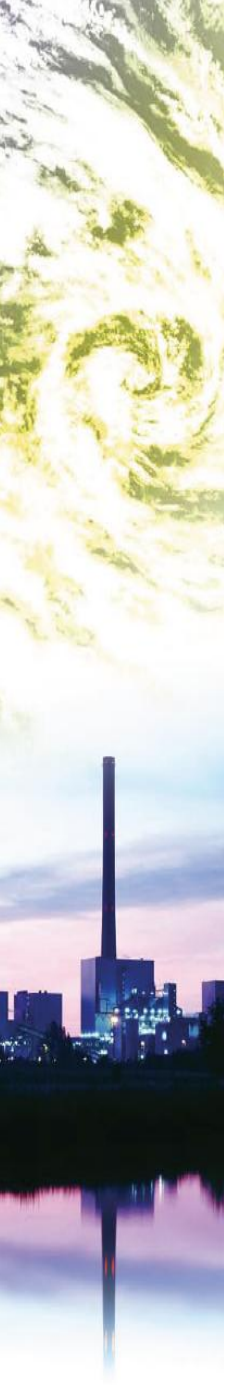


IEA Day COP-14 2008

Electrical End-Use Energy Efficiency Policy: Lighting, Appliances, Motors and Utilities

Paul Waide
Senior Policy Analyst
Energy Efficiency & Environment Division
International Energy Agency

9th December 2008, Poznan

IEA energy efficiency policy analysis

Sector/end-use analysis & implementation support
- Appliances/Equipment
- Buildings
- Transport
- Industry
- Indicators
- Standardisation

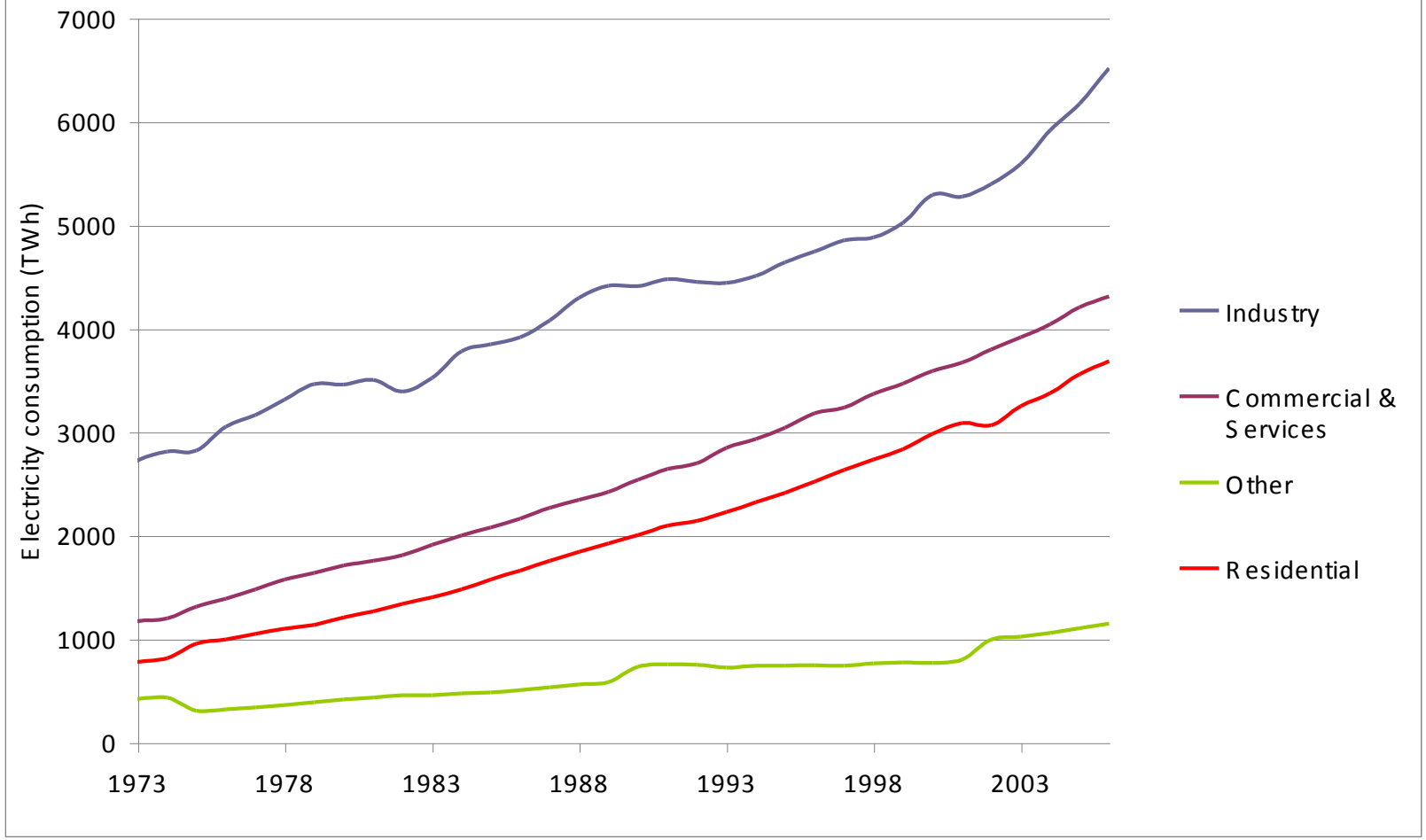
Cross-sectoral policy analysis
- Finance
- Barriers
- Energy efficiency strategies
- Evaluation & compliance
- Carbon constrained world
- Cities
- Utilities
- Energy scenarios

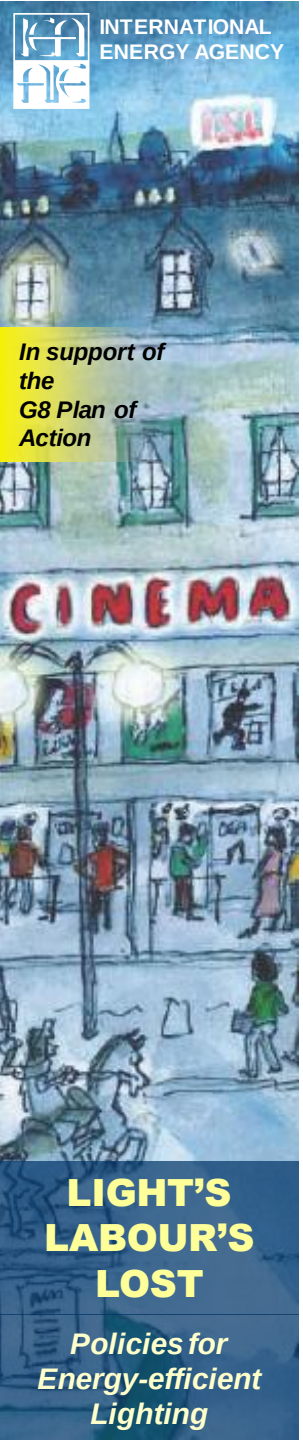
International cooperation and outreach

G8
- Recommendations
- Progress reporting

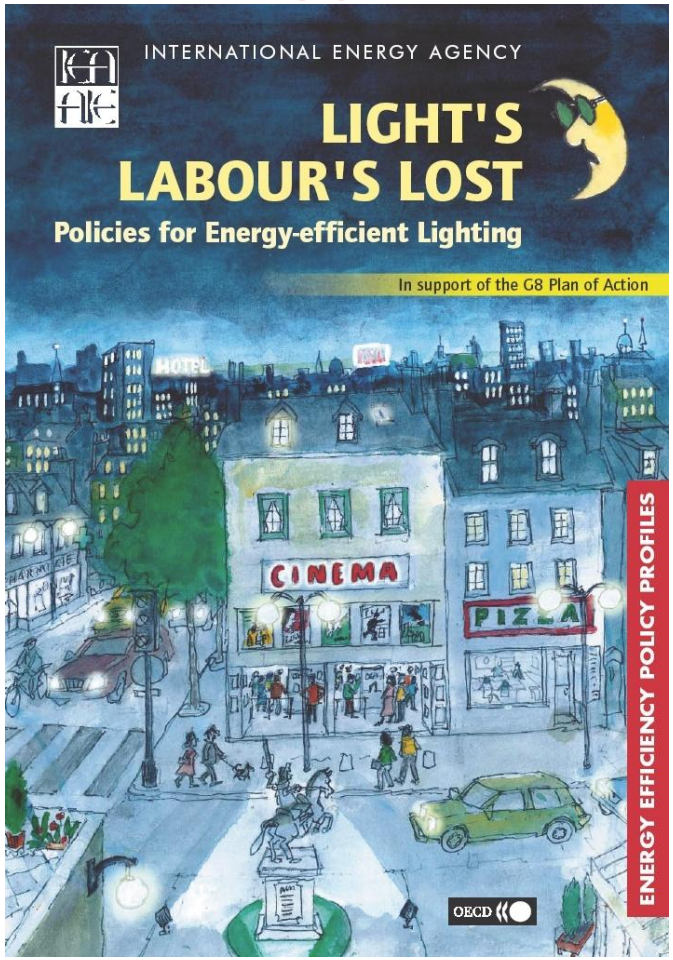
Other
- Workshops/Facilitation
- Implementing Agreements
- Bi-lateral measures
- Non-member countries
- Country reviews

Global electricity consumption by user sector





Light's Labour's Lost
Policies for Energy-efficient Lighting

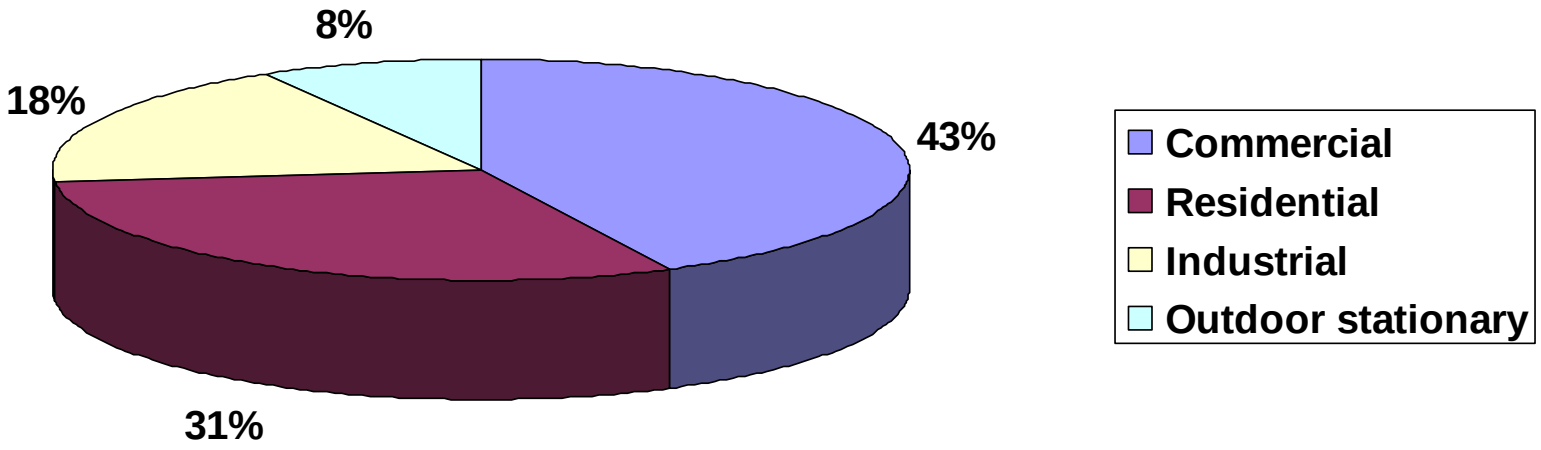


Claude Mandil, Executive Director
Paul Waide, Senior Policy Analyst
International Energy Agency

