Method to Identify Building Energy Index (BEI), NET BEI, GFA, NFA, ACA in several projects in Malaysia since 2000 (including KeTTHA and agencies)

Malaysian Green Technology Corporation

(GreenTech Malaysia)

PREVIOUSLY KNOWN AS PUSAT TENAGA MALAYSIA

fendi@greentechmalaysia.my

www.greentechmalaysia.my

Sustainable Energy Development Authority (SEDA) Malaysia

steve@seda.gov.my

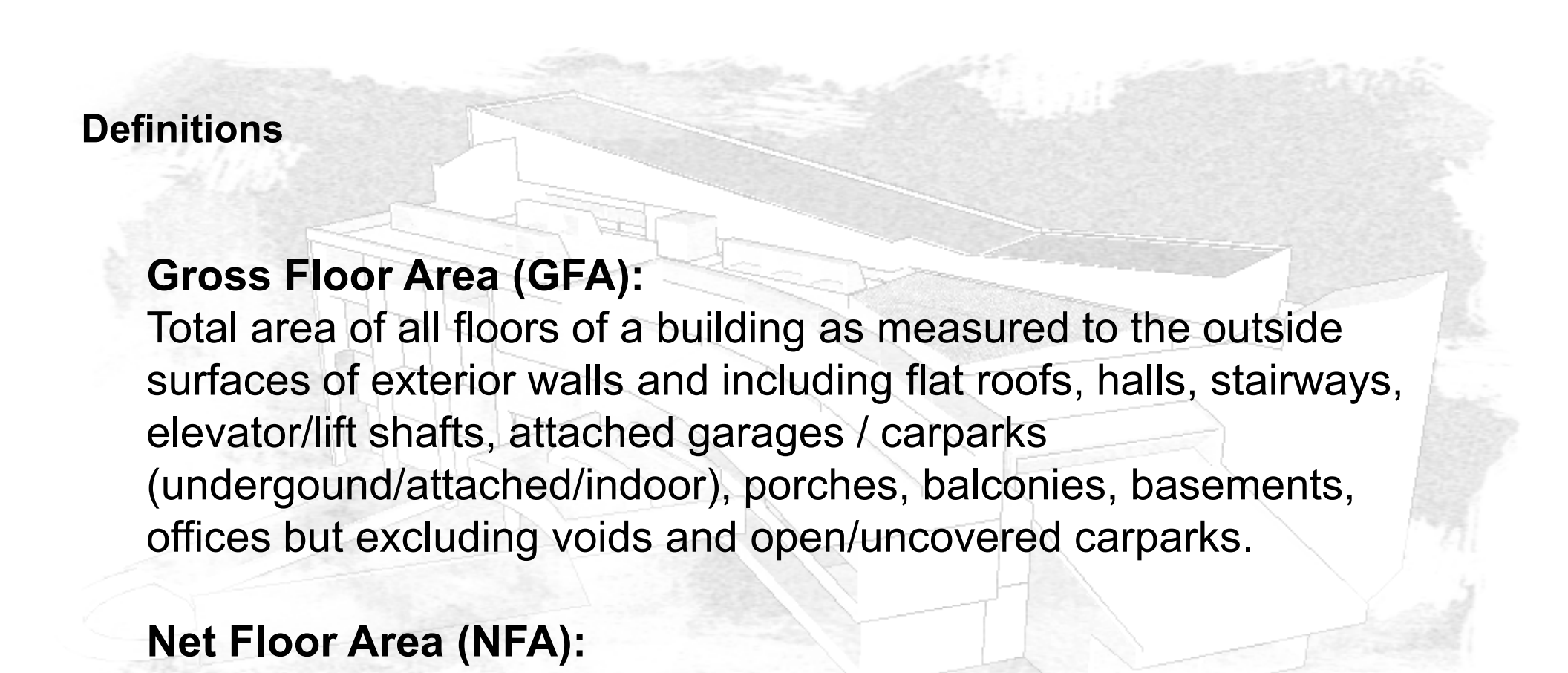
www.seda.gov.my

May 2013

Building Consumption Input System

Definition
Gross Floor Area (GFA),
Net Floor Area (NFA),
Air-Cond Area (ACA)
Building Energy Index (BEI)
Net Building Energy Index (Net BEI)

