EECA
Energy Efficiency and Conservation Authority
Te Tari Tiaki Pūngao

S.E.E.R Workshop

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APEC Asia-Pacific Economic Cooperation

EECA BUSINESS.

EECA energywise.

New Zealand Government

The Problem

- 21% of NZ homes have an Air Conditioner: Heat Pump.
- Up from 4% in 2000
- 50% of new houses have A/C:H/P's installed
- Heat pumps are the most popular choice for 'clean heating'.
- Many areas in NZ are bringing in clean air regulations.
- People often specify and buy them for one function (cooling or heating) but use them all year round

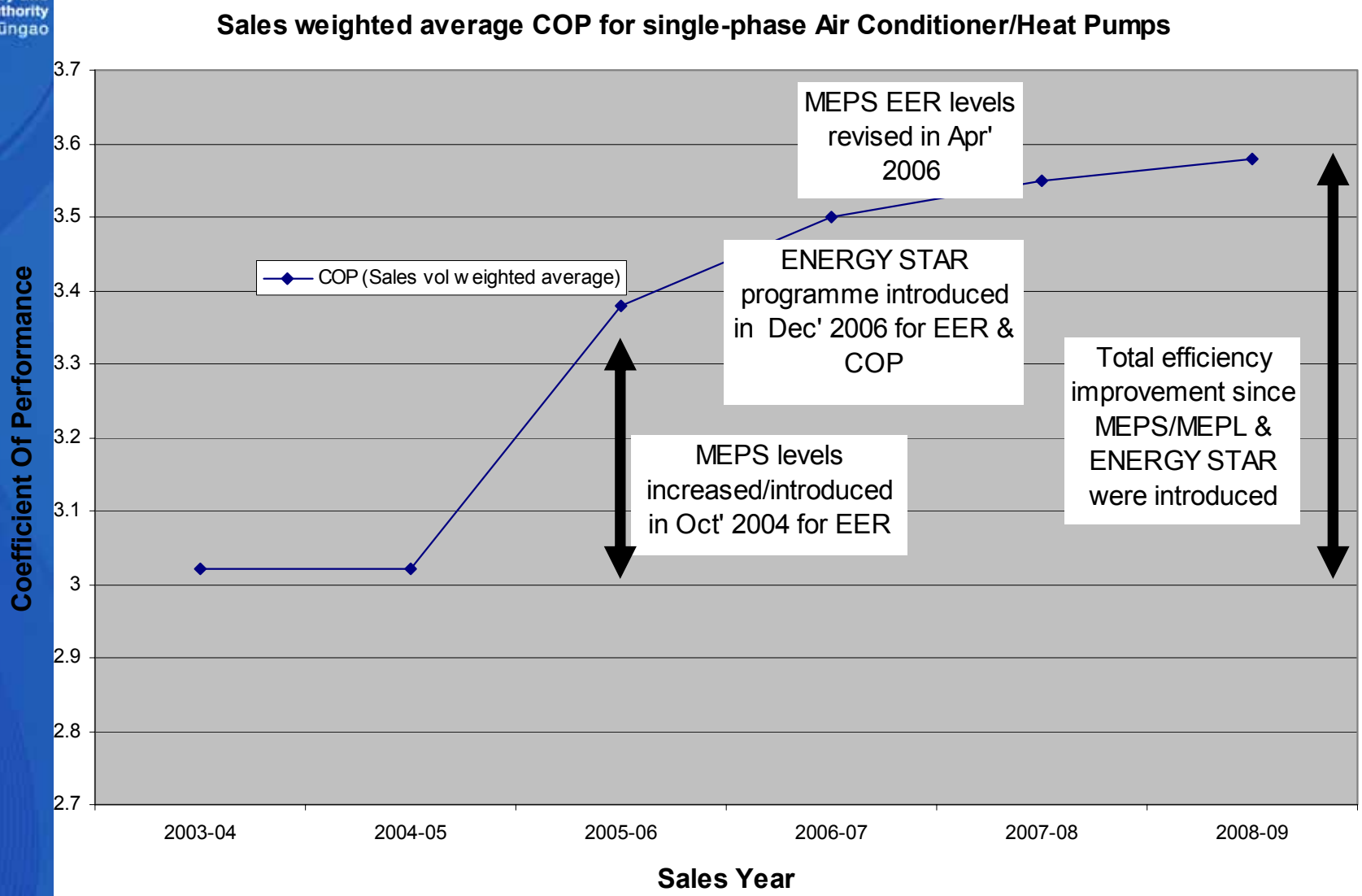
Standards &Testing

- AS/NZS 3823.1 Methods of testing (for non-ducted & ducted reverse-cycle air conditioners)
- AS/NZS 3823.2 Registration, MEPS & labelling
- A Joint program with Australian Gov't - Minimum Energy Performance Standards have been in place since 2001(3 Phase) & 2004 (single Phase)

Why we need Standards?

