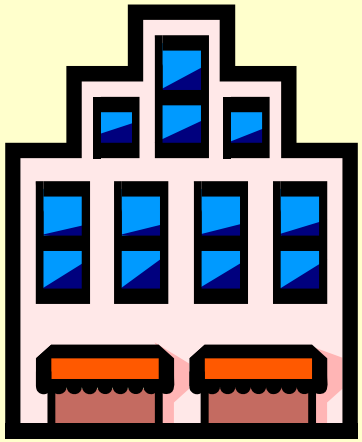
Asian Building Technologies 2008 / Asian Elenex 2008

Building Services Technical Seminars

4-5 June 2008



Development of Building Energy Labels in Hong Kong

Dr. Sam C M Hui

Department of Mechanical Engineering

The University of Hong Kong

E-mail: cmhui@hku.hk

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- Experience in Europe
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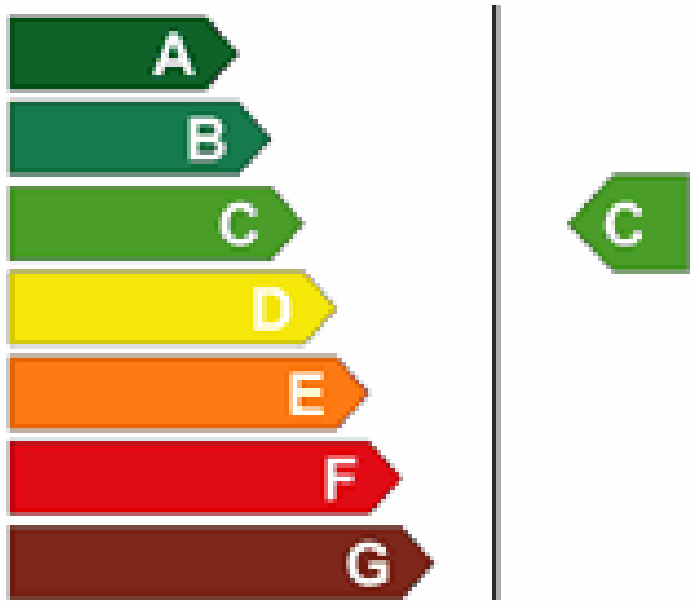
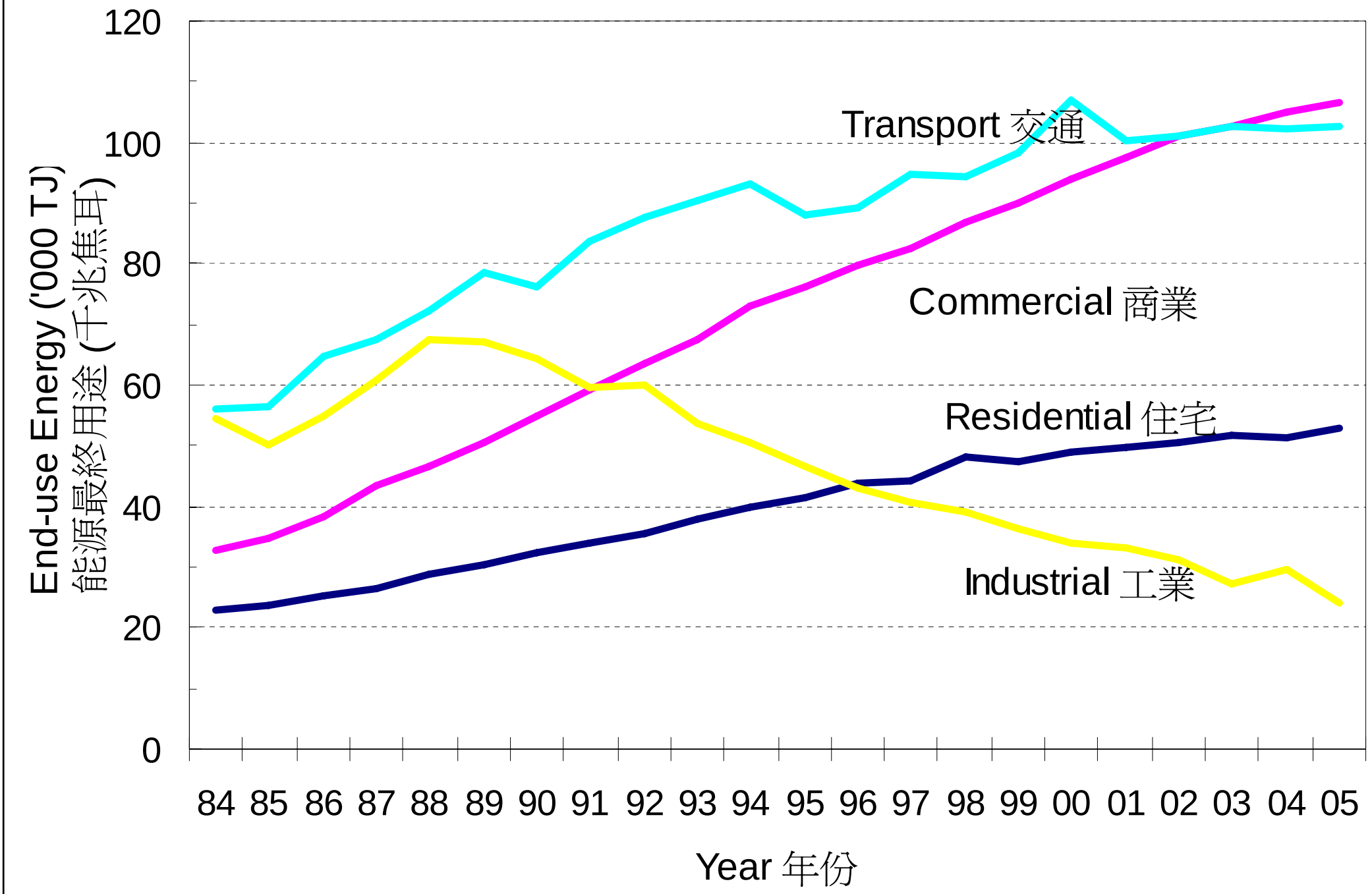


Building Energy Use in HK

- **Energy** is important to every society
  - Economic, environmental & social impacts
  - It is also a key issue for ***sustainable development***
- Use energy …
  - Consume finite fossil fuels (oil, coal, natural gas)
  - Cause air pollution & environmental damage
  - Contribute to global warming
  - Cost money

Building Energy Use in HK

- **Buildings** constitute 30-50% of energy needs
  - Residential + commercial + industrial
  - The potential for energy saving is large
- Possible benefits from energy efficiency:
  - Life-cycle cost savings
  - Reduced CO_2 emissions and consumption of fossil fuels
  - Improved building design and operation
  - Better working environments
  - Added market value of buildings
  - Reduced capital cost by better integration of building fabric and systems