Definitions

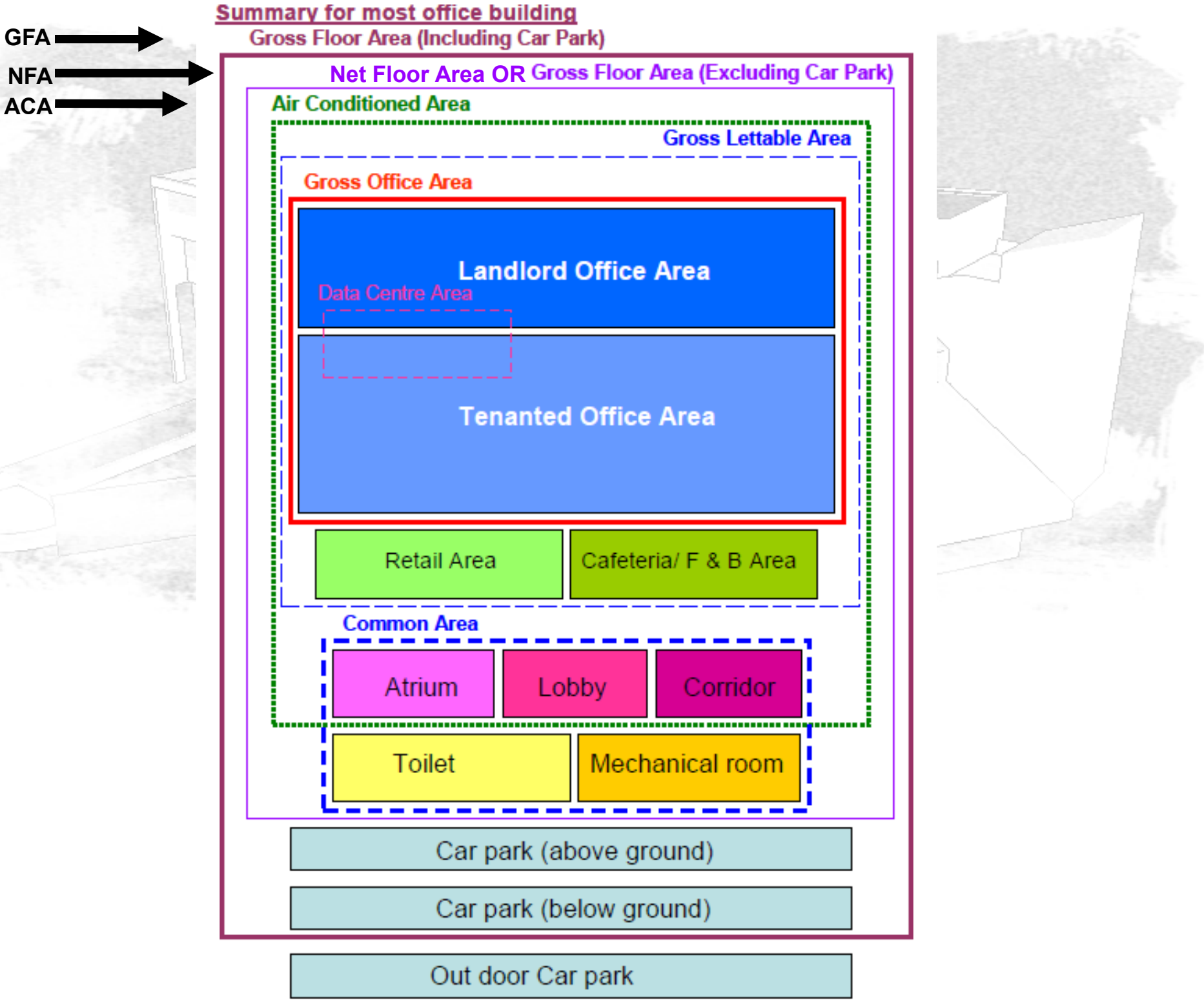


Gross Floor Area (GFA):
Total area of all floors of a building as measured to the outside surfaces of exterior walls and including flat roofs, halls, stairways, elevator/lift shafts, attached garages / carparks (undergound/attached/indoor), porches, balconies, basements, offices but excluding voids and open/uncovered carparks.