- Customer information - *"Buy by the Stars"* - the more 'stars' the better
- Government information and monitoring
- Removes worst performers from market and ensures NZ is not a "dumping ground" for poor performing products
- Drives improvements in technology

Benefits of doing this?



Energy Rating Label

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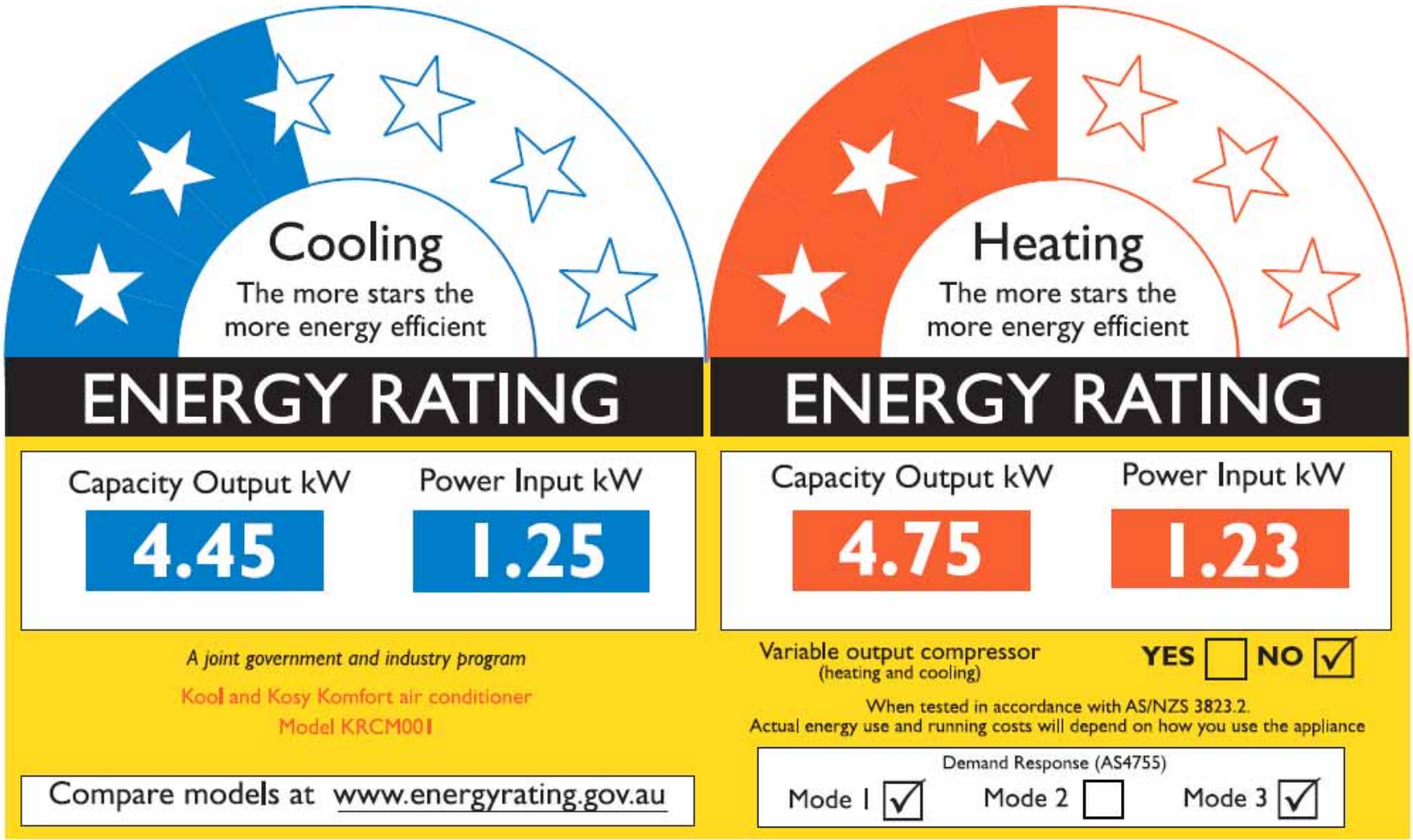


Star Rating Index

SRI. Algorithm =

$$\frac{[\,(\text{EER/COP} \times 8) - 18\,]}{4}$$

But, this is based on "Rated" capacity (i.e. at 100%), for heating or cooling operations

Star Rating	EER/COP
1	2.75
1.5	3.00
2	3.25
2.5	3.50
3	3.75
3.5	4.00
4	4.25
4.5	4.50
5	4.75
5.5	5.00
6	5.25

Test points

- A/C products **must** be tested at *"T1"*
- = 35°C Dry-bulb/24°C Wet-bulb. Can also be tested at other temps for hotter and cooler climates.
- Heat-pumps **must** be tested at *"H1"*
- = 7°C Dry-bulb/6°C Wet-bulb. Can also be tested at other temps for colder and very cold climates.

