‘Visi Coolers’ – November 2021

Workshop at AVARI- Lahore

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NEECA

Efficient Appliances for People & the Planet

Current Scope of work

- We are currently looking at: "*Glass fronted commercial cooling cabinets*" also known as Visi Coolers
- In 2022 we will focus on Commercial Chest Freezers. Domestic Chest Freezers may be in scope as well.
- Other current work includes policies for water heaters and distribution transformers for NEECA.
- Procurement standards for two cooling appliances for PEECA.
- Previous work includes: MEPS & Labels for Motors, and fans.
- KCEP Project – working with the MOCC on:
  - revision of NDCs,
  - PCAP &
  - MEPS for a couple of cooling appliances.

A brief intro to benefits of having Standards and Labels

“Definition” of MEPS and Labelling

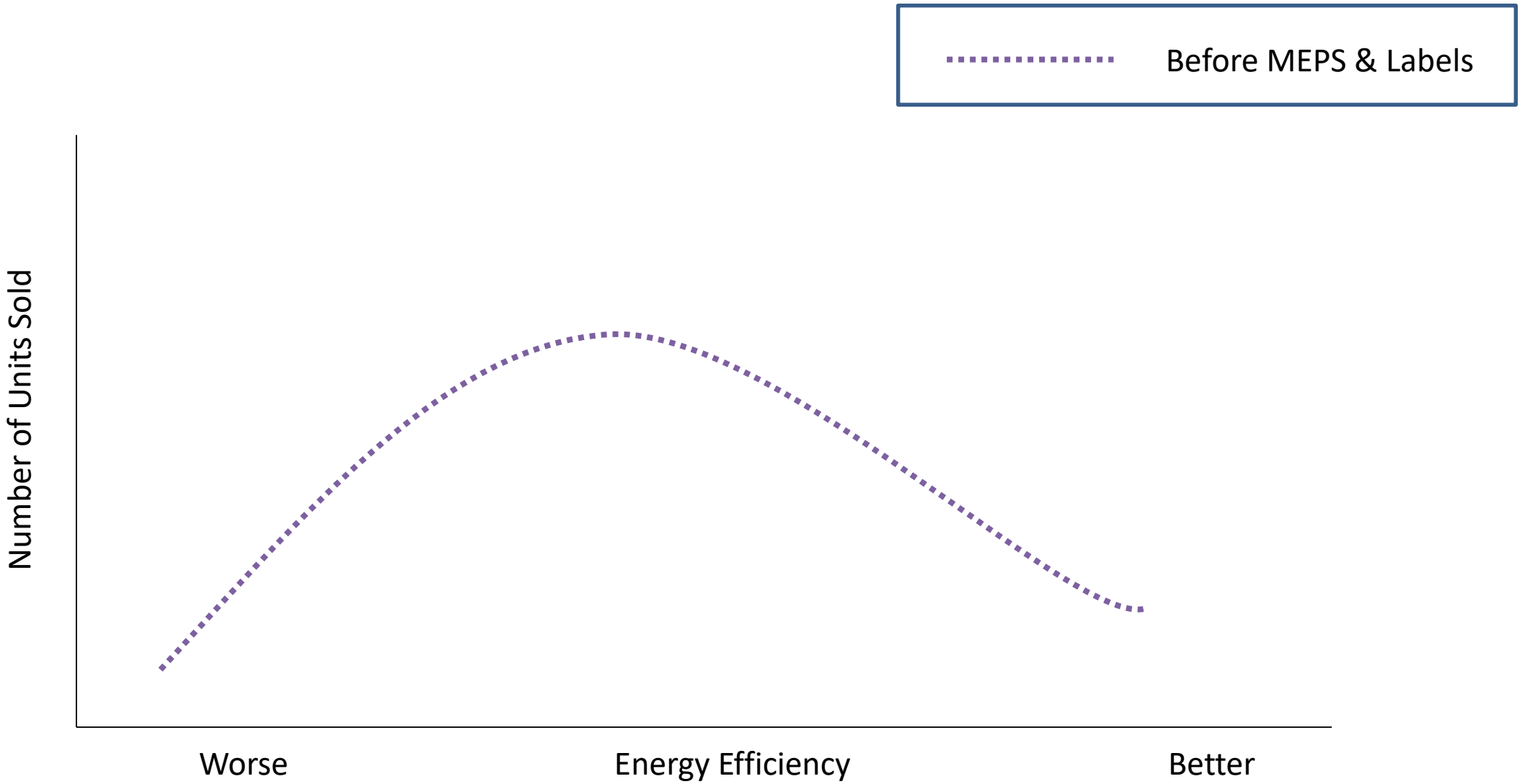
Minimum Energy Performance Standards (MEPS)

- Removal from the market of products that are deemed to have unacceptably low energy performance.