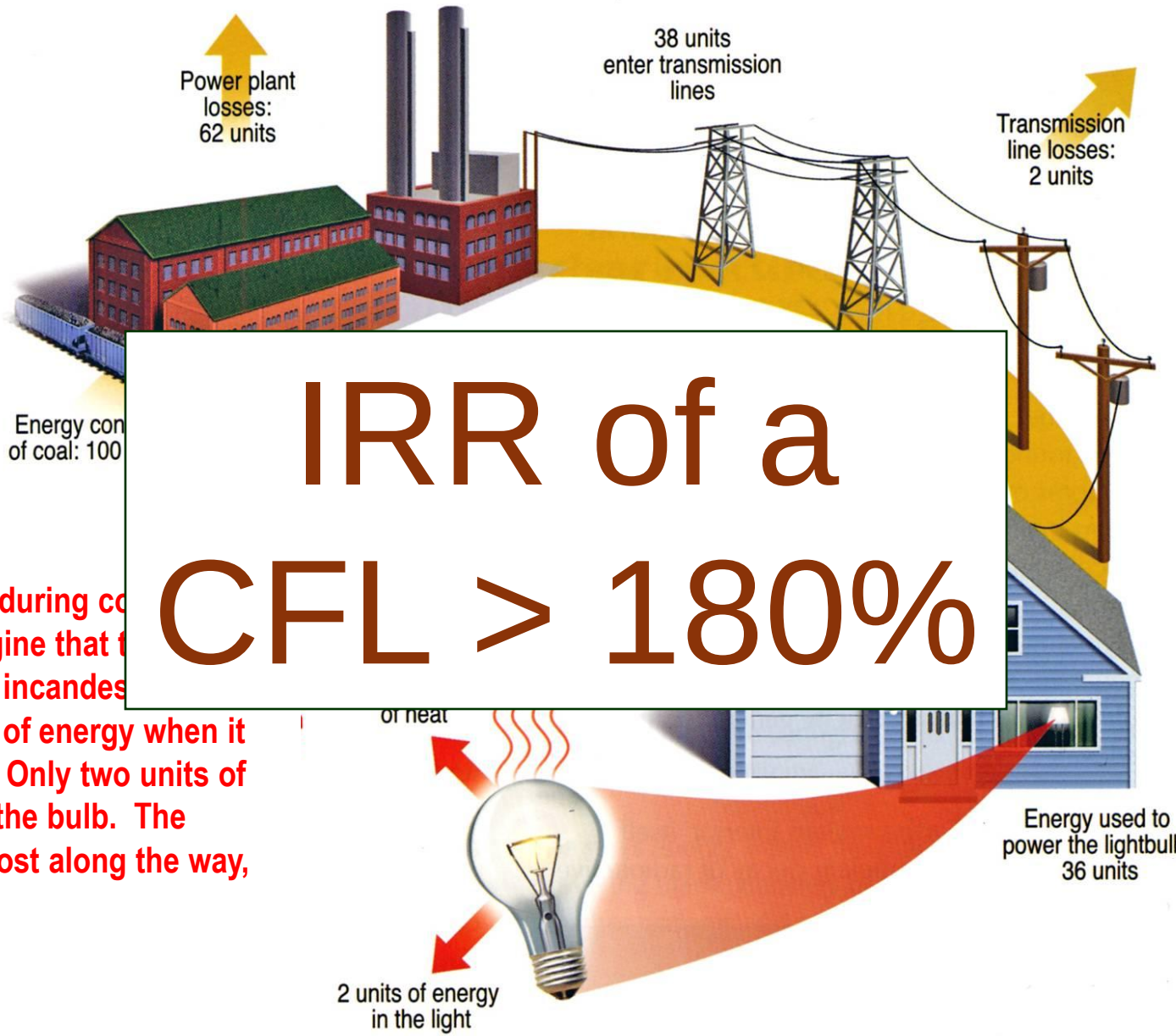
How important is lighting?

- 2650 TWh of electricity consumption
- some 19% of global electricity use (15-17% greater than nuclear or hydro power)
- equivalent to production of all gas-fired power generation, or 1265 power plants
- Emits 1900 Mt of CO_2/yr = 70% of the emissions of the world's car's

Lighting electricity consumption shares by sector in 2005



Overall efficiency of an incandescent lamp = 2%

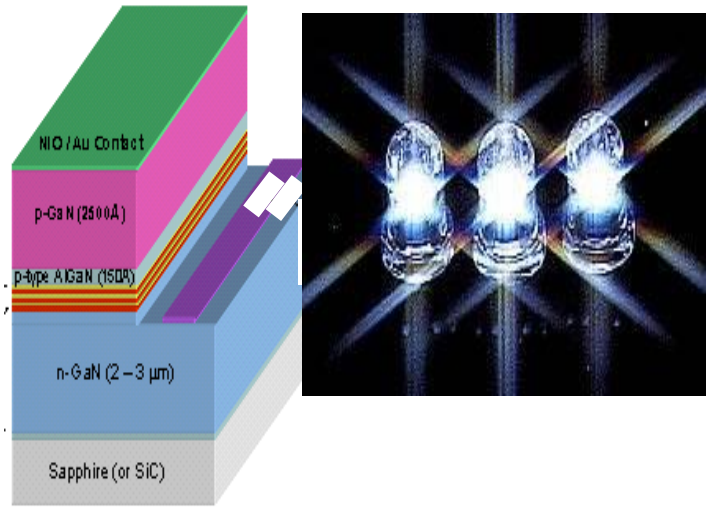


IRR of a CFL > 180%

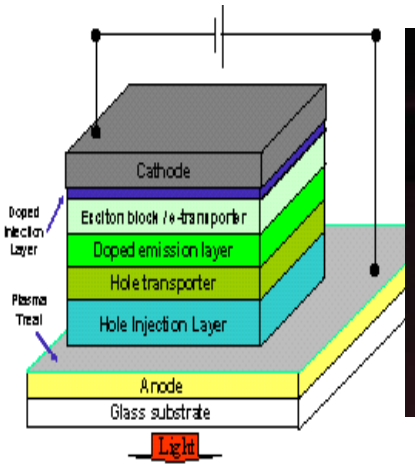
Example of energy lost during co
and transmission. Imagine that t
needed to illuminate an incandes
bulb contains 100 units of energy when it enters the power plant. Only two units of energy eventually light the bulb. The remaining 98 units are lost along the way, primarily as heat.

2008

Solid state lighting can do much better – already 10 times



Schematic and image of solid-state lighting based on inorganic semiconducting light emitting diodes (LEDs), which provide point light sources.



Schematic and image of small molecules-based organic light emitting diodes (OLEDs), which provide diffuse planar light.

Source: Sebastian Moffatt, CONSENSUS Institute

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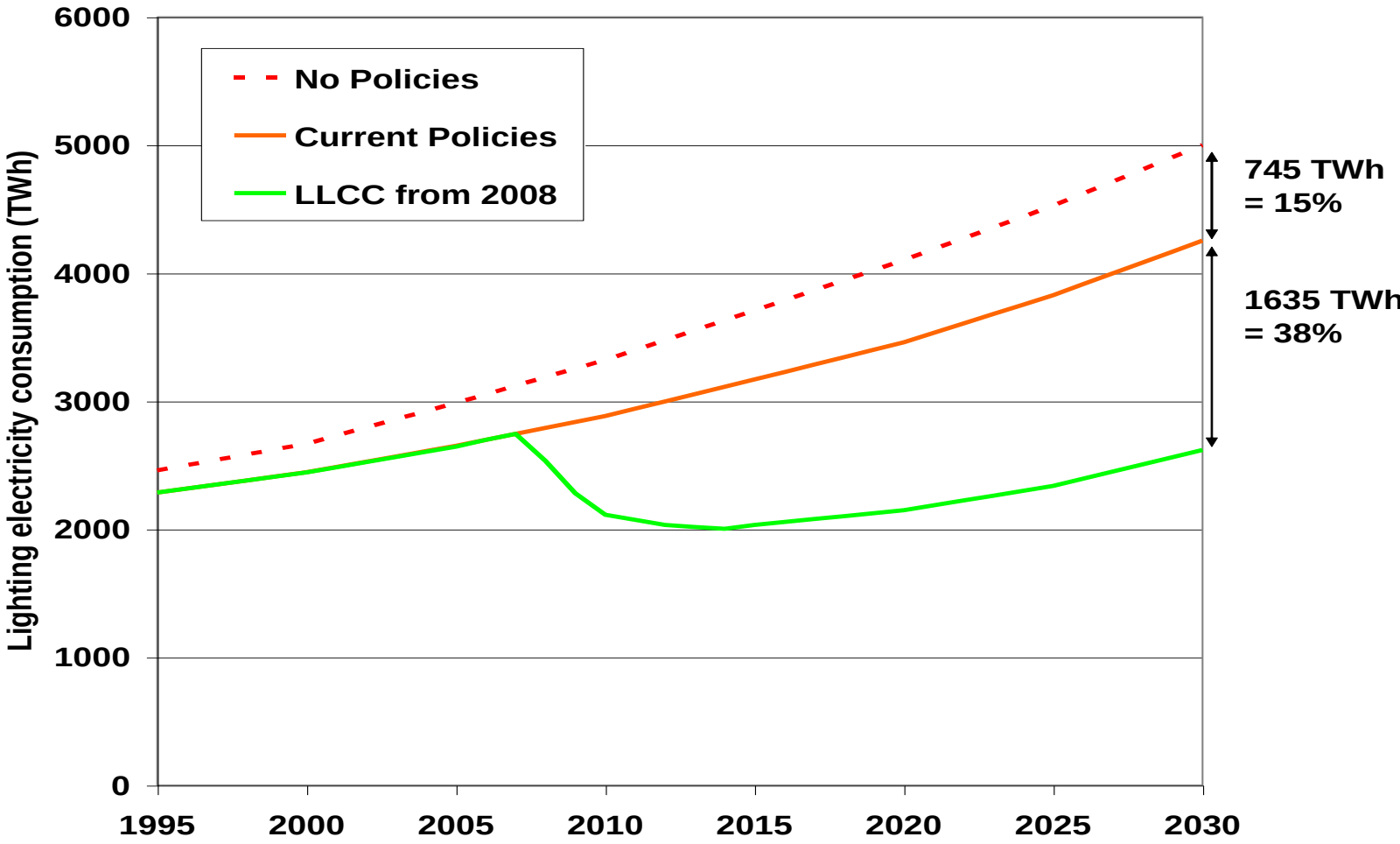
Efficient lighting saves money

IRR = 50%

LIGHT'S LABOUR'S LOST

Policies for Energy-efficient Lighting

Global lighting electricity demand: What can be saved cost-effectively?



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Policy is needed: the market doesn't deliver all cost-effective savings

- Missing or partial information on energy efficiency – it is not visible to end users
- Low levels of awareness re cost-effective savings potentials
- Split incentives: Landlord-Tenant issue; division of capital acquisition vs. operation & maintenance budgets; energy capital lifespan often longer than ownership period, etc.
- Fragmented supply chains and shortage of necessary skills to deliver higher efficiency
- Energy budgets have low priority: EE is bundled-in with more important capital decision factors
- All result in emphasis on 1st not Life-cycle costs

In support of the G8 Plan of Action

Countries in the process of phasing-out incandescent lamps

- IEA made recommendations to G8 (2006 & 2007)
- Cuba (already done!)
- Australia + New Zealand (start 2008)
- US (2012-14 but also CA, NV)
- EU (by 2012?)
- Canada + Switzerland (finalising regulation details)
- Japan (drafting requirements)
- Philippines, Thailand, Mexico, Argentina, Tunisia
- China + other non-OECD ?
- Global incandescent lamp sales are now in sharp decline
- Up to 500Mt CO_2 could be saved by 2012

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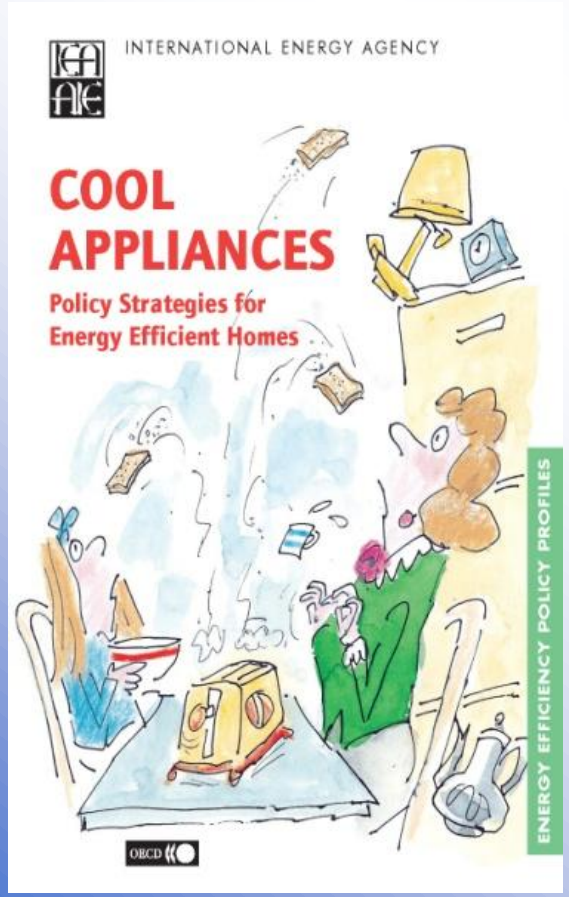
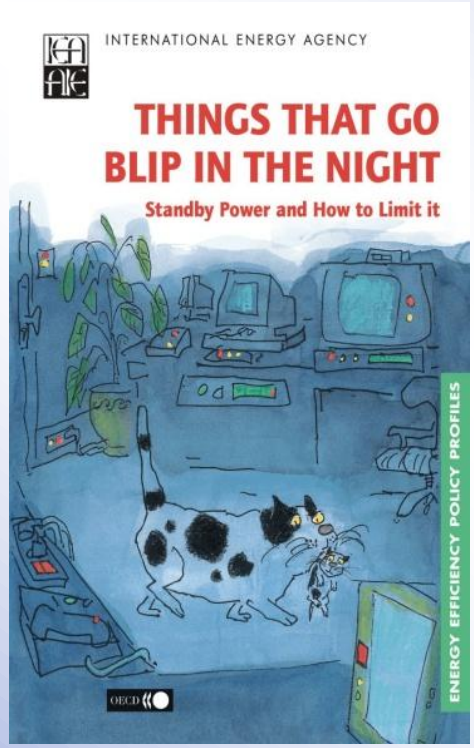
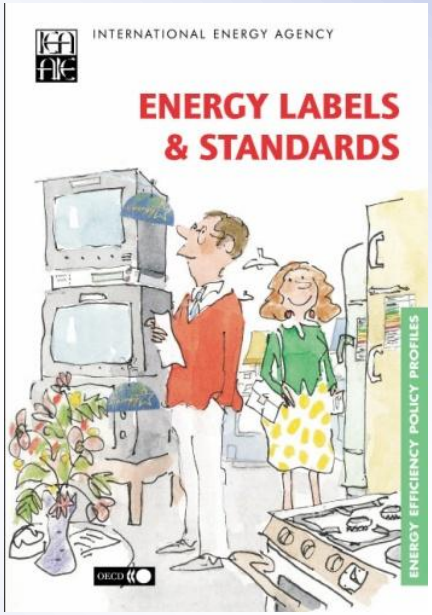
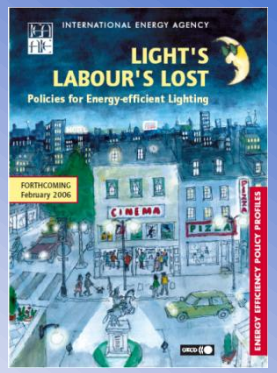
IEA publications on equipment energy efficiency