Net Floor Area (NFA):
Also called Net-Usable Area or Occupied Area. ***Gross Floor Area excluding Carparks & External Corridor***; the area included in surrounding walls of a building e.g offices, stores, meeting rooms, risers, internal porches etc, or portion thereof.

Air Cond Area (ACA):
is Net-Floor Area which has air conditioning/ cooling spaces excluding toilet (for some buildings) and M&E rooms.

Source: EAEF – Office Building Energy Benchmarking Project



Source: EAEF – Office Building Energy Benchmarking Project

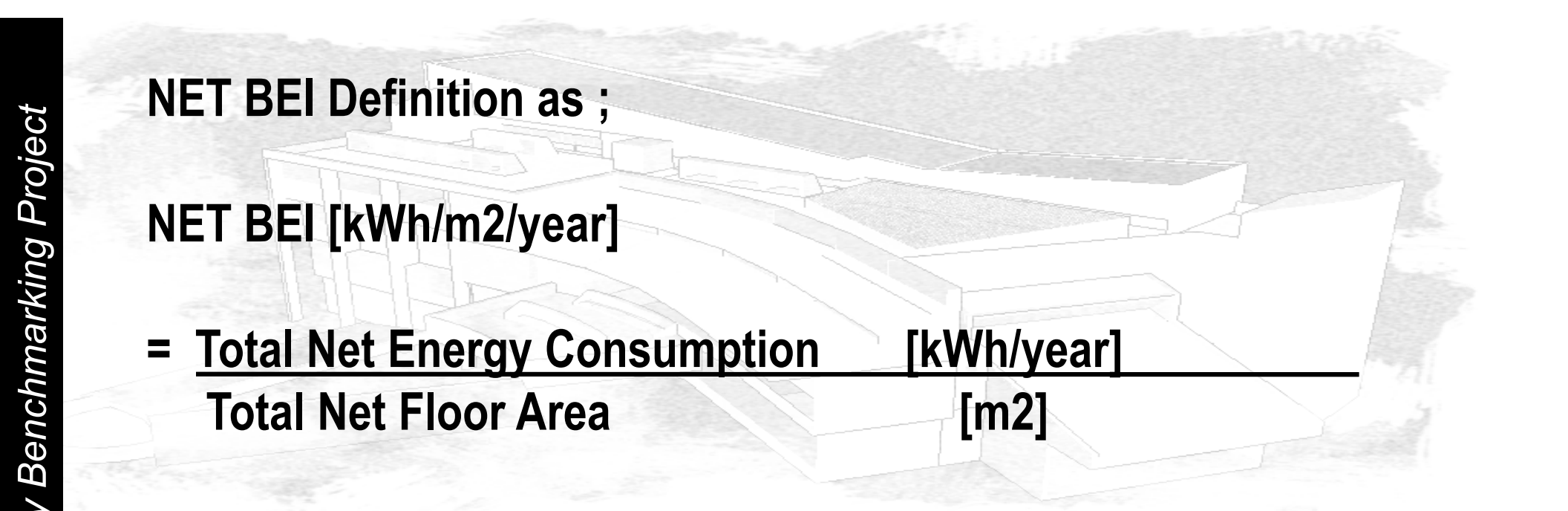
BEI Defination as ;

Building Energy Index (BEI) [kWh/m2/year]

$$= \frac{\text{Total Energy Consumption a year [kWh/year]}}{\text{Total Occupied or Net Floor Area [m2]}}$$

Total Energy Consumption is defined as total energy of electricity (or electricity equivalent) consumed by the building in kWh per annum.

- **All energy consumed by the Gross Floor Area (occupied and unoccupied in building including energy for ICT.**
- **Excluding energy produced by Renewable Energy.**



NET BEI Definition as ;

NET BEI [kWh/m2/year]

$$= \frac{\text{Total Net Energy Consumption} \quad [\text{kWh/year}]}{\text{Total Net Floor Area} \quad [\text{m2}]}$$

Total Net Energy Consumption is defined as total energy of electricity (or electricity equivalent) consumed by the building in kWh per annum and Total Energy Generated (electricity equivalent) in the building.

