

Electric Heating Load, How Can Limit It?

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

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Overview

1. Winter Peak Load

2. Electric Fan Heaters & Electric Stoves

**3. Variable Refrigerant Flow (VRF)
Multi-Split Heat Pumps**

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°C in Seoul during last winter

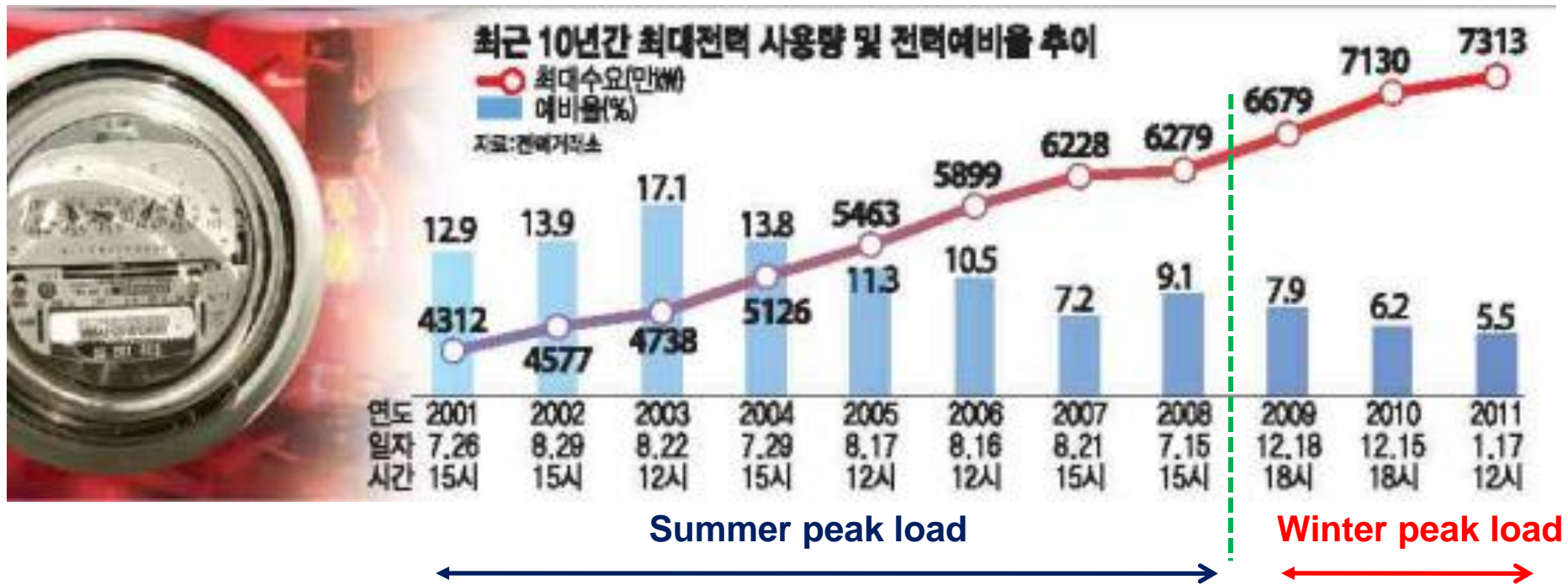
: * $-10^{\circ}\text{C} \sim -12^{\circ}\text{C}$: 6 days, $-12^{\circ}\text{C} \sim -15^{\circ}\text{C}$: 3 days, $-15^{\circ}\text{C} \sim -18^{\circ}\text{C}$: 3 days



