Electric Heating Load, How Can Limit It?

Electric fan heaters, electric stoves and VRF multi-split heat pumps

2 November 2011

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Overview

1. Winter Peak Load
2. Electric Fan Heaters & Electric Stoves
3. VRF Multi-Split Heat Pumps
4. Energy Standards & Labeling
5. Performance Improvement
6. Comparison of Refrigerators

1. Winter Peak Load

◆ It was shocking that winter peak load happened

- There were 30 days during last winter that electric power reserve rate is below 10% in Korea

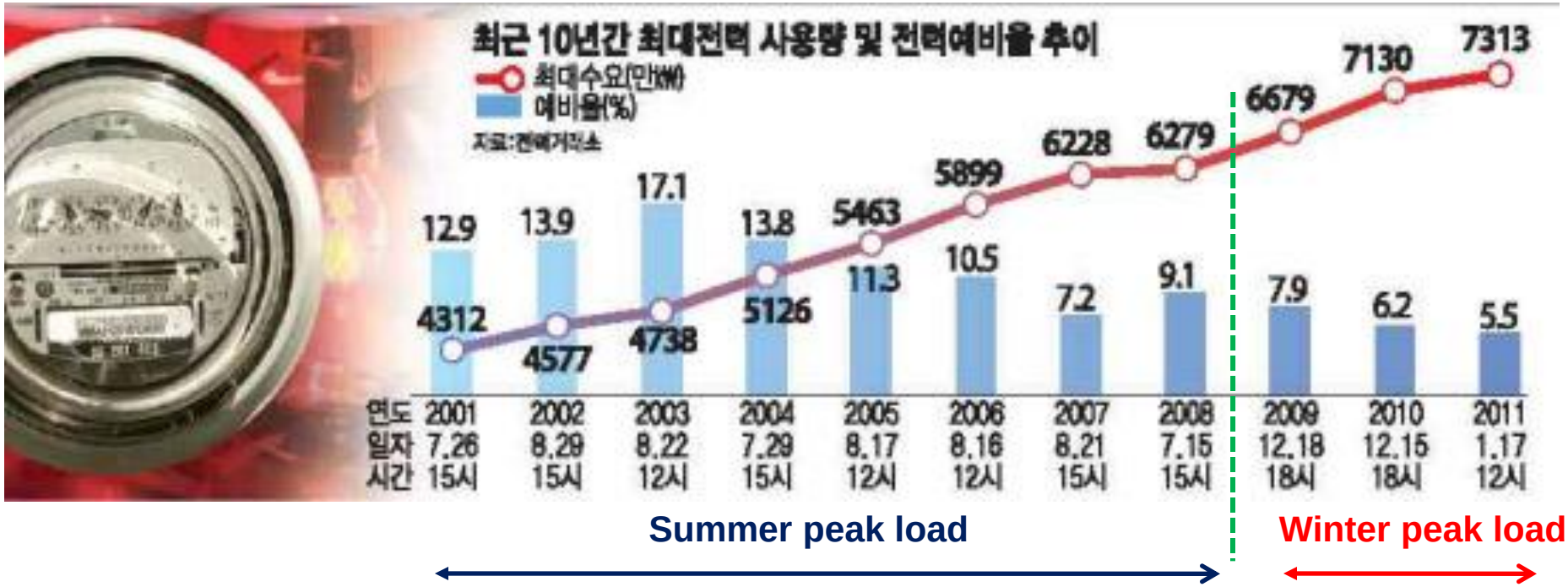
- It was 12 days that temperature is below -10℃ in Seoul during last winter

: * -10℃~-12℃ : 6 days, -12℃~-15℃ : 3 days, -15℃ ~-18℃ : 3 days

Peak Load Trend

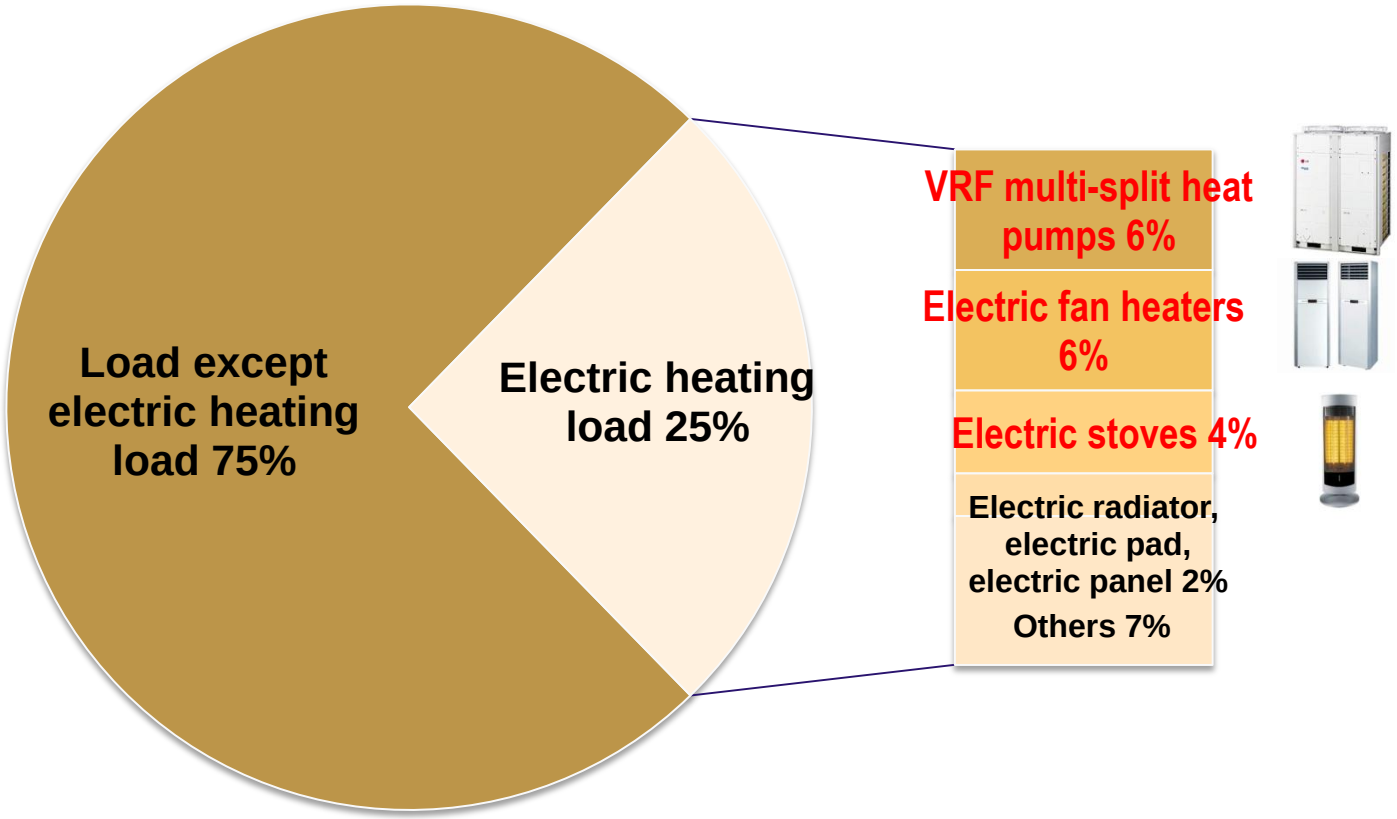
◆ Peak load season moved from summer to winter