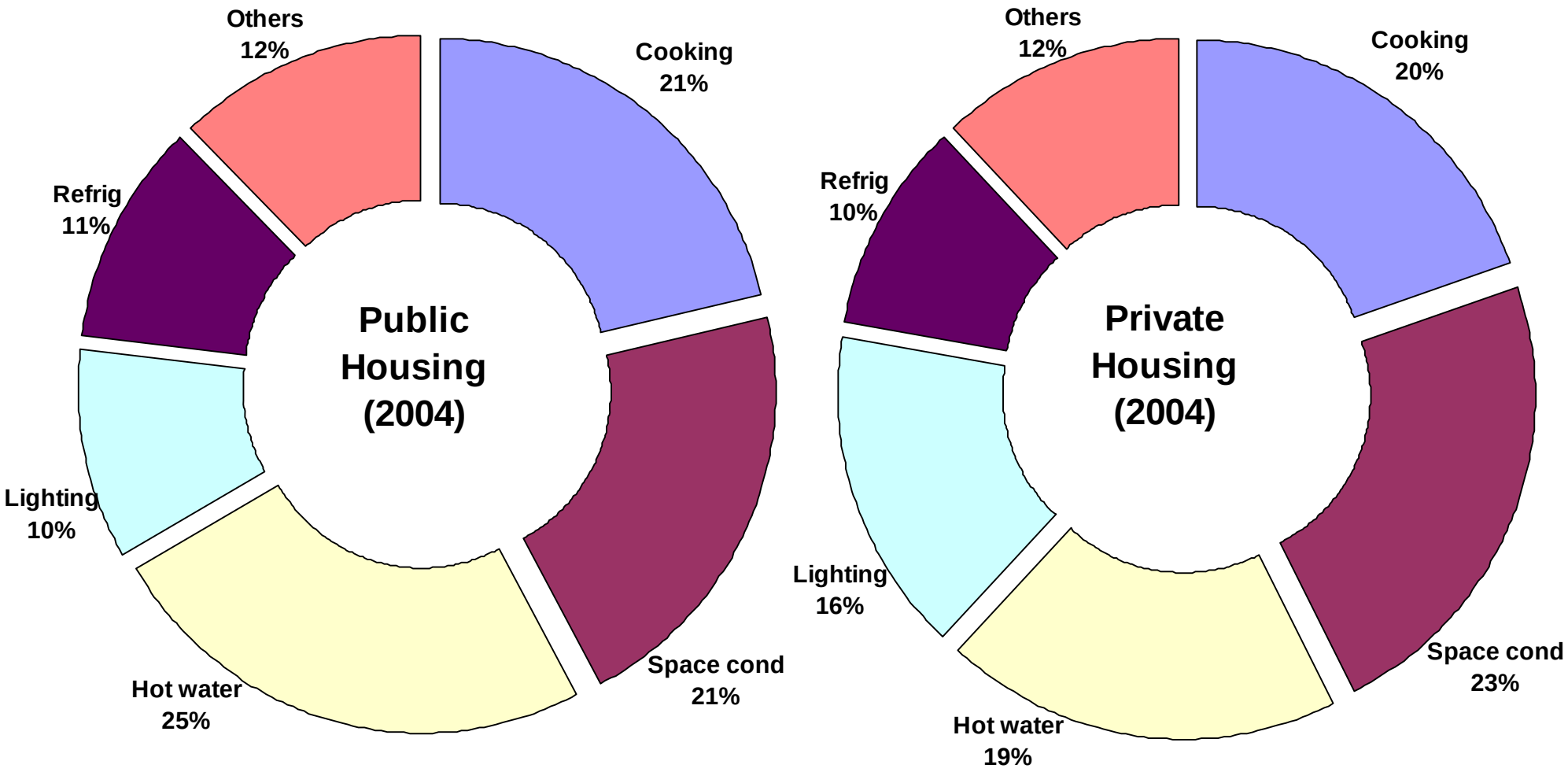


Energy end-use in Hong Kong by sectors, 1984-2005

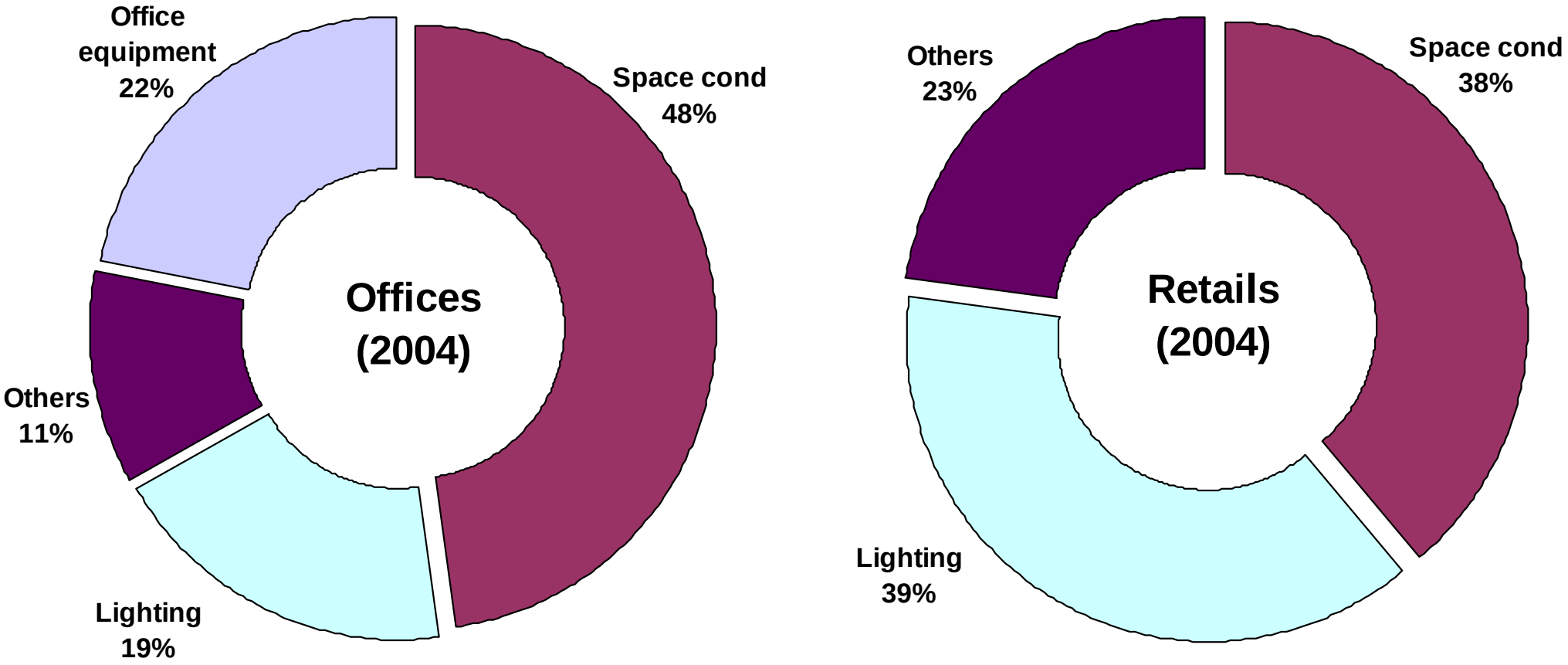
Table 1 - Final energy requirements (FER) in Hong Kong (year 2005)

Unit: MJ	**Commercial**	**Residential**	**Industrial**	**Total**
Electricity	93 724 (65%)	35 811 (25%)	14 636 (10%)	144 172 (100%)
Town gas	10 919 (40%)	15 444 (57%)	898 (3%)	27 261 (100%)
Elec. + town gas	104 643	51 255	15 534	171 433
% in total FER	31.5%	15.5%	4.7%	51.7%

(* Source: *Hong Kong Energy Statistics 2005 Annual Report*)



Energy consumption patterns in residential buildings
(Data source: Energy Efficiency Office, HK)



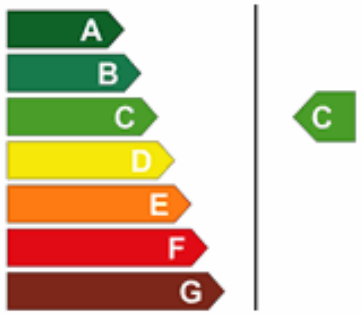
Energy consumption patterns in offices and retails
(Data source: Energy Efficiency Office, HK)

Building Energy Use in HK

- Policy to promote building energy efficiency: HK building energy codes
  - Lighting
  - Air-conditioning
  - Electrical
  - Lifts & escalators
  - Performance-based code

- Put under the Hong Kong Energy Efficient Building Registration Scheme (voluntary)

Energy Efficiency Labels



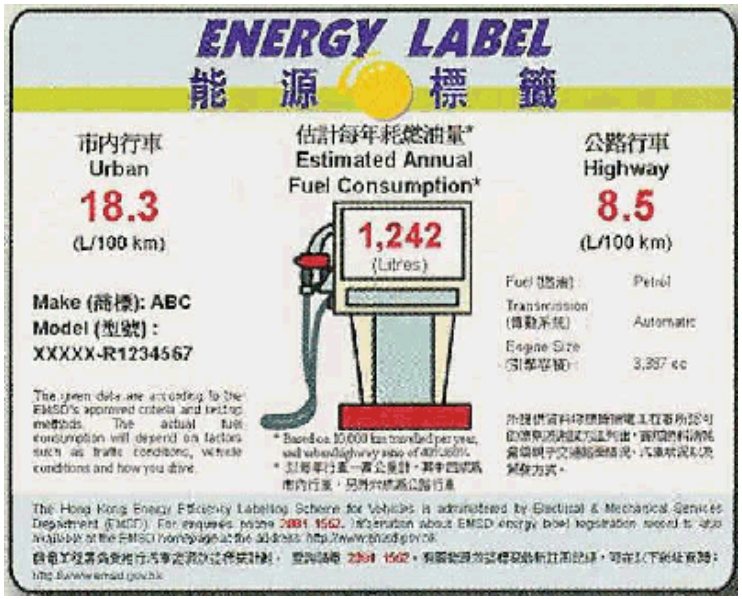
- **Energy efficiency labels**
  - *Informative* labels to describe the energy performance of a product or system
    - Indicate energy use, efficiency, or energy cost
  - Commonly used for appliances and equipment
    - Give consumers the data necessary to make *informed* purchases or decisions
  - Two types of labels:
    - Grading-type (comparative)
    - Recognition-type (endorsement)

Examples of energy efficiency labels in Hong Kong

Energy label for appliance (grading-type)

Energy label for appliance (recognition-type)

Energy label for passenger car



(Source: www.emsd.gov.hk)

Examples of energy efficiency labels in the world (endorsement)

Endorsement labels provide a government stamp of approval.

Figure 5-1 Examples of energy endorsement labels

(Source: www.clasponline.org)

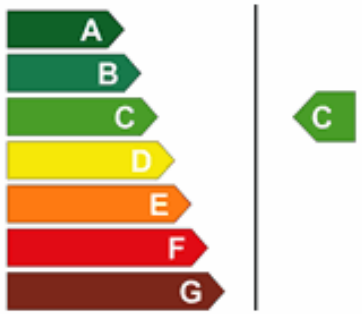
Examples of energy efficiency labels in the world (comparative)

Comparison labels use either categories or a continuous scale.