Meteorological Statistics

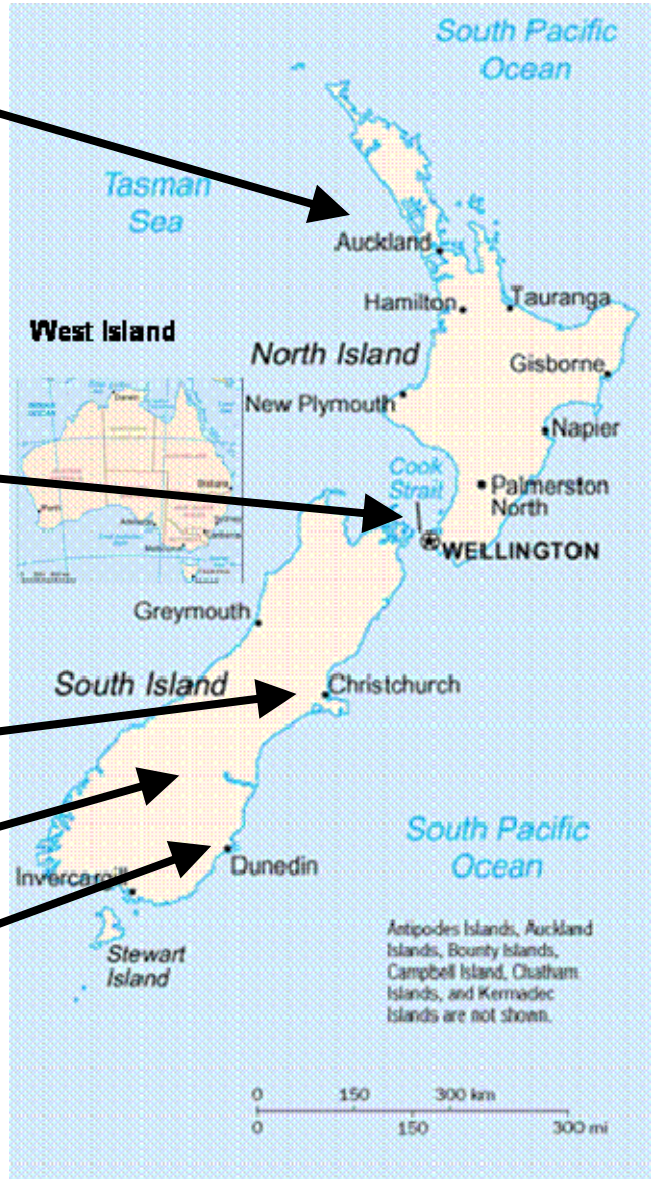
Auckland (15^{0}C)

Wellington (12^{0}C)