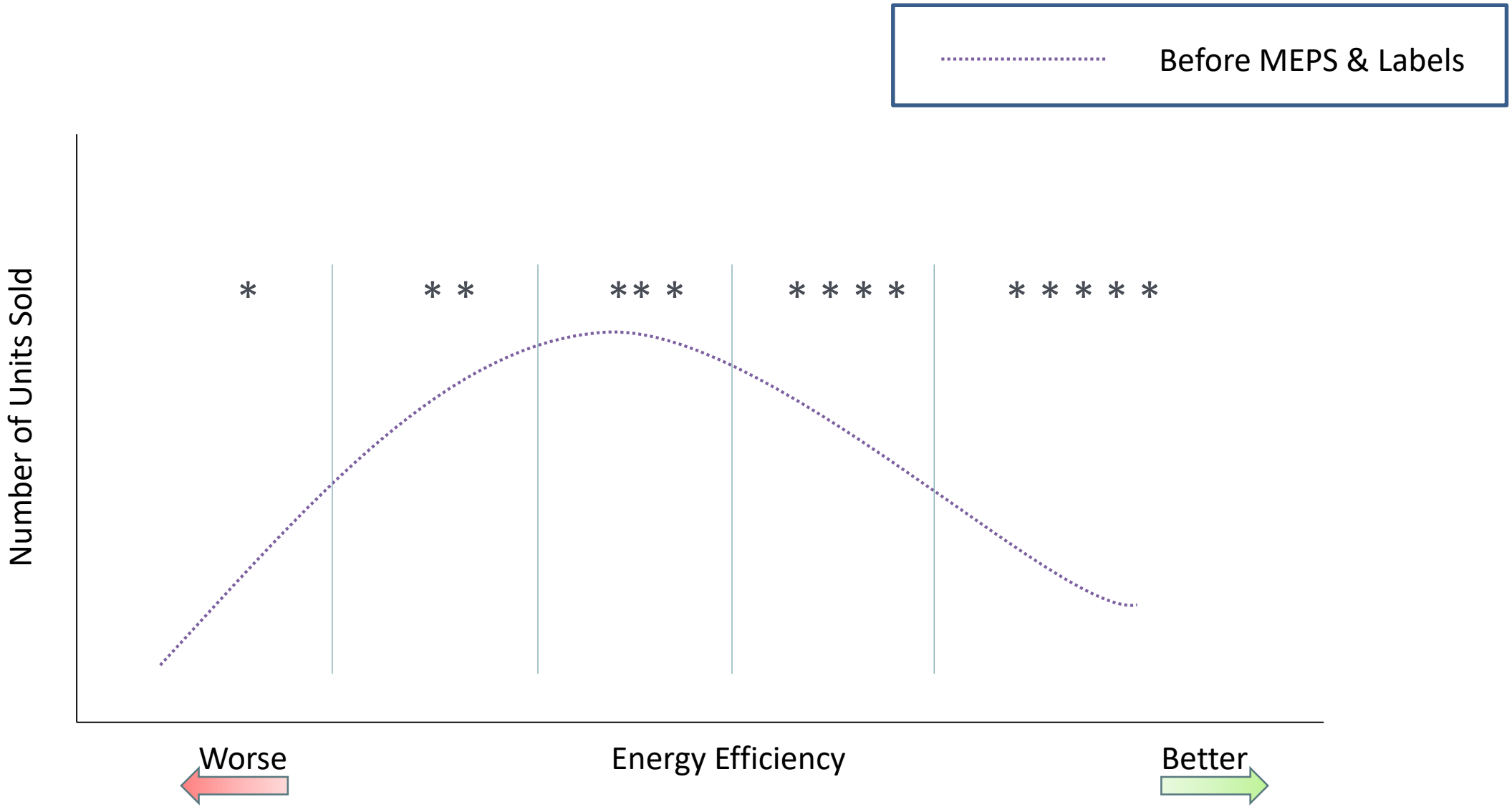
Labelling

- To categorise the energy performance of products to enable differentiation of the “better” products from the “less good” products.
  - *Consumers get more transparency for decision making*
  - *Allows effective implementation of other policy (eg procurement)*