- **All energy consumed by the Gross Floor Area (occupied and unoccupied in building including energy for ICT.**
- **Include energy produced by Renewable Energy.**

NET BEI [kWh/m2/year]

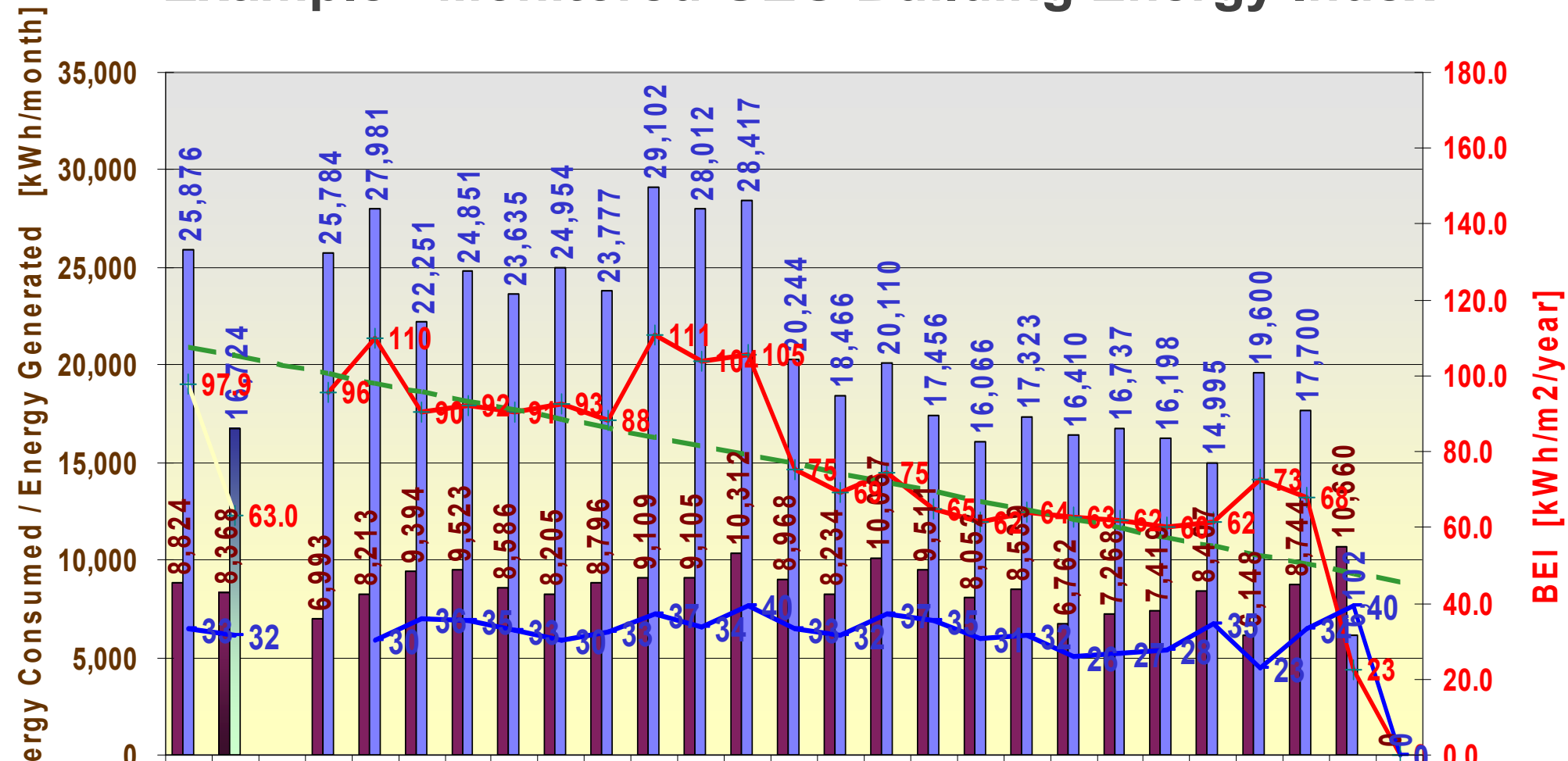
$$= \frac{(\sum \text{Energy Consumption} - \sum \text{Energy Generated by RE}) \quad [\text{kWh/year}]}{\text{Total Net Floor Area} \quad [\text{m2}]}$$

Source: EAEF – Office Building Energy Benchmarking Project

Notes : This conventional BEI formula has been used in series of government and private projects and documents such as;