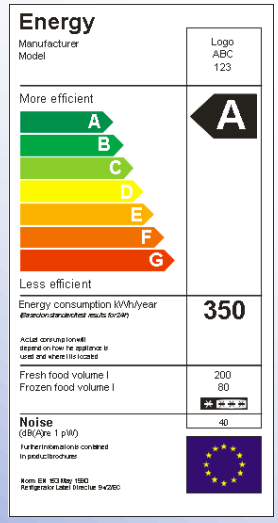


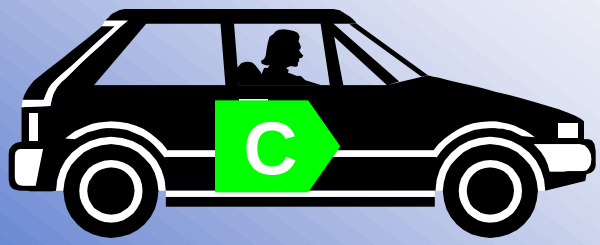




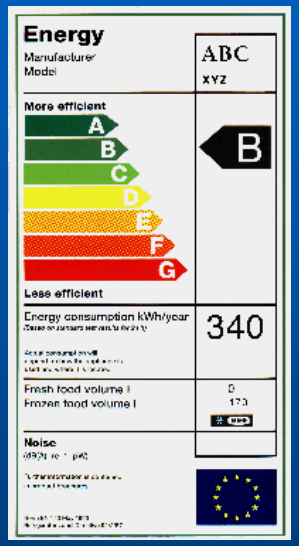


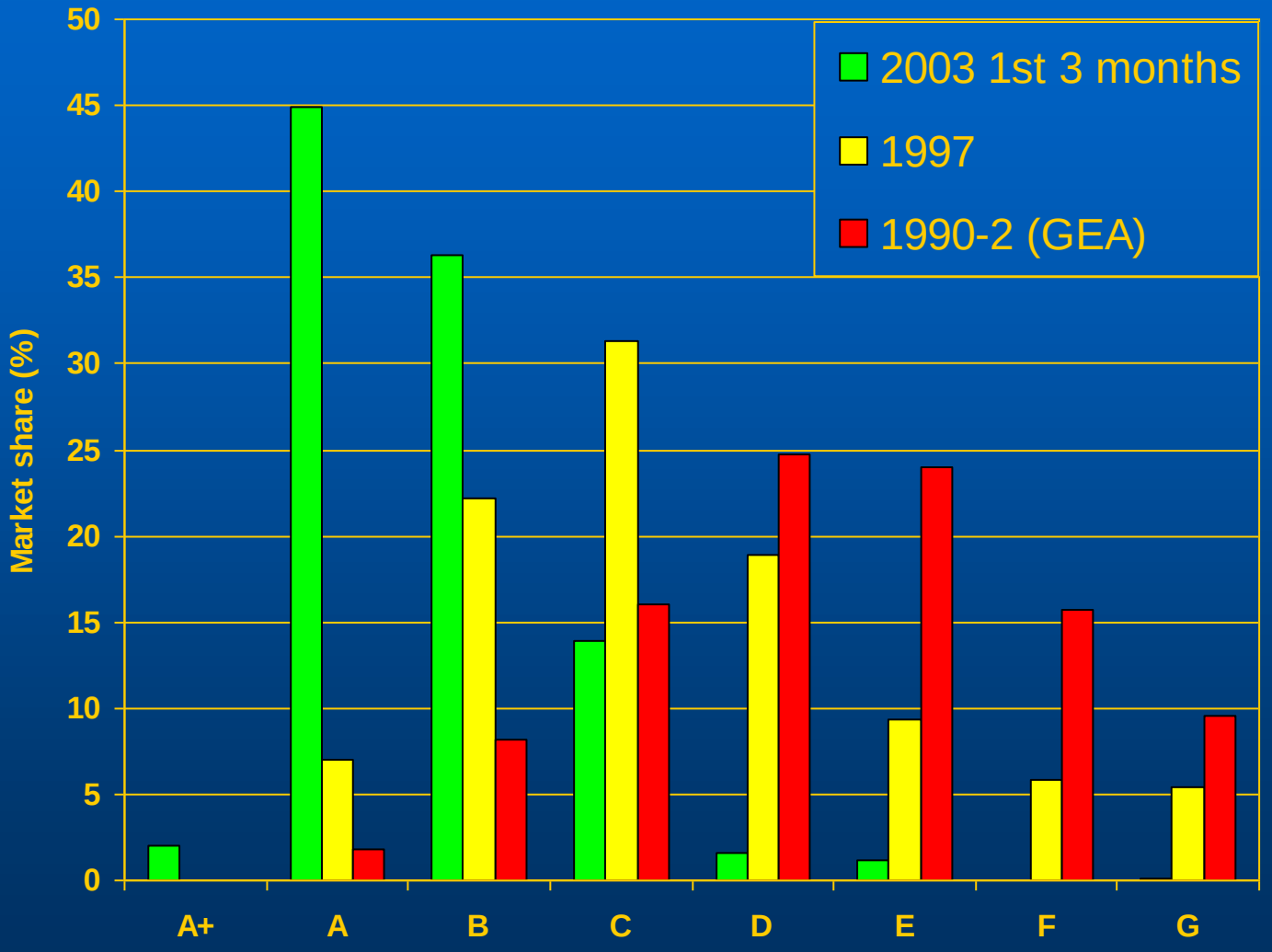
The importance of making energy efficiency visible





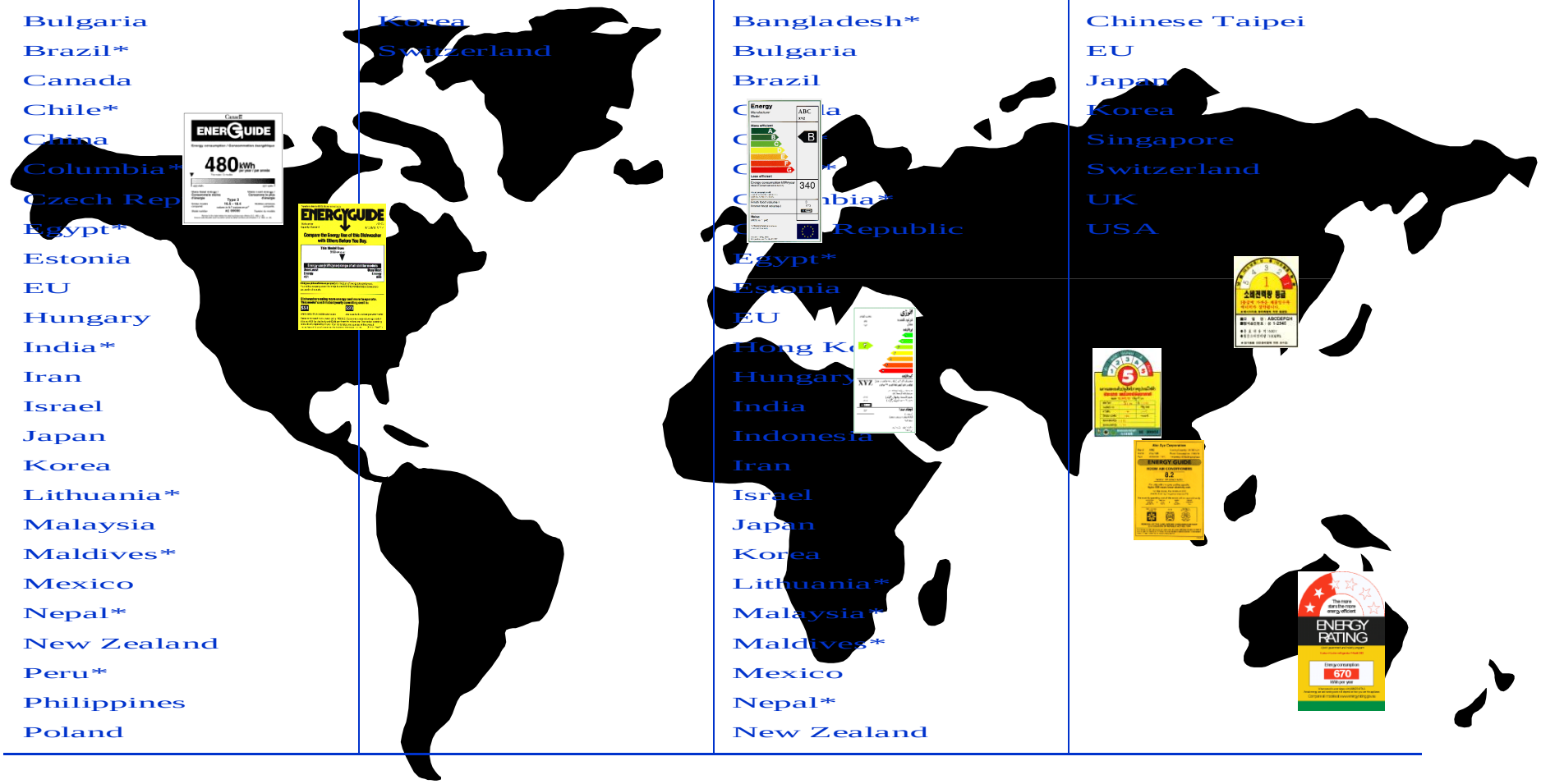
Labelling can produce major market transformation: e.g. refrigerators in EU





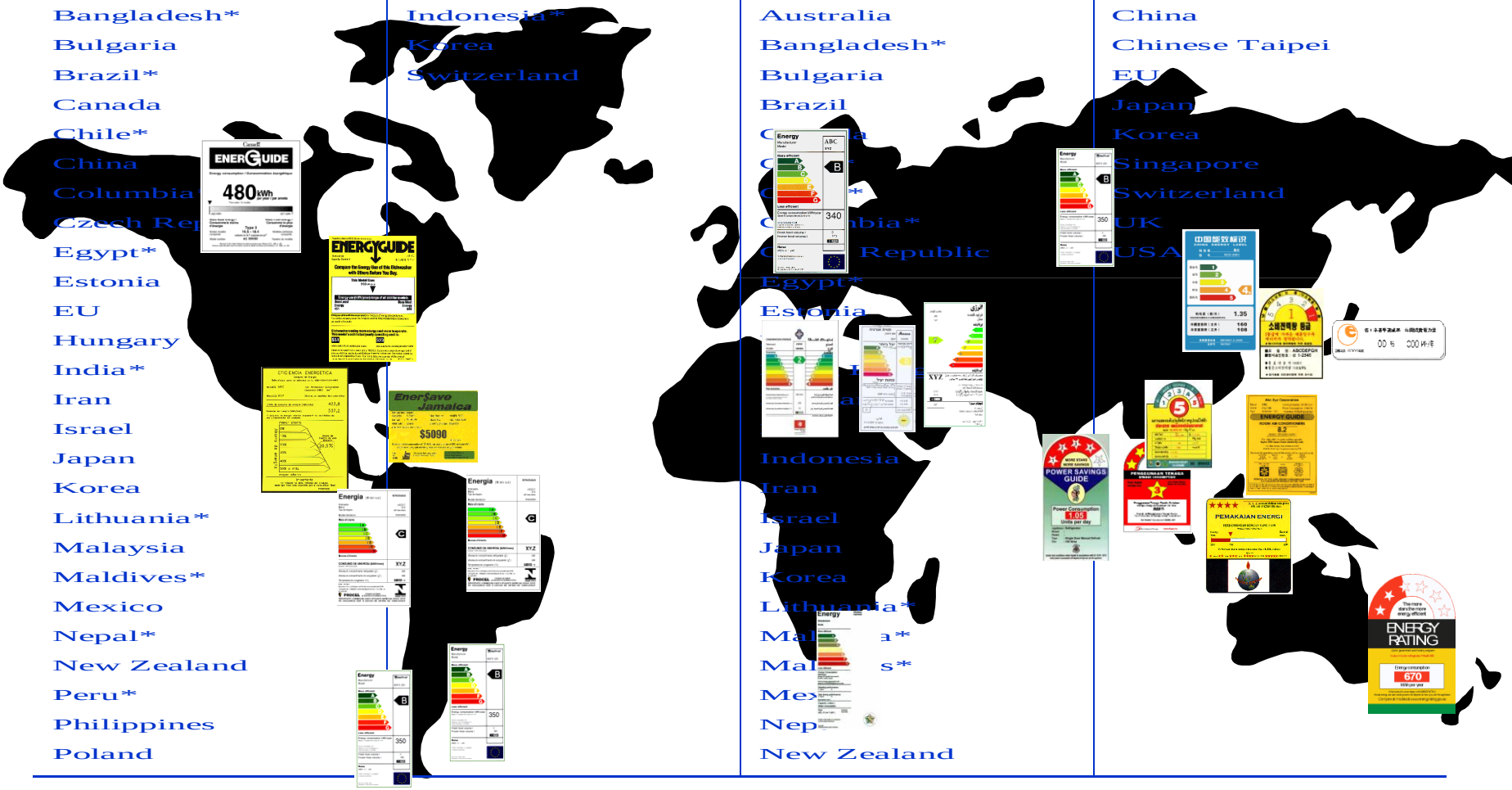
In 1997 ~22 countries with 16% of the world's population had standards and labelling