Peak Load Trend

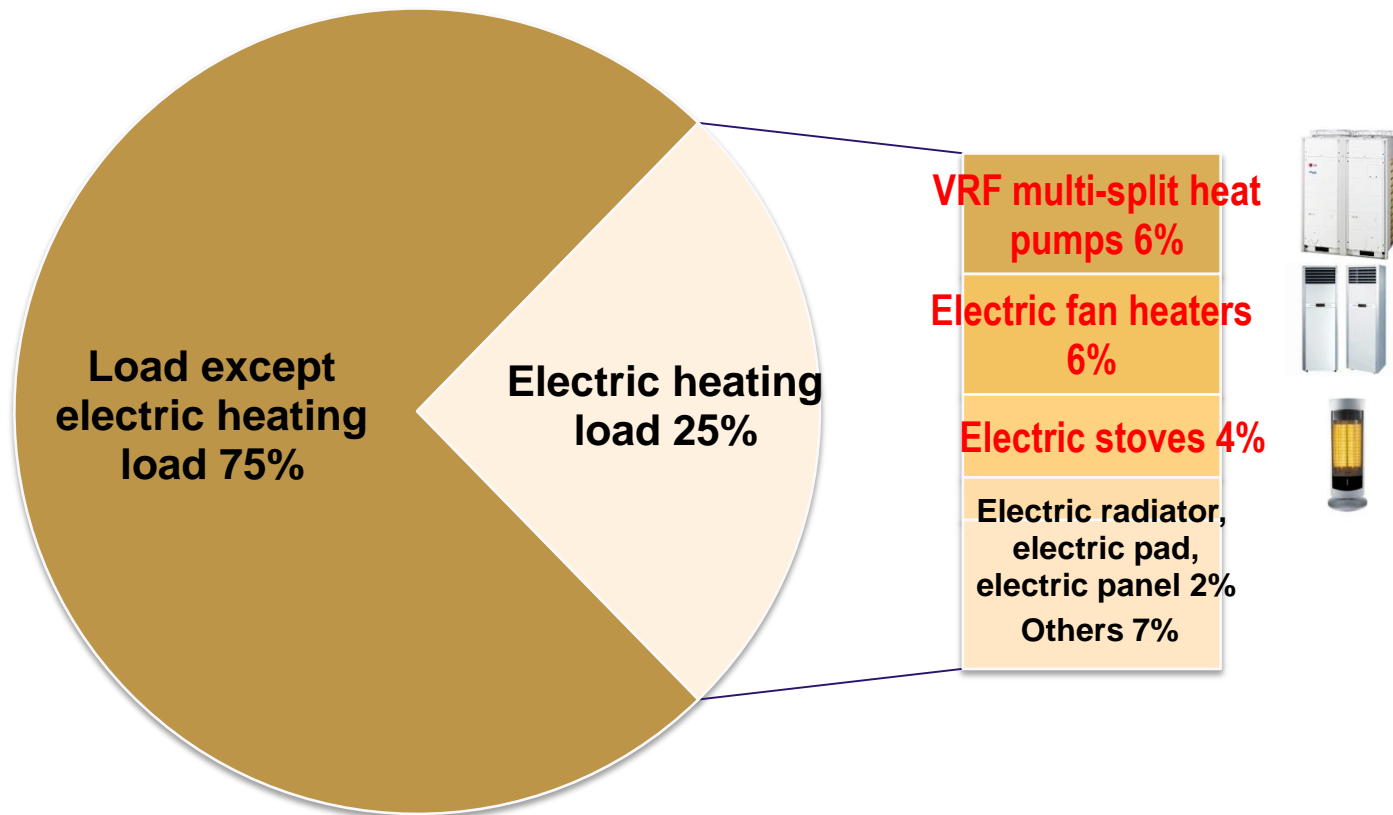
◆ Peak load season moved from summer to winter