Figure 5-3 Examples of comparative energy labels

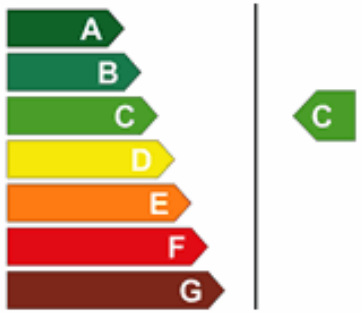
(Source: www.clasponline.org)

Energy Efficiency Labels



- Energy labels can stand alone or complement energy codes or standards
- Major market impacts of energy labels:
  - Influence consumers to compare and choose more efficient products
  - Create competition among manufacturers and suppliers to market energy-efficient models
  - Provide a common benchmark for utility companies and government to design incentive programmes and policies

Energy Efficiency Labels



- The effectiveness of energy labels is heavily dependent on:
  - How they present information to the consumer
    - Understand the information that labels communicate
  - How they are supported by:
    - Information campaigns
    - Financial incentives
    - Other related programmes
  - Whether it is voluntary or mandatory

Energy labels as the tip of the iceberg

The energy label is just the tip of the program iceberg.

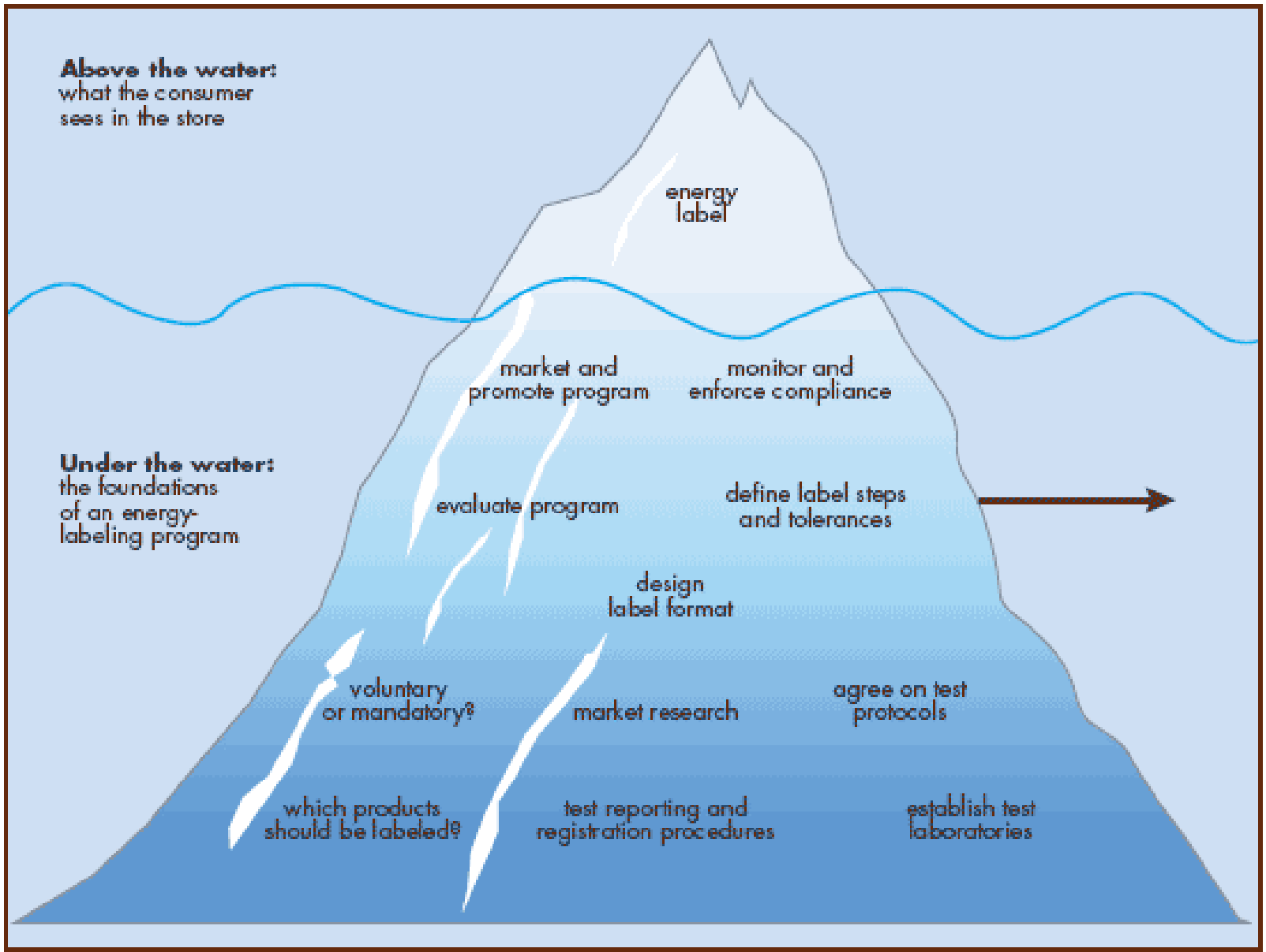
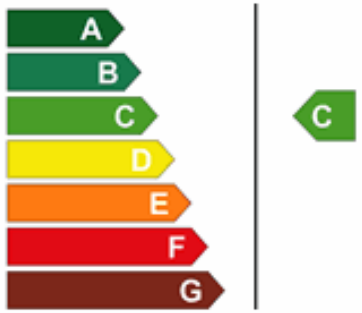


Figure 5-5 The "Iceberg" of energy labeling

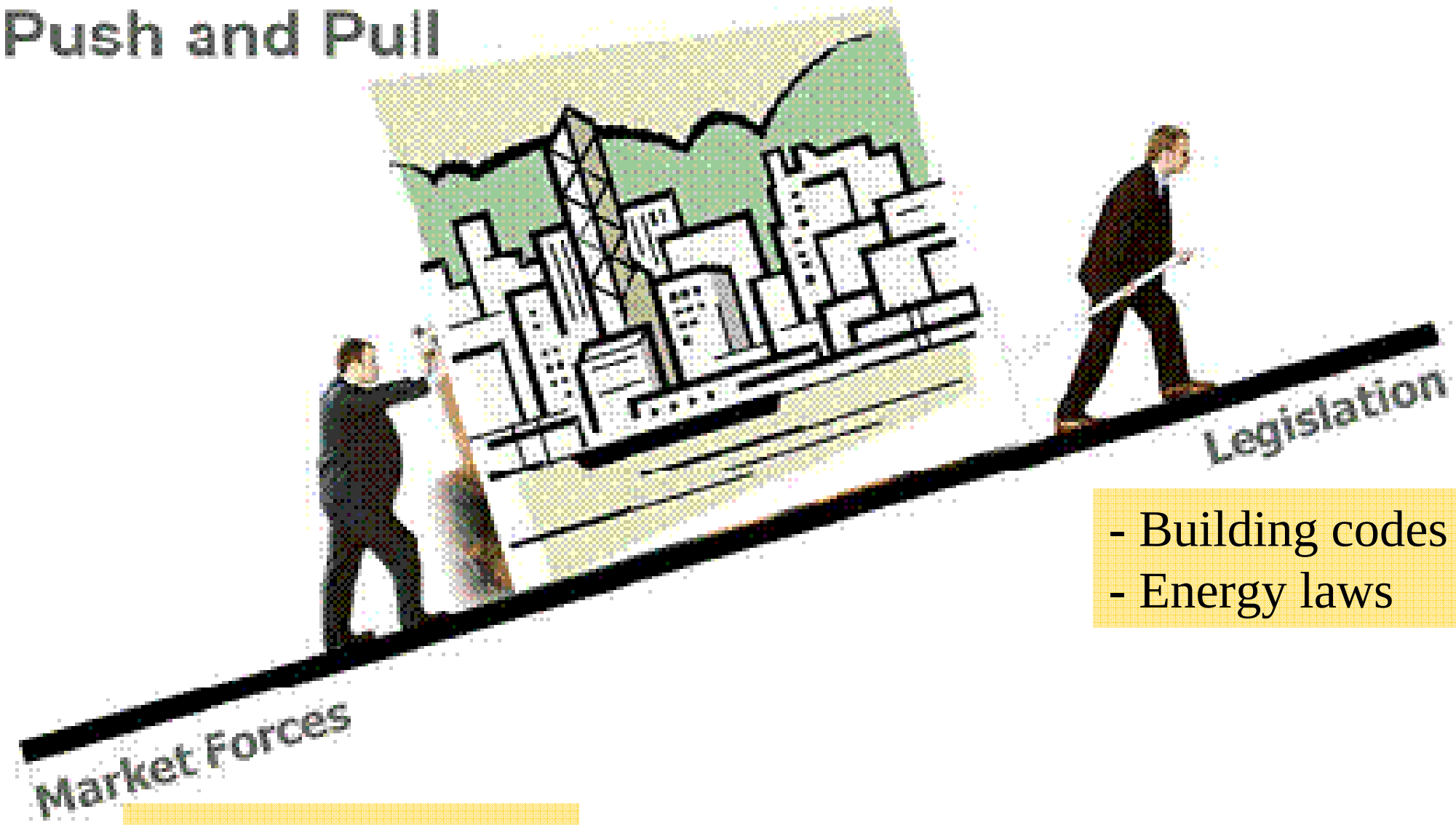
(Source: www.clasponline.org)