Mandatory standards	Voluntary Standards	Comparative Label	Endorsement Label
Algeria*	EU	Algeria*	Australia
Australia	India	Argentina*	Brazil
Bangladesh*	Indonesia*	Australia	China
Bulgaria	Korea	Bangladesh*	Chinese Taipei
Brazil*	Switzerland	Bulgaria	EU
Canada		Brazil	Japan
Chile*		C la	Korea
China		C	Singapore
Columbia*		C *	Switzerland
Czech Rep		C bia*	UK
Egypt*		C Republic	USA
Estonia		Egypt*	
EU		Estonia	
Hungary		EU	
India*		Hong K	
Iran		Hungary	
Israel		India	
Japan		Indonesia	
Korea		Iran	
Lithuania*		Israel	
Malaysia		Japan	
Maldives*		Korea	
Mexico		Lithuania*	
Nepal*		Malaysia*	
New Zealand		Maldives*	
Peru*		Mexico	
Philippines		Nepal*	
Poland		New Zealand	

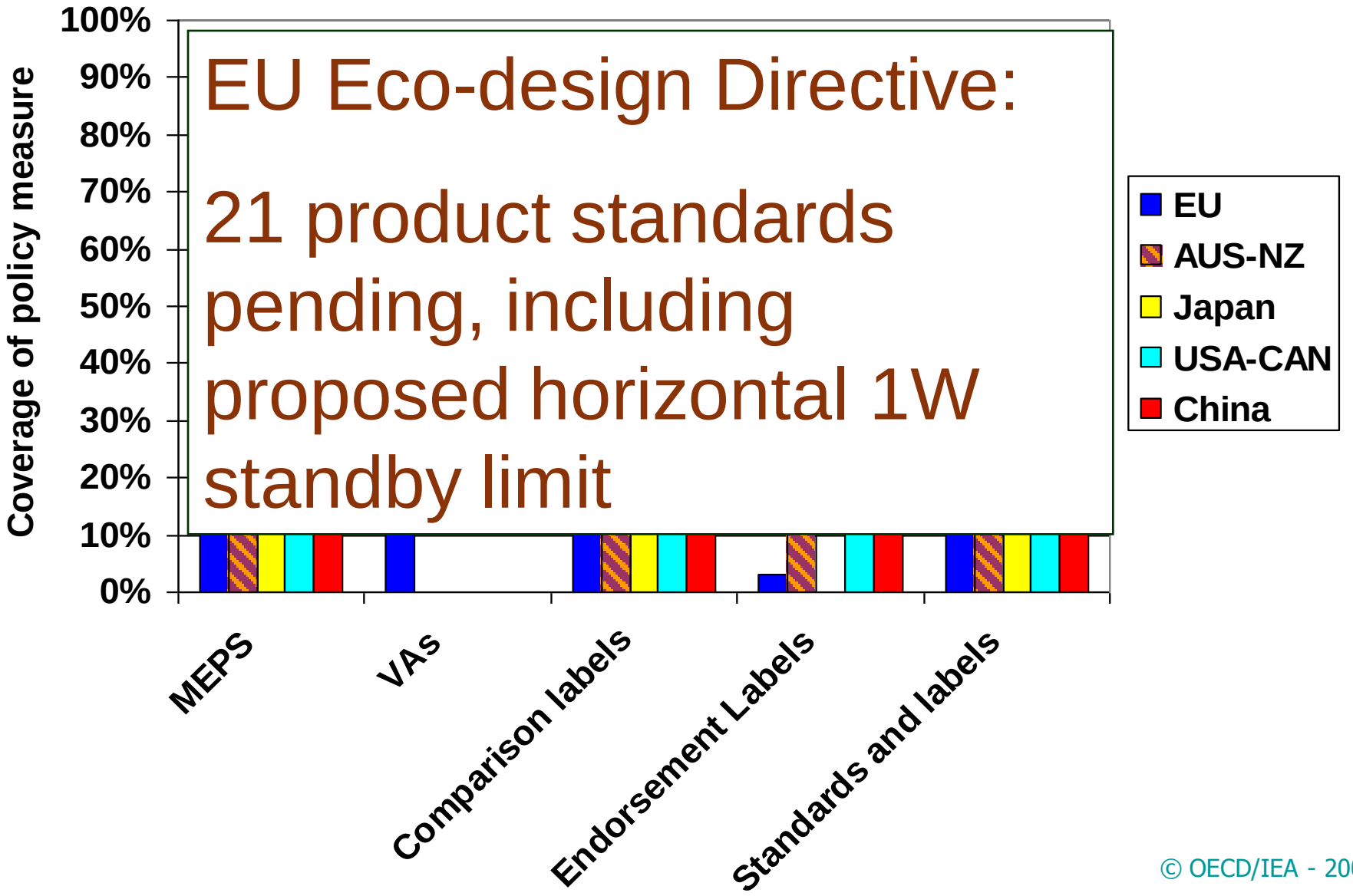


Today 61 countries with more than 80% of the world's population have standards & labelling

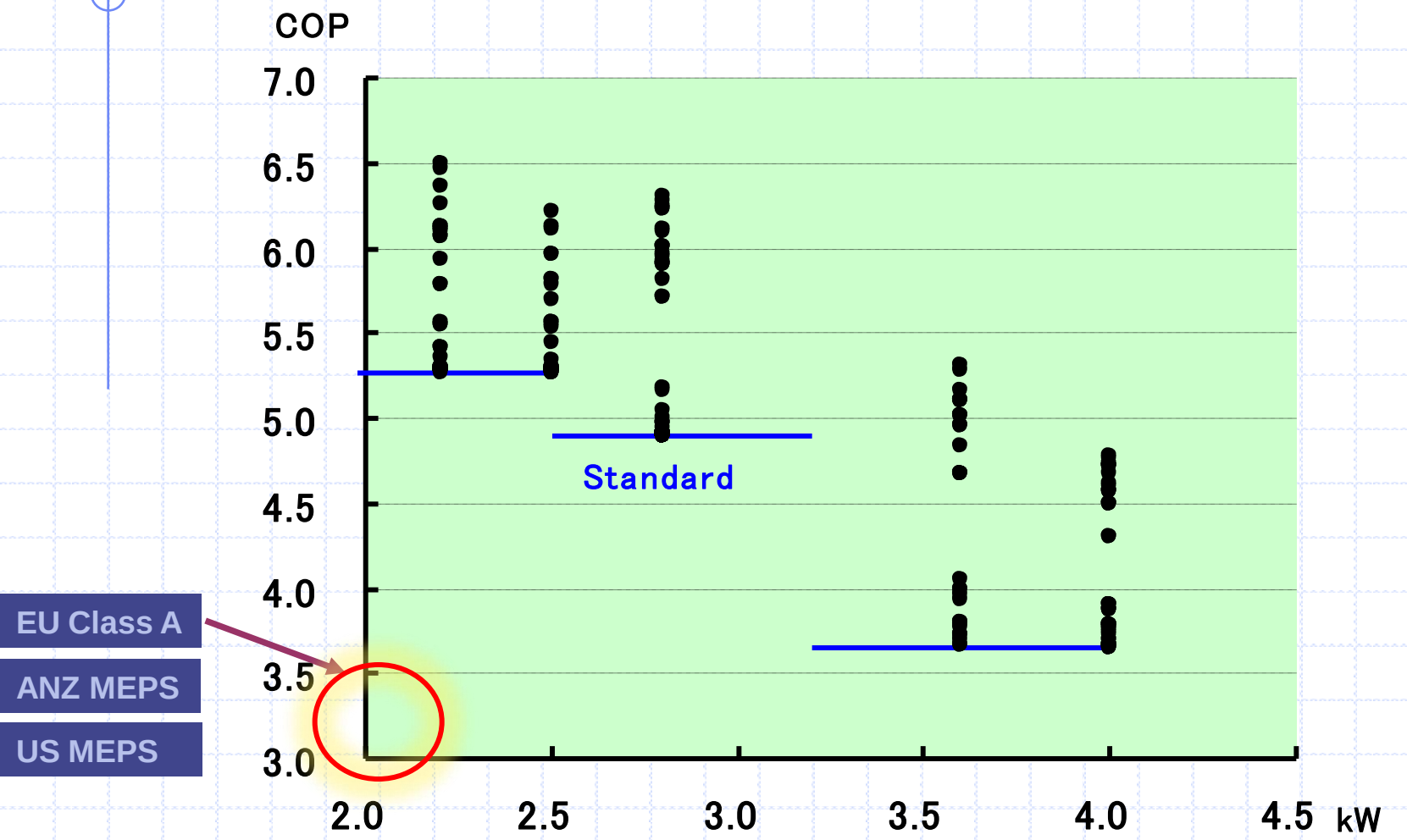
Mandatory standards	Voluntary Standards	Comparative Label	Endorsement Label
Algeria*	EU	Algeria*	Australia
Australia	India	Argentina*	Brazil
Bangladesh*	Indonesia*	Australia	China
Bulgaria	Korea	Bangladesh*	Chinese Taipei
Brazil*	Switzerland	Bulgaria	EU
Canada		Brazil	Japan
Chile*		C a	Korea
China		C *	Singapore
Columbia		C bia*	Switzerland
Czech Re		C Republic	UK
Egypt*		Egypt*	USA
Estonia		Estonia	
EU			
Hungary			
India*			
Iran			
Israel			
Japan		Indonesia	
Korea		Iran	
Lithuania*		Israel	
Malaysia		Japan	
Maldives*		Korea	
Mexico		Lithuania*	
Nepal*		Mal a*	
New Zealand		Mal s*	
Peru*		Mex	
Philippines		Nep	
Poland		New Zealand	



Yet policy coverage as a share of residential electricity use is still incomplete



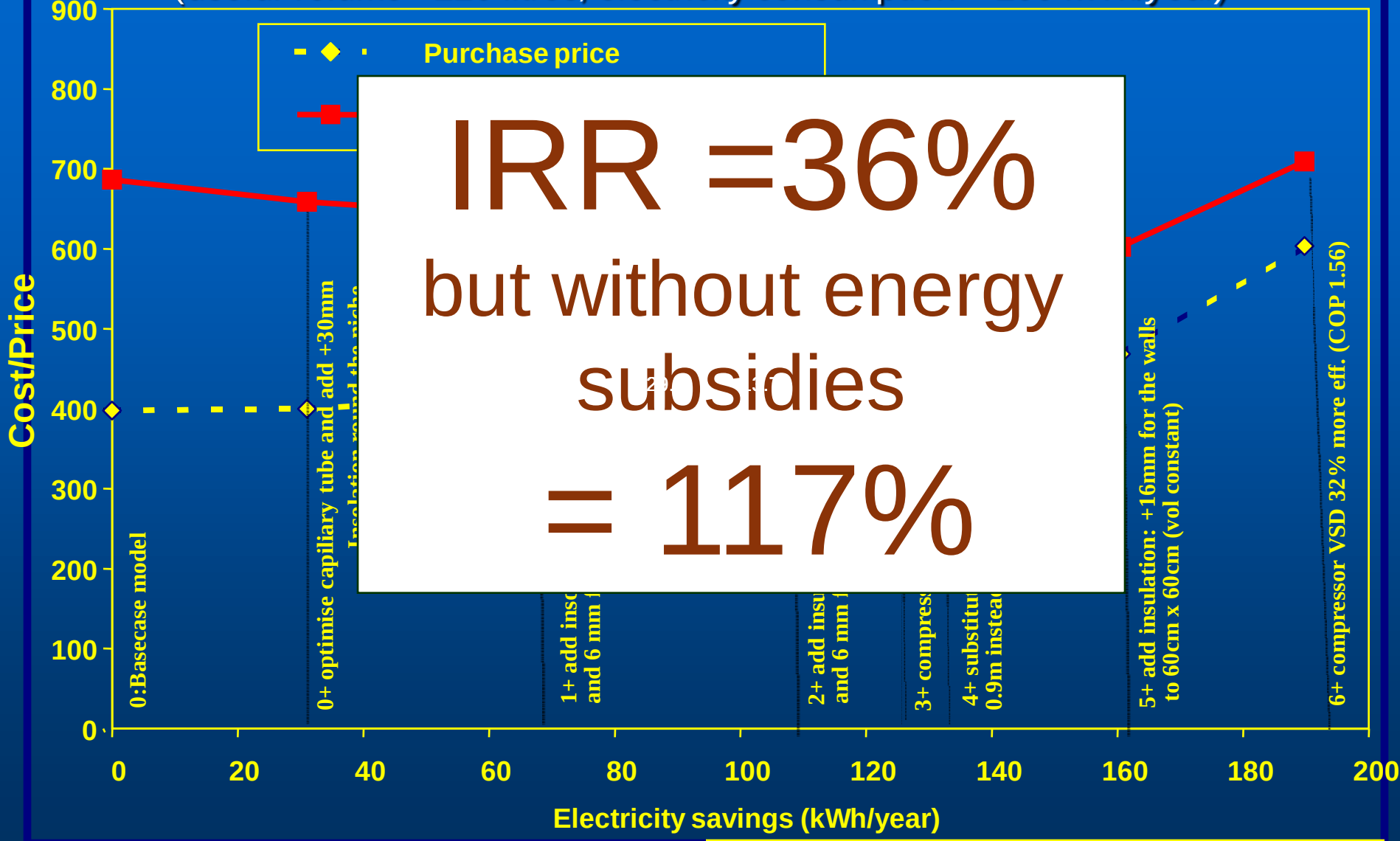
And stringency can be increased e.g. Japanese "Top Runner" standards for reversible room air conditioners