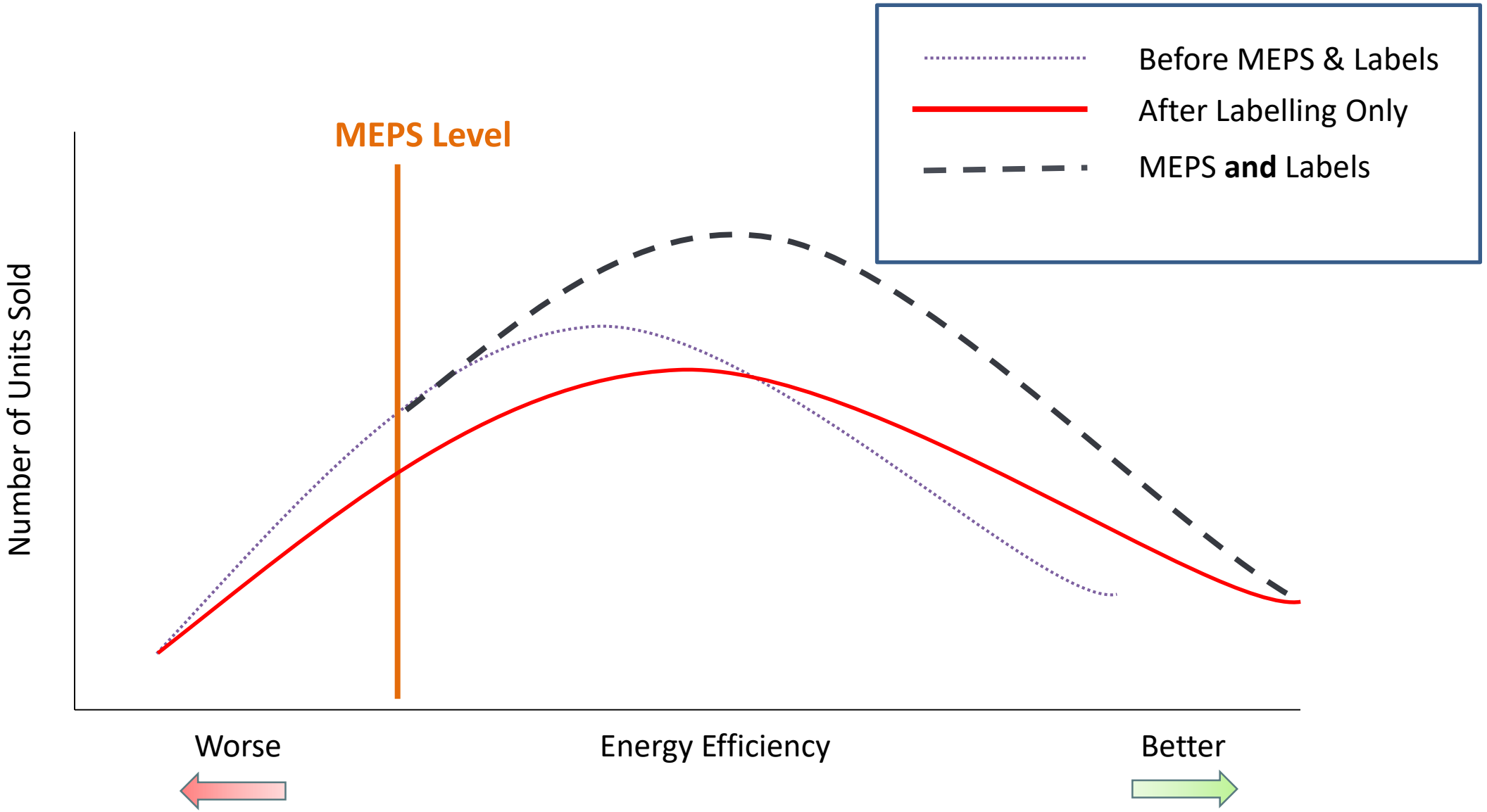
Distribution of Performance of Products in Market



Effect of Labelling: Transparently "Grading" Product Performance



Effect of MEPS and Labelling



MEPS and Labelling around the world (2014)