Energy Efficiency Labels



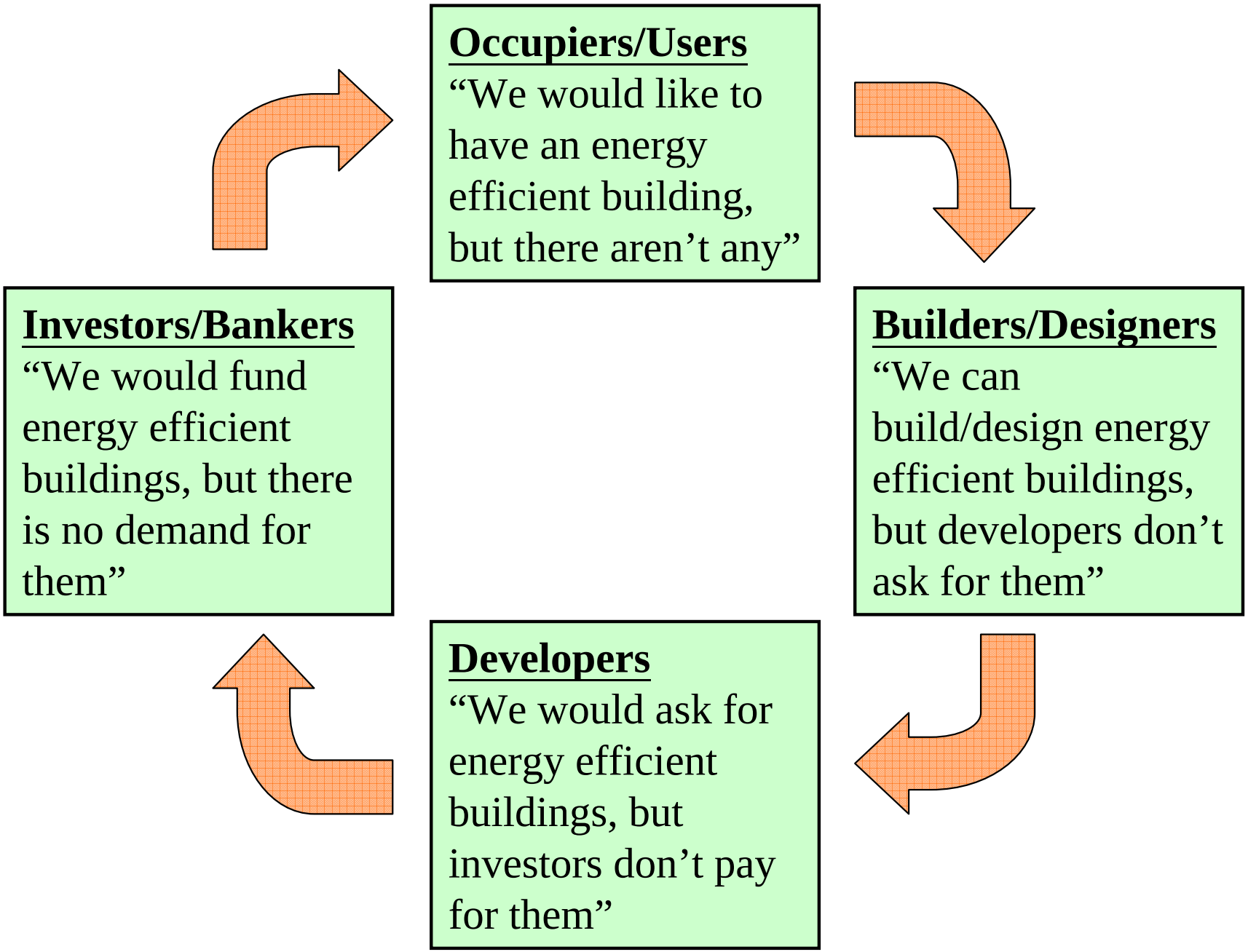
- Building energy labels
  - More complicated than appliances or equipment
  - Must be considered in a holistic way
- Current problems and limitations
  - Low energy awareness of building owners & users
  - Not easy to define building energy performance
  - Lack of good info. & data on building energy use
  - Market and institutional barriers

Strategy for promoting energy efficiency in buildings



- Building codes
- Energy laws

- Energy labels
- Voluntary schemes



The vicious circle of energy efficient buildings
(From EU studies)

Experience in Europe

- European Commission's Action Plan on Energy Efficiency (2000) proposed the *EU Directive on the Energy Performance of Buildings*, 2002/91/EC, 16 December 2002
  - Become European Law on 4 Jan 2003
  - In each EU country, legislation must be in place by 4 Jan 2006 and will affect all buildings
  - EU countries must develop suitable energy rating systems and certification schemes by 2009

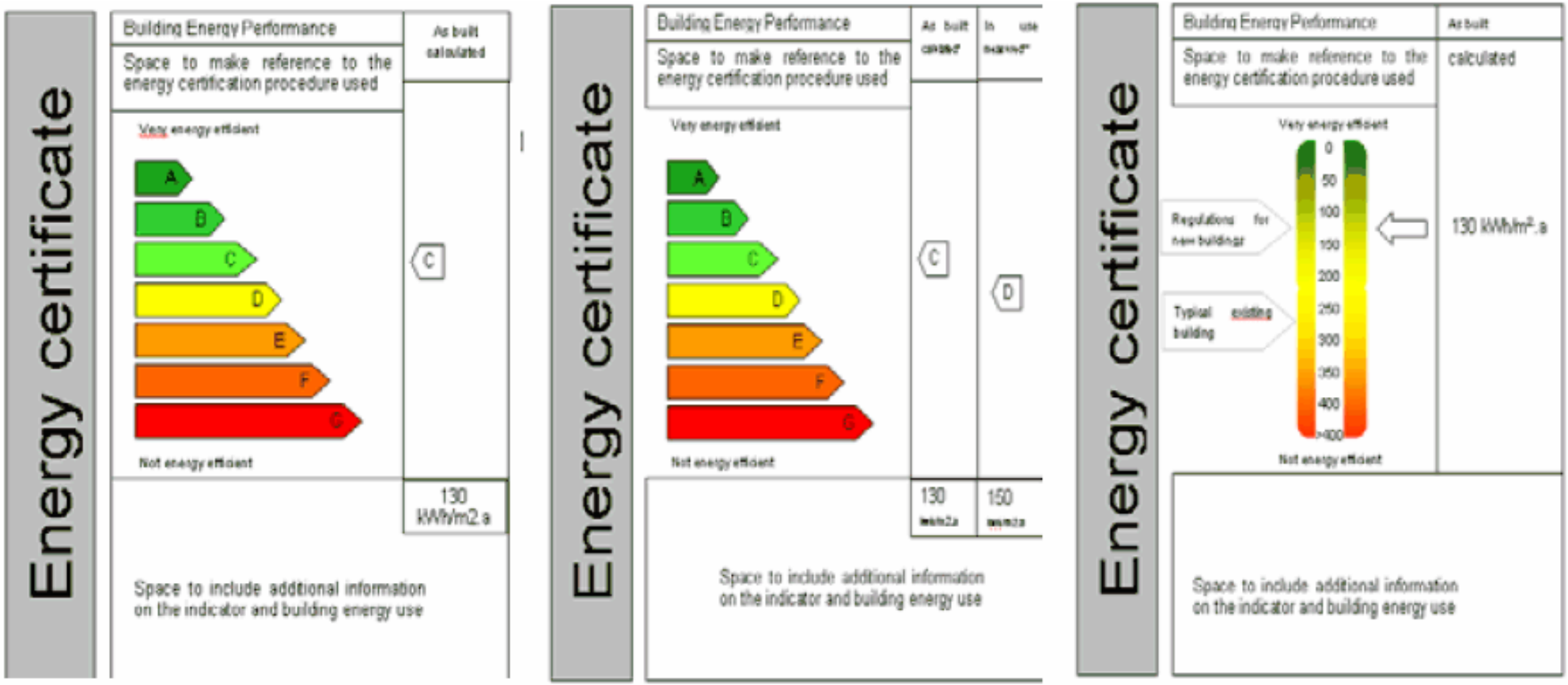
Experience in Europe

- Certification schemes for all buildings
  - To facilitate the transfer of clear and reliable *information* on energy performance of buildings
  - To make energy efficiency more attractive
- Energy performance certificates for new and existing buildings should be available when they are constructed, sold or rented out
  - Improve awareness & information
  - Increase investments in energy efficiency measures among the stakeholders