- Peak load happened winter since 2009



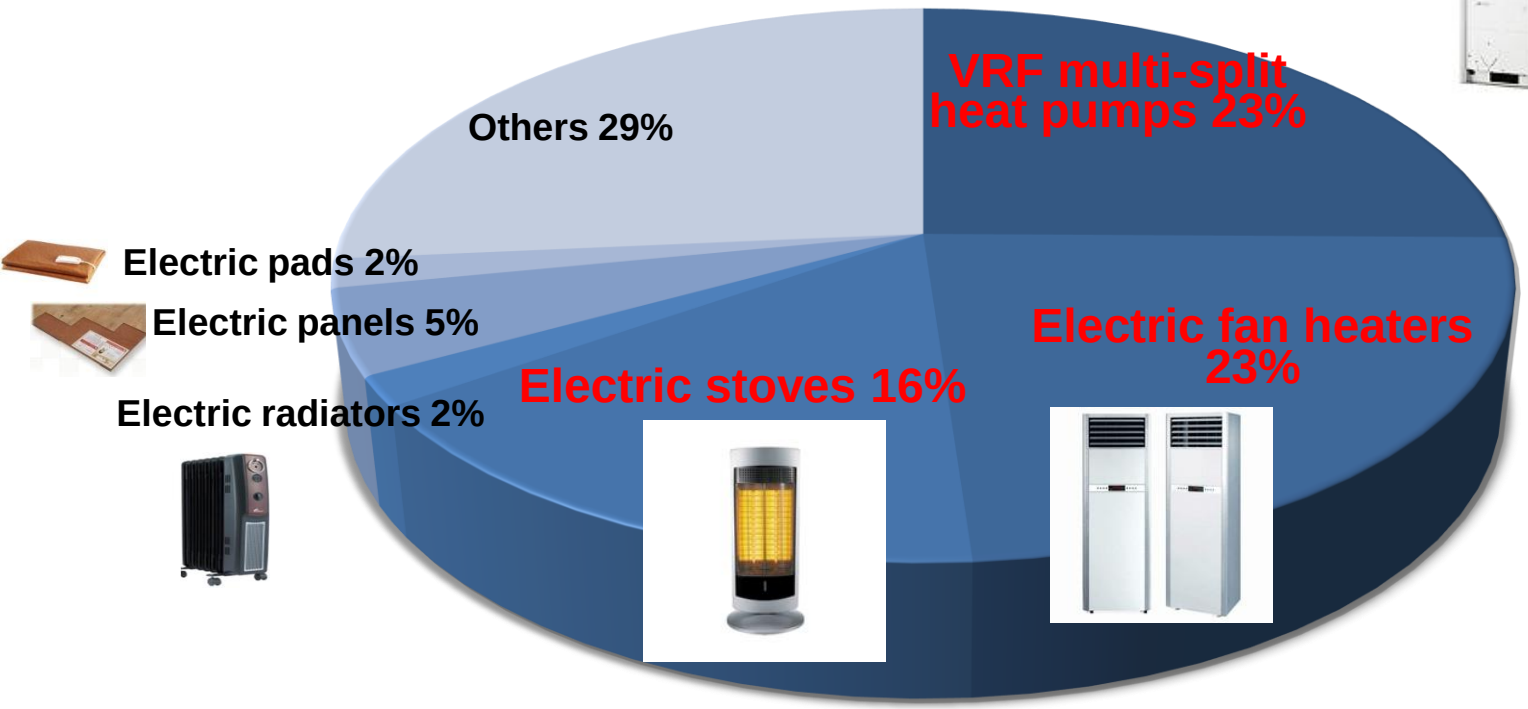
Cause of Winter Peak Load

- **Three electric heating equipments account for 16% of winter peak load**



Electric Heating Equipments

◆ Portion of electric heating load



2. Electric Fan Heaters & Electric Stoves

◆ No policy even if they are inefficient products

- We can not divide energy efficiency rating for electric fan heaters and electric stoves

  : All electric fan heater's and electric stove's COP is same

< Electric fan heaters >

< Electric stoves >

Energy Charges System of Household

◆ Monthly energy charges

- Monthly energy charges are applied progressive rate in household

: 57.30 → 118.40 → 175.0 → 258.70 → 381.50 → 670.60 KRW/kWh

Monthly power consumption per household	Progressive rate
≤ 100 kWh/month	57.30 KRW/kWh
101-200 kWh/month	118.40 KRW/kWh
201-300 kWh/month	175.00 KRW/kWh
301-400 kWh/month	258.70 KRW/kWh
401-500 kWh/month	381.50 KRW/kWh
> 500 kWh/month	670.60 KRW/kWh

Advertisement Problem of Heaters

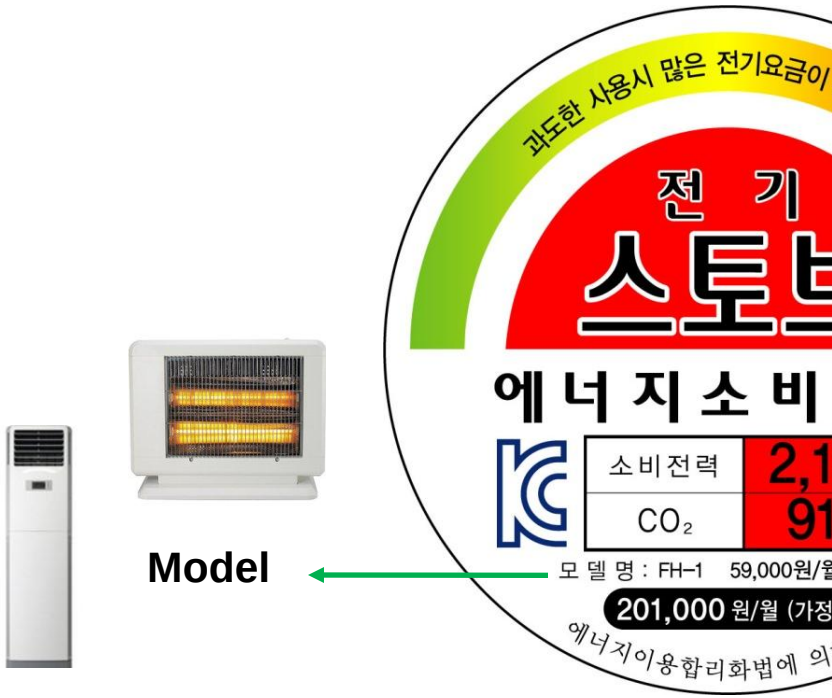
◆ It was social problem on electric heaters

- Even if energy charges will be big when consumers use electric fan heaters or electric stoves because of progressive rate system, but sellers advertise only small energy charges

Energy Cost Label

- **Policy solution is mandatory energy cost indication through energy efficiency label**

  - Red label means inefficient products



Please aware that you will have big energy charges if you use this product for a long time

Power consumption

CO_2 emission per hour

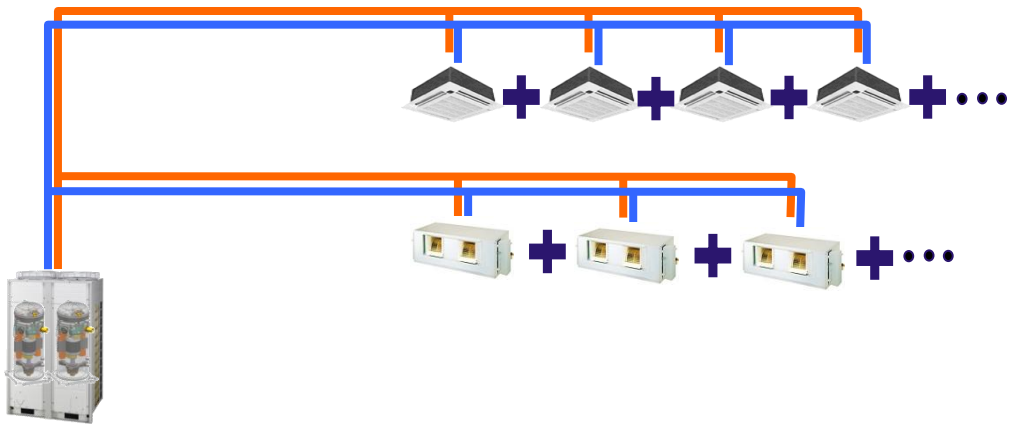
Model

Monthly energy cost
(applied big progressive rate, 384 KWR/kWh)

3. VRF Multi-Split Heat Pumps

◆ Variable Refrigerant Flow(VRF) multi-split heat pumps

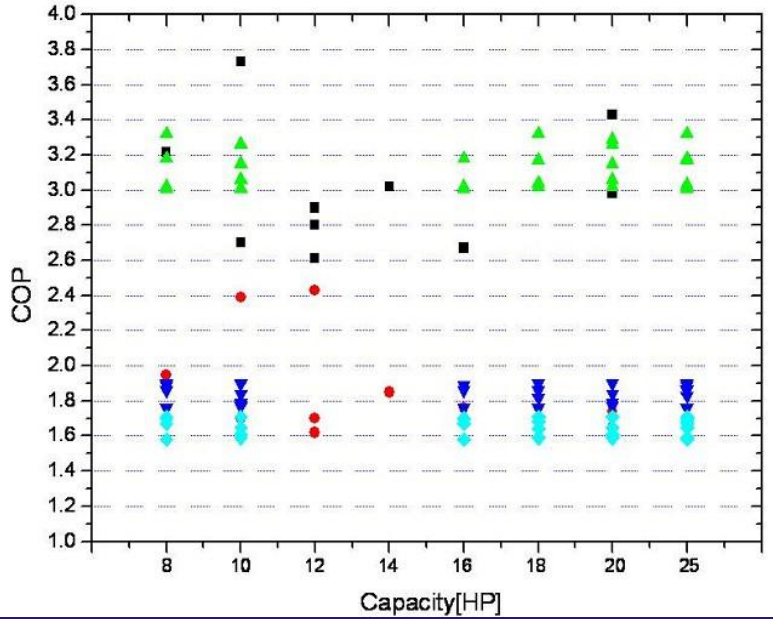
- Outdoor unit
- Indoor unit
- Pipeline



Irony of VRF Multi-Split Heat Pumps

- **Air source VRF multi-split heat pumps are ordinary energy efficient products, but…?**

  - It was very low when it was tested at temperature condition -15℃ (average COP is only 1.9)