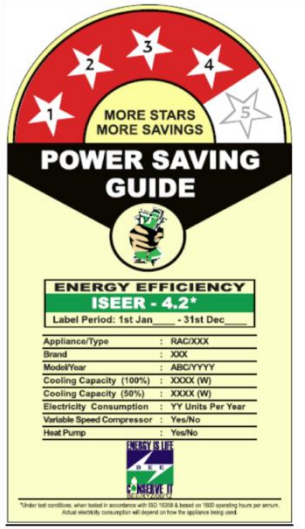
	Minimum Standards	Comparative Labels
Europe	939	652
Asia Pacific	243	228
North America	92	44
Central America	43	88
Middle East	79	78
Africa	57	59
Total	**1453**	**1149**

1,900+

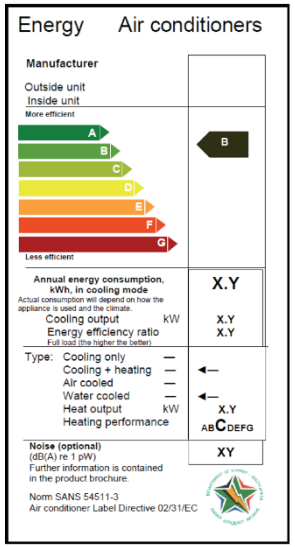
Source: Energy Standards and Labelling Programmes Around the World: in 2013, Department of Industry, Australia (2014)