Experience in Europe

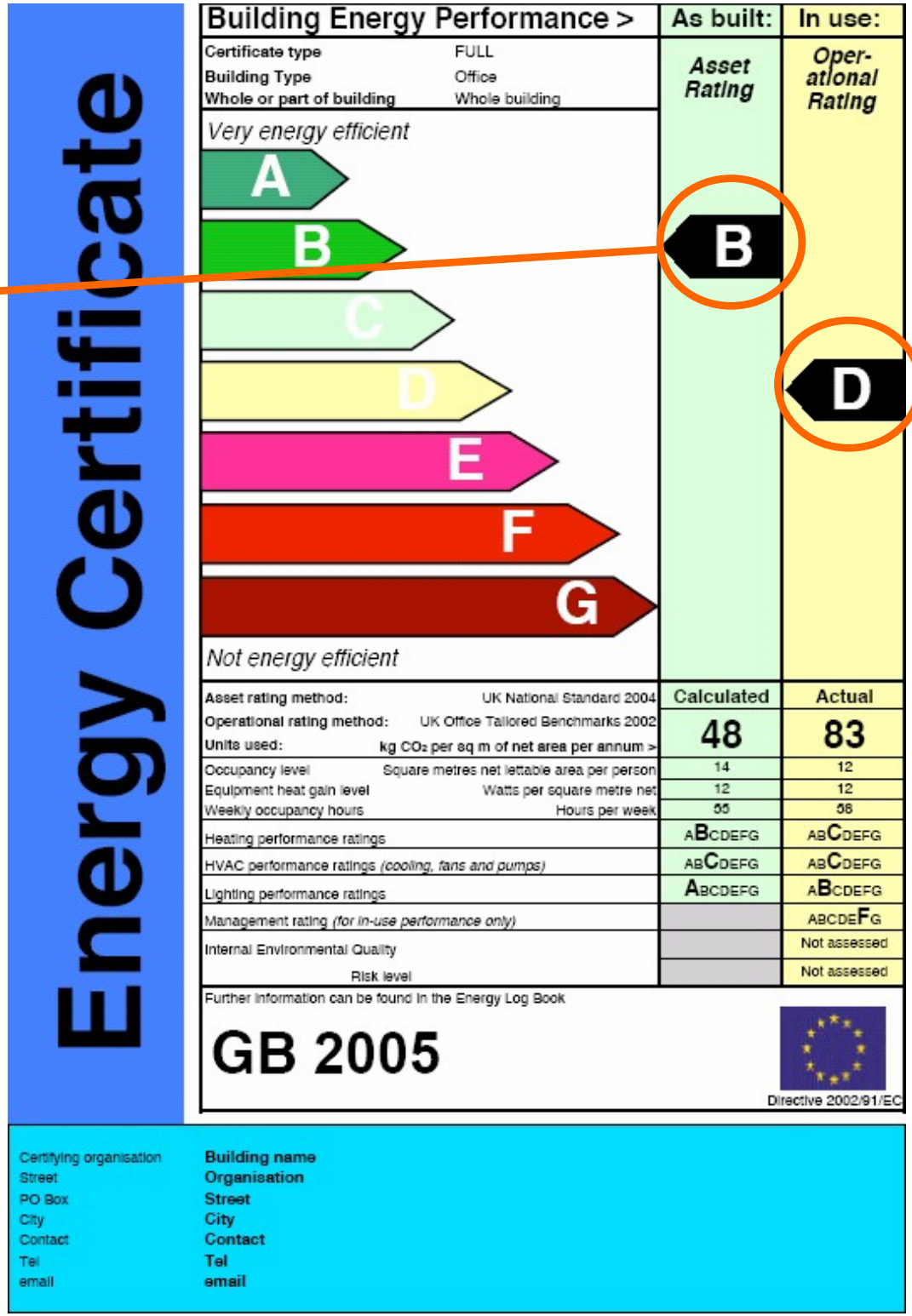
- **EU's energy performance certificates**
  - Should not be more than 10 years old
  - Be accompanied with advice on how to improve the energy performance
  - Be carried out by independent and qualified experts
- Publicising the certificates
  - Display them in a prominent place
  - Form the basis for building energy rating or label

Just like academic results (成績表) for a building!
Grade A – B – C – D – E …



Three examples of energy certificate proposed in Europe

As built:
Asset rating
(calculated)



In use:
Operational
rating
(actual)

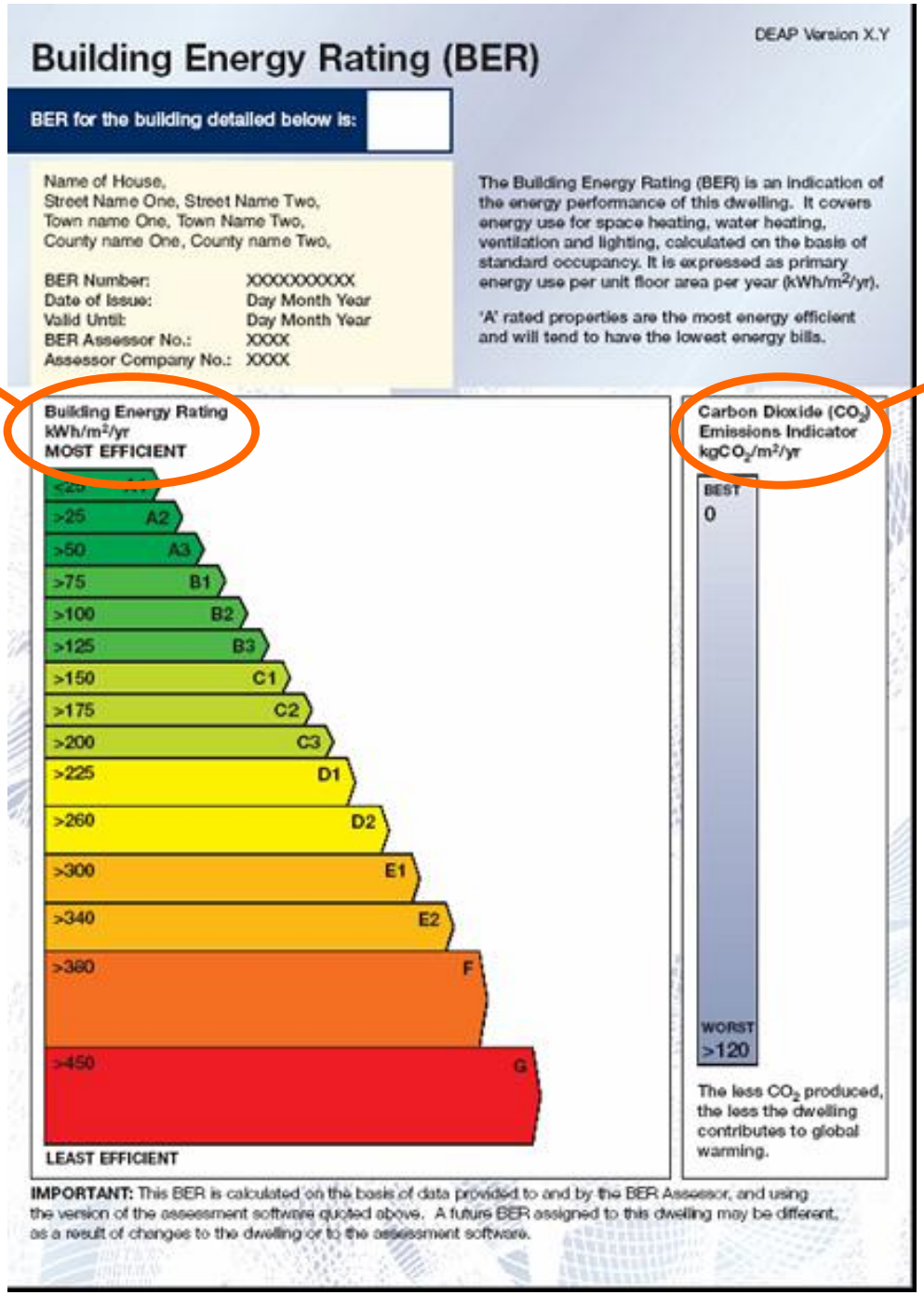
Proposed energy certificate of buildings in Europe
(source: ww.eplabel.org)

- Rating method & units
- Occupancy level
- Heating performance
- HVAC performance
- Lighting performance
- Management rating
- Internal environ. quality

Example of building energy rating (Ireland)

Building energy rating ($kWh/m^2/yr$)

