

# **Singapore's Green Building Energy Efficiency Standards**

1000-1-111- ARCAN

## Singapore BCA Green Mark Scheme

- A green building rating tool for the tropics
- Launched in Jan 2005
- To evaluate buildings for its environmental impact & performance



Towards a Sustainable Singapore





# PSTLES v2.0 2015

| • | Building Sustainability                                                                         |   |                                                    |  |  |
|---|-------------------------------------------------------------------------------------------------|---|----------------------------------------------------|--|--|
| • | Greenmark Platinum for new buildings                                                            | • | Water Efficient Building                           |  |  |
|   | A/C FA> 5,000m²)                                                                                |   | Install private water meters New                   |  |  |
| • | <b>Greenmark Gold</b> <sup>PLUS</sup> for buildings<br>(A/C FA > 10,000m <sup>2</sup> ) by 2020 |   |                                                    |  |  |
| • | Greenmark Gold for small and mid-sized<br>existing buildings (GFA>5000m <sup>2</sup> ) by2020   |   |                                                    |  |  |
| • | Office Sustainability                                                                           |   |                                                    |  |  |
| • | Green Mark Gold for Office Interior Revised at next retrofit                                    | • | Recycling programmes                               |  |  |
| • | Indoor Air Temp >24°C                                                                           |   |                                                    |  |  |
| • | Green Procurement                                                                               |   |                                                    |  |  |
| • | ENERGY STAR for ICT equipment                                                                   | • | Events and functions to be held in Green New       |  |  |
| • | office rental in Green Mark Gold <sup>PLUS</sup> buildings New                                  |   | Mark certified hotels, convention centre           |  |  |
|   |                                                                                                 | • | Green leasing of government buildings and premises |  |  |
| • | Capability Building                                                                             |   |                                                    |  |  |

• Training for SMs & FOMs

### **Incentives & Financing Schemes**

Bonus Gross Floor Area

Green Mark-GFA

> 58,000 m<sup>2</sup> Committed

Incentive Schemes

\$20m New Buildings Fully Committed

S\$100m Existing Buildings Fully Committed

S\$5m Design Prototype S\$2m Committed

S\$50m Existing Building and Premises NEW! Financing Schemes

Building Retrofit Energy Efficiency Financing (BREEF)

Co-share risk with Private Financial

Institutions

## Legislating Minimum Green Building Standards

#### **Building Control (Environmental Sustainability) Regulations 2008**



Minimum GM standards for new buildings

#### **Environmental Sustainability Measures for Existing Buildings (2012)**





Minimum GM standards for existing buildings

Three-yearly energy audit on cooling system and compliance of design system efficiency

Annual submission of building information & energy consumption data

#### Mandatory Energy Data Disclosure by Building Owner

#### **Building Energy Consumption**

**Building Energy Submission System (BESS)** 

Analysis of consumption patterns

**Building Energy Benchmarking Report (BEBR)** 

Building Owners' & Tenants' Electricity Consumption





Phased approach in energy disclosure and building energy display

> Voluntary Building Energy Performance Disclosure

## **Building Energy Benchmarking Report**



EUI of Offices

## Legislating Minimum Green Building Standards

#### **Existing Building Legislation Phase I**

(effective from 2<sup>nd</sup> Jan 2014)



## Legislating Minimum Green Building Standards

#### **Existing Building Legislation Phase II**

(effective from 2<sup>nd</sup> Jan 2017)