- Peak load happened winter since 2009



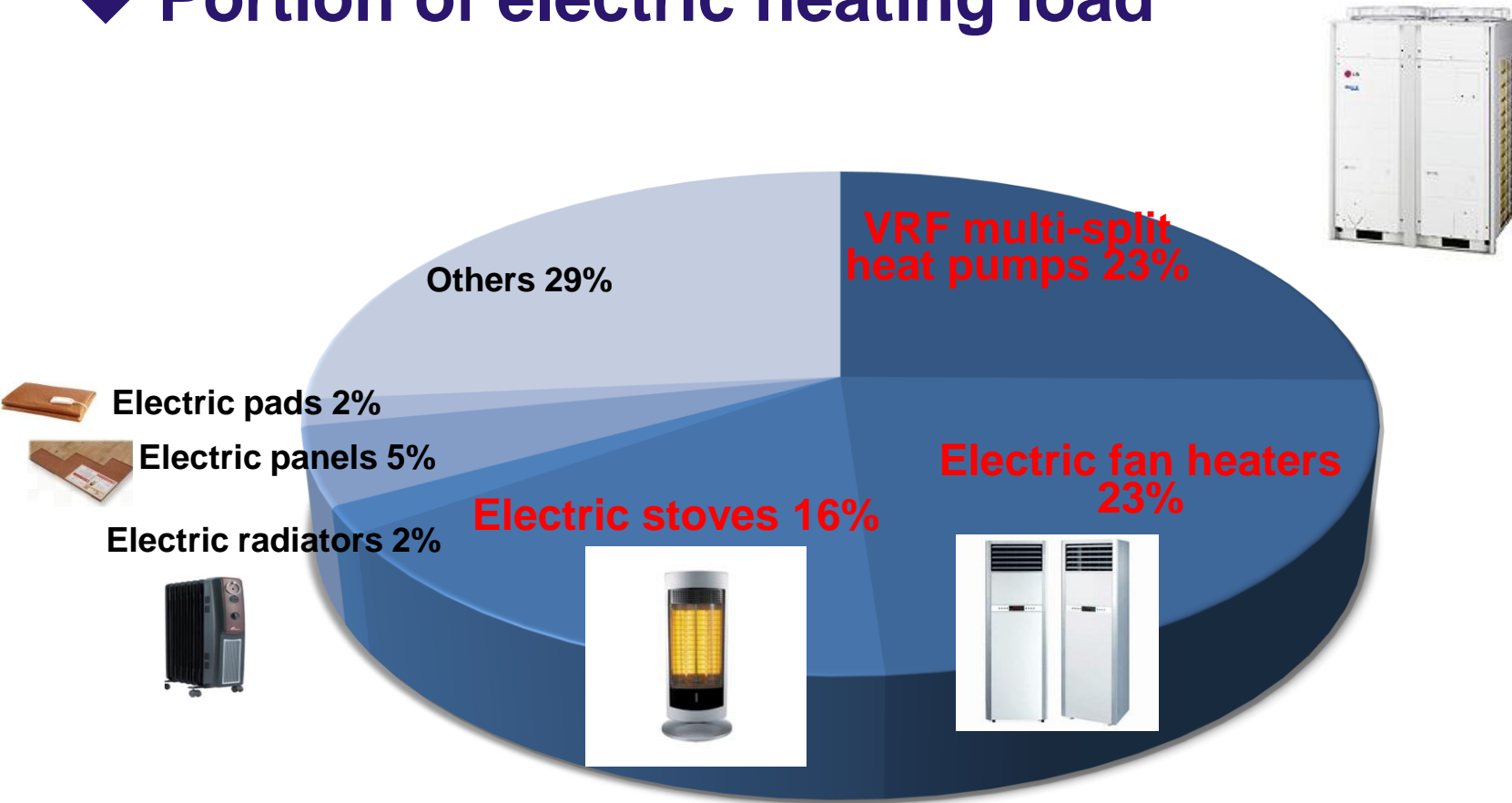
Cause of Winter Peak Load

- ◆ 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 → 175.00 → **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