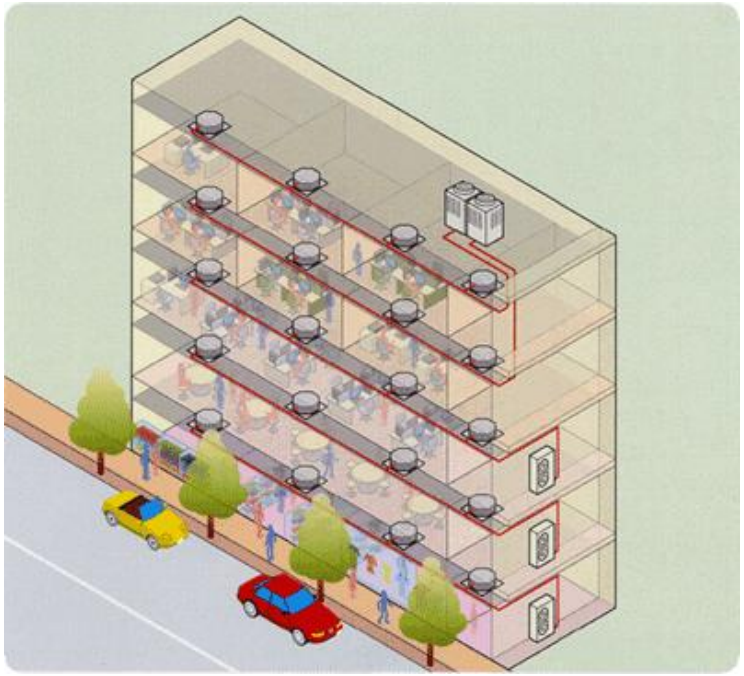
7℃

-15℃

Scope

◆ Scope of VRF multi-split heat pumps

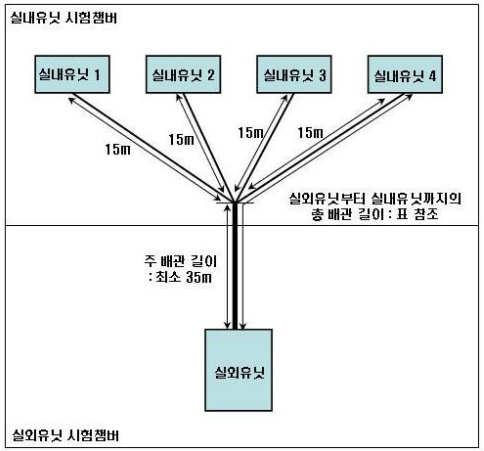
- Rated cooling capacity : from 23kW to 70kW

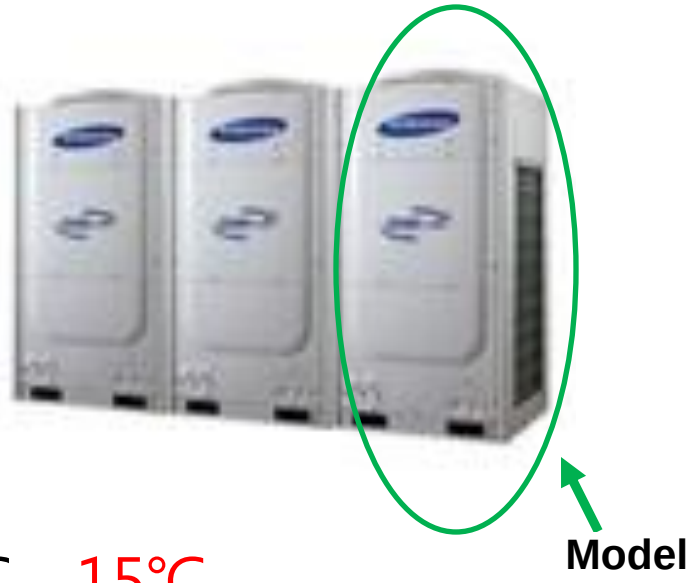


Issue of Test Condition

◆ There were three big issue of test condition with VRF multi-split heat pumps

- Model scope : Unit model of outdoor (No combination model)
- Pipeline length : 50m





- Heating temperature : 7℃, -15℃

Test Result

◆ Test result of cooling and heating efficiency

No	Capacity	IEER (Cooling)					COP (Heating)			EERa
Load		100%	75%	50%	25%	IEER	COP1	COP2	COP	
Temperature		35℃	27.5℃	20℃	18.3℃		7℃	-15℃		
1	22000W	2.60	3.77	3.98	3.60	**3.77**	3.22	1.95	**2.59**	**3.18**
2	28000W	2.71	5.03	5.42	4.16	**4.97**	3.73	2.39	**3.06**	**4.02**
3	28000W	2.17	3.76	4.23	3.80	**3.85**	2.70	1.70	**2.20**	**3.03**
4	28000W	1.85	4.43	4.54	4.39	**4.40**	2.61	1.70	**2.16**	**3.28**
5	33600W	2.48	4.45	5.45	4.84	**4.70**	2.90	2.43	**2.67**	**3.69**
6	33600W	2.48	3.72	4.38	4.19	**3.98**	2.80	1.62	**2.21**	**3.10**
7	39000W	2.44	4.04	4.00	3.34	**3.91**	3.02	1.85	**2.44**	**3.18**
8	44800W	2.20	3.84	4.93	4.08	**4.10**	2.67	1.76	**2.22**	**3.16**
9	56000W	2.23	3.45	3.53	3.29	**2.90**	2.98	1.65	**2.32**	**2.61**
10	56000W	2.58	3.75	3.98	4.28	**3.98**	3.43	1.74	**2.59**	**3.29**

MEPS

◆ Minimum Energy Performance Standard

(unit : W/W)

EERa	IEER (100%, 75%, 50%, 25%)	COP	COP2 (-15℃)
2.40	2.80	2.00	1.50
EERa = (IEER+COP)/2			

MEPS (Minimum Energy Efficiency Performance standard)

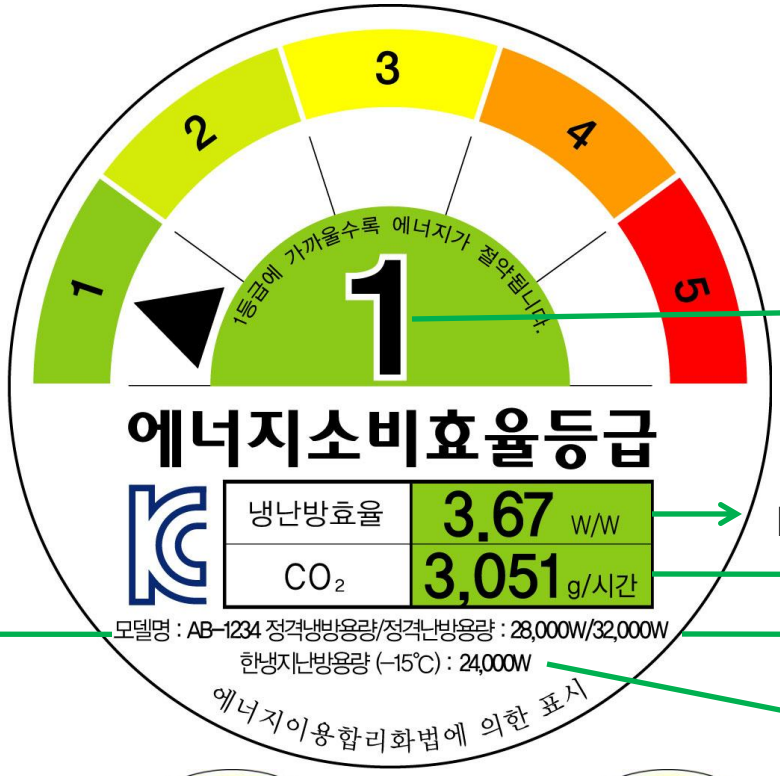
A mandatory energy efficiency standard that prohibits manufacturing and sales activities of products falling below the minimum energy efficiency level (subject to a fine of below $US 19 thousand dollars).

Energy Efficiency Label Standard

◆ Energy efficiency level for VRF multi-split heat pumps

R	Grade
3.5 ≤ R	1
3.25 ≤ R < 3.50	2
3.00 ≤ R < 3.25	3
2.75 ≤ R < 3.00	4
2.40 ≤ R < 2.75	5
R = EERa = (IEER+COP)/2	

Energy Efficiency Grade Label



Energy efficiency level

Energy efficiency ratio(EERa)

CO_2 emission per hour

Rated cooling capacity /Rated heating capacity

Heating capacity at -15℃

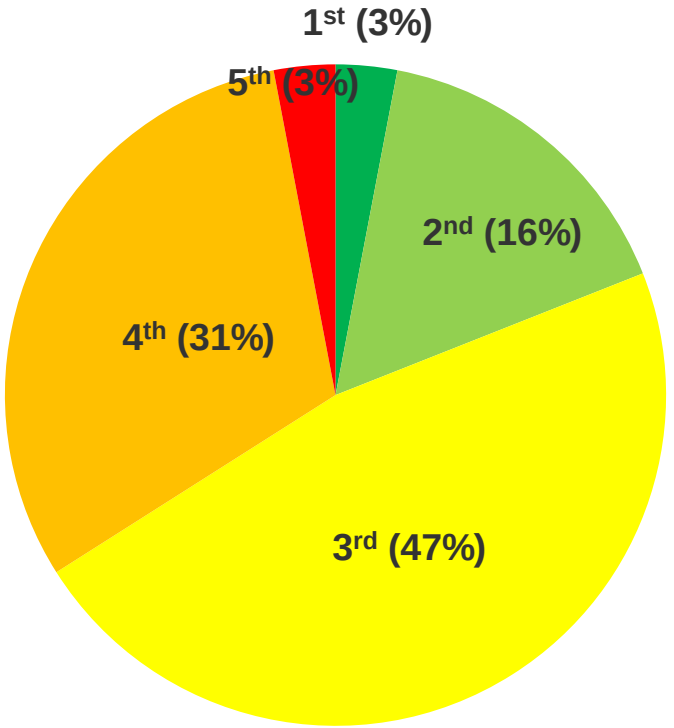
Model

Distribution of Efficiency Grade

◆ Estimated distribution of grade

- 1st grade is 3%
- Estimated distribution of grade

Rating	Distribution
1st grade	3%
2nd grade	16%
3rd grade	47%
4th grade	31%
5th grade	3%
Total	100%