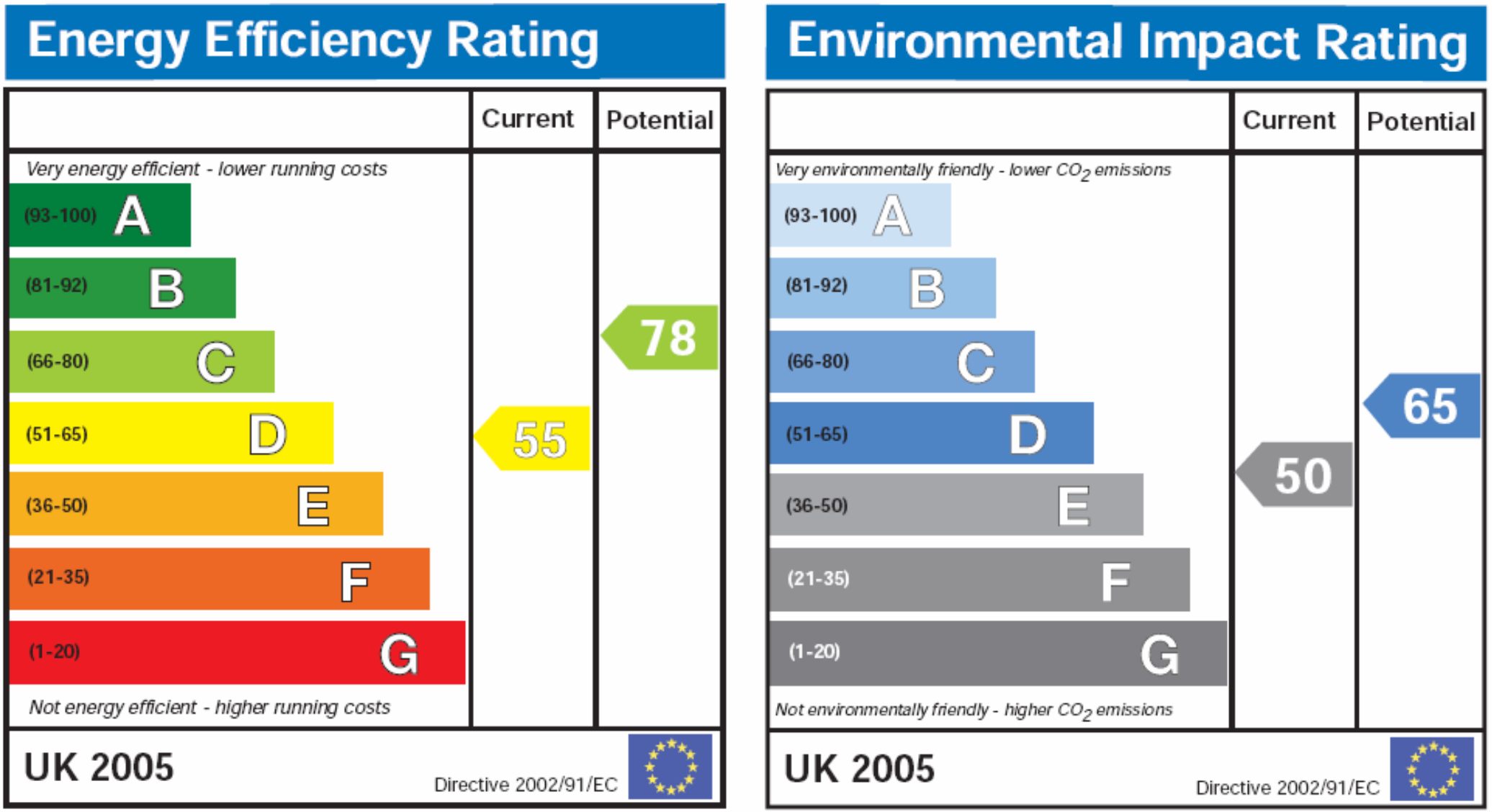
CO_2 emission indicator ($kgCO_2/m^2/yr$)



(source: Sustainable Energy Ireland, www.sei.ie)

Experience in Europe

- The certificates apply to public buildings, homes, offices, etc.
- Some EU countries develop it further to include environmental impact rating
  - Such as UK and Denmark
    - Energy efficiency rating based on fuel cost
    - Environmental impact rating based on CO_2 emissions
- Future trends: links with mortgage, rates & tenancy agreement ($$ incentives)



Energy efficiency rating and environmental impact rating in UK

(Source: www.energysavingtrust.org.uk)

Certificate number:	XXXX
Date issued:	XXXX
Name of inspector:	XXXX

Section H: Energy Performance Certificate

Summary of this home's energy performance related features

The table shows the current performance of each element of this home on the following scale:
Extremely poor/ Very poor/ Poor/ Average/ Good/ Very good/ Excellent

Element	Description	Current performance
Main walls	Uninsulated cavity wall	Poor
Main roof	Pitched, 100mm loft insulation	Average
Main floor	Uninsulated solid concrete (assumed)	Average
Windows	Single glazed throughout	Extremely poor
Main heating	Mains gas back boiler	Poor
Main heating controls	No controls	Extremely poor
Secondary heating	Flame effect fire	Extremely poor
Hot water	From main heating system; uninsulated cylinder	Extremely poor
Lighting	Low energy lighting throughout	Excellent
Current energy efficiency rating		D 55
Current environmental impact rating		E 50

Example of how the performance of each element is indicated

(Source: www.energysavingtrust.org.uk)

Measures to improve this home's performance ratings

The improved performance ratings are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

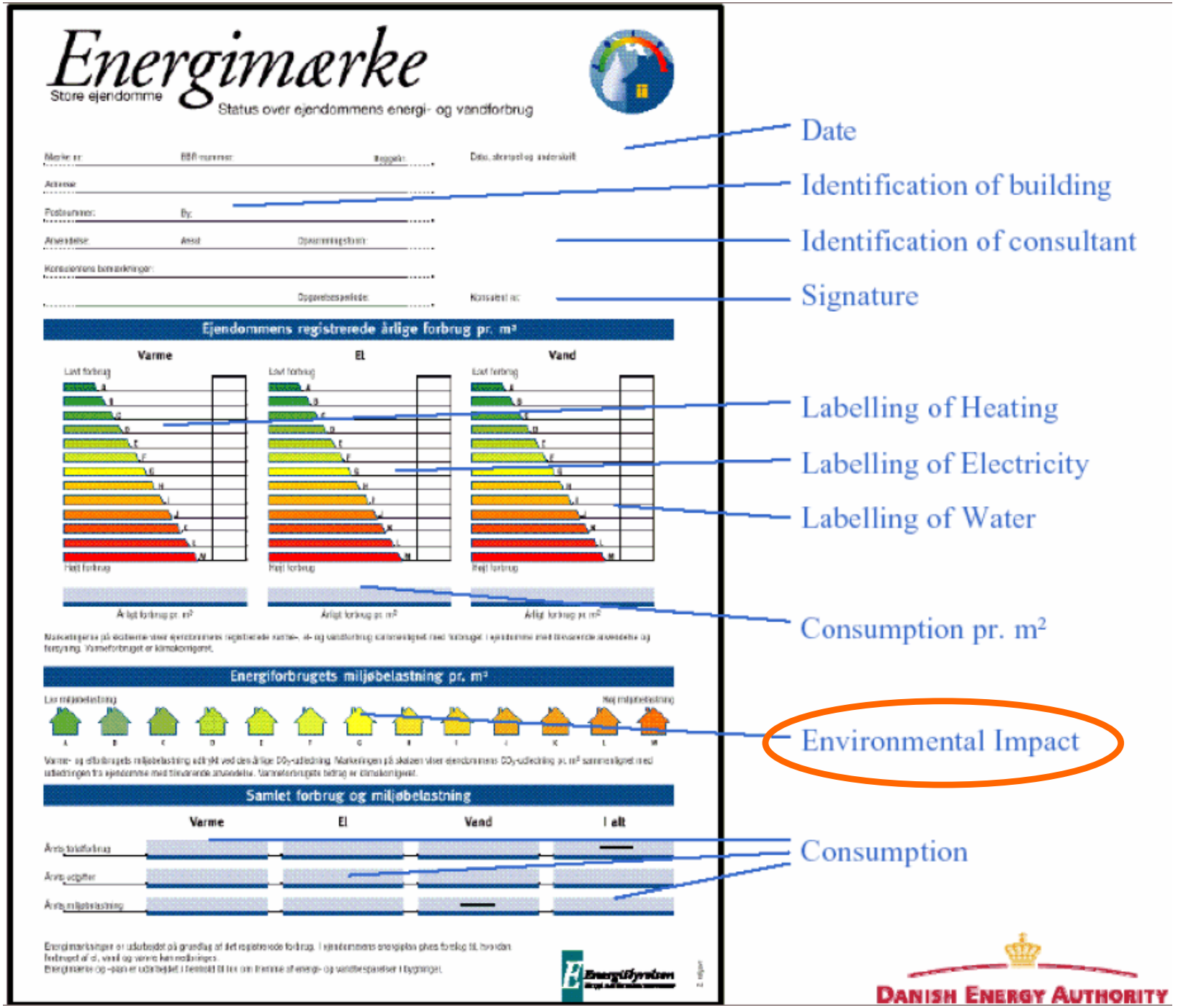
Lower cost measures	Typical savings	Performance ratings after improvement	
		Energy efficiency	Environmental impact
Cavity wall insulation	£xx per year	D 65	D 56
Loft insulation top up to 250mm	£xx per year	C 68	D 57
Hot water tank and pipe work insulation	£xx per year	C 69	D 58
	Sub Total £xx per year		
Higher cost measures			
Condensing boiler	£xx per year	C 75	D 63
Installation of a full heating controls package	£xx per year	C 78	D 65
	Sub Total £xx per year		
Potential energy efficiency rating		C 78	
Potential environmental impact rating			D 65