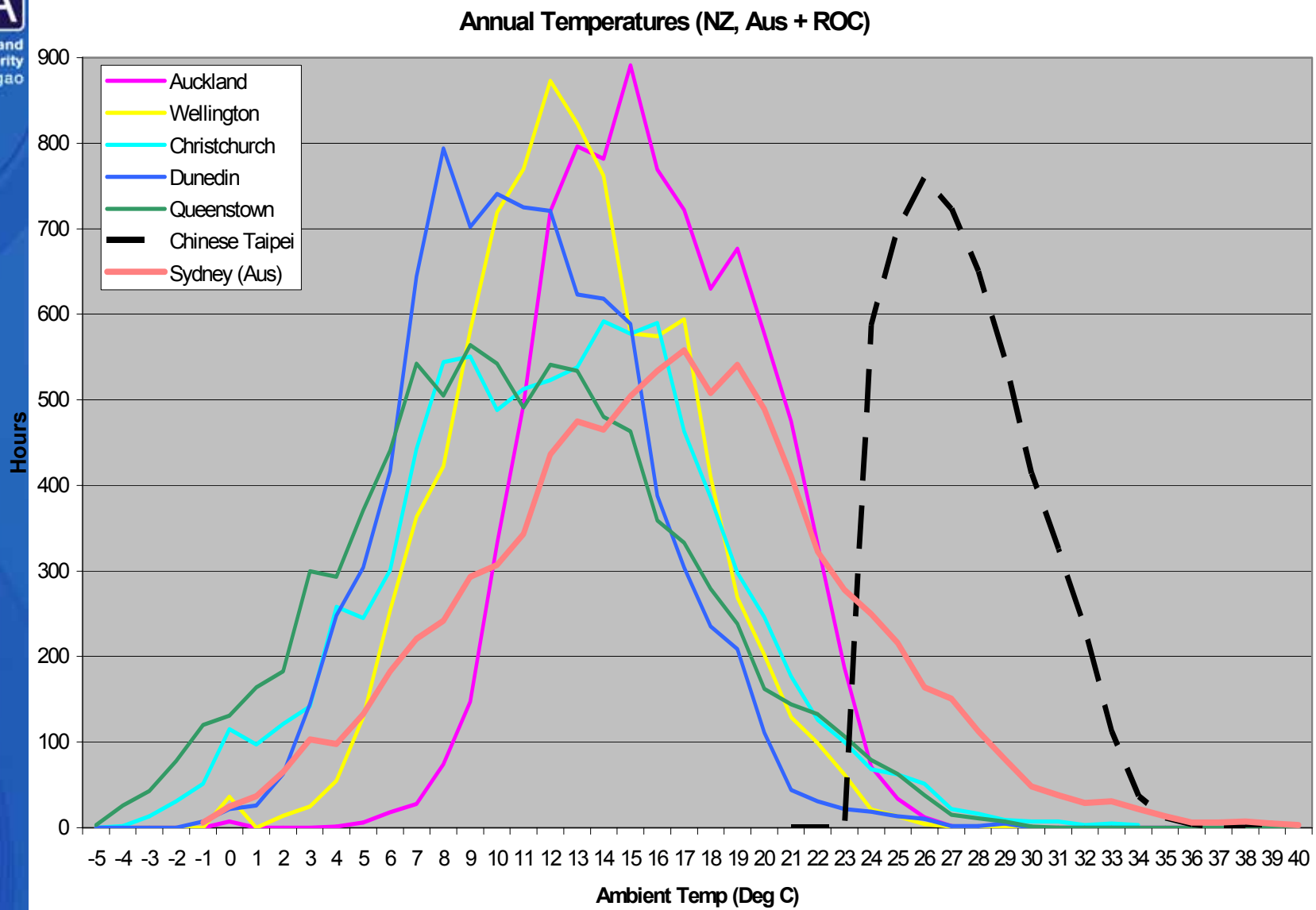
Christchurch (14^{0}C)

Queenstown (9^{0}C)

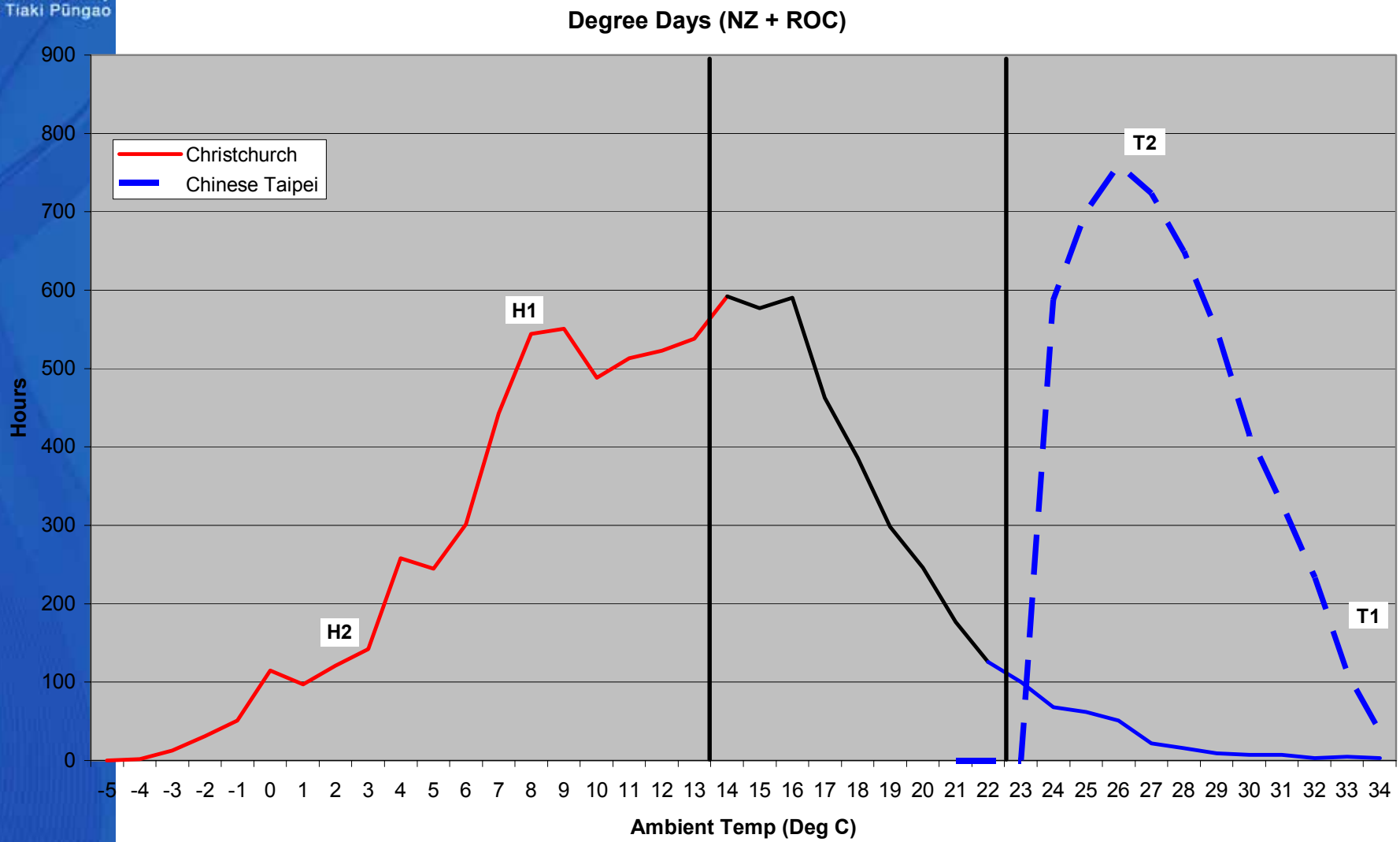
Dunedin (13^{0}C)