SI 신일 원동형 전기난로

하루 8시간 사용기준 전가로 부가세 및 전력기반금 제외 누진세 미적용

가정용 854원 (8시간 x 1.9kw x 56.2 = 854,24원)	영업용 1,111원 (8시간 x 3kw x 46,30원 = 1111,2원)
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본 방송은 재방송으로 해당 경품 및 프로모션이 적용되지 않을 수 있으며 일부구상 및 사은물에 차이는 있을 수 있습니다

고유가시대
난방비 절약형

하루 8시간 사용기준
단 404원 (가정용 기준 누진세 미적용)

전도 안전장치
넘어지면 자동 전원차단

1.8W 소형 열선 분리식 난방
가정용 78,000원 미만

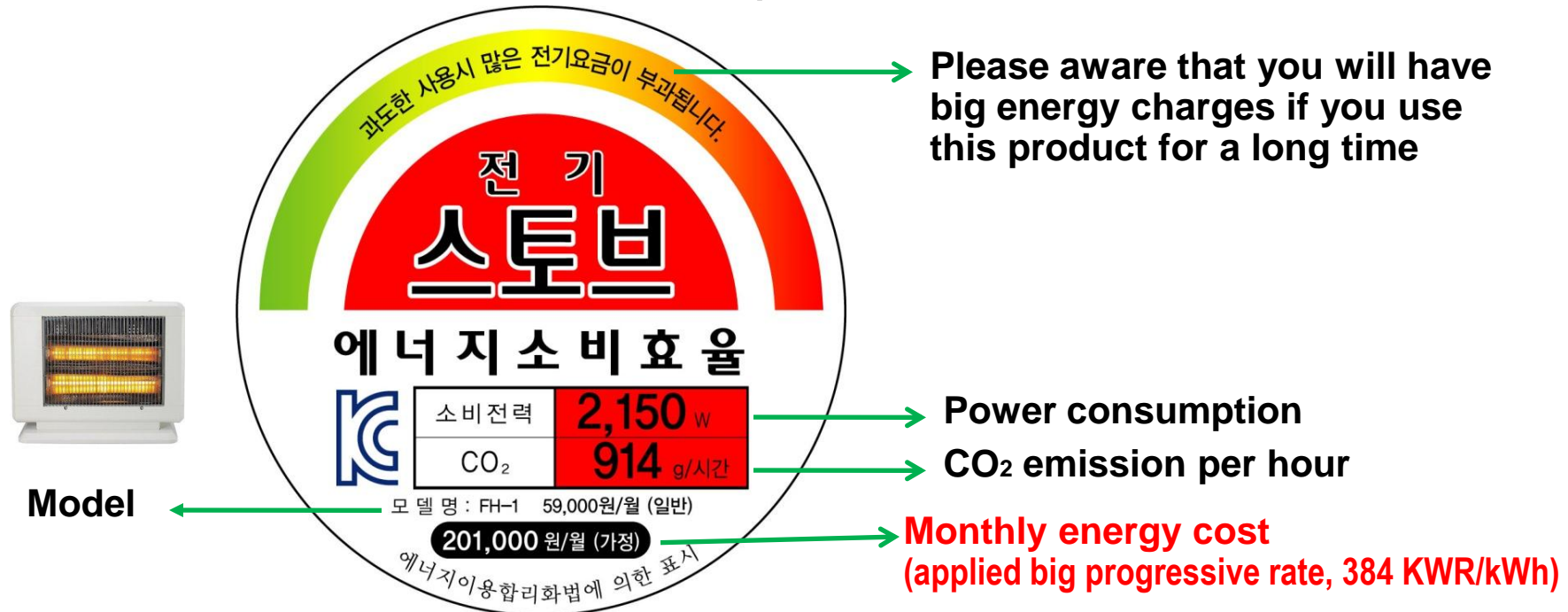
전도 안전장치
넘어지면 자동 전원차단

Electric Heating Load,
How Can Limit It?