4. Energy Standards & Labeling

Energy Efficiency Label and Standard Program (including MEPS)

- Mandatory (since 1992)
- MEPS & 5-grade labeling
- Refrigerators, Automobiles, etc (28 items)

Programs related standby

Energy Standards & Labeling

High-efficiency Appliance Certification Program

고효율기자재

- Voluntary (since 1996)
- LED traffic lights, Pumps, etc (34 items)

e-Standby Program

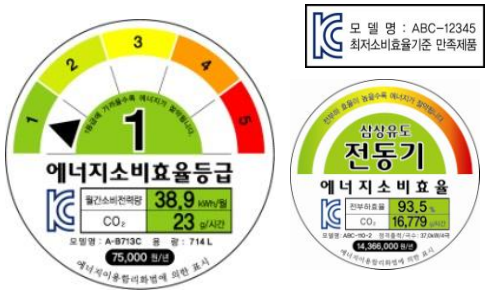
에너지절약

- Voluntary (since 1999)
- Mandatory (from 2009)
- TVs, STBs (22 items)

Energy Efficiency Label and Standard Program

◆ Mandatory Energy Label and Minimum Energy Performance Standard

- Mandatory indication of energy
- efficiency grade from 1 to 5
- Number one is the best in Korea
- MEPS will be applied below 5 grade
- 28 products with over 20,000 models
- 160 million/year of products are related



Mandatory
Including MEPS

: Refrigerators, freezers, kimchi refrigerators, air conditioners, washing machines, drum washing machines, dish washers, dish driers, coolers, rice cookers, vacuum cleaner, electric fans, air cleaners, incandescent lamps, CFLs, ballasts, fluorescent lamps, 3 phase electric motors, gas boilers, external power supplies, heat pumps, commercial refrigerators, gas water heaters, TVs, windows, transformers, tires, automobiles (28 products)

High-efficiency Appliance Certification Program

◆ Voluntary High-efficiency Certification

- Certification by KEMCO
- Voluntary
- High efficiency certificate
- Government purchase
- Target products

고효율기자재

Pumps, UPS, industrial gas boilers, industrial oil boilers, oil burning water boilers, LED traffic lights, LED guide lights, LED lamps, general LED lighting equipments, LED guard lighting equipments, LED sensor lighting equipments, converters for LED lighting modules, PLS equipments, heat recovery ventilators, ventilation fans, centrifugal blowers (34 products)

e-Standby Program

◆ Core program to reduce standby

- Voluntary “Energy Boy” label
  or mandatory standby warning label
- Government purchase
- 22 products with over 9,000 models
- 90 million/year of products are related

: Computers, set top boxes, TVs, monitors, printers, multifunction devices, microwave ovens, VCRs, audios, DVD players, home gateways, fax machines, copiers, scanners, bidets, door phones, cordless phones, energy saving & controlling devices, radios, modems home gateways, severs, hand dryers (22 products)