Meteorological Statistics



Metereorological Statistics



Annualised Performance

$$\frac{2{,}000 \times \text{Cooling/heating}}{(2{,}000 \times P_E) + (6{,}760 \times E_S)}$$

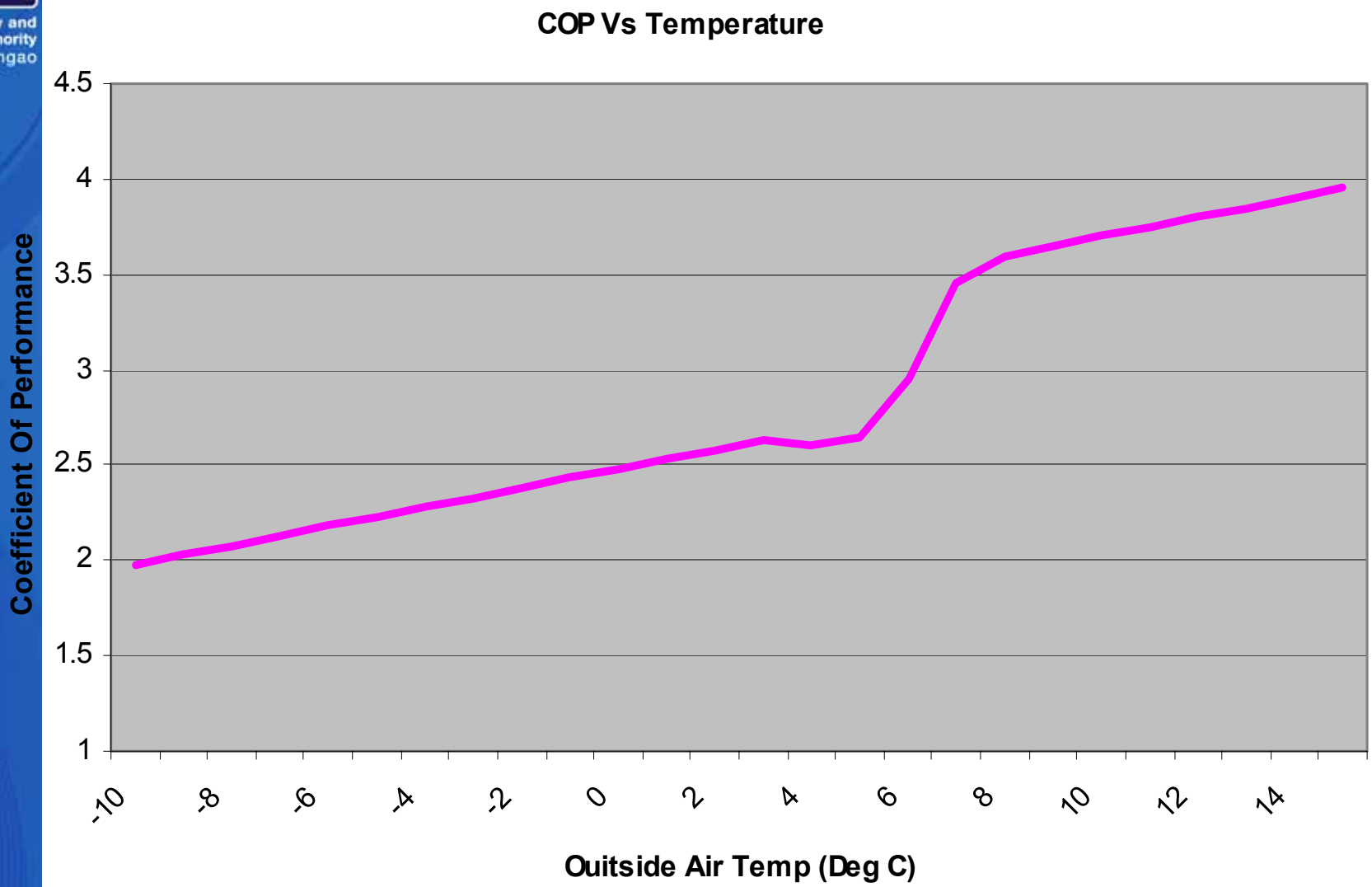
- Uses tested “rated” (i.e. 100%) output for cooling/heating (kW)