Further measures to achieve even higher standards

Double glazing	£xx per year	C 80	C 67
Solar water heating	£xx per year	B 85	C 72
Enhanced energy efficiency rating		B 85	
Enhanced environmental impact rating			C 72

Example of improvement measures suggested

(Source: www.energysavingtrust.org.uk)



Energy certificate or label for buildings in Denmark

Experience in USA

- Energy Star Label for Buildings
  - www.energystar.gov
  - For buildings (commercial & industrial)
  - For homes (residential)
- Building energy rating system in some States (e.g. Florida)
  - Categorical ranking (e.g. scale 1 to 5 or stars 1 to 5)
  - Continuous scale (a bar graph)
  - Information only (w/o comparing to others)

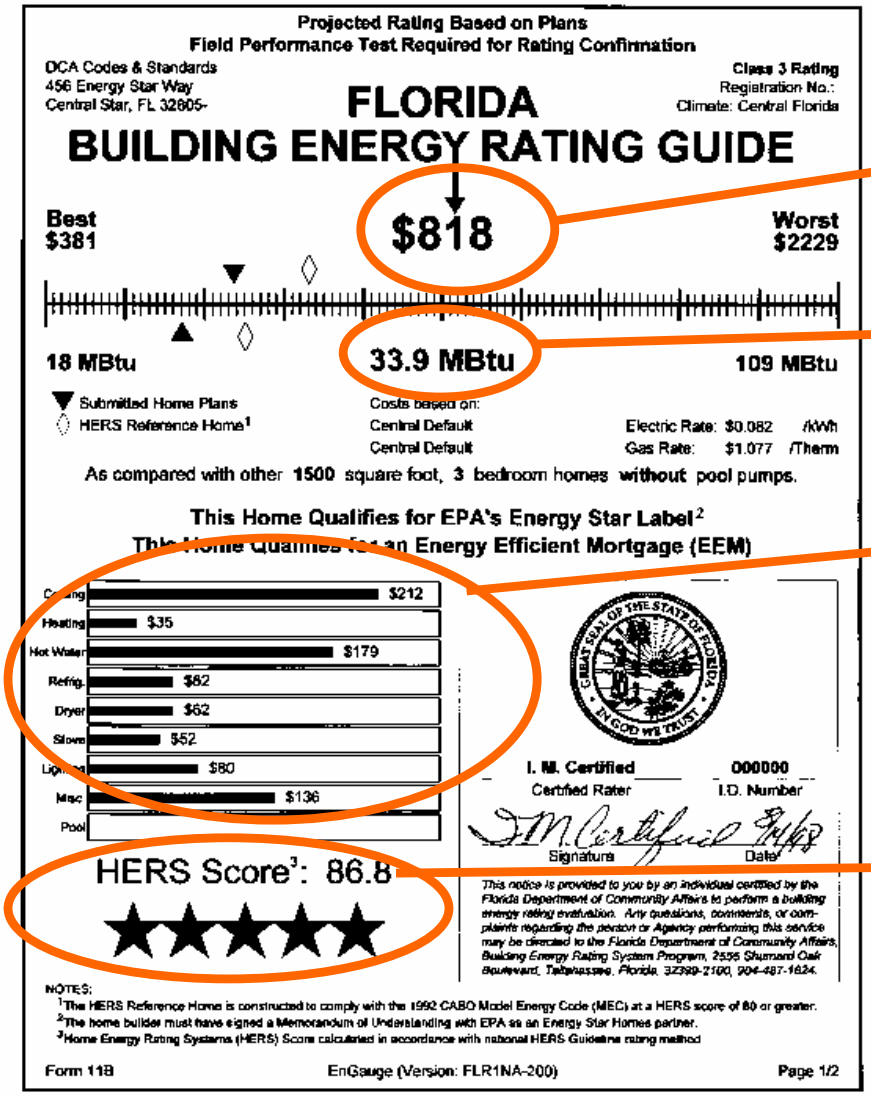
Energy label and rating systems for buildings in USA

Energy Star Label for Buildings

Buildings that rate in the top 25% of energy-efficient buildings in USA

http://www.energystar.gov/

Building Energy Rating System (Florida)



Energy cost

Energy consumption

Breakdown of energy use

Overall score

http://www.fsec.ucf.edu/ratings/

Experience in USA

- Benchmarking energy performance
  - Determine how efficient the building is
    - e.g. “Statement of Energy Performance”
  - Set targets for increased efficiency
  - Also important for energy performance contracting to quantify savings (measurement & verification, M&V)
- Energy Star Label
  - Voluntary by design; partnerships are critical
  - An *information* and *branding* campaign

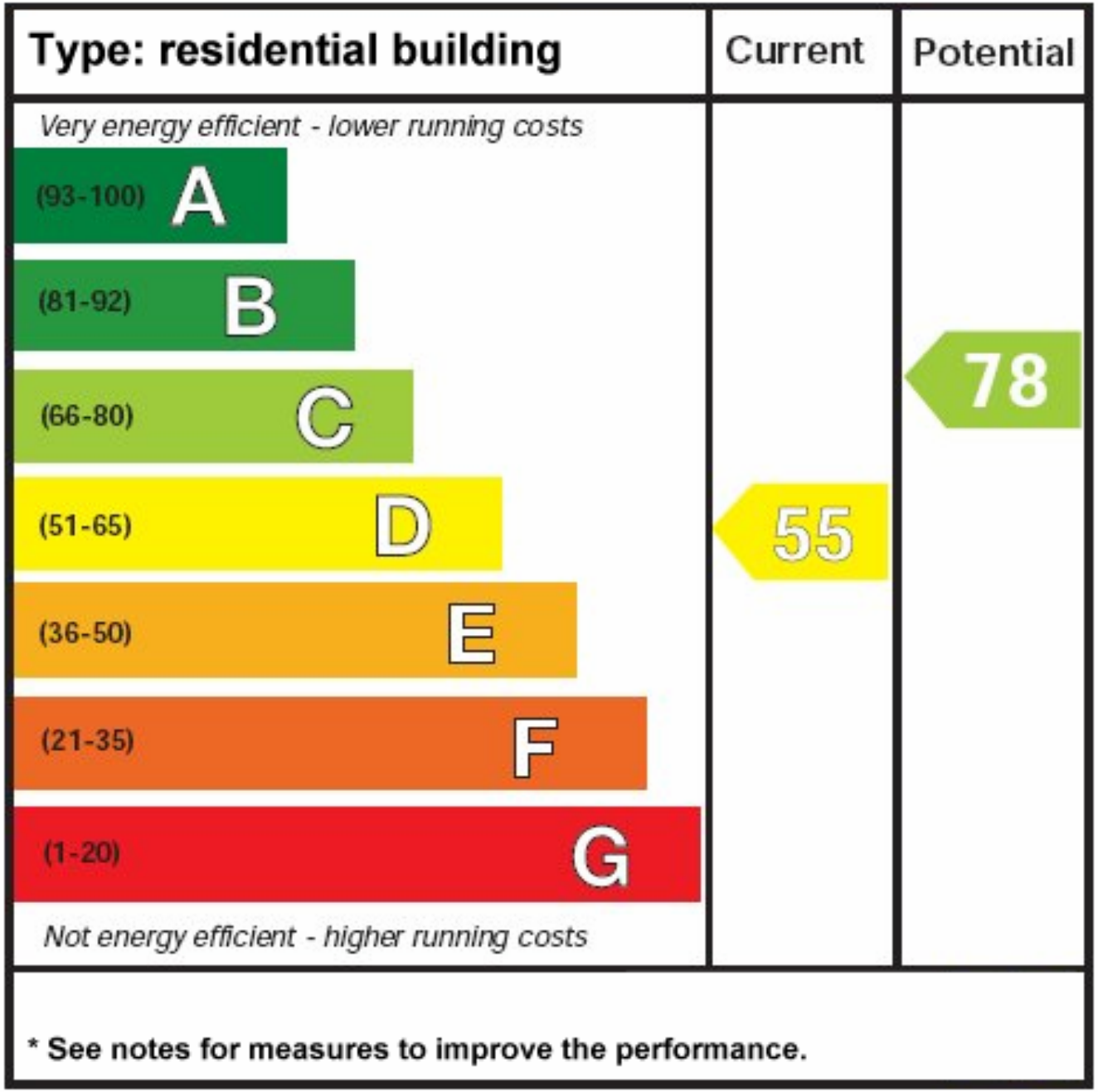
Experience in USA

- Energy Star for Buildings: tools & resources
  - Energy Star Challenge (publicity toolkit)
    - www.energystar.gov/challenge
  - Energy Star Partnership (assistance)
  - Energy Star Leaders (portfolio)
  - Guidelines for Energy Management (information)
  - Building Upgrade Manual (information)
  - New Building Design Guidance (information)

Conclusions

- Current situation in Hong Kong
  - Developers are not interested in energy efficiency
  - Building owners/tenants pay for running costs
  - Lack of clear info. on bldg. energy performance
  - Need for better awareness & education
- The "*Push*" strategy: enhance information on building energy performance
  - Building energy labels, energy audits, awards
  - Policy to promote market forces and education

Hong Kong Building Energy Label



How could we develop such a building energy label in Hong Kong?