Voluntary

Products satisfying standby standard

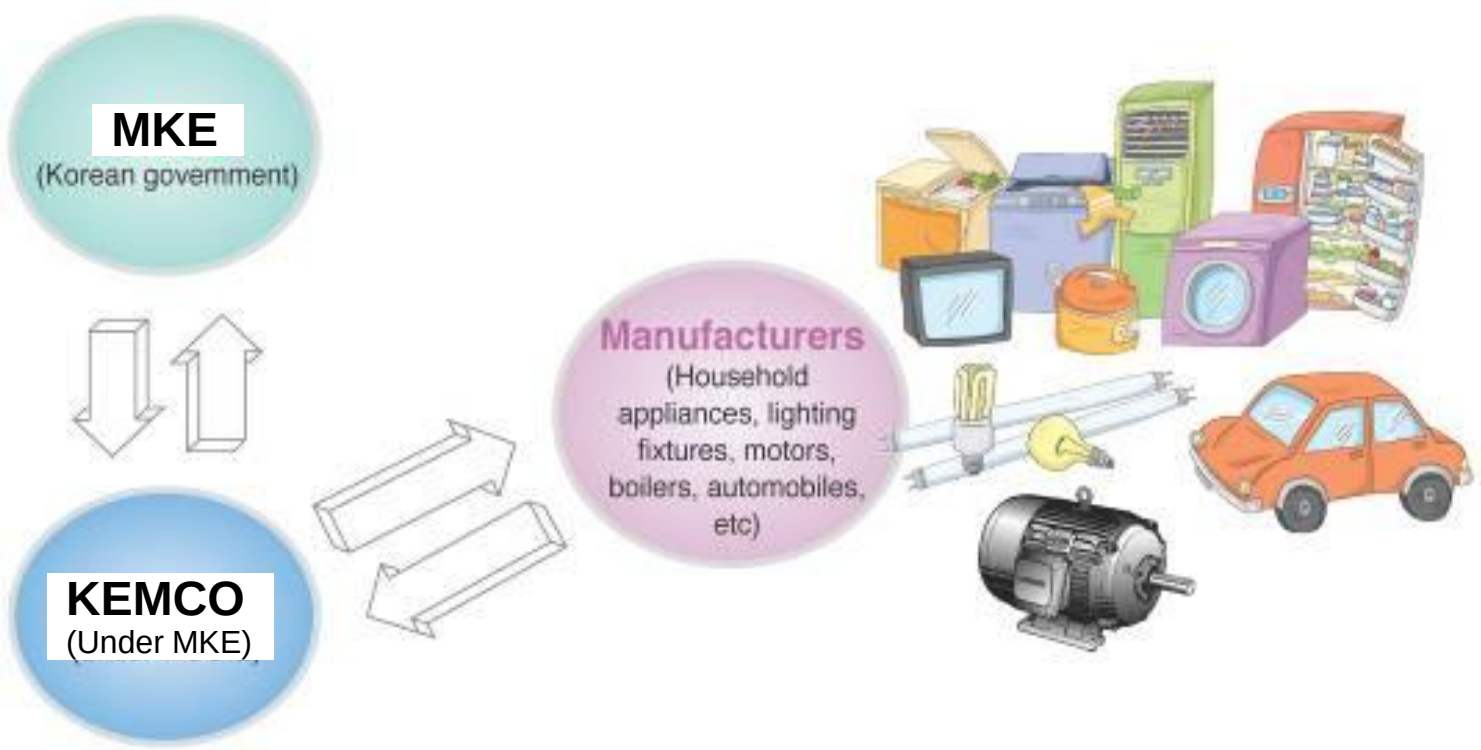
or

Mandatory

Products failing standby standard

Policy Implementation Organization

◆ Korea's energy standards & labeling

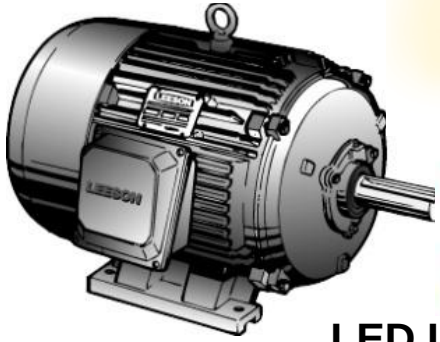


5. Performance Improvement

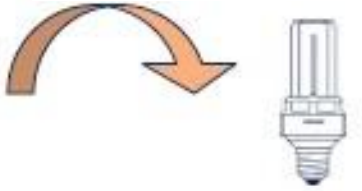
Domestic Gas Boilers

Refrigerators

Electric Motors



Phase-out of Incandescent lamps



Air Conditioners

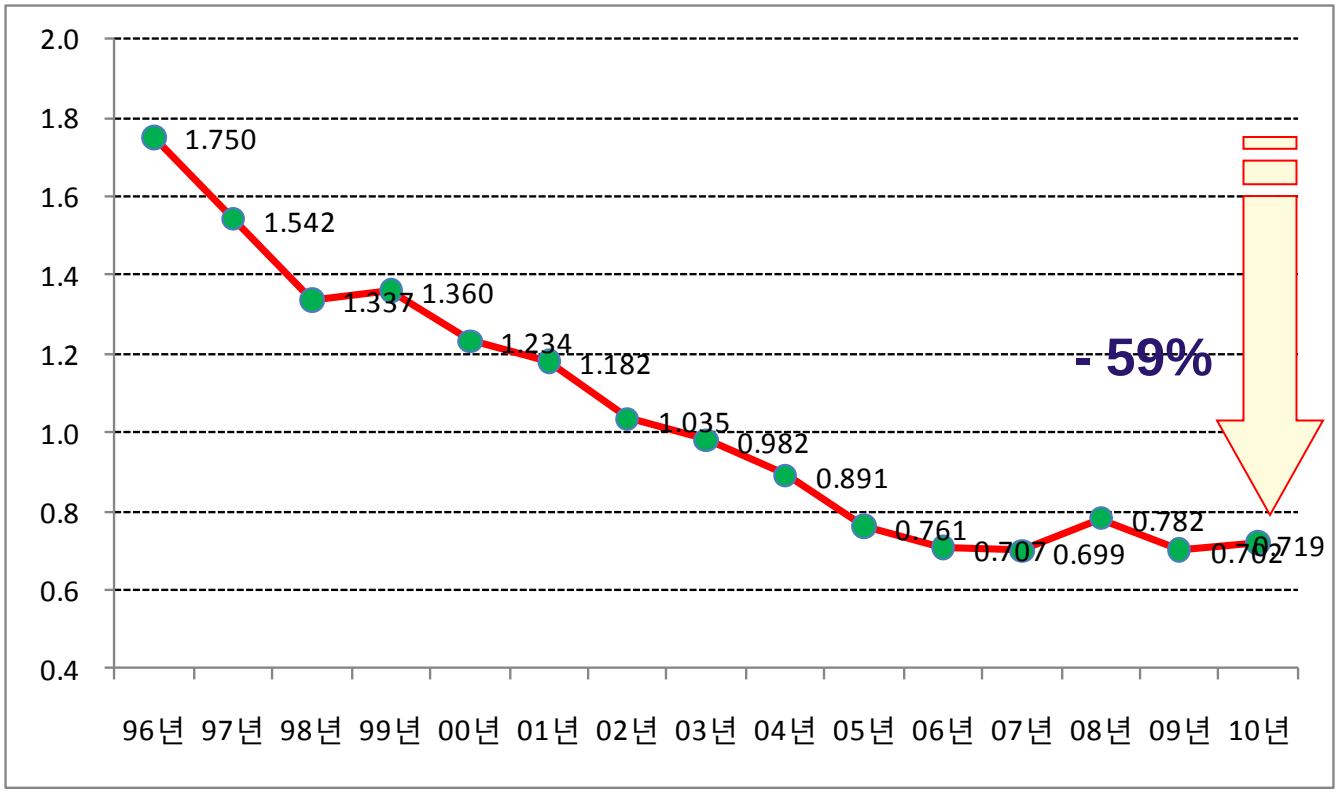
Washing Machines

LED Lights

Refrigerators

◆ Power consumption is reduced 59%

- kWh/L per year : 1.750 (1996) – 0.719 (2010)

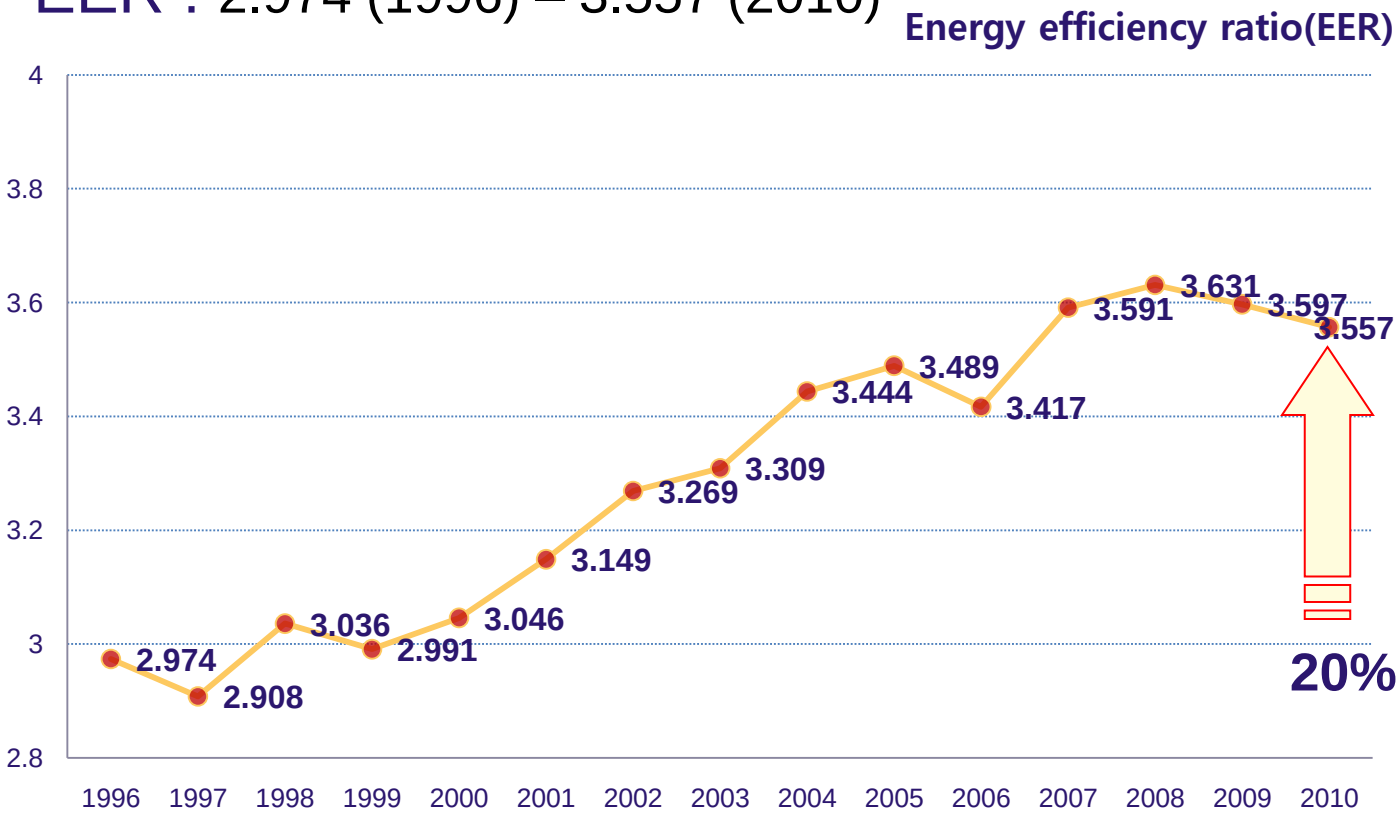


MEPS & energy efficiency grade label (Mandatory)

Air Conditioners

◆ Energy efficiency ratio go up 20%

- EER : 2.974 (1996) – 3.557 (2010)



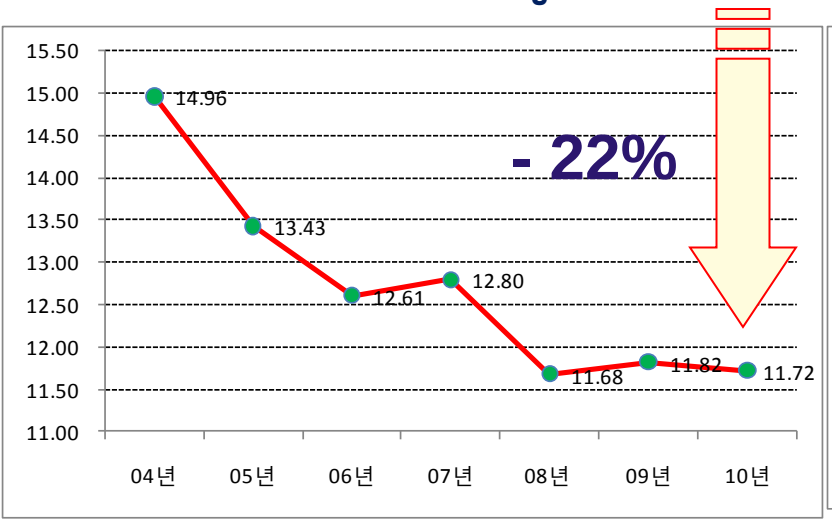
MEPS & energy efficiency grade label (Mandatory)

Washing Machines

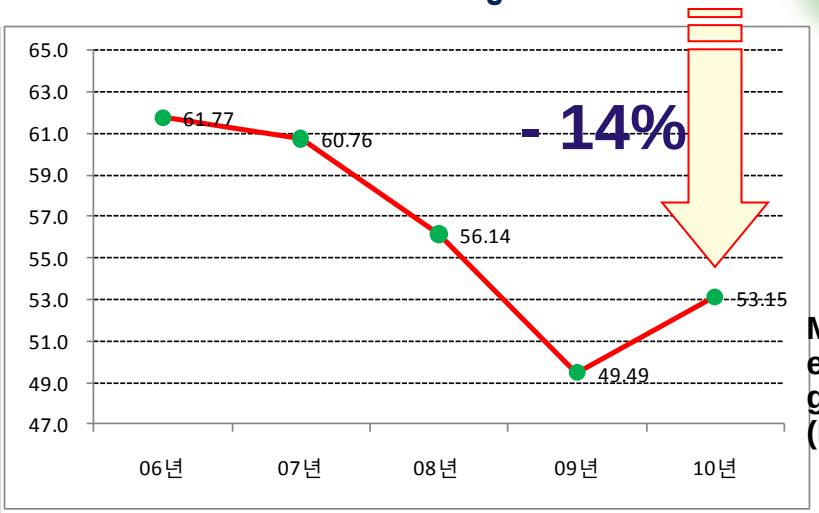
◆Power consumption is reduced from 14% to 22%

