

Building Energy Standards and Codes

Ir K K Lam
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Background

International Review:

- **BEC widely adopted international**
- **Mainly on OTTV, Lighting and AC**
- **Prescriptive BEC**
- **Performance-based BEC**

Background

Hong Kong Situation:

- **Energy Efficiency Office set up in 1994**
- **BEC - one of the first initiatives**
- **4 energy consuming areas:**
 - AC (48%), Office equipment (22%),
 - Lighting (19%), Lifts & others (11%)

Prescriptive BEC

- **Stipulate the control thresholds**
- **Requirements are simple to use & enforce**
- **Products written into the codes at a time when alternatives did not exist**
- **Difficult for new, innovative and possibly more cost-effective products and designs to gain wide acceptance in the marketplace**
- **Inflexible for trade-offs**

Performance-based BEC

- **Use the total building energy approach**
- **Provide an alternative channel to the prescriptive BEC**
- **Designers have the flexibility to use any products provided the energy consumption of the whole building equal to or less than that of the same building that complies with every aspect of the prescriptive BEC**
- **Difficult to predict the actual energy use**

Introduction

Building Energy Standards & Codes

- **OTTV**
- **Lighting**
- **Air-conditioning**
- **Electrical**
- **Lifts and escalators**
- **Performance-based BEC**

OTTV Code

- Launched 1995 (Buildings Department with support from EMSD)
- Building (Energy Efficiency) Regulation (Cap. 123M)
- Control of building envelope
- Review in 6/2000
 - Tower 30 W/m² (previous 35)
 - Podium 70 W/m² (previous 80)

OTTV Code

- Mandatory
- Simple to use as there are computer programmes performing the calculations
- Reflective glass or low emissive glass have to be used

Lighting Energy Code

Published in 1998

- Requirements:
 1. Minimum Lamp Luminous Efficacy
 - 6 lm/W for Tungsten
 - 160 lm/W for SOX
 - 40 to 75W for Fluorescent & CFL
 2. Maximum Lamp Control Gear Loss
 - Fluorescent – 7 to 18 W
 - CFL – 7 to 10 W

Lighting Energy Code

3. Maximum Allowable LPD
 - office 25 W/m²
 - car park 8 W/m²
 - banquet 40 W/m²
4. Lighting Control Points in Office
 - 1 control point per 10m²

Lighting Energy Code

- Control parameters are not stringent as they code was written many years ago.
- The use of fluorescent fittings with low loss ballast can satisfy the requirement.
- Efficacy & control gear loss stipulated
- LPD for different areas stipulated.
- Maximum area served by a switch stipulated.
- Easy to use and computer programme is available for calculation

Air-conditioning Energy Code

Published in 1998

1. Load design:
 - Indoor conditions
 - Outdoor conditions
 - Load calculation
2. Air side power (fan > 5kW)
 - CAV ≤ 1.6 W / l/s
 - VAV ≤ 2.1 W / l/s ;
 - < 55% power at 50% flow
 - Duct leakage test
 - Special zone separate system

Air-conditioning Energy Code

3. Water side power (pump)
 - Variable flow to 50%
 - Friction loss ≤ 400 Pa/m
4. Minimum COP (for >10 kW)
 - 2.2 for (air-cool unitary plant)
 - to 5.2 (water cool centrifugal)
5. Insulation
 - Depending on size, T, K
 - Ductwork, AHU
 - Chilled water / refrigerant pipe

Air-conditioning Energy Code

6. Office control points
 - System min. 1 auto control
 - Cooling adjustable to ≥ 29 C
 - Heating adjustable to ≤ 16 C
 - 2C cool/heat dead band
 - Control of Humidity, Zone, & Off-hour

Air-conditioning Energy Code

- Standard forms available for submission
- Variable speed drives to be used to control air flow and water flow
- System load design stipulated
- Air & Water side system design stipulated
- Control requirement stipulated
- Insulation requirement stipulated
- AC equipment efficiency stipulated