Label Examples

Australia



Europe



China

USA

Korea

Standards and Labelling in Pakistan

Currently Voluntary for Fans

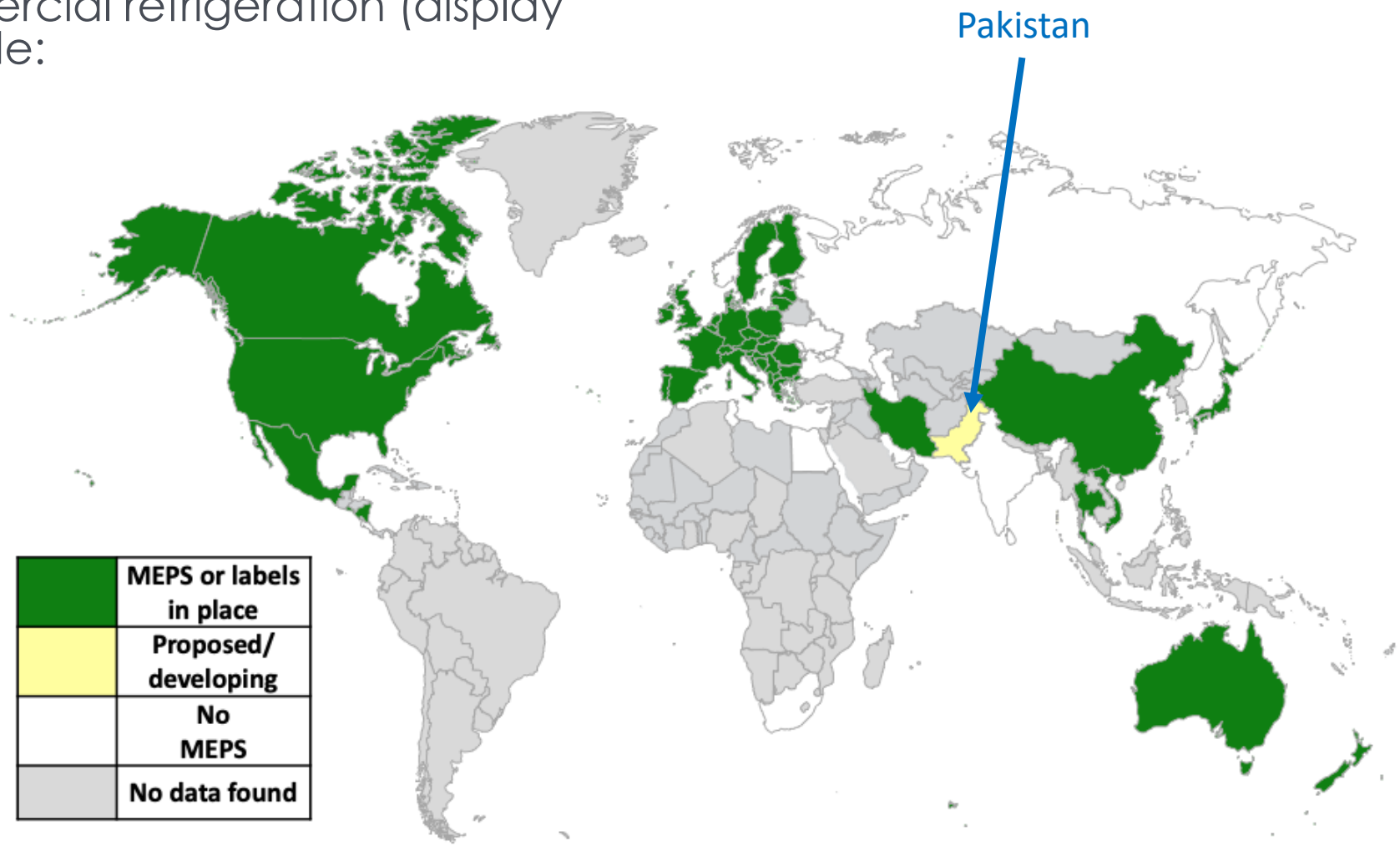
Soon to be Mandatory

- **Fans**
- Air Conditioners
- Refrigerators
- **Electric Motors**
- **Water Heaters**
- ***Transformers***
- ***Commercial Refrigeration***

Commercial refrigeration standards and labels policies around the world

Countries with standards and/or energy labels for commercial refrigeration (display cabinets), include:

- Australia
- China
- El Salvador
- European Unic
- Iran
- Mexico
- New Zealand
- Nicaragua
- Switzerland
- Thailand
- Vietnam



Market Summary

Supply and Demand Sides of the market

SUPPLY SIDE

- Varioline
- Caravel
- Waves
- PEL
- A few other manufacturers

DEMAND SIDE

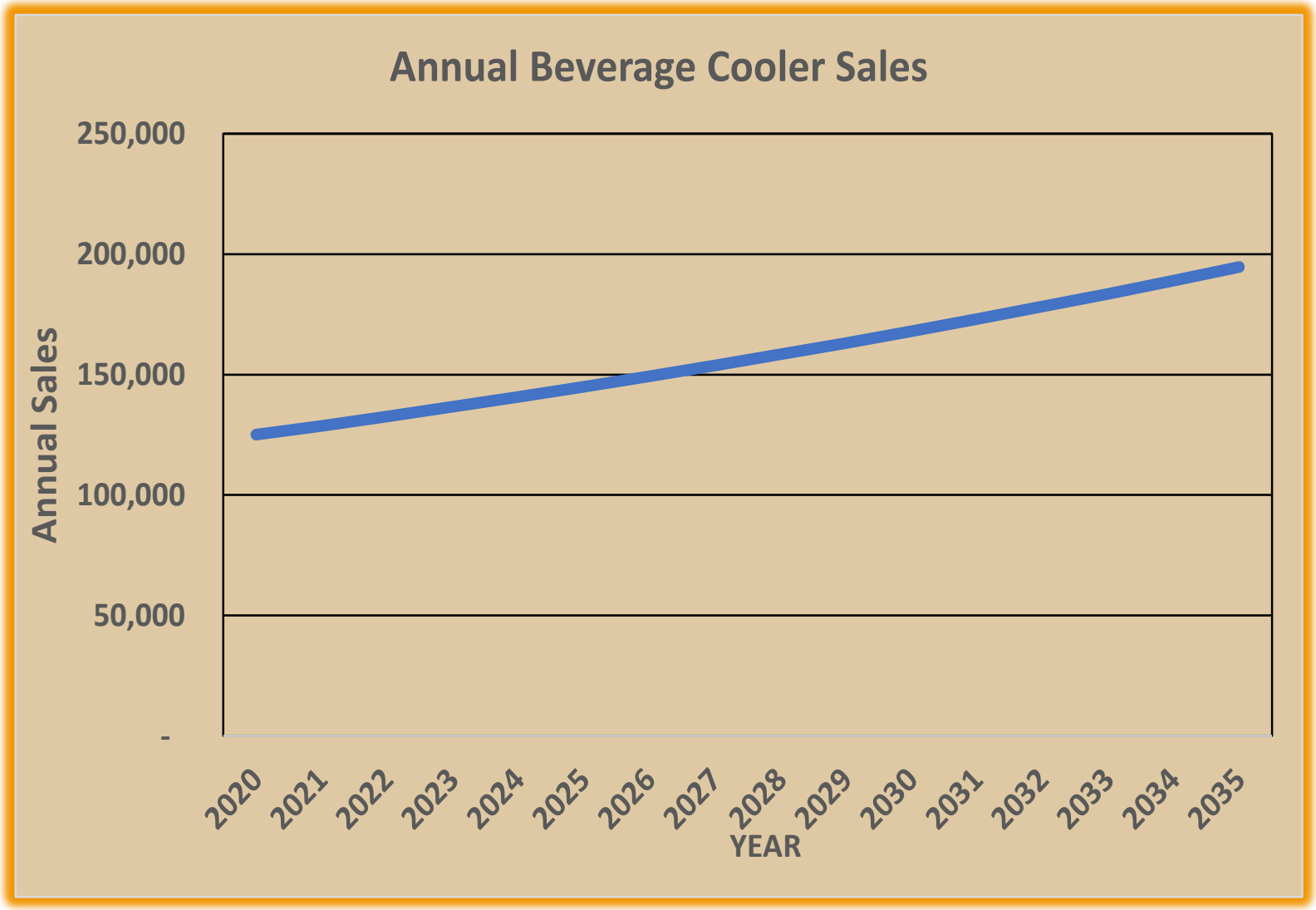
- Demand side is divided into two main segments:
  - Three large global beverage and food companies – **86%**
  - Milk Companies, Private Bakeries/grocery stores, and small shops – **14%**
- There are large bakery / grocery chains which all buy Visi Coolers for their products. Some of the big ones have a countrywide network.
- Stuart will talk more about the distinction internationally between Beverage coolers and display cabinets.