Energy Cost Label

◆ Policy solution is mandatory energy cost indication through energy efficiency label

- **Red label** means inefficient products



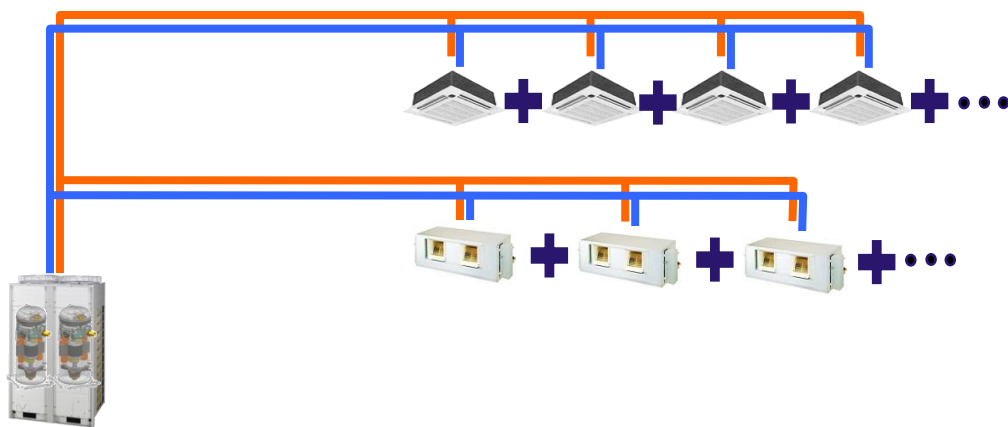
Electric Heating Load,
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3. Variable Refrigerant Flow (VRF) Multi-Split Heat Pumps

- ◆ VRF multi-split heat pumps consist of outdoor unit, indoor unit and pipeline

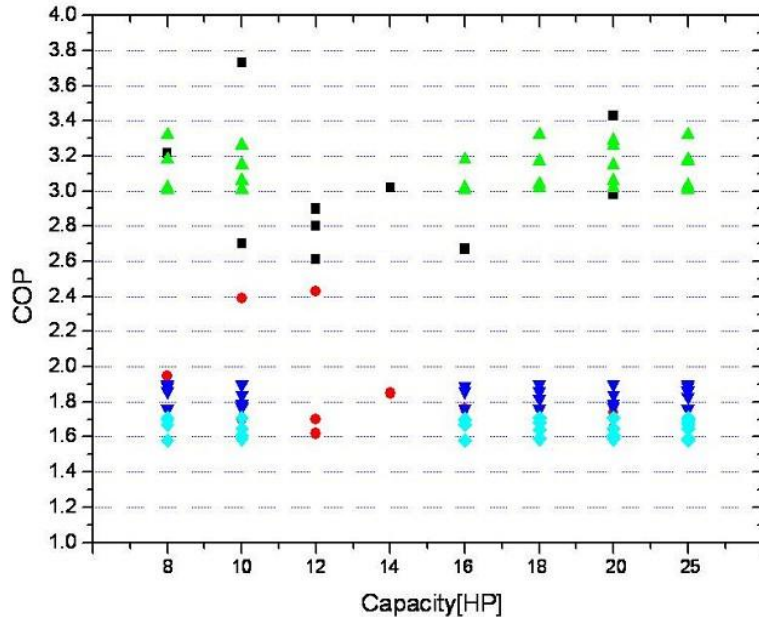


Irony of VRF Multi-Split Heat Pumps

◆ 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°C (average COP is only 1.9)