- Wh/kg (General Washing Machines) : 14.96 (2004) – 11.72 (2010)
- Wh/kg (Drum Washing Machines) : 61.77 (2006) – 53.15 (2010)

< General Washing Machines >



< Drum Washing Machines >

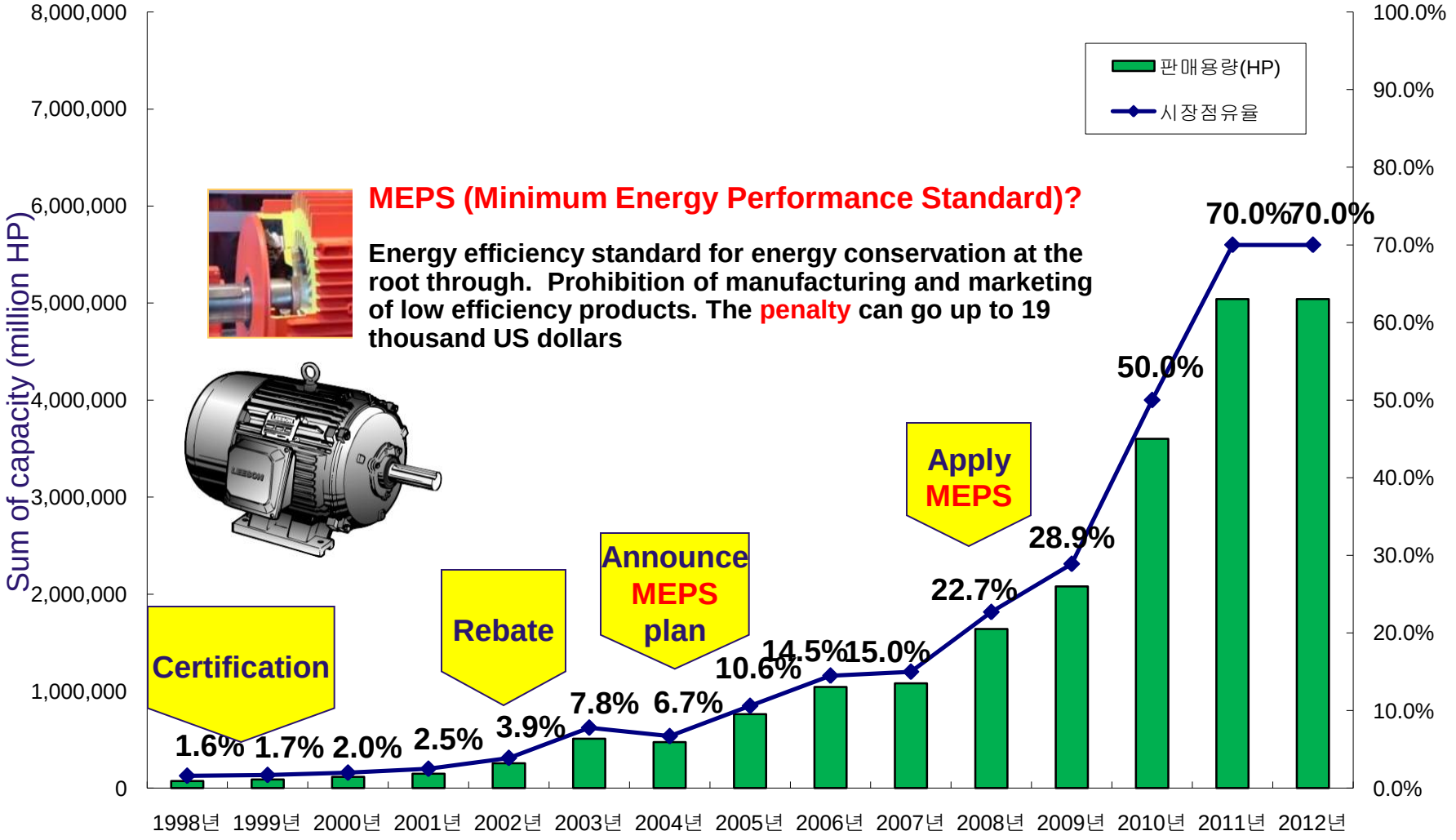


MEPS & energy efficiency grade label (Mandatory)

Three Phase Electric Motors(IE2)

MEPS (Minimum Energy Performance Standard)?

Energy efficiency standard for energy conservation at the root through. Prohibition of manufacturing and marketing of low efficiency products. The penalty can go up to 19 thousand US dollars



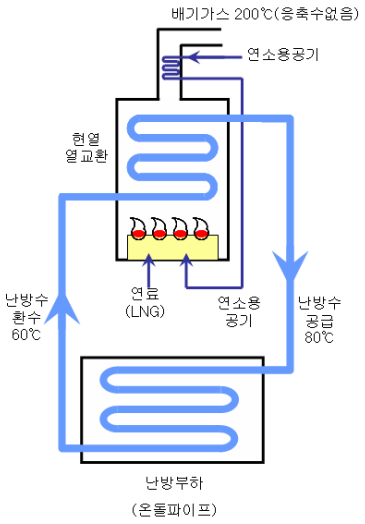
Domestic Gas Boilers

◆ Domestic gas boiler consumed 50% of natural gas in Korea

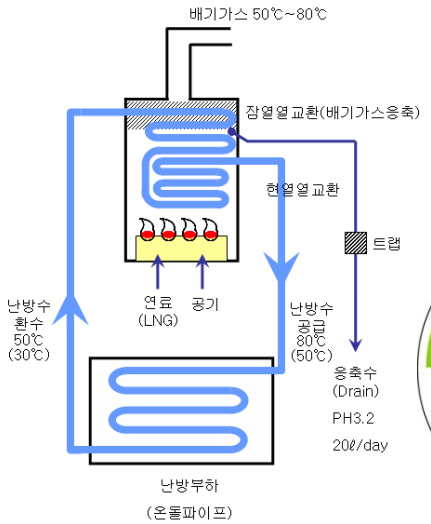
- Condensing gas boiler can save energy from 10 to 28% than general gas boiler

: Market share of condensing gas boiler : 6%(2008) → 10% (2010)

< General gas boiler >



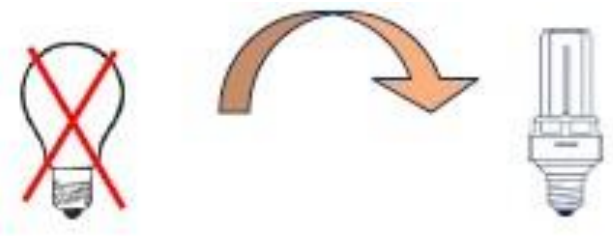
< Condensing gas boiler >



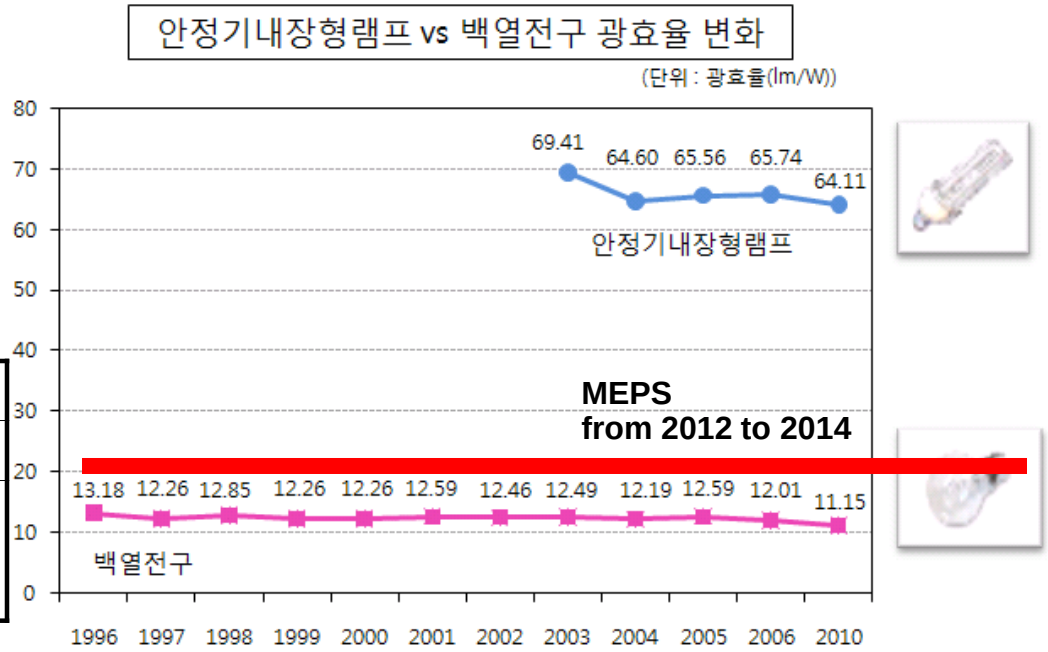
Phase out Incandescent Lamps

◆ Phase out by 2013

- MEPS will be applied above 20 lm/W from 2012 to 2014



Power consumption	MEPS (lm/W)		
	Current	From 1 Jan 2012	From 1 Jan 2014
25W - 40W	8.3	8.3	**20.0 (Phase out)**
40W - 70W	11.4	11.4	**20.0 (Phase out)**
70W - 150W	13.2	**20.0 (Phase out)**	**20.0 (Phase out)**