*P_E = "Effective Power Input = Energy used in "Operational Mode“ (kW)

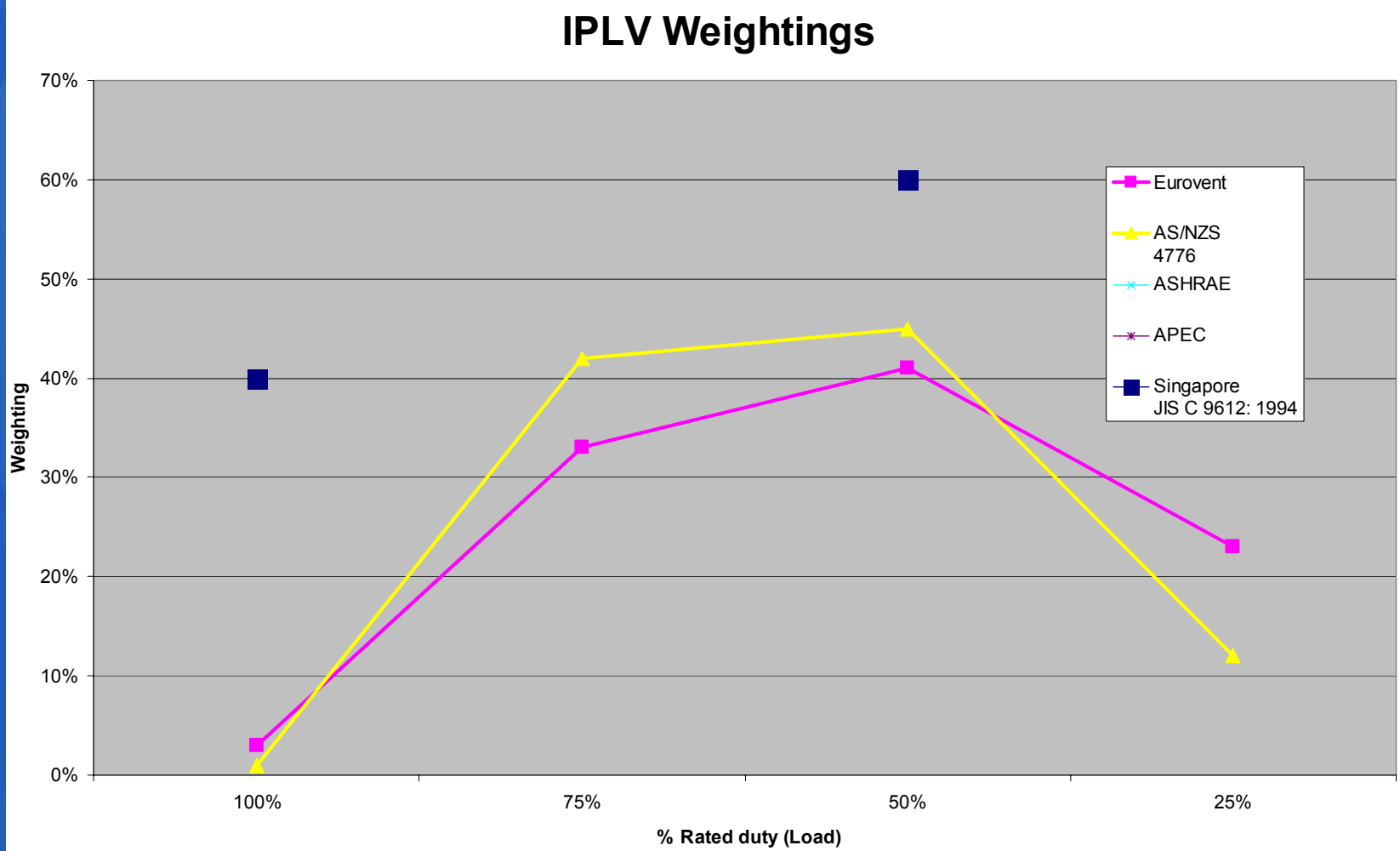
* E_S = Energy used in "Standby" or "Non-Operational Mode“ (kW)