Sales, Stock and Lifetime

Sales, Stock & Lifetime

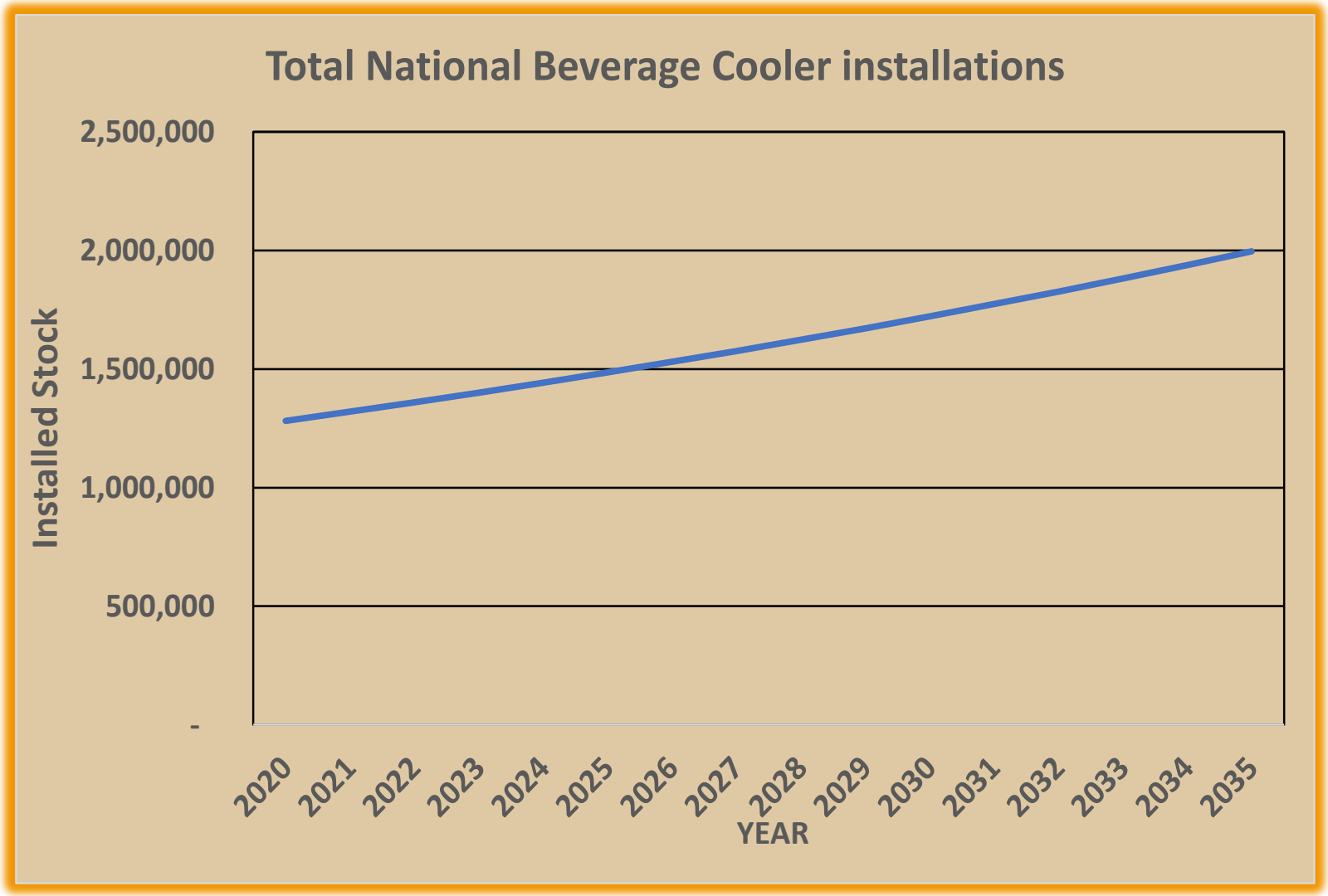
- According to estimates around **100,000 to 125,000** new visi coolers enter the market on average each year.
- Estimated stock as per manufacturers; varies between **1.2 Million to 1.6 Million.**
- **80%** of the stock is comprised of the **400** Liter Visi Cooler. In most cases this is actually a 385 Liter capacity Visi.
- Other common sizes are the 250 Liter and the 550 Liter
- Current Sales Growth is estimated at 03 to 05%
- Some migration currently also happening from Chest Freezers to Visi Coolers to host beverages
- Lifetime is estimated to be ~ 12 years.
- A considerable number of coolers get refurbished and sent back into the market every year.
- Unaccounted for coolers !

