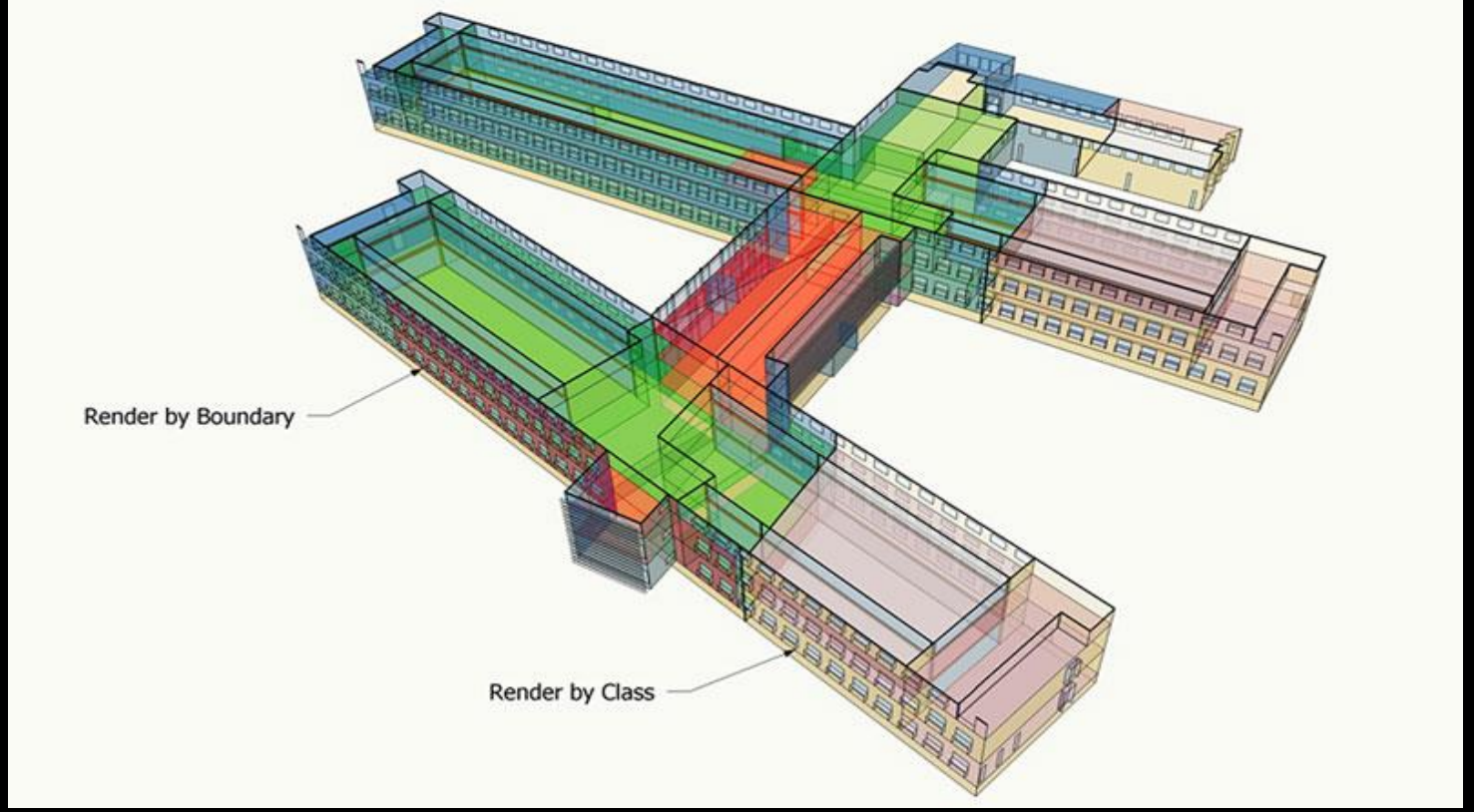