Conclusions

- Strategy to develop building energy labels
  - Labelling concept
    - Select measuring indicator & labelling method
  - Rating method (quite complicated)
    - Determine assessment tools & methods
    - Decide on calculation methodology
  - Certification process
    - Comparison & benchmarking
  - Publicity & displaying the labels

Conclusions

- Energy label & certification of buildings
  - For new buildings: specify energy performance baseline (allow people to know & compare)
  - For existing buildings: upgrade to meet the building energy codes (during retrofits)
- More than a building energy label
  - Provide other related info (CO_2 emission, water consumption, % renewables)
  - Offer suggestions for improvement (simple actions, technical solutions)

Building energy label from Display Campaign in Europe

Category ranking (A to G)

Energy consumption ($kWh/m^2/yr$)

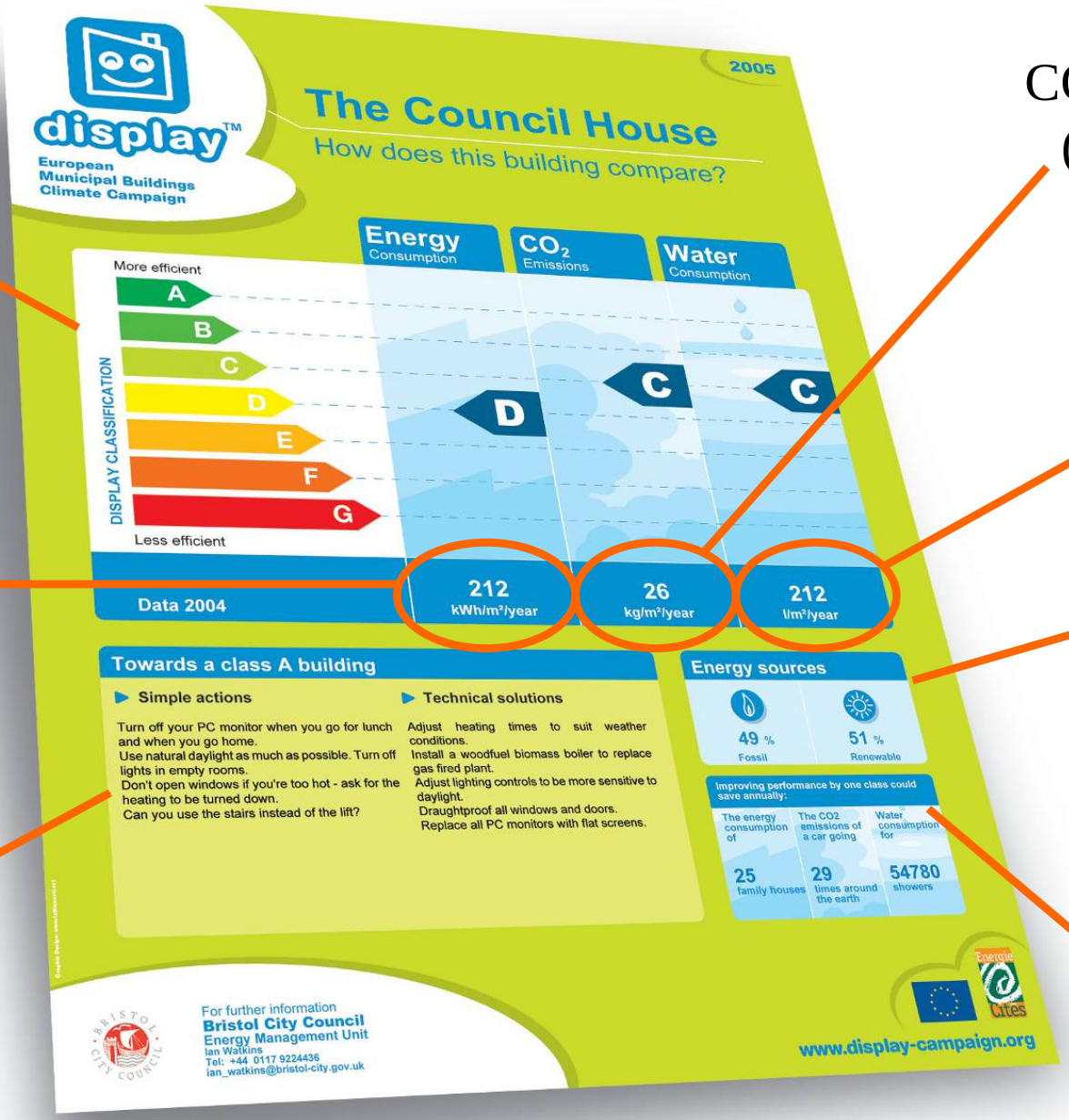
Simple actions & Technical solutions

CO_2 emission ($kg/m^2/yr$)

Water consumption ($l/m^2/yr$)

Energy sources: % fossil & % renewables

Improve performance by one class could save annually



(source: www.display-campaign.org)

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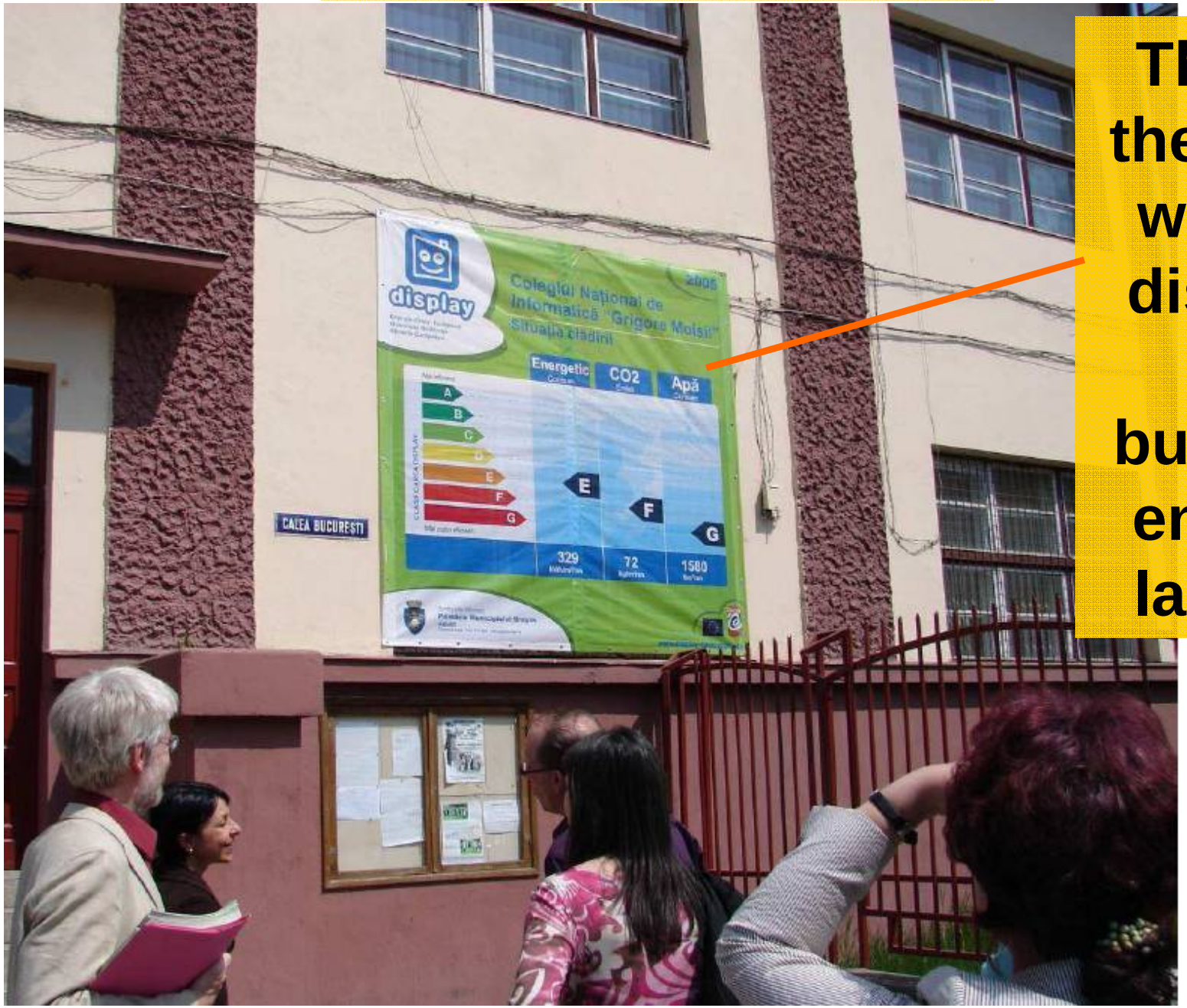

This is the right way to display the building energy label !!

(source: www.display-campaign.org)