## **Green Mark Criteria for Air-Con Plant Efficiency**

| Water-cooled | d chilled wate                     | r systems | Air-cooled chilled water systems / Unitary |                                    |                   |  |  |
|--------------|------------------------------------|-----------|--------------------------------------------|------------------------------------|-------------------|--|--|
| Green Mark   | Peak Building Cooling Load<br>(RT) |           | Green Mark                                 | Peak Building Cooling Load<br>(RT) |                   |  |  |
| Rating       | <500 ton                           | ≥ 500 ton | Rating                                     | <500 ton                           | ≥ 500 ton         |  |  |
|              | Efficiency (kW/RT)                 |           |                                            | Efficiency (kW/RT)                 |                   |  |  |
| Certified    | 0.85                               | 0.75      | Certified                                  | 1.1                                | 1.0               |  |  |
| Gold         | 0.80                               | 0.70      | Gold                                       | 1.0                                | Not<br>Applicable |  |  |
| GoldPlus     | 0.75                               | 0.68      | GoldPlus                                   | 0.85                               |                   |  |  |
| Platinum     | 0.70                               | 0.65      | Platinum                                   | 0.78                               |                   |  |  |



#### Mandating Periodic Energy Audit of Chiller Plant

(effective from 2<sup>nd</sup> Jan 2014)

#### **Energy Consumptions in Buildings**



### Mandating Periodic Energy Audit of Chiller Plant

(effective from 2<sup>nd</sup> Jan 2014)

#### **3-Yearly Cycle**



#### Mandating Periodic Energy Audit of Chiller Plant

(effective from 2<sup>nd</sup> Jan 2014)



### Measurement & Verification Requirements for Chilled Water Systems



## Energy Use Intensity (EUI) of 100 Retrofitted Existing Buildings



#### Study on Air-Con System Efficiency

**Retrofitting Existing Chiller Plants** 

### 40-50% Energy Savings Achieved

by Adopting a Systems-based approach in Retrofitting Existing Chiller Plants



### Continuous Monitoring Through Chiller Efficiency Smart Portal

- Continuous monitoring
- Performance base-lining by machine learning
- Trend Analytics to spot performance variance
- Autonomous alarm



### Continuous Monitoring Through Chiller Efficiency Smart Portal



## Air Distribution System Efficiency Study

**Distribution of Energy Within Air-Conditioning System** 



## Air Distribution System Efficiency Study



**BCA GREEN MARK** 

### Air Conditioning System Efficiency

High potential savings in air distribution system



Total Air Eff, Water Eff, Sys Eff

## Energy Labelling and Standards for Appliances & Equipment

- NEA administers the Mandatory Energy Labelling Scheme (MELS) and Minimum Energy Performance Standards (MEPS)
- Mandatory Energy Labelling Scheme (MELS)
  - Empowers households to make better purchasing choices
  - Encourages suppliers to bring in more EE appliances as technology improves
  - Covers air-conditioners, refrigerators, clothes dryers, televisions and lamps for general lighting purposes
- Minimum Energy Performance Standards (MEPS)
  - Help households avoid being locked into high energy consumption and energy costs of the most inefficient appliances
  - Improve lifecycle cost savings for households
  - > Cover air-conditioners, refrigerators, clothes dryers and lamps



#### **Energy Labelling & Standards for Air-conditioners**

**Covers single-phase, non-ducted air-conditioners** ٠





Up to 17.6 kW





Up to 17.6 kW



Up to 8.8 kW

## **Energy Labelling & Standards for Lamps**

Covers incandescent lamps for <u>general lighting purposes</u> and lamps intended as their direct replacements



Tungsten-halogen

• Studying feasibility of extending MEPS/MELS to other lamp types

### **Barriers & Counter-measures**

**Close Collaboration with Singapore Green Building Council** 



Building owner can work with an Energy Performance Contracting (EPC) firm achieve greater energy efficiency with zero capital outlay. A standard reference document for both sides of the industry: the building owners and the EPC firms when procuring energy efficiency retrofit or renewable energy installation works

## Singapore Green Building Week 2017

#### IGBC - The Premier Green Building Event in Asia



12 – 14 September 2017 Marina Bay Sands, Singapore

What to anticipate at IGBC 2017:

- Behind the Success of Positive/Zero/Super Low Energy Buildings
- Digitalisation of Buildings
- A Bird's Eye View of the Sustainable Built Environment
- Updates of Green Mark Schemes
- Changing Behaviour towards Sustainability
- Building Healthy Spaces
- Green Tours







Strategic Partners





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## Thank you