Sales



- Average annual Sales = 125,000
  - Annual Growth rate = 3%

Stock



- Installations 2020 = ~1.28m
  - At agreed sales rates requires average lifetime = 12 years
  - Implies significant "second lifetime" outside "original ownership"
- Installations 2035 = 2m
  - at the sales growth rate = 3%

Refrigerants

Refrigerants and Parts

- R 134 A has been the refrigerant of choice and that is the one installed in vast majority of the current stock.
- Some manufacturers have the experience of working with R 290 and driven by MNCs some of the Visi Cooler industry will also shift to R 290 during 2022.
- Manufacturers have come up the curve as far as R290 is concerned and mainly because of Unilever and Engro who got them to use this refrigerants for their respective ice cream brands: Walls and Omore.
- The target date for shifting at the moment is Jan 2022 for some manufacturers.
- Some of the big buyers are concerned with potential maintenance issues with more efficient refrigerants as they are more flammable.
- Compressors based on R290 are inherently more efficient.

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Standards and energy labels for ‘Visi’ beverage cabinets

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The ISO (global) test methods

For beverage cabinets:

- **ISO 22044**: [2022] *Commercial beverage coolers — Classification, requirements and test conditions* (expected January 2022)
- Developed for the beverage sector
- To sell drinks at temperatures specified by drinks manufacturers
- Performance: kWh per litre storage volume
- Energy test with doors closed
- Includes pull-down test (half reload of warm can[illegible]t recover <20 hrs c[illegible]: amb[illegible]