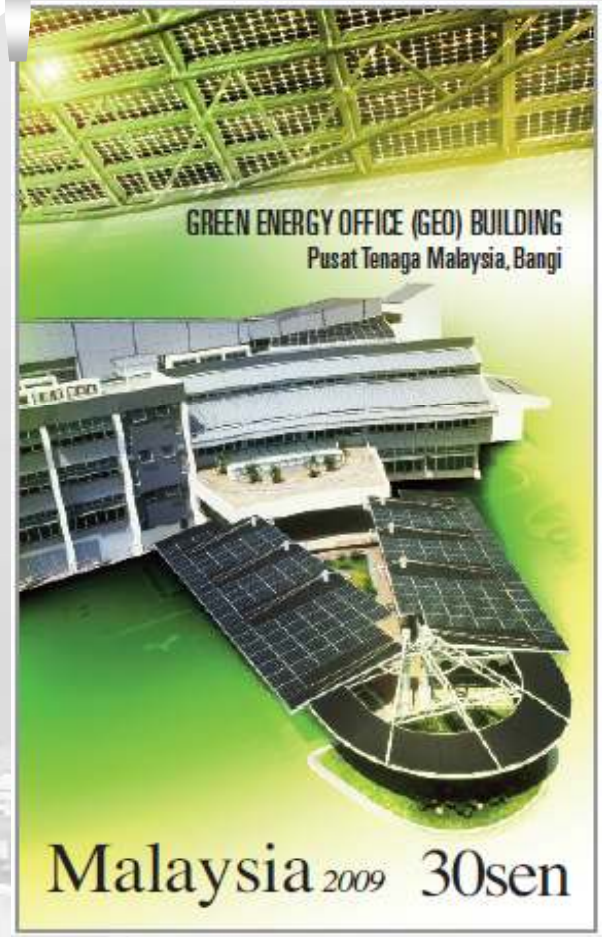
- More than 38 government buildings in UiTM Energy Auditing Projects ECO-Energy-PTM (2000-2001).
- 12 Government Buildings Energy Audit by ESCOs & PTM (2003).
- LEO Building (since 2002).
- GEO Building (Since 2007).
- EPU – DANIDA Integrated Resources Planning – EE in Office, Hospital & Hotels (2004-2006)
- Putrajaya Government Energy Audit & Retroffiting Projects by KeTTHA / SEDA (2010 - 2012).
- Prime Minister Office Enegry Audit by JKR (2010)
- Low Carbon Cities Framework (by KeTTHA/GreenTech Malaysia and launched by YAB PM in Sept 2011).
- Draft of Construction Industry Standard (CIS) 20, GreenPASS by CIDB (since 2011).
- Europe Asean Energy Funding Project (Building Benchmarking PTM - NUS) (2007).
- Online Building Consumption Input System (BCiS) (since 2010).
- More than 50 Government Buildings in Putrajaya (by JKR Putrajaya).
- Common Carbon Metric Building Study in Putrajaya (2010).
- Energy Audits of Government Quarters by JKR & ECO Energy (2006).
- Energy Audits of Government Clinic at Taman Ehsan by DANIDA-JKR (2003).
- Energy Audits of Government Schools by JKR & ECO-Energy (2006)
- Energy Efficiency Design of Government School Computer Lab (2004).
- ESB-Panasonic Green Warehouse in Shah Alam (2012)
- IKEA Warehouse Shah Alam by ECO-Energy (2007).
- Private own buildings on commercial and industrial.
- Energy Management project by the Industry / ESCOs.
- Energy manager and Energy management training course.
- Energy Audit trainings

