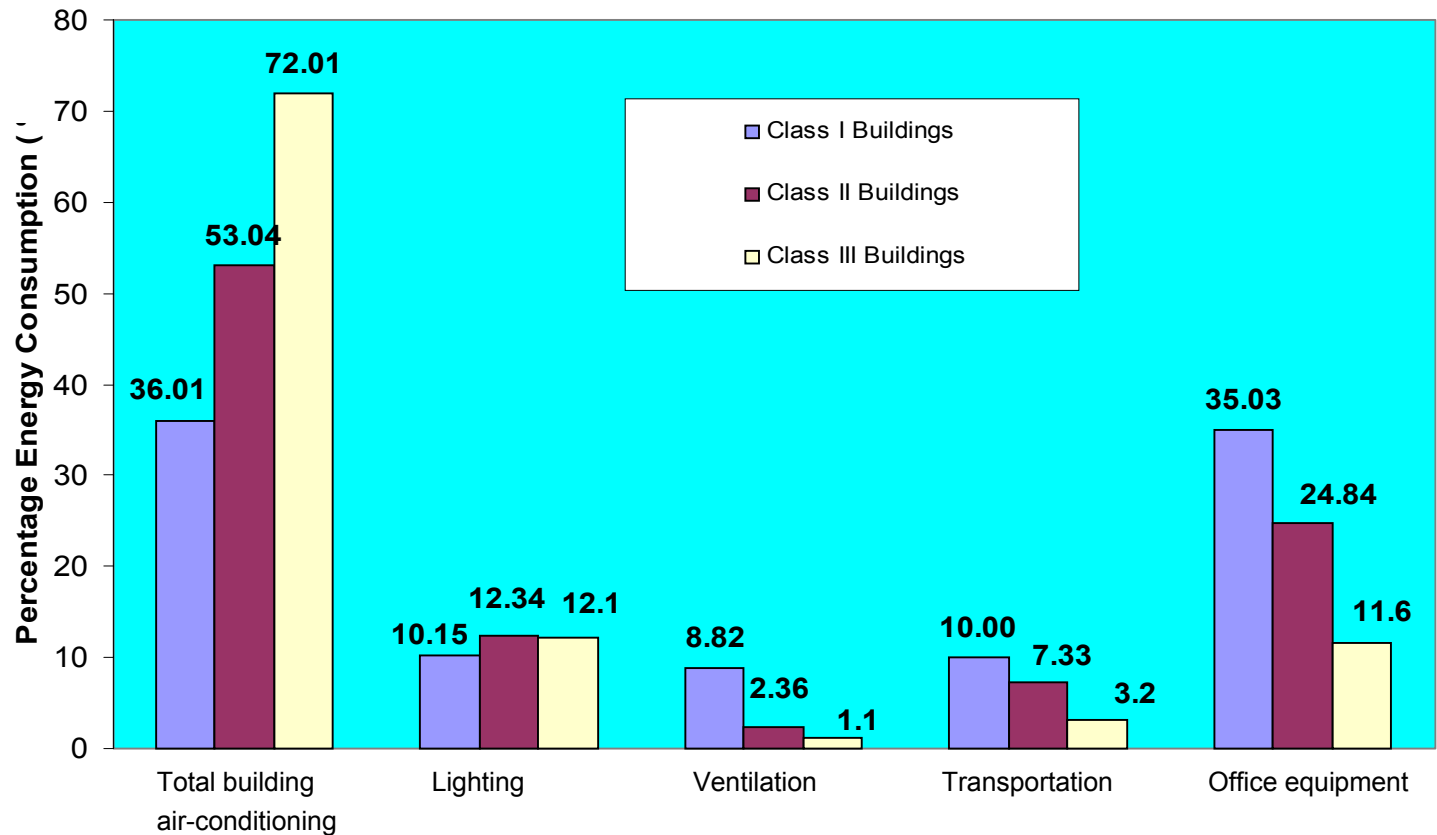
Profiling
heat load
density



Significance
of OTTV on
TBEE



Building energy consuming equipment energy consumption in the total building energy consumption excluding car park for 3 different class buildings



1. Creation of a green environment around and on roof of the building
 - Vegetation (sky-garden) helps to reduce heat transfer (lower U-value) into building, thus reducing the cooling load
2. Building orientation, with preference to south and north facing windows, where solar heat is less than for other orientations.

Expected to contribute to achieving the goal of low energy office buildings are:

1. A well insulated building facade and building roof
 - Transmissivity, reflectivity, absorptivity, emissivity, shading coefficients and air changes per hour for openings / fenestrations
 - Thermal capacity and conductivity for interior
2. Shading device
 - Shields the indoor occupants & content from direct solar gain, while tapping daylight.

3. Energy efficient space planning

- design of service core (double-sided, single-sided, central)
- space layout
- shape of building
- size of floor plate and floor-to-ceiling height
- space division
- provision of building services (AC, lighting, others)
- Provision of amenities

1. Energy Efficient office equipment
 - Prioritise the ones that deserve attention according to business need
 - less heat load will lead to less cooling demand and in turn lower electricity consumption

 2. Mechanical equipment (lighting, lift, ACMV, office equipment)
 - design efficiency (right sizing, and redundancies measure vary from building to building)
 - actual performance
- e.g. energy efficient cooling system, where the air volume for each building zone is controlled individually using ventilation demand control strategy

1. Maximise use of diffuse daylight and use of high efficiency lighting, controlled according to daylight availability and occupancy.

1. Implementation of an Energy Management System
 - lighting and air-conditioning comfort condition at least energy costs
 - lift monitoring system
 - ventilation control strategy

2. Operation schedules
 - number of hours per week, setpoints, external climate condition, occupancy load, start-up period, shut-down period, standby mode.

Best practices are goal within reach, and the steps are

Step 1: Passive design – environment and the building shell

Step 2: Active design – right-sizing and redundancies measure

Step 3: Mixed mode design - flexibility and adaptability

Step 4: Operation and management

Low energy office buildings should be measured in terms of economic lifespan using LCC approach.

Construction items – a basket of goods – allocation of resources using value engineering approach to decide the envelope system, interior system, mechanical system and structural system

Cost benchmark – it is not necessarily to spend more on new building development. It is a question of right resource allocation and selection criteria.

Existing buildings
– a dilemma or
an opportunity?

For existing buildings, owners spend money on facelift, toilets, other aesthetic impression. It is a commercial decision to draw tenants.

There are still room for energy efficient measures – selection of materials, choice of lighting, spatial layout, interior design, how to cool the space concerned.

Facility manager and energy manager are useful here.

For buildings that need significant work on the environment, it is not unusual for M & E systems to be upgraded.

Performance contracting is likely the way to convince building owners that there are indeed true opportunities in unlocking latent dollar values

Next Milestone

Low-energy office building is the next leap forward.

Conclusion

ASEAN Energy Focus - better energy efficiency best practices

Opportunities are plenty

Tropical building design – a novel product –
pace setting – new benchmark – new rules of
engagement

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