Source: C. Murakoshi et al, Jyukankyo Research Institute

Example: 2-star refrigerator (1 door) in Tunisia

(useful volume ~220 litres, electricity consumption = 299 kWh/year)

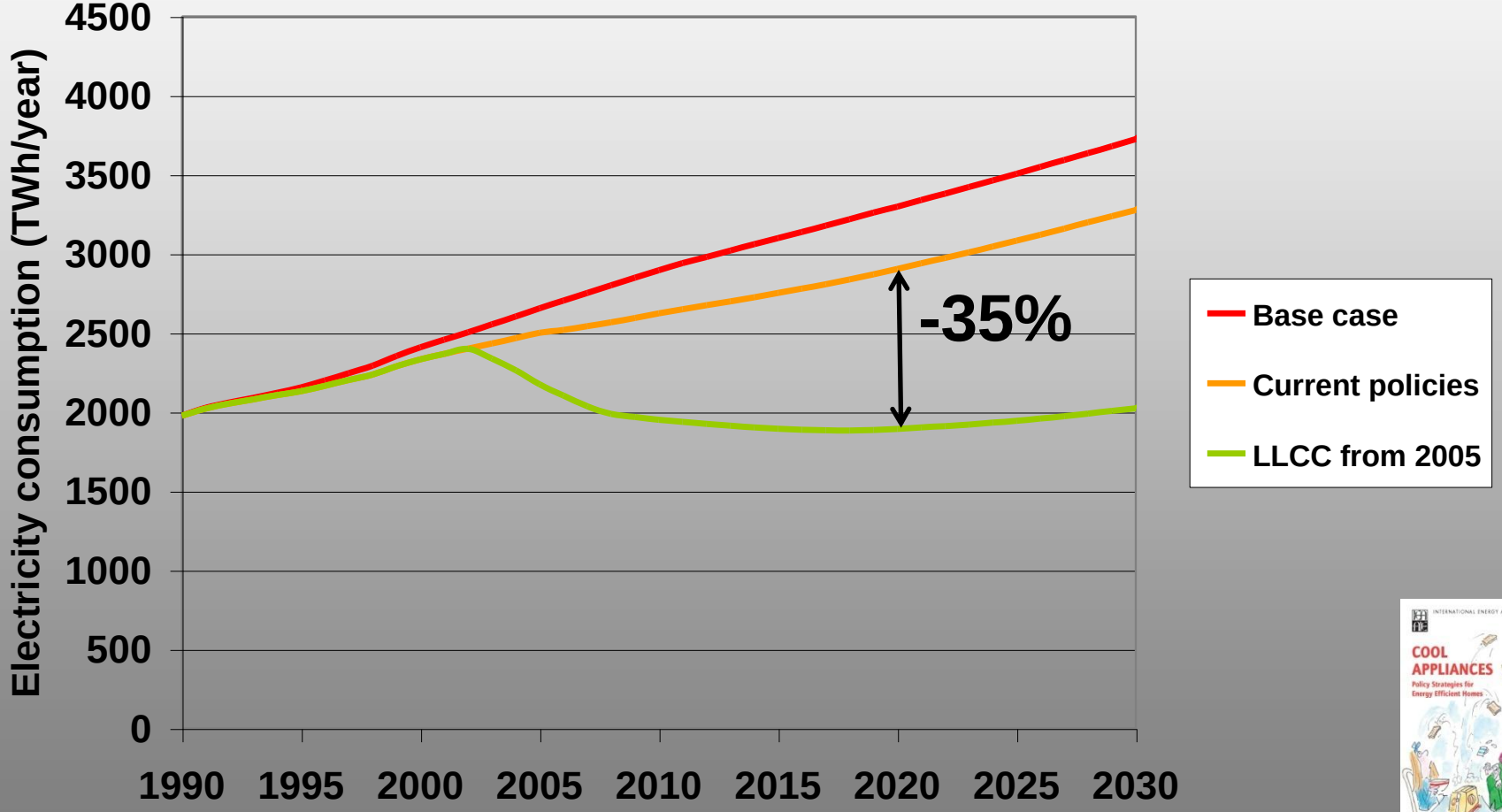


IRR =36%

but without energy subsidies

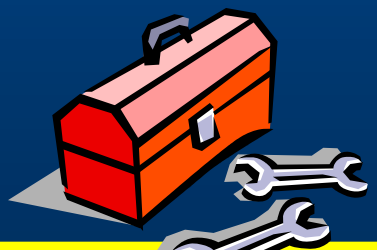
= 117%

Residential electrical electricity consumption scenarios in IEA countries 1990-2030



Cost and CO_2 impacts of *LLCC from 2005* scenario compared with *Current Policies*

- Compared with Current Policies implementing the LLCC from 2005 scenario across the OECD would:
  - reduce electricity demand by 35% in 2020
  - avoid 524 Mt-CO_2 emissions in 2020
- The cost of avoided CO_2 in 2020 is projected to be:
  - -$66/Tonne-$CO_2$ in OECD-North America
  - -169 Euro/Tonne-CO_2 in OECD-Europe



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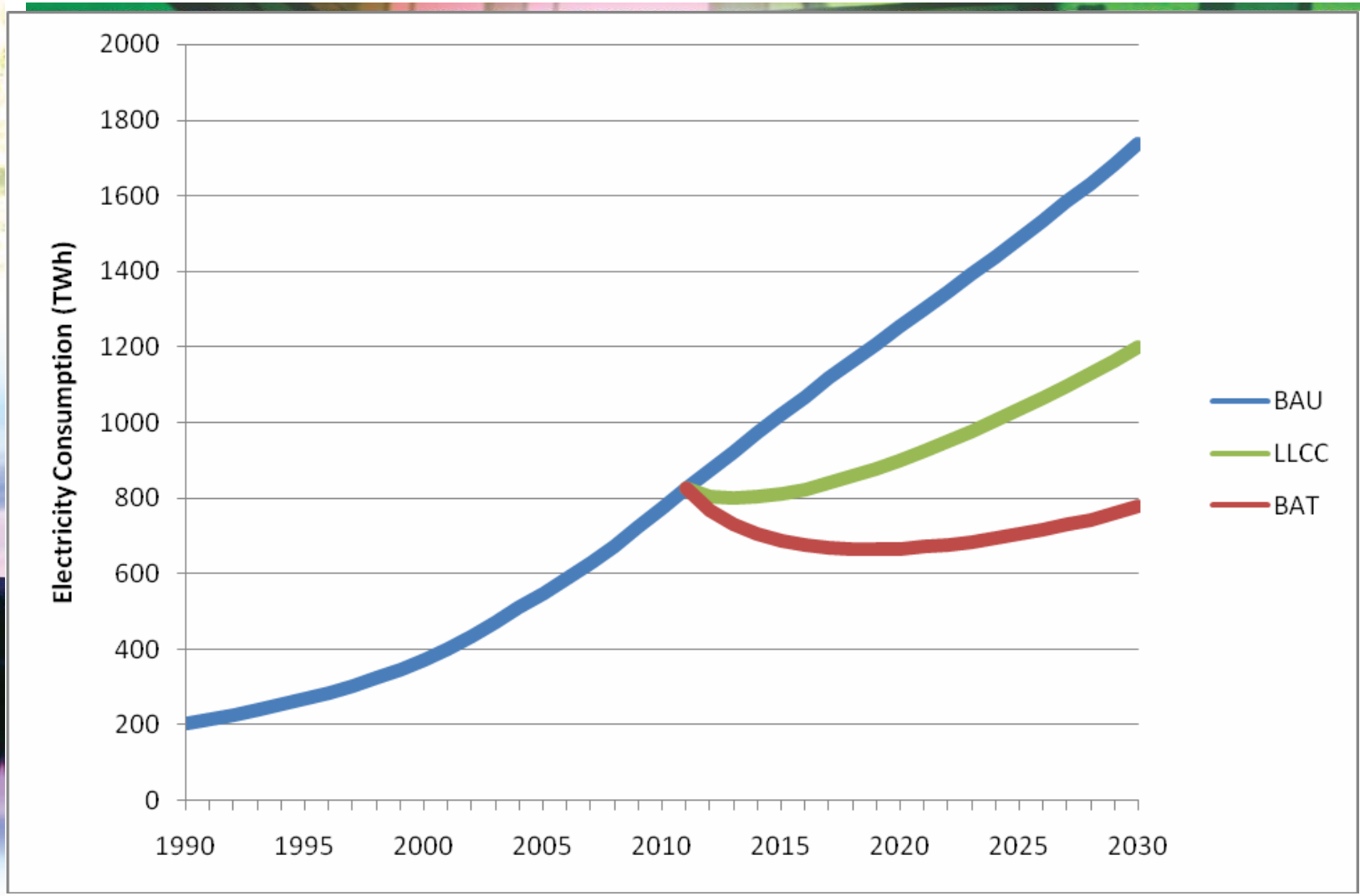
Estimated global residential ICT & CE electricity consumption



Source: Appliances in a Digital Age

WWW.IEA.ORG

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Residential ICT and Consumer Electronics (CE) electricity usage

- Reaching BAT would reduce growth in electricity demand from 4.5% p.a. to 1%
- The majority of savings will be achieved through improved power management to ensure that energy is only used when, and to the extent that, it is needed
- This will save ~150GW of new power demand and US$130 billion in electricity bills each year by 2030

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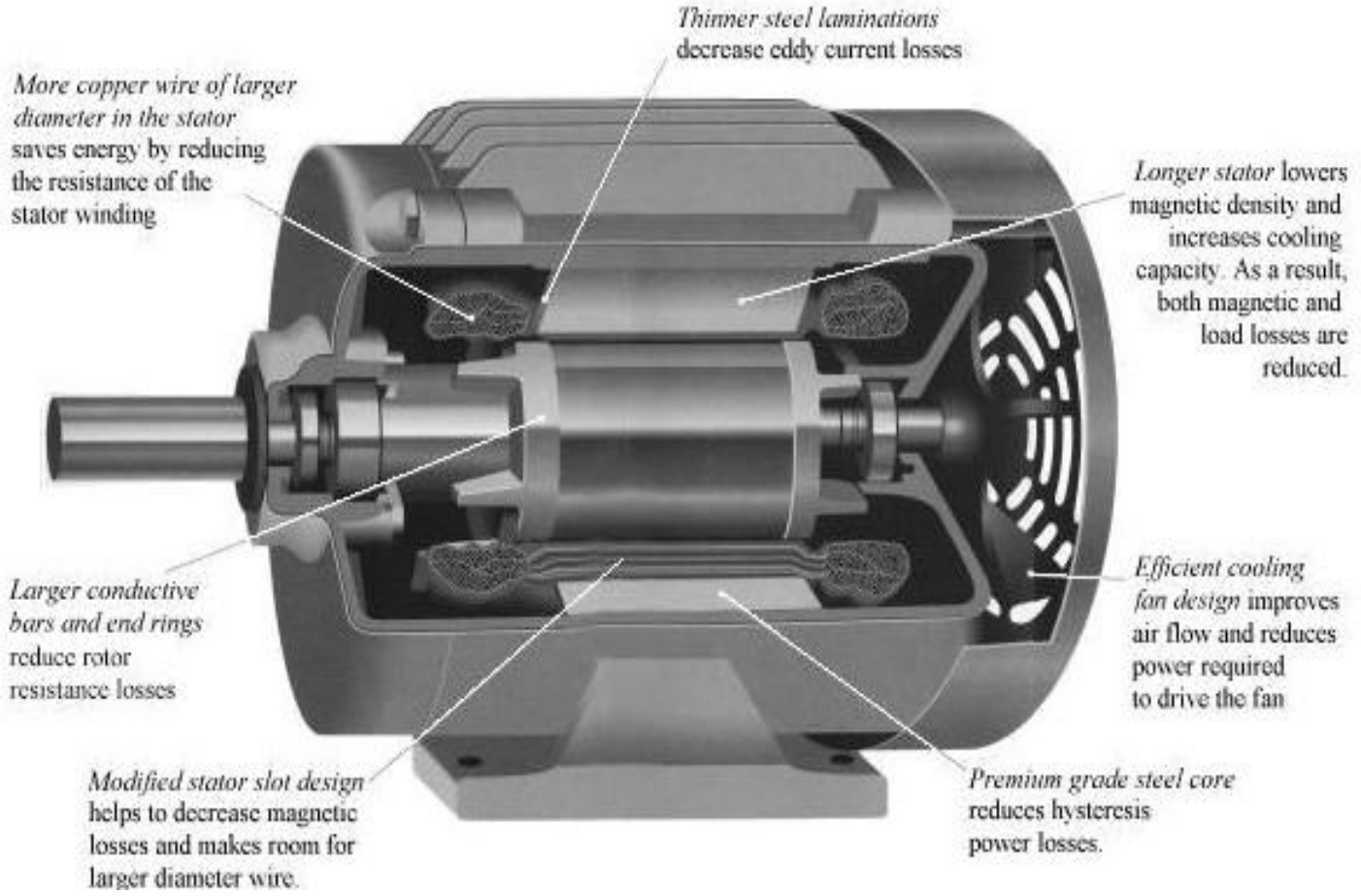
Source: Appliances in a Digital Age

But what about more efficient electric motors & systems?