Example - Monitored GEO Building Energy Index

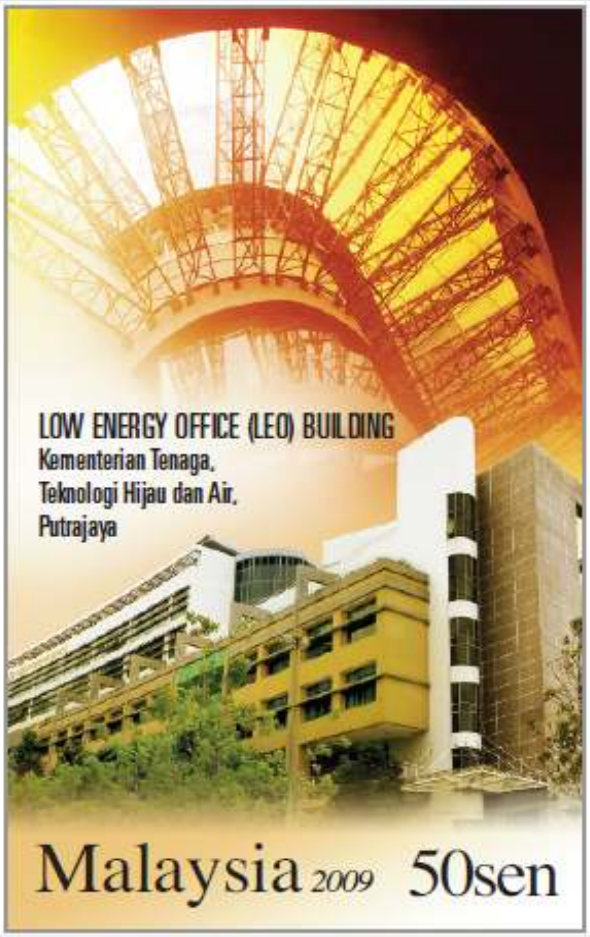


	Average	Average (with		July 08	Aug 08	Sept 08	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mac 09	Apr 09	May 09	June 09	July 09	Aug 09	Sept 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mac 10	Apr 10	May 10	June 10
kWh PV	8,824	8,368		6,993	8,213	9,394	9,523	8,586	8,205	8,796	9,109	9,105	10,312	8,968	8,234	10,067	9,511	8,052	8,539	6,762	7,268	7,419	8,407	6,148	8,744	10,660	0
kWh Total	25,876	16,724		25,784	27,981	22,251	24,851	23,635	24,954	23,777	29,102	28,012	28,417	20,244	18,466	20,110	17,456	16,066	17,323	16,410	16,737	16,198	14,995	19,600	17,700	6,102	0
Num of Days				13	31	30	31	30	31	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	2	0
BEI [kWh/m2/yr]	97.9	63.0		96	110	90	92	91	93	88	111	104	105	75	69	75	65	62	64	63	62	60	62	73	68	23	0
BEI PV	33	32			30	36	35	33	30	33	37	34	40	33	32	37	35	31	32	26	27	28	35	23	34	40	0