Electrical Energy Code

Published in 1999

1. Power Distribution loss
 - HV > 50 -storey/175m
 - TX eff 98% - 99%
 - Main circuit $\leq 0.5\%$
 - Feeder circuit $\leq 2.5\%$
 - Sub-main $\leq 1.5\%$
 - Final circuit (>32 A) $\leq 1\%$

Electrical Energy Code

2. Power Utilisation (motor ≥ 5 kW)
 - Motor eff 84% to 92%
 - Motor sizing $\leq 25\%$
 - Synchronous belt drive
 - Power factor ≥ 0.85
3. Power Quality
 - THD current
 - $\leq 20\%$ (< 40 A)
 - to 5% (>2000 A)
 - Unbalanced load $\leq 10\%$ (≥ 100 A)

Electrical Energy Code

4. Metering and Monitoring
 - Main circuit ≥ 400 A:
Meter or provisions to measure V, A, PF, kWh & kVA
 - Sub-main circuit & feeder ≥ 200 A: Meter or provisions to measure A & kWh

Electrical Energy Code

- One of the first of its kind.
- The IEEE had obtained permission from HK Government to include this code into their new revision of Standard 241 “Recommended Practice for Electrical Systems in Commercial Buildings”
- Standard forms available for submission
- Requirements of power distribution, utilization & power quality stipulated.
- Requirements of metering & monitoring stipulated.

Lifts & Escalators Energy Code

Published in 2000

1. Max. Power
 - Not to exceed kW limit according to load and speed e.g. 750kg 1m/s not to exceed 7kW, 5000kg at 9 m/s not to exceed 290kW)
2. Energy Management
 - 1 lift (in lift bank) at standby
 - standby lift not responsive to call
 - Meters for V, A, PF, kWh & kVA
 - 2 minute idling shut off fan

Lifts & Escalators Energy Code

3. Handling capacity
 - Sky lobby lift bank 20%
 - Zone lift bank 10%
4. Lift traffic design
 - Zone-type building
 - (at least 10 storey) > 1.5m/s -
 - Up Peak Interval:
30s (office) to 55s (industrial)
5. Total Harmonic Distortion
 - Lift: 15% (<800A) to 35% (<80A)
 - Escalator: 22.5% (<400A) to 35% (<80A)

Lifts & Escalators Energy Code

- One of the first of its kind
- Standard forms available for submission
- Requirements of traffic analysis
- Maximum power demand of motor drive stipulated for various combination of loading and speed.
- Requirement of THD stipulated.
- Energy management requirements
- Handling capacity requirements

Performance-based BEC

Published in 2003

- Total Energy Budget approach
- Numerical method for building energy analysis using approved programme
- Determination of energy consumption:
 - Building envelope
 - Lighting
 - HVAC
 - Lift & escalator
 - Other systems
- Submission requirements

Performance-based BEC

- Make reference to ASHRAE 90.1 2001
- Alternative path for compliance with the prescriptive BECs
- Certain basic requirements of the 5 prescriptive BECs must be complied.
- Building energy simulation using approved computer programmes, e.g. DOE2.
- Comparison of the design energy with the energy budget of the reference building.

Energy Efficiency Building Registration Scheme

Nature of Scheme

The scheme is *voluntary self certifying* in nature.
RPE is required to certify that installations of the building comply with the requirements in the BEC

A Registration Certificate will be issued to successful applicant

Participant is allowed to include the Information of the registration in public signs, display, advertisement, etc. as a commercial sales point

Energy Efficiency Building Registration Scheme

A list of registered building and latest information on HKEERSB can be found in the Internet :

www.emsd.gov.hk/emsd/english/energy/codes/buildenergy/data.html

Some Examples:

The Center	HK International Airport
Nanyang Plaza	EMSD HQ
Prosperity Centre	North Point Govt Offices
Lippo Sun Plaza	Knowles Bldg, HKU
Laguna City	Fanling Health Centre

Thank You