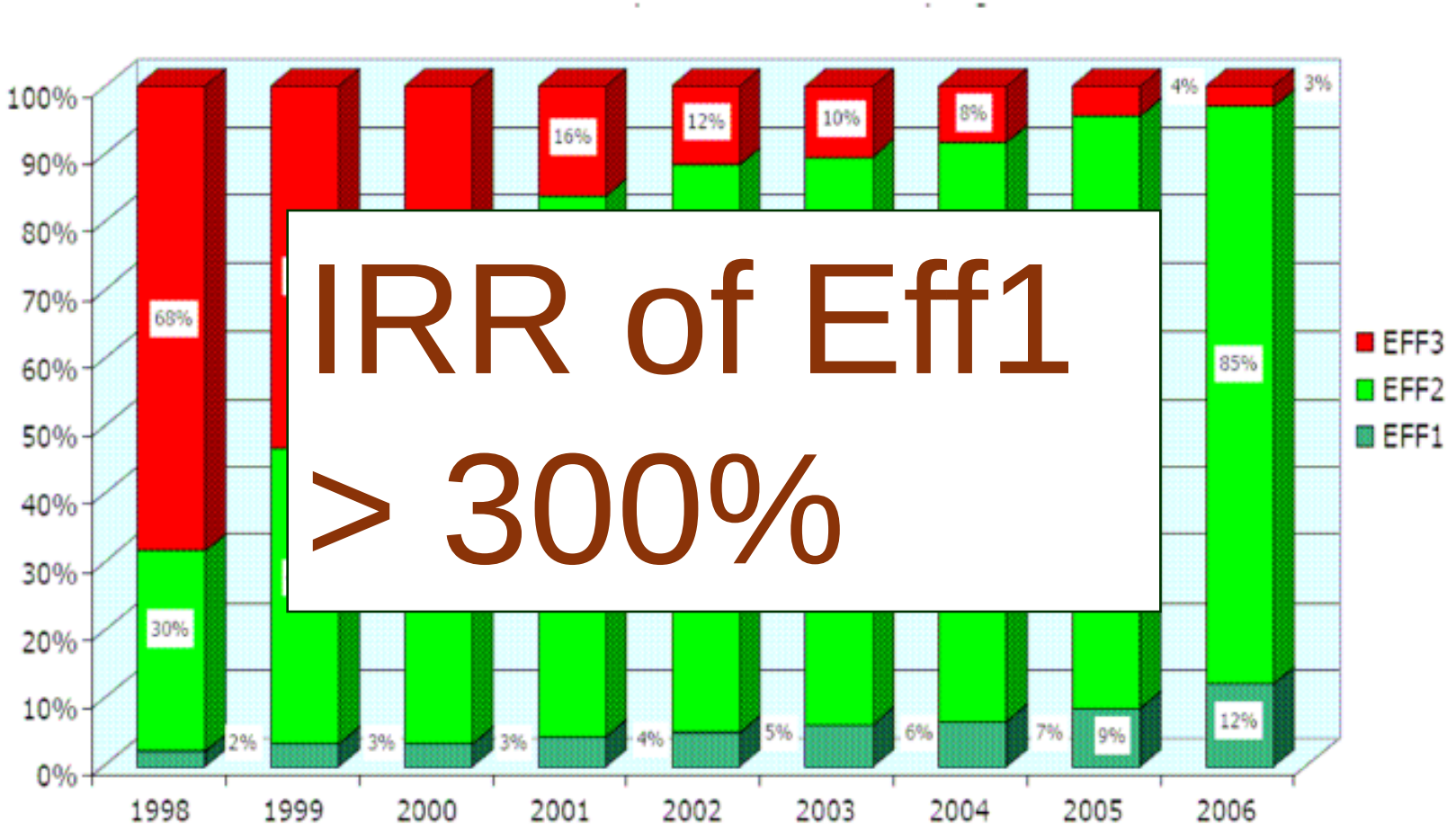


Source: MotorUp

Electric motors: 40% of all electricity

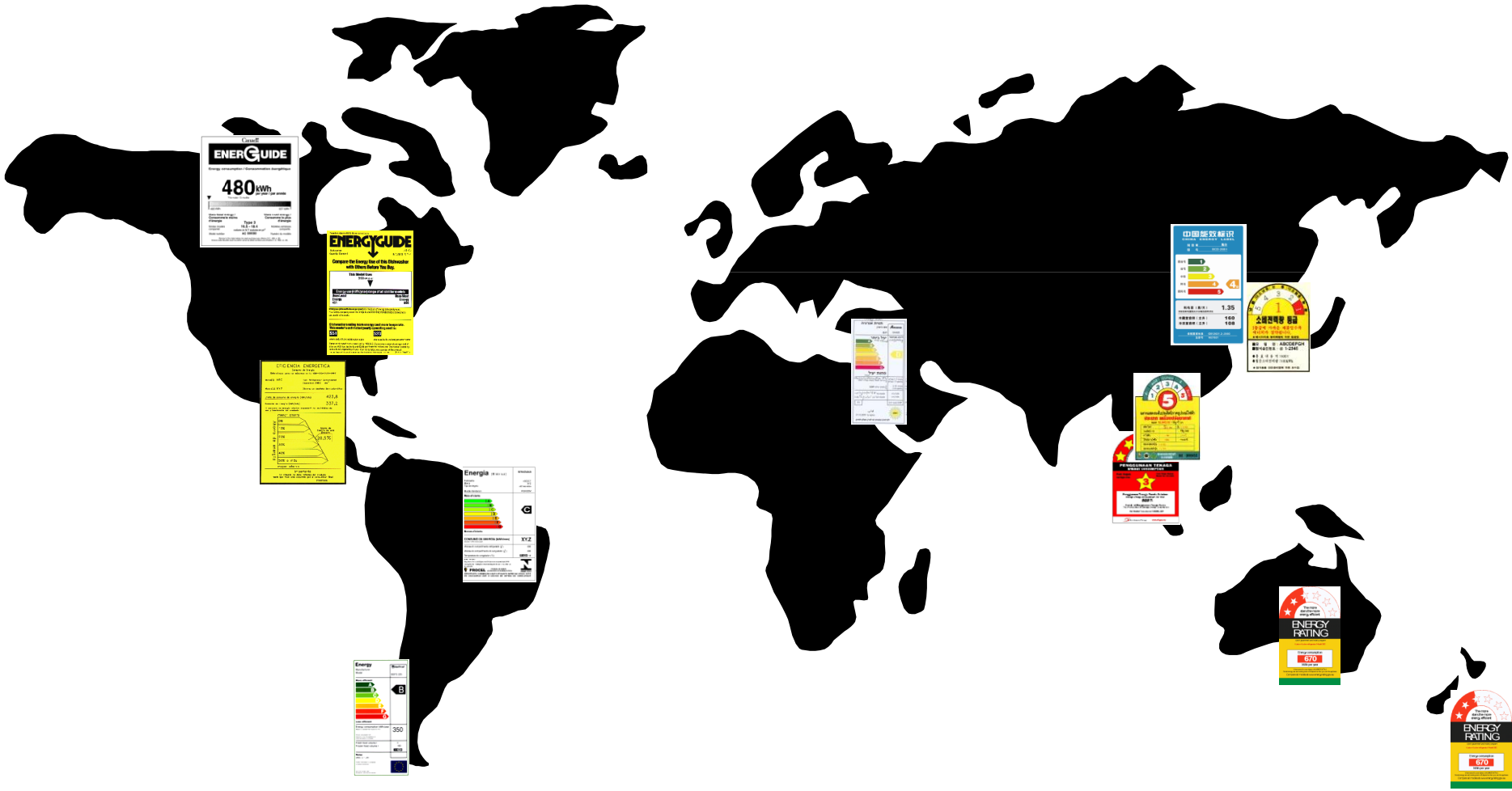
- Electric motors are the single largest use of electricity and account for about 40% of global electricity demand ~6000 TWh of final electricity
- About 2.4 times global nuclear power output
- This electricity results in ~4.4 billion tonnes of CO_2 emissions (16% of all energy-related CO_2 emissions)
- Demand is estimated to rise to 11900 TWh by 2030 and lead to 7.5 billion tonnes of CO_2 emissions
- ~ 97% of their lifecycle cost is for energy in use

EU motor sales by efficiency class: impact of CEMEF voluntary agreement

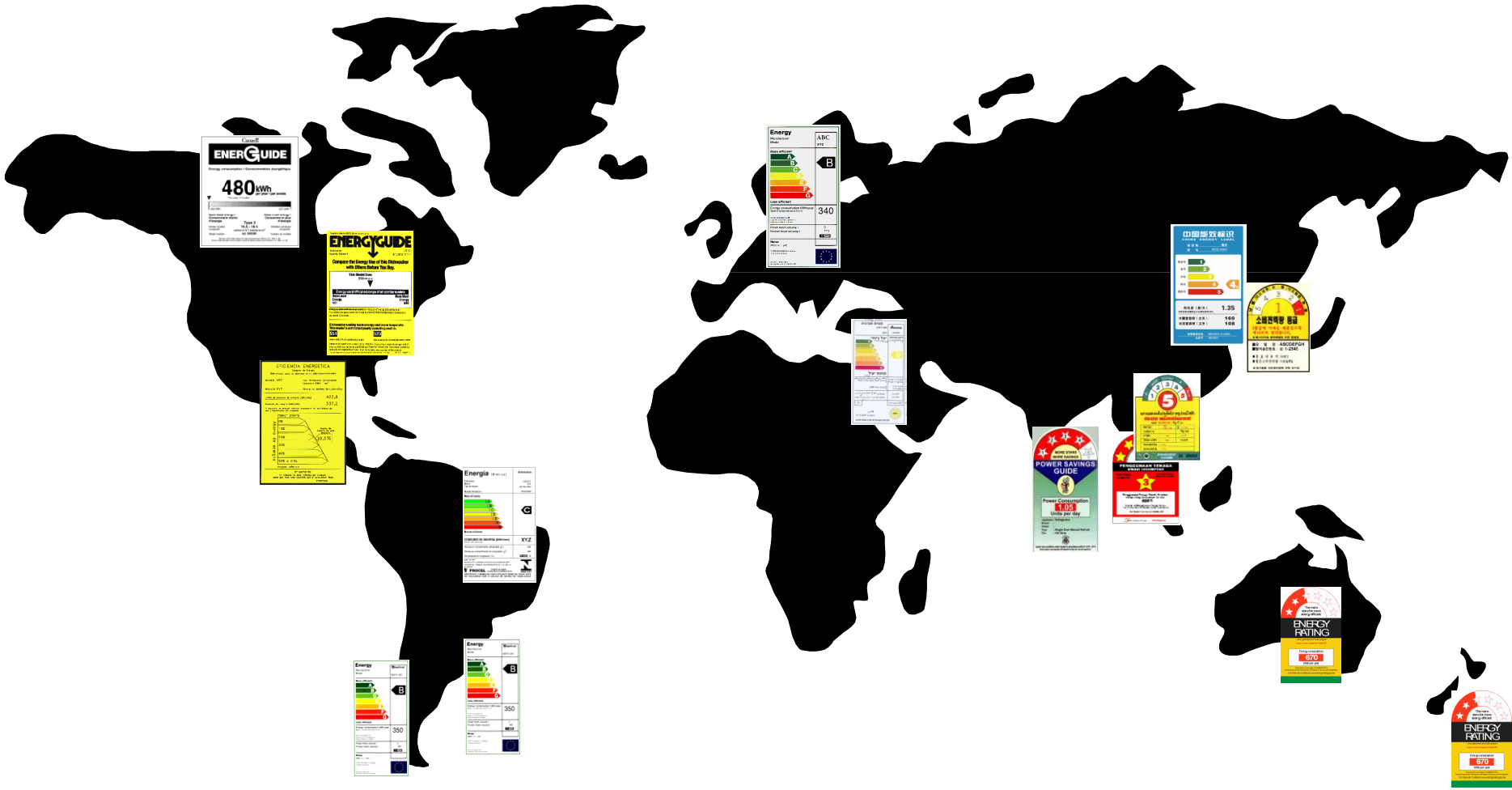


IRR of Eff1 > 300%

12 countries with a third of the world's population have efficiency standards for 3-phase industrial electric motors