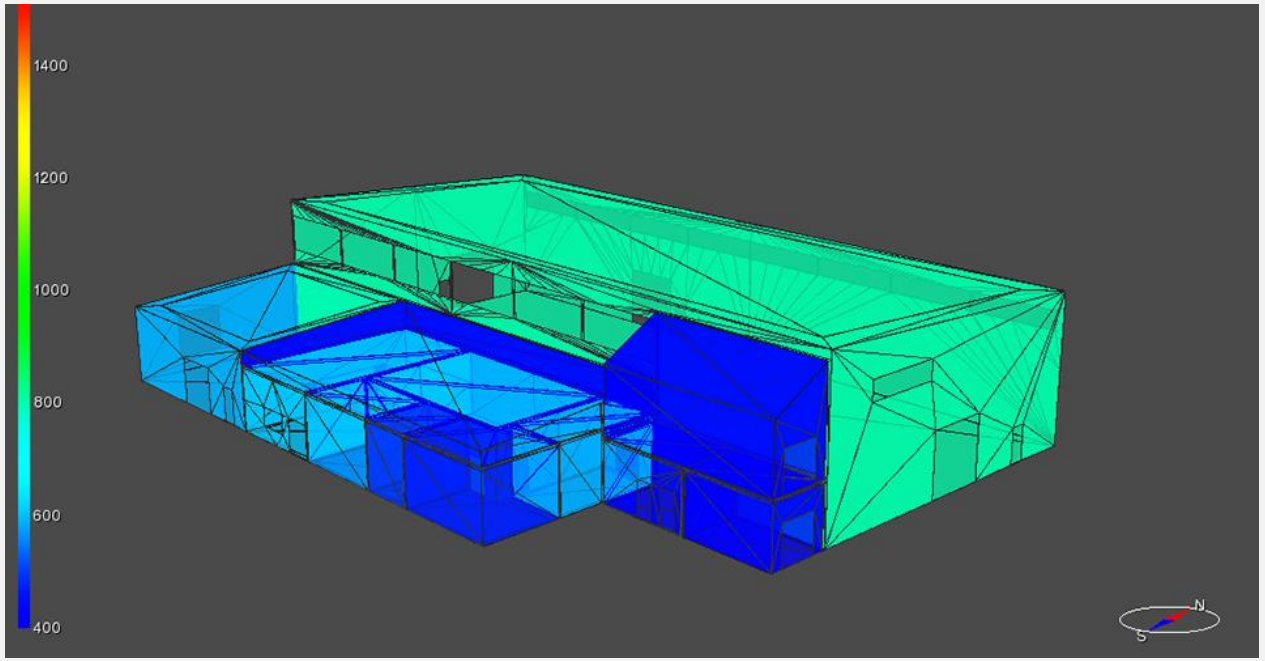