* Assumes 2,000 hours of operation

Performance Vs Temperature.



Integrated Part Load Values (Chillers)



$SEER =$

$$\frac{(P_{OUT\text{-}COOL100\%} \times Hrs_{COOL100\%}) + (P_{OUT\text{-}COOL50\%} \times Hrs_{COOL50\%})}{(P_{IN\text{-}COOL100\%} \times Hrs_{COOL100\%}) + (P_{IN\text{-}COOL50\%} \times Hrs_{COOL50\%}) + (8760 - Hrs_{COOL100\%} - Hrs_{COOL50\%}) \times P_{IN\text{-}NOP}}$$

Desc.	*Example*
$P_{IN\text{-}COOL100\%}$	*1.82*
$P_{IN\text{-}COOL50\%}$	*1.35*
$P_{OUT\text{-}COOL100\%}$	*5.00*
$P_{out\text{-}COOL50\%}$	*4.50*
$P_{IN\text{-}COOL\text{-}NOP}$	*0.001*
$Hrs_{COOL100\%}$	*50*
$Hrs_{COOL50\%}$	*800*

EER = 2.75

SEER = 3.27

SCOP (HSPF) =

Desc.	*Example*
$P_{IN\text{-}HEAT100\%}$	*2.51*
$P_{IN\text{-}HEAT50\%}$	*1.49*
$P_{OUT\text{-}HEAT100\%}$	*8.00*
$P_{OUT\text{-}HEAT50\%}$	*5.50*
$P_{IN\text{-}HEAT\text{-}NOP}$	*0.002*
$Hrs_{HEAT100\%}$	*155*
$Hrs_{HEAT50\%}$	*1,000*
Hrs_{NOP}	*6,737*

COP = 3.19

SCOP = 3.61

SHCPF

(Seasonal Heating & Cooling Performance Factor) =

$$\frac{(P_{OUT\text{-}HEAT100\%} \times Hr_{\text{-}HEAT100\%}) + (P_{out\text{-}HEATL50\%} \times Hr_{\text{-}HEAT50\%}) + (P_{OUT\text{-}COOL100\%}\ Hrs_{COOL100\%}) + (P_{out\text{-}COOL50\%} \times Hrs_{COOL50\%})}{(P_{IN\text{-}HEAT100\%} \times Hrs_{HEAT100\%}) + (P_{IN\text{-}HEAT50\%} \times Hrs_{HEAT50\%}) + (P_{IN\text{-}COOL100\%} \times Hrs_{COOL100\%}) + (P_{IN\text{-}COOL50\%} \times Hrs_{COOL50\%})\ (8760 - Hrs_{HEAT100\%} - Hrs_{\text{-}HEAT50\%}) - Hrs_{COOL100\%} -}$$