The EU, India, Argentina and Japan are currently preparing motor efficiency standards



Greatest savings in motor systems

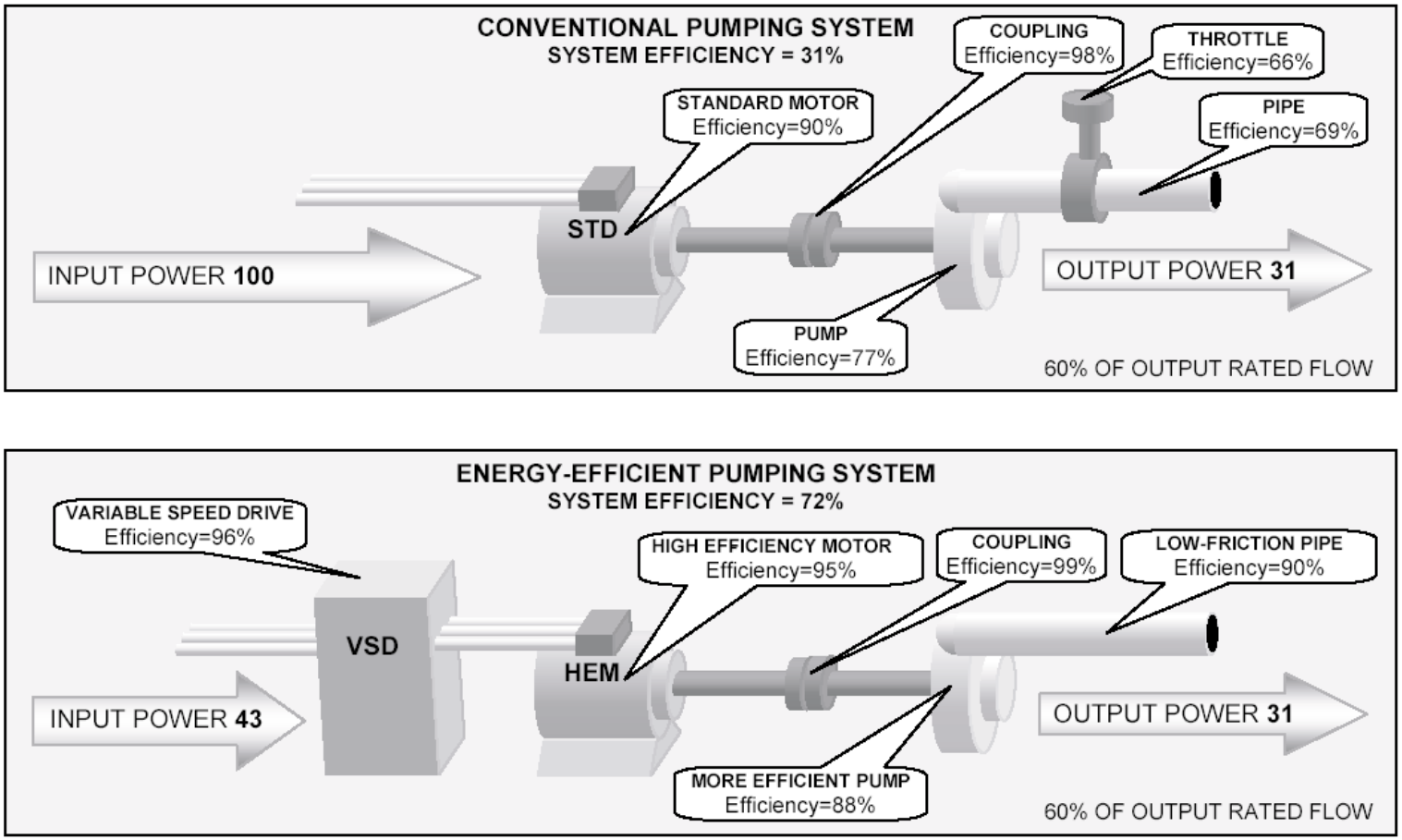


Figure 1 - a) Conventional pumping system (total efficiency = 31%)
b) Energy-efficient pumping system combining efficient technologies (total efficiency = 72%)

Technical savings potential of 10% of global electricity demand

- It is estimated that full optimisation of all electric motor driven systems would save about 25% of electricity demand for this end-use (20-30%) and 2.5 Gt of CO_2 emissions by 2030
- i.e. ~10% of all global electricity demand
- Most of these savings come from dynamic optimisation of the motor output power to match the power requirements of the drive train and are largely associated with the use of power control electronics, variable speed drives and improved transmission
- About 3 to 5% of global motor energy use can be saved through the use of high efficiency motors

Should utilities support end-use energy efficiency?

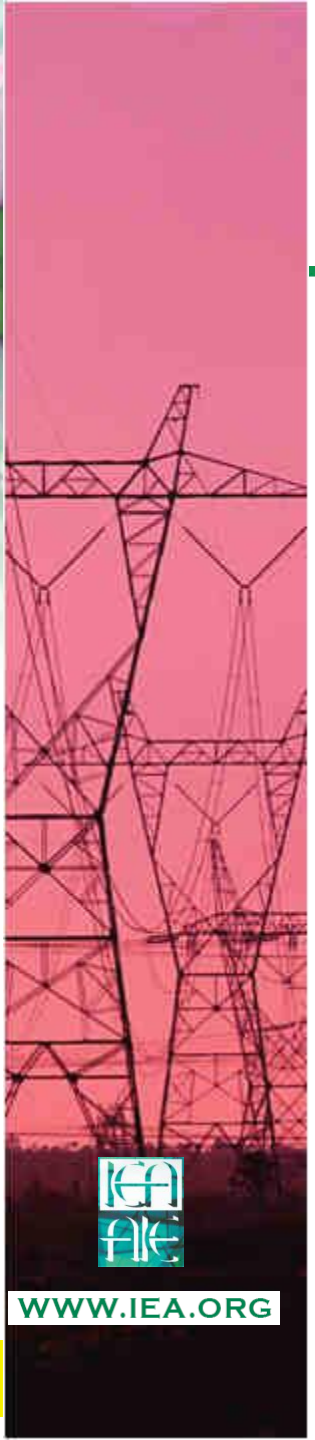
- Many economies have had successful experiences in stimulating energy utilities to deliver end-use energy savings among their customer base through energy efficiency schemes
- The arguments for engaging utilities in such schemes are:

➢ they have significant financial and human resources and can fund the efficiency measures via tariff adjustments (their ability to do this is also dependent on how they are regulated and the degree to which the regulator supports the programme)

➢ they have access to the end-use customer (providing they have a retailer function)

➢ they have knowledge of how much energy is sold, to whom and at what time and hence can strategically target conservation efforts

➢ they typically have competence in marketing and in engineering



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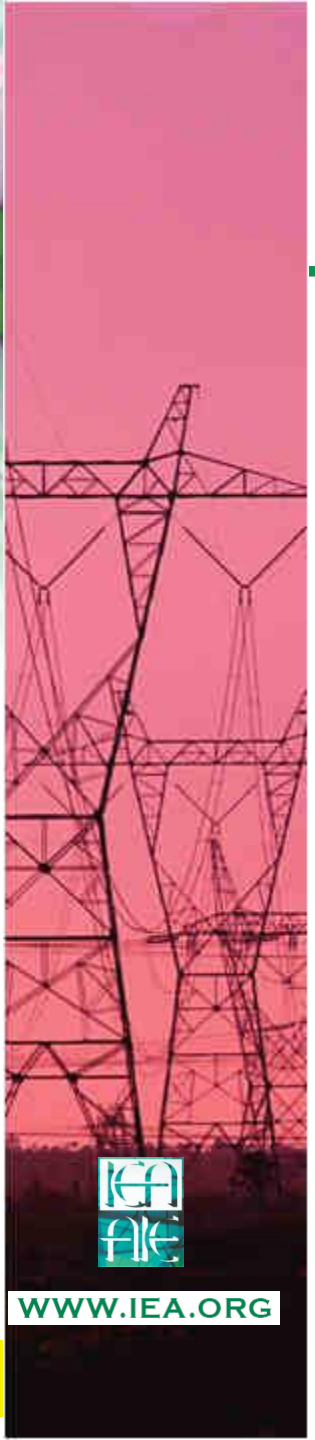


Where are utility savings obligations schemes currently being operated?

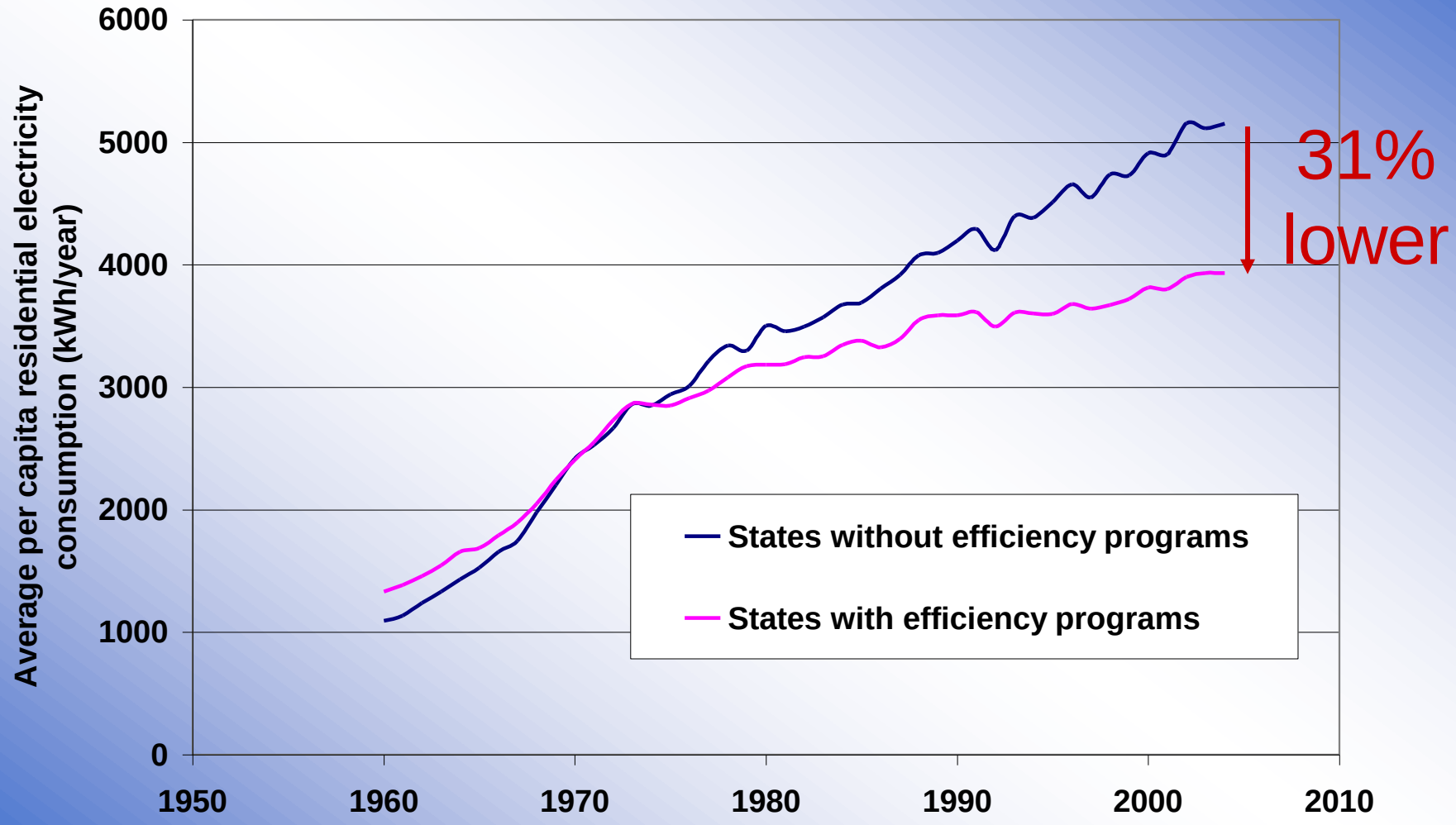
- As experience with such schemes has increased there has been a tendency to strengthen the incentives for utilities to design and deliver effective low-cost energy savings
- Many schemes combine a regulatory requirement to meet an energy saving target with the use of market-based instruments to enable utilities to trade savings obligations and to allow competition in the delivery of energy services towards savings targets
- These schemes are relatively simple to design and administer and providing the non-compliance penalties are appropriate and enforced create a strong incentive for utilities to produce energy savings at least cost