NOTES ON BUILDING PERFORMANCE SIMULATION

Ir. Dr. Abdul Murad bin Zainal Abidin
Makmal Penyelidikan Mekanikal

CREaTE
Pusat Kecemerlangan Kejuruteraan & Teknologi JKR

what is it?



(Source: unlimited.hamk.fi)

The building energy simulation method is a performance-based approach to compute the predicted energy use of buildings.

why is it important?

International Energy Agency (IEA) report (2018):

*The buildings sector accounted for about **28% of total energy-related CO_2 emissions**, two-thirds of which is attributable to emissions from electricity generation for use in buildings. The sector's energy intensity per square metre improved, **but its emissions increased more than 25% since 2000**.*

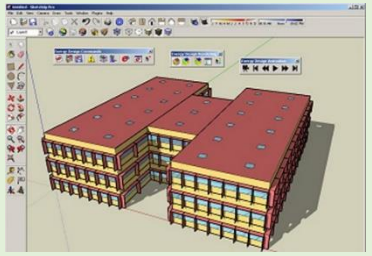
*Electricity use in buildings **grew five-times faster** than improvements in the carbon intensity of power generation since 2000, and rising demand for equipment such as air conditioners is putting pressure on electricity systems.*

when simulation is done?

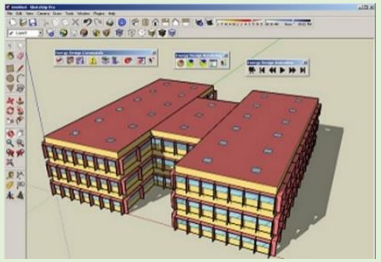
Comparison of actual energy use against tendered specification

(JKR SPB)

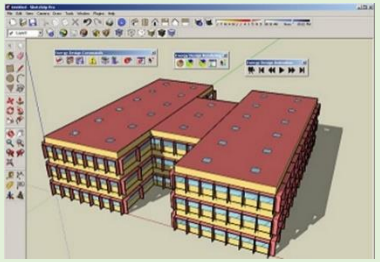
Preliminary Design → Detailed Design → Design Review → Design Verification → Design Validation



Design concept for overall energy performance



After client input & agreement



Building operation

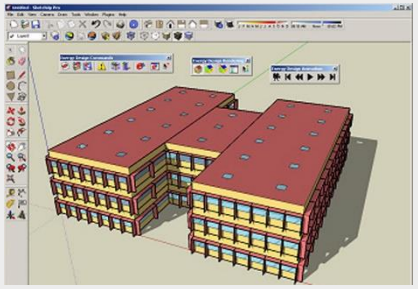
MS 1525 requirement

1

Create design building

Modelled accurately from the architectural design drawings

2 (simulate for energy use)



Should incorporate:

1) hourly simulation of occupancy, lighting power, miscellaneous equipment power, thermostat set-points, & Air-conditioning and mechanical ventilation (ACMV) system operation
2) thermal mass effects
3) sufficient thermal zone to model the ***design building***

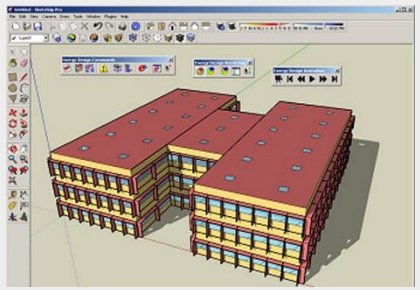
3

Create base building (reference)

Base building shall have:

1) same floor area as the *design building*
2) same number of floors as the *design building*
3) same function (internal load) as the *design building*
4) minimum requirements in MS 1525

4 (simulate for energy use)



Do the modelling for:

1) building envelope
2) lighting, daylighting & lighting control
3) ACMV system

what we want in the end?

1) Annual energy use:

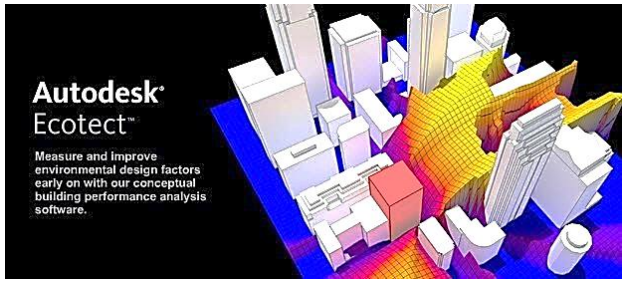
design building < base building

2) Energy performance **rating** for equipment:

design building > base building

Low energy building

what is available?



IES

ENERGY - 10

blast

EnergyPlus

DOE-2

eQUEST

Solar-5

ESP-r

ENER-WIN®
Hourly Energy Simulation Program for Buildings

Building Energy Simulation Software

TRNSYS

DesignBuilder SOFTWARE

Carrier

E-20-II & HAP

HOT2000

TRANE

TRACE 600

ADELINE

Tas

how building simulation benefit JKR?

Output

JKR designs that comply with pH JKR and MyCREST

Outcome

Government buildings that are energy-efficient and sustainable

Impact

GOVERNMENT BUILDING

Targeted Emission reduction
98.2 $ktCO_2eq$ *(2020)*

ULTIMATE AIM