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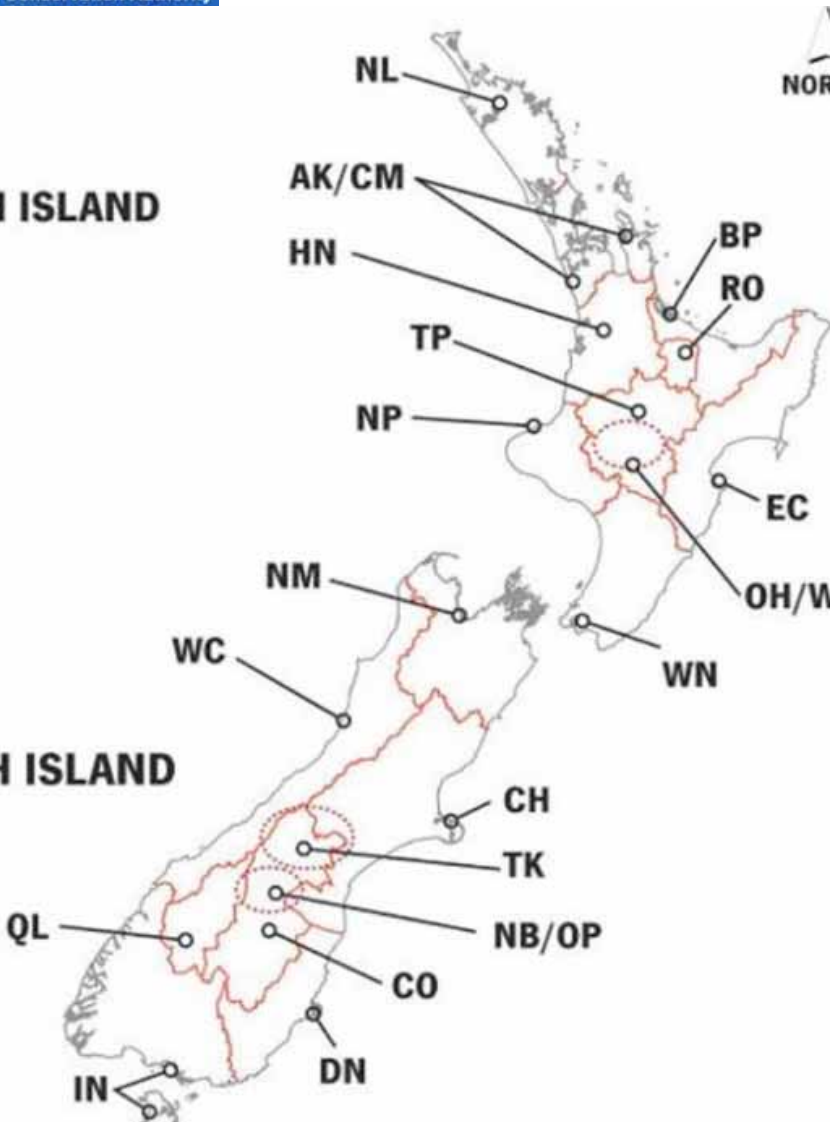
Sizing

SIZING YOUR HEAT PUMP

EECA energywise
THE POWER TO CHOOSE



(A)	Region		**Wellington**
	Climate Index		**3**
	Design temperature		**1 Degrees C**
(B)	Room Type (Design Temperature)		**Lounge (20 Deg C)**
	Bed Rm/Hall (16 Deg C)	0	**2**
	Dining Rm (18 Deg C)	1	
	Lounge (20 Deg C)	2	
(C)	Insulation		**Good (2008 onwards)**
	High/Best Practice	1	**2**
	Good (2008 onwards)	2	
	OK (NZBC 1978 - 2008)	3	
	Poor/none	4	
(D)	Windows - Size in Rm		**Large - 60%**
	Small - 25% of wall space	1	**3**
	Medium - 40%	2	
	Large - 60%	3	
	Very Large - 80%	4	
(E)	Number of outside walls		**Two**
	One	1	**2**
	Two	2	
	Three	3	
(F)	Total score = (A) + (B) + (C) + (D) + (E) +		**12**
(G)	Room area X 8		**160**
	Length (m)		**5**
	Width (m)		**4**
(H)	= (G) + 100		**260**
	Heater size (W) = (F) X (H)		**3,120 W**
	Heat size (kW) = (F) X (H)		**3.12 kW**

But remember, this must be sized at the Heat Pump's "Design Temperature" for **1 Degrees C**
Also allow for local variation (i.e. valleys, rivers etc)

ENERGY STAR

- In New Zealand, you'll find the ENERGY STAR mark on leading heat pumps, dishwashers, fridge/freezers, washing machines, TVs, DVD players, home theatre systems, computers and office equipment.
- By choosing to buy products and appliances that have earned the ENERGY STAR mark, you'll save money on your power bill, plus you'll be helping to protect our environment.
- ENERGY STAR is awarded to the most energy efficient products available, typically the top 25% of each class
- However, incorrect sizing or installation can **still** reduce performance and undermine efficiency

The Future??

- Ver 1 – based on rated EER & COP only
- Ver 2 - “annualised” EER & COP, with standby power consumption included in the calculation
- Ver 3? – “Regional” capacity & power consumption?
- Ver 4 - “Regionalised” annualised capacity & power consumption, based on Seasonal Heating & Cooling Performance

Questions ?

Thankyou ☺

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