Map of US States operating Utility EE Resource Standards circa October 2007

WWW.IEA.ORG

- 2007

But do efficiency policies work?
Half of US states have utility EE progs…

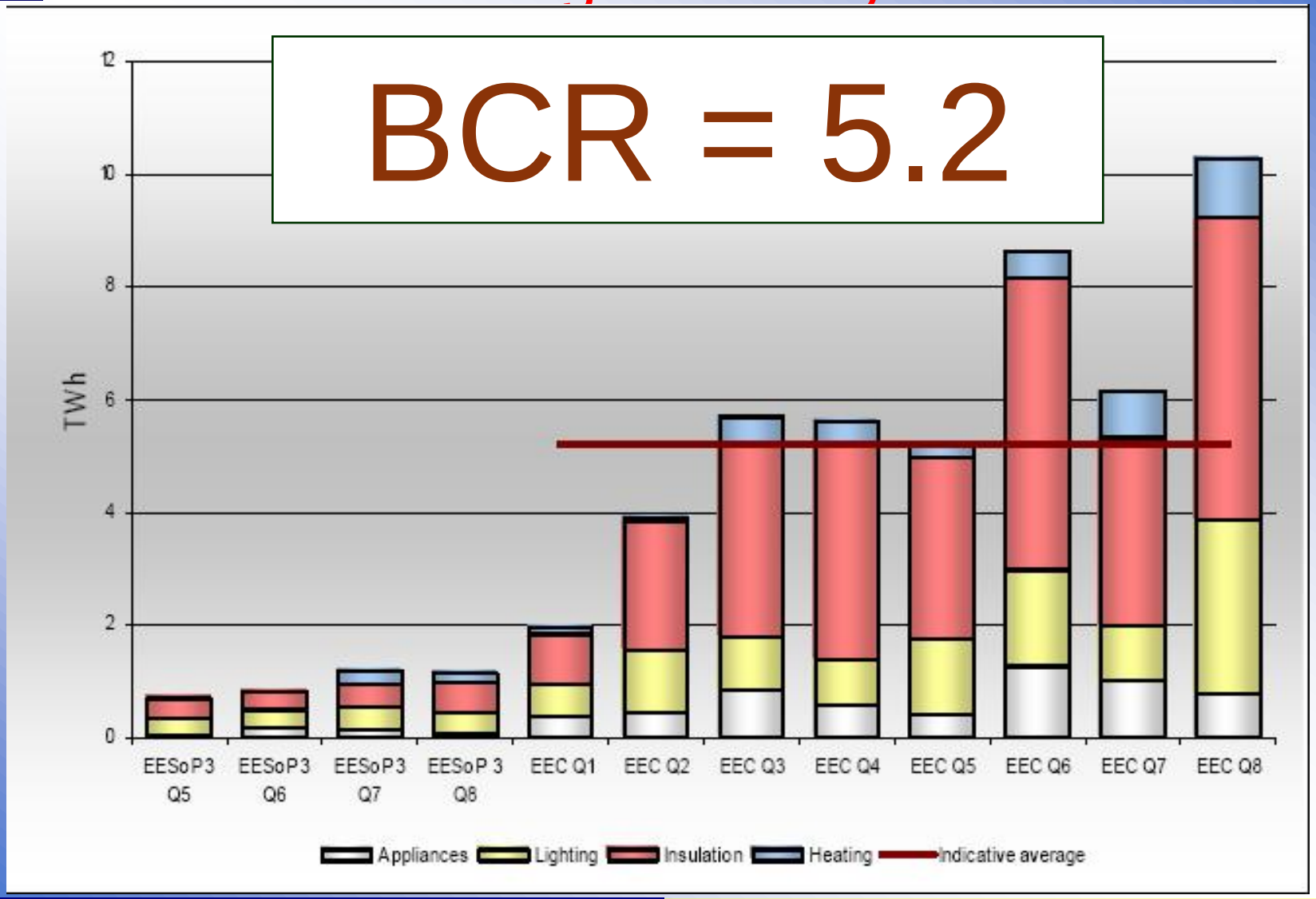


Growing no. of utility efficiency obligation schemes

Country	Target and period	% of annual demand
Denmark	7.5 PJ/yr in 2006-13	1.7% (end year)
France	194 PJ total in 2006-08	1% (average)
Great Britain	468 PJ total in 2005-08	1% (average)
Italy	230 PJ total in 2005-09	0.5% (average)
Netherlands	65 PJ total in 2020	1.8% (end year)

Source: www.EuroWhiteCert.org

e.g. UK Energy Efficiency Commitment savings over 2 years



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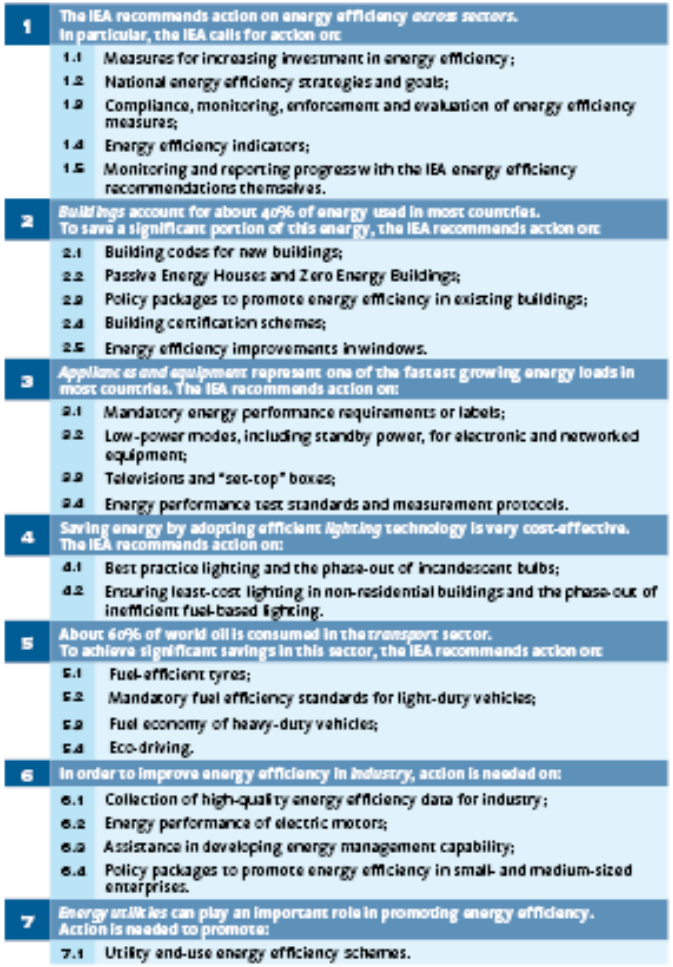
IEA energy efficiency policy recommendations to the G8+5

25 recommendations address:

- Buildings
- Appliances
- Lighting
- Transport
- Industry
- Utilities
- Cross-sectoral



1	**The IEA recommends action on energy efficiency *across sectors*. In particular, the IEA calls for action on:**
1.1	Measures for increasing investment in energy efficiency;
1.2	National energy efficiency strategies and goals;
1.3	Compliance, monitoring, enforcement and evaluation of energy efficiency measures;
1.4	Energy efficiency indicators;
1.5	Monitoring and reporting progress with the IEA energy efficiency recommendations themselves.
2	***Buildings* account for about 40% of energy used in most countries. To save a significant portion of this energy, the IEA recommends action on:**
2.1	Building codes for new buildings;
2.2	Passive Energy Houses and Zero Energy Buildings;
2.3	Policy packages to promote energy efficiency in existing buildings;
2.4	Building certification schemes;
2.5	Energy efficiency improvements in windows.
3	***Appliances and equipment* represent one of the fastest growing energy loads in most countries. The IEA recommends action on:**
3.1	Mandatory energy performance requirements or labels;
3.2	Low-power modes, including standby power, for electronic and networked equipment;
3.3	Televisions and "set-top" boxes;
3.4	Energy performance test standards and measurement protocols.
4	**Saving energy by adopting efficient *lighting* technology is very cost-effective. The IEA recommends action on:**
4.1	Best practice lighting and the phase-out of incandescent bulbs;
4.2	Ensuring least-cost lighting in non-residential buildings and the phase-out of inefficient fuel-based lighting.
5	**About 60% of world oil is consumed in the *transport* sector. To achieve significant savings in this sector, the IEA recommends action on:**
5.1	Fuel-efficient tyres;
5.2	Mandatory fuel efficiency standards for light-duty vehicles;
5.3	Fuel economy of heavy-duty vehicles;
5.4	Eco-driving.
6	**In order to improve energy efficiency in *industry*, action is needed on:**
6.1	Collection of high-quality energy efficiency data for industry;
6.2	Energy performance of electric motors;
6.3	Assistance in developing energy management capability;
6.4	Policy packages to promote energy efficiency in small- and medium-sized enterprises.
7	***Energy utilities* can play an important role in promoting energy efficiency. Action is needed to promote:**
7.1	Utility end-use energy efficiency schemes.

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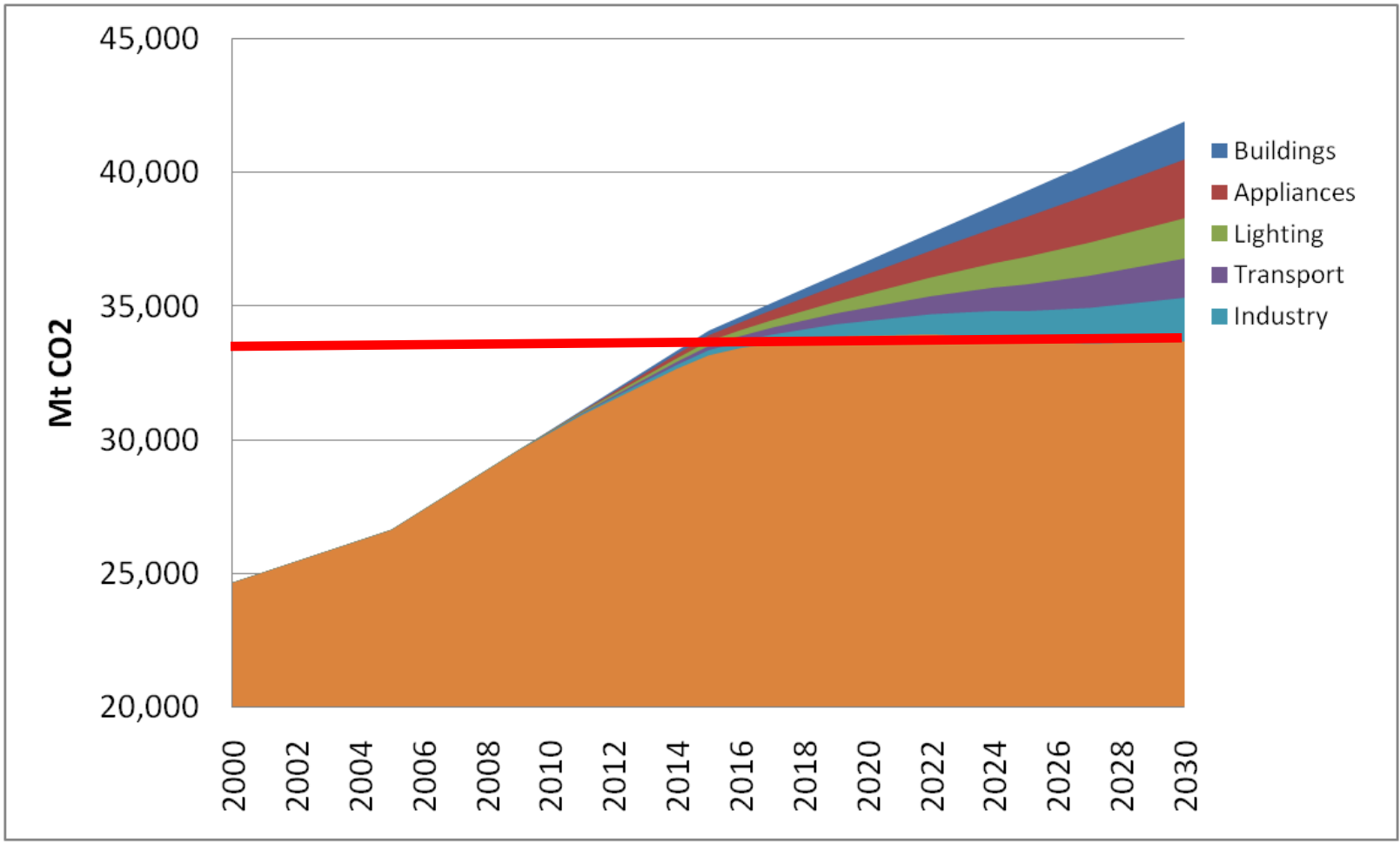
INTERNATIONAL ENERGY AGENCY

Estimated impact of full implementation of IEA G8 policy recommendations on world CO_2 emissions



In support of the G8 Plan of Action

Implementation issues

- **Energy performance test procedures:**
  - repeatable, reproducible, representative
- **Reliable performance declarations**
  - Certification, market-monitoring, compliance
- **Communication and outreach**
  - Effective labels, awareness building, actions through the supply chain
- **Timely implementation processes**
  - Structured design and policy setting process envisaging revision
- **Evidence-based decision making**
  - Sound broadly-based analysis, proper process and impact evaluation
- **Supporting measures**
  - Fiscal/financial incentives, procurement programmes, retailer/distributor engagement, R&DD, utility programmes, white certificates, etc..

Conclusions

- Electrical energy efficiency presents a vast under-exploited and cost-effective GHG saving opportunity
- A carefully designed, well implemented and soundly evaluated portfolio of measures is needed to address all barriers
- IEA recommendations support this but need much stronger support and engagement to be properly implemented

These actions deliver on all energy policy goals

- economic efficiency
- energy security
- environmental protection

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