LED Lights

◆ LED lighting equipment dissemination scenario

Types	'07	'08	'09	'10	'11	'12	'13	'14	'15	Remark
Traffic lights etc	Certification('02), Regional energy project support				MEPS					
Guiding lights / halogen replacements	Certification Pilot dissemination project		Financial rebate					MEPS		
Replacing incandescent lamps / channel displays			Certification	Pilot dissemination project		Financial rebate				MEPS
Replacing fluorescent lamps and street lights				Certification	Pilot dissemination project		Financial rebate			MEPS

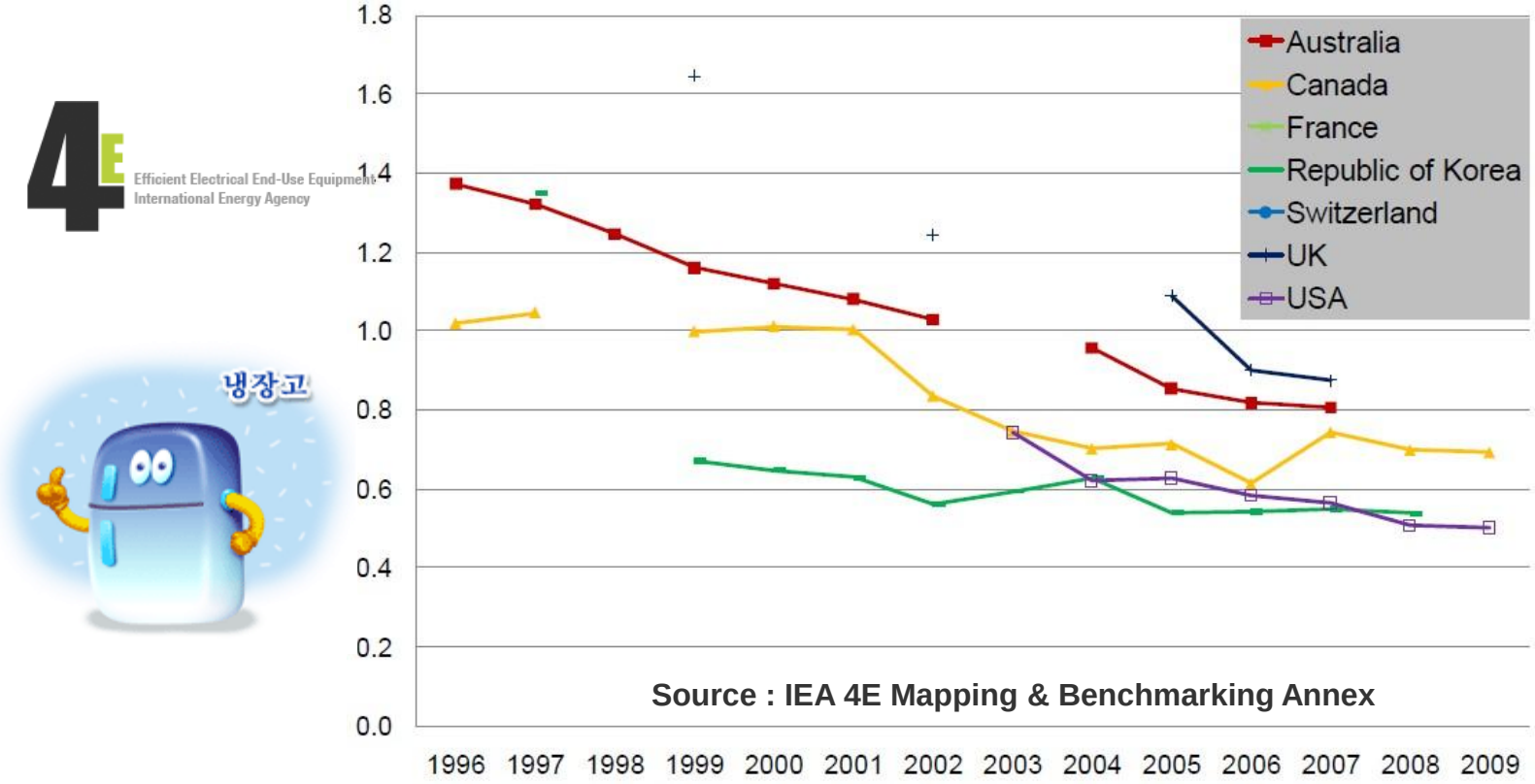
Applying Standby ≤1W Standard

Policy tools for ≤1W		Standby	Enforcement of date	Target products
e-Standby Program	Standby warning Label 	≤1W (Off or Passive standby)	28 Aug 2008	TVs
			1 Jul 2009	Computers, monitors, printers, multifunction devices, sep top boxes, microwave ovens
			1 Jul 2010	VCRs, audios, DVD players, radios, bidets, cordless phones, door phones, modems, fax machines, copiers, scanners, home gateways
	Energy Boy label	≤1W (Cut off automatically)	1 July 2001	Energy saving & controlling devices
Energy Efficiency Label and Standard Program	MEPS	≤0.5W (No load)	1 Jan 2009	External power supplies
	1st Energy Efficiency Label 	≤1W (Off or Passive standby) ≤3W (Active standby or sleep)	1 Jan 2007	Washing machines, dish washers
			1 Jan 2008	Rice cookers
			1 Jul 2008	Air cleaners
			1 Jan 2009	Drum washing machines, electric fans
			1 Jan 2010	Air conditioners, house hold gas boilers
			1 Jan 2011	Dish dryers, gas water heaters

6. Comparison of Refrigerators(1)

◆ Annual power consumption per adjusted volume

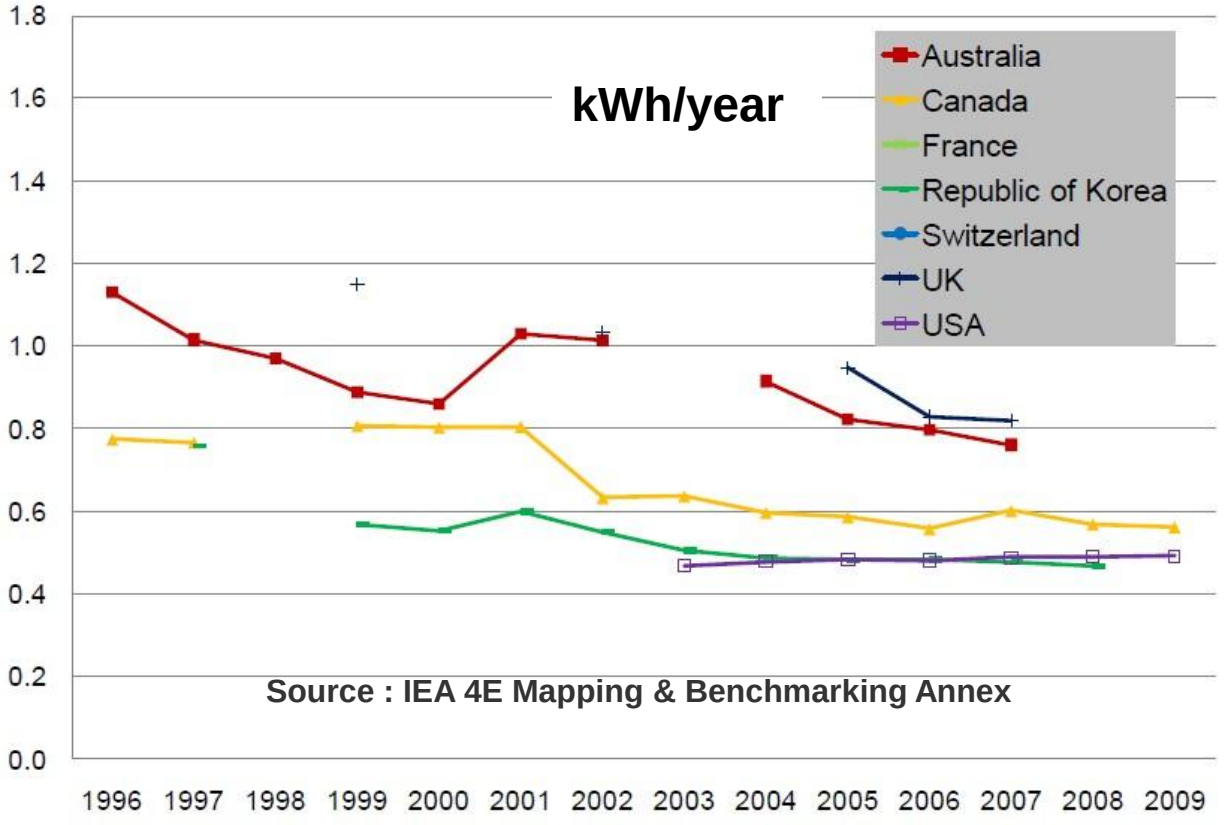
- USA(Energy Star)→Korea→Canada→Australia→European countries



Comparison of Refrigerators(2)