Examples of Low Carbon Buildings by the Government

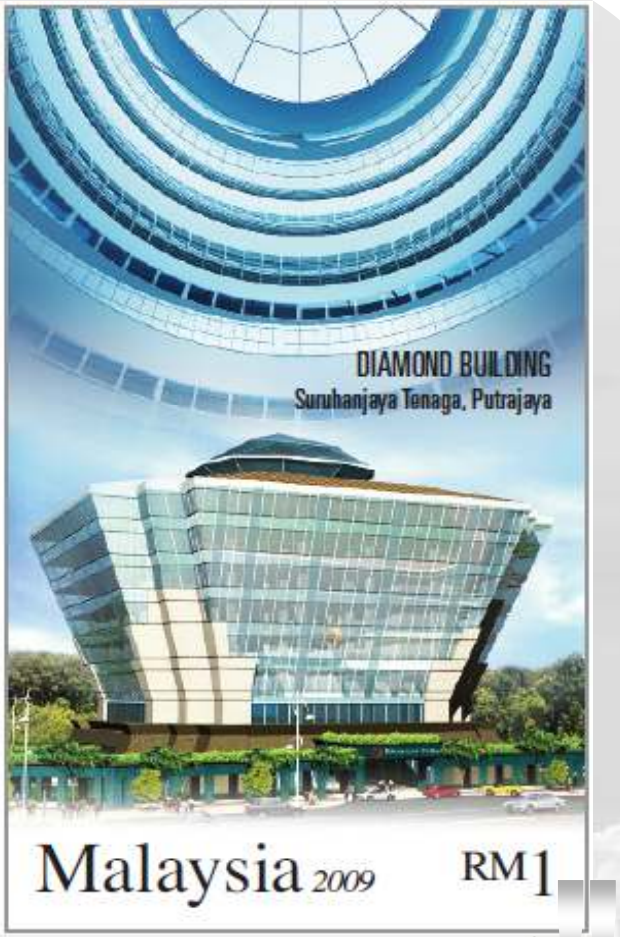


BEI = 65
Net BEI = 30 (86% reduce)
65 TonCO2/year
ASEAN EA : 2009/2010/2011



BEI = 114 (59% reduce)
1,490 TonCO2/year

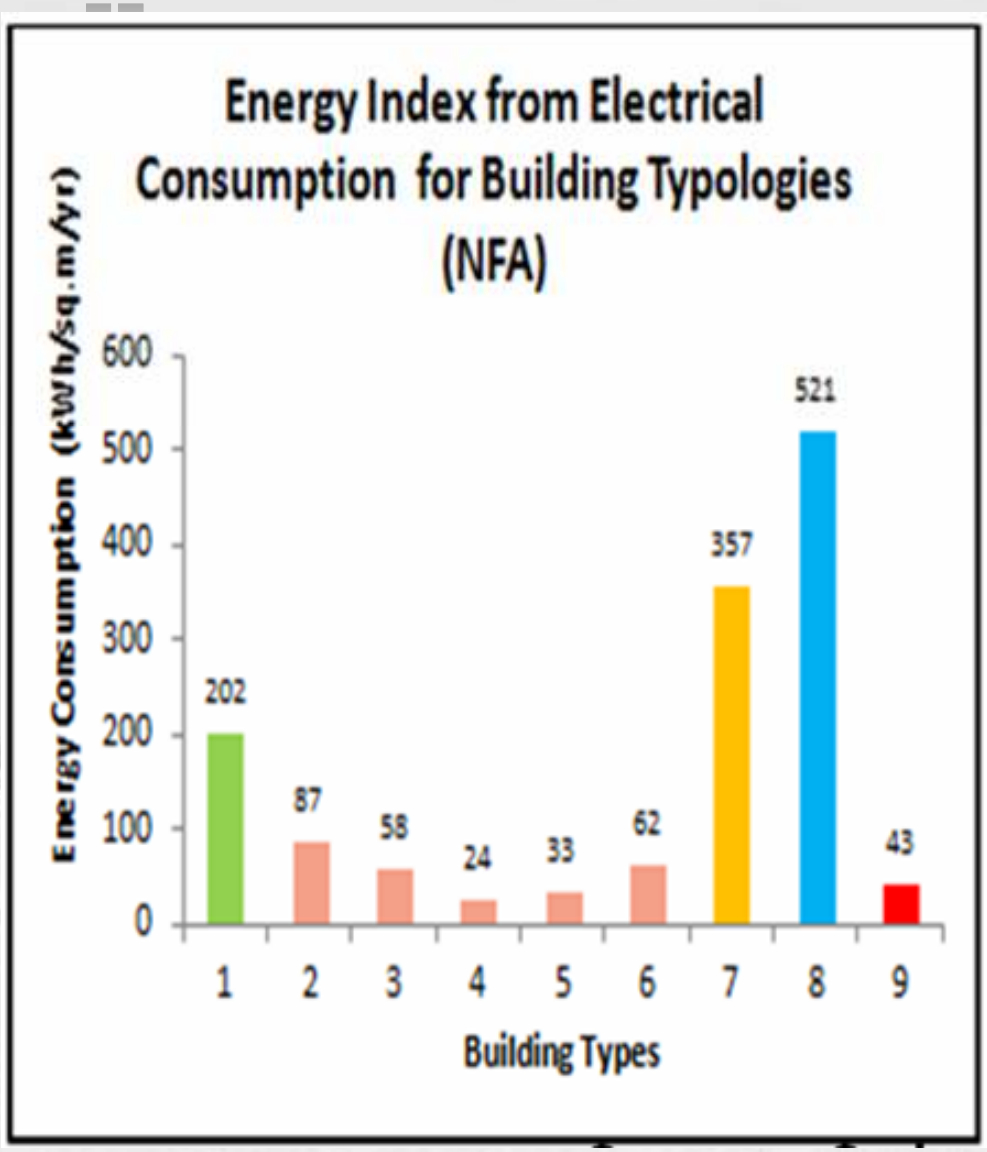
ASEAN Energy Award : 2006



Design BEI = 85 (>60% reduce)
637 TonCO2/year (**To verify)

ASEAN Energy Award : 2012

BEI and Common Carbon Metric (CCM) Study in Putrajaya (2010)



In PUTRAJAYA