7°C

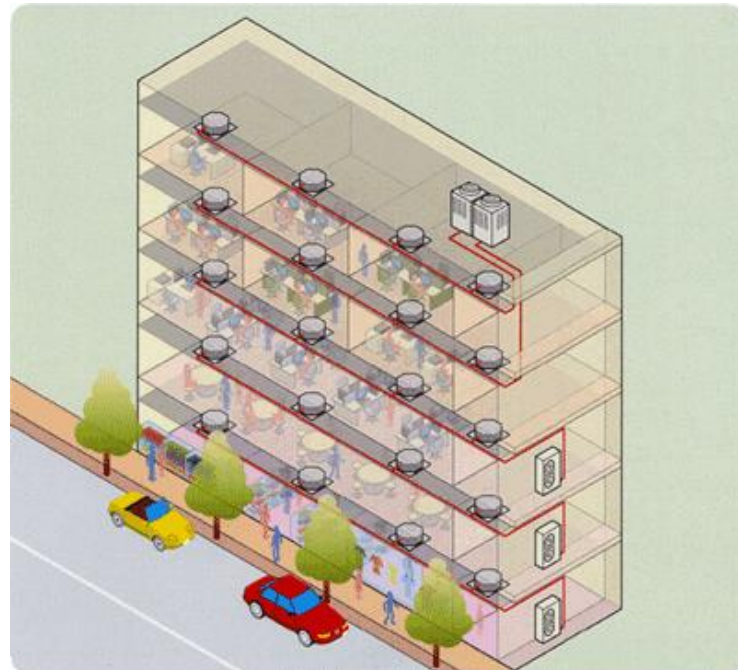
-15°C



Scope

◆ Scope of VRF multi-split heat pumps

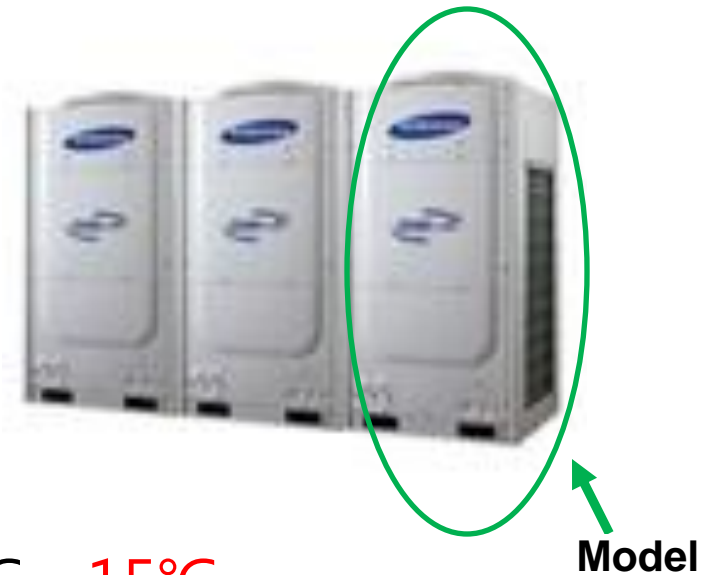
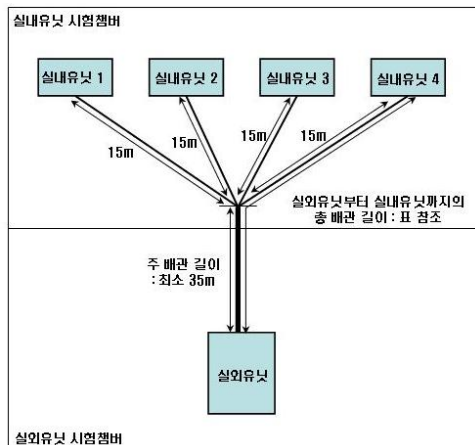
- Rated cooling capacity : from 23kW to 70kW



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°C , -15°C

Test Result

◆ Test result of cooling and heating efficiency

No	Capacity	IEER (Cooling)				IEER	COP (Heating)			EERa
		Load	100%	75%	50%		25%	COP1	COP2	
		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



◆ Minimum Energy Performance Standard

(unit : W/W)

EERa	IEER (100%, 75%, 50%, 25%)	COP	COP2 (-15°C)
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).