◆ Annual power consumption per liter

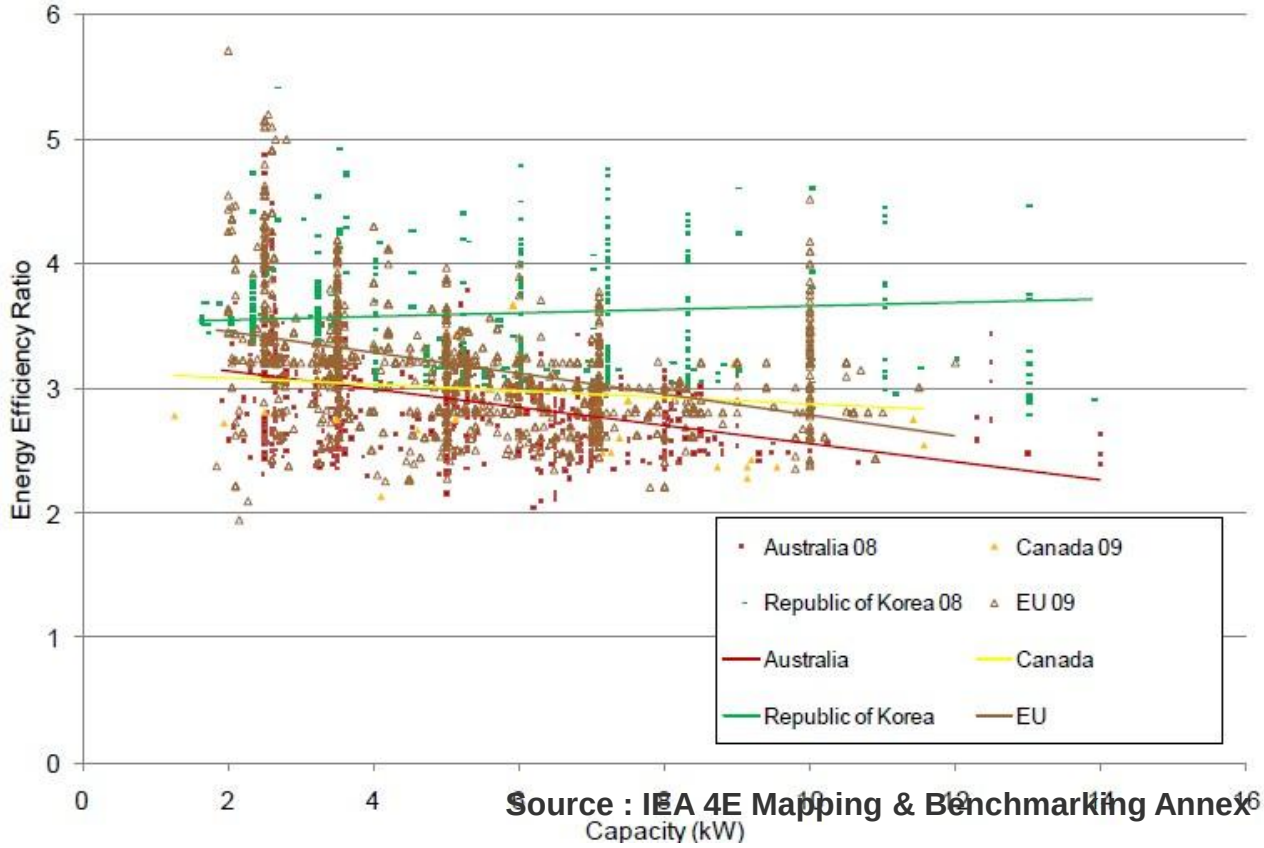
- Korea→USA(Energy Star)→Canada→Australia→European countries



Comparison of Air Conditioners(1)

◆ Energy efficiency ratio (EER)

- Korea→Canada→European Countries→Australia

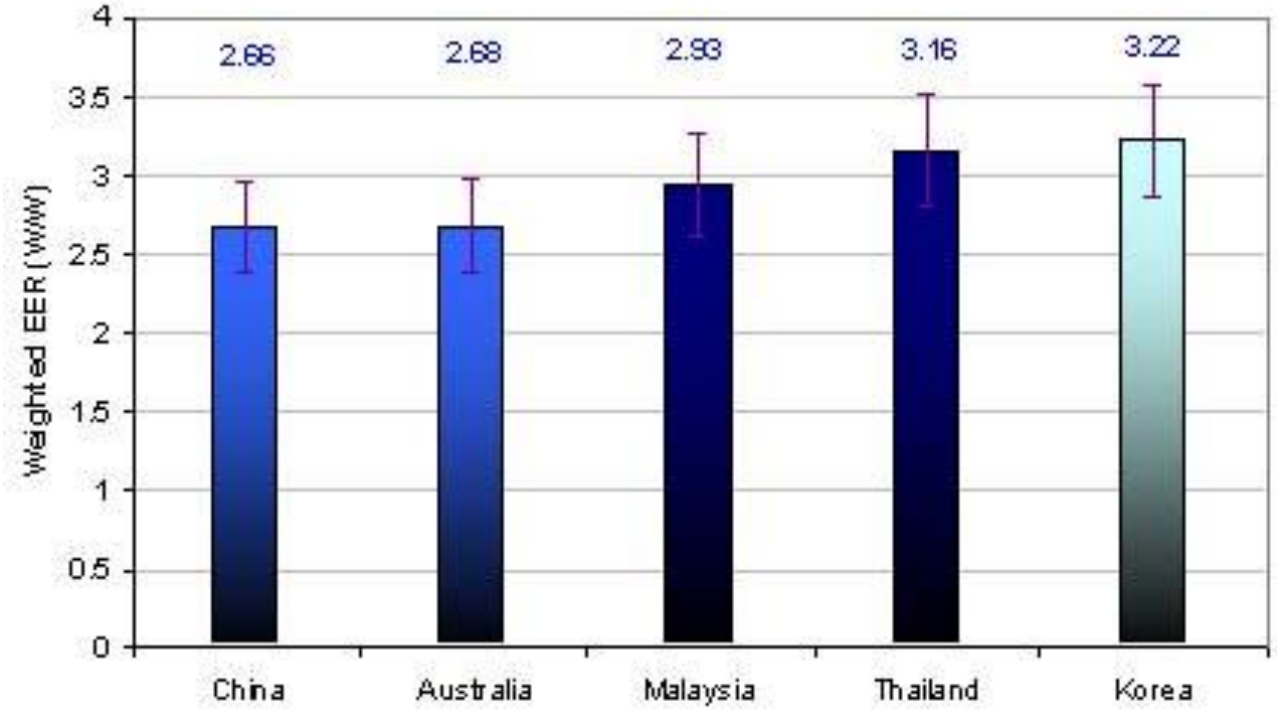


Source : IEA 4E Mapping & Benchmarking Annex

Comparison of Air Conditioners(2)

◆ Energy efficiency ratio (EER)

- Korea→Thailand→Malaysia→Australia→China



APEC
Asia-Pacific Economic Cooperation

Source : APEC-ESIS

Assessment of Korea

◆ Report submitted by IEA to G8 Summit

"Korea recently developed a mandatory programme over a relatively short period of time, incorporating the better elements from the more established national programmes and adding new initiatives, such as the threat of using mandatory warning labels for products that fail to meet standby power targets."

International Energy Agency

Source : Energy Efficiency Policy Recommendations Prepared by the IEA for the G8 Under Gleneagles plan of Action (21 March 2008)

APEC EGEE&C

38th APEC EGEE&C meeting & Workshops

Asia-Pacific Economic Cooperation

7-11 November 2011, Seoul Palace Hotel, Seoul, Korea

Monday		Tuesday		Wednesday		Thursday		Friday	
7 November 2011		8 November 2011		9 November 2011		10 November 2011		11 November 2011	
APEC Energy Efficiency Air conditioners and Transformers Workshop (SKY room on the 12th floor)		**38th APEC EGEE&C meeting** (SKY room on the 12th floor)		**38th APEC EGEE&C meeting** (SKY room on the 12th floor)		**APEC Smart Appliance Standards for Air Conditioners and Other Appliances Workshop** (SKY room on the 12th floor)		**APEC Smart Appliance Standards for Air Conditioners and Other Appliances Workshop** (SKY room on the 12th floor)	
9.00	**Air conditioners workshop** (lead by ICA and KEMCO)	9.00	**Welcome Address by Ministry of Knowledge Economy**	9.00	**38th APEC EGEE&C meeting**	9.00	**Smart Appliance Standards workshop** (lead by Australian Government)	9.00	**Smart Appliance Standards workshop**
		9.15	**38th APEC EGEE&C meeting** (Participants of workshop can attend as observers)						
12.30		12.00		12.00		12.00		12.00	
Lunch									
13.45	**Transformers workshop** (lead by ICA and KEMCO)	13.30	Bus start for Site Tour at Seoul Palace Hotel **Site Tour** (Samsung Electronic) (for all participants of APEC EGEE&C and workshops)	13.30	**38th APEC EGEE&C meeting**	13.30	**Smart Appliance Standards workshop**	13.30	**Smart Appliance Standards workshop**
		17.30	Bus start for Welcome Reception at Seoul Palace Hotel						
		18.30	**Welcome Reception hosted by KEMCO** (SamcheongGak) (for all participants of APEC EGEE&C and workshops)						

Thank you

If you have any question,

please e-mail to yrkim@kemco.or.kr