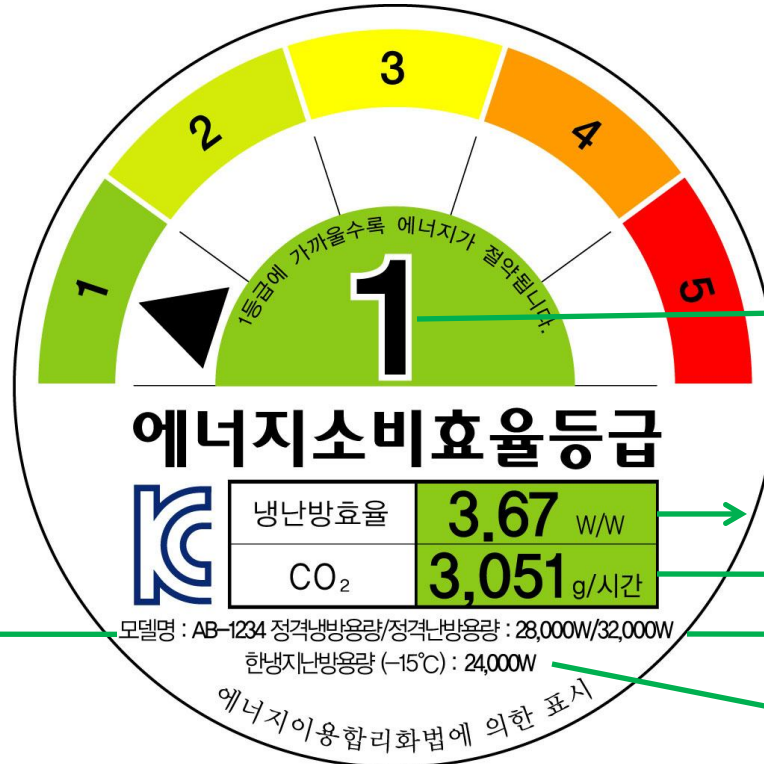
Energy Efficiency Label Standard

◆ Energy efficiency level for VRF multi-split heat pumps

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



Energy Efficiency Grade Label



Energy efficiency level

Energy efficiency ratio(EERa)

CO₂ emission per hour

Rated cooling capacity

/Rated heating capacity

Heating capacity at -15°C

Model



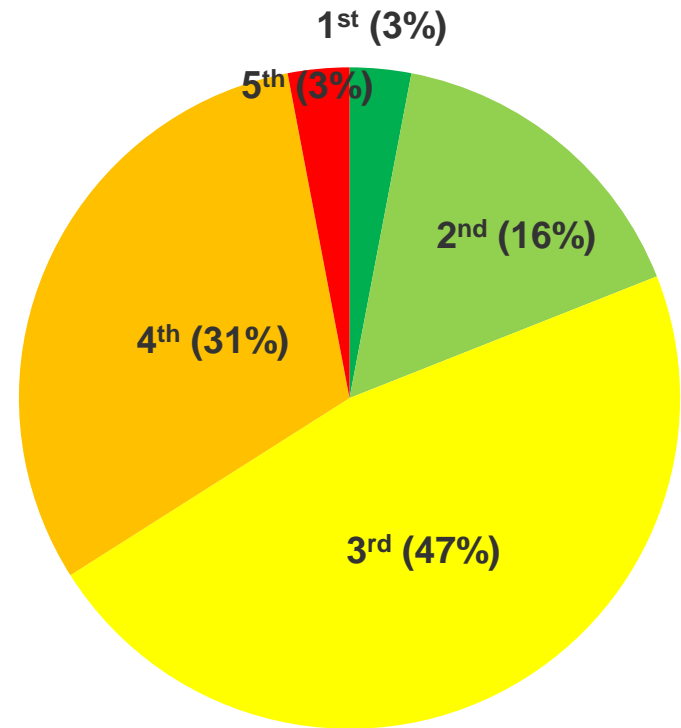
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Distribution of Efficiency Grade

◆ Estimated distribution of grade

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

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



Thank you

If you have any question,

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