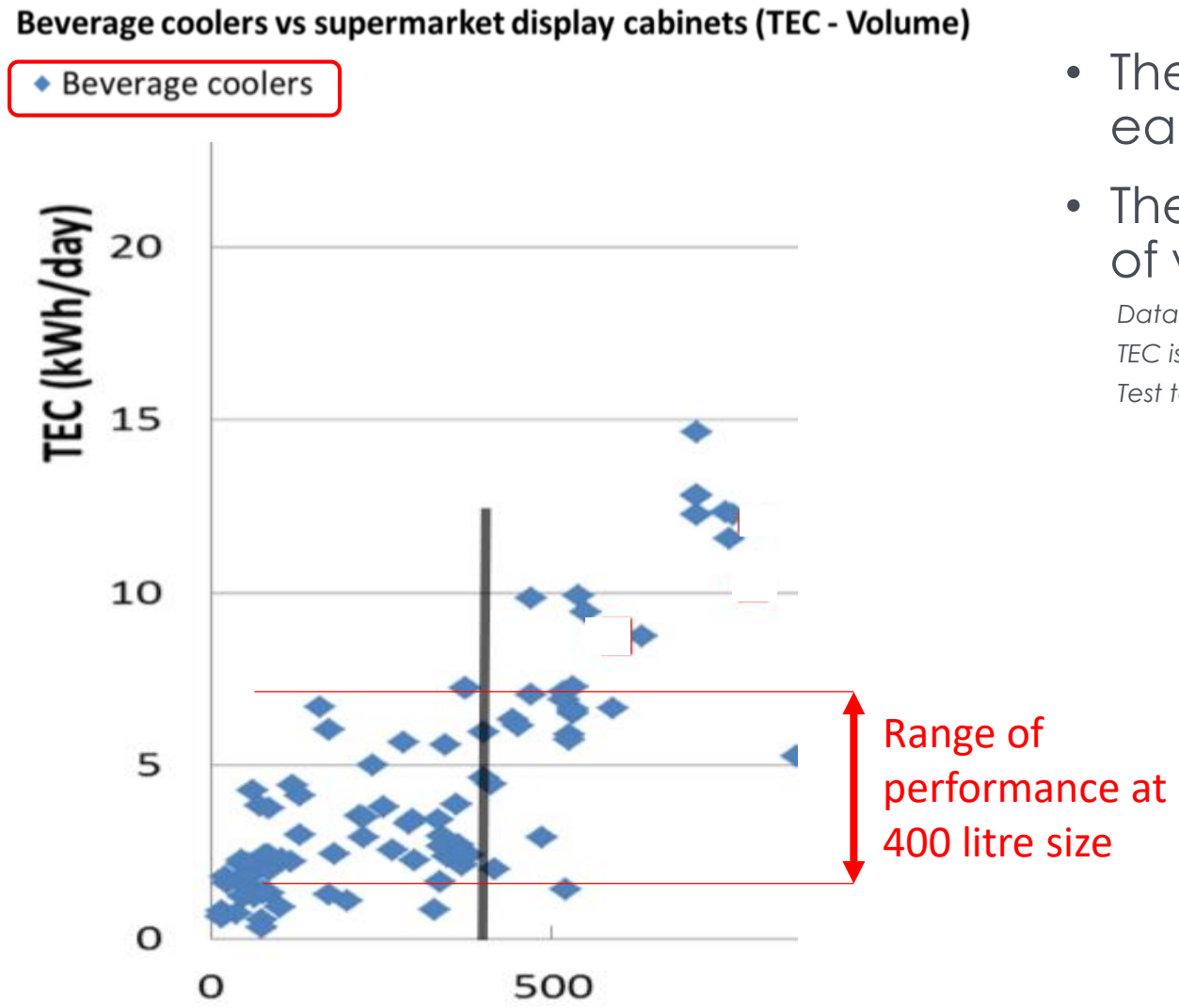


For display cabinets:

- **ISO 23953**: 2015 *Refrigerated display cabinets*, Part 1; Part 2 (new version expected 2022)
- Developed for the food retail sector
- To display perishable food at safe temperatures
- Performance: kWh per m^2 display area
- Energy test with door openings
- No pull-down test; but stricter temperatures
- MEPS in EU etc. [illegible]nix of [illegible]ose [illegible]ets [illegible]al



There is scope to improve performance (EU data from 2014)



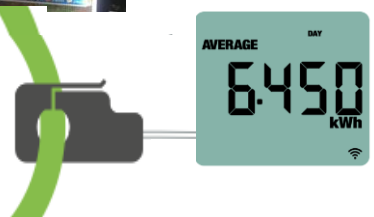
- There is a wide range of performance for each size of cabinet
- The best cabinets consume less than half of worst cabinets

Data shown based on internal storage volume (litres)
TEC is 'Total Energy Consumption'
Test to 16902 (pre-cursor ISO22044)

Source: European Commission JRC, 2014 report on beverage coolers in support of the EU ecodesign and energy label regulation development

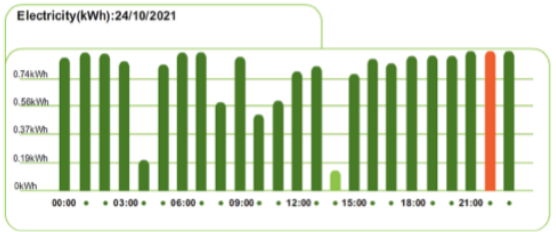
Cabinet performance benchmarks - measured in shops

400 litre chilled vertical glass door beverage cabinet (Visi)



Visi coolers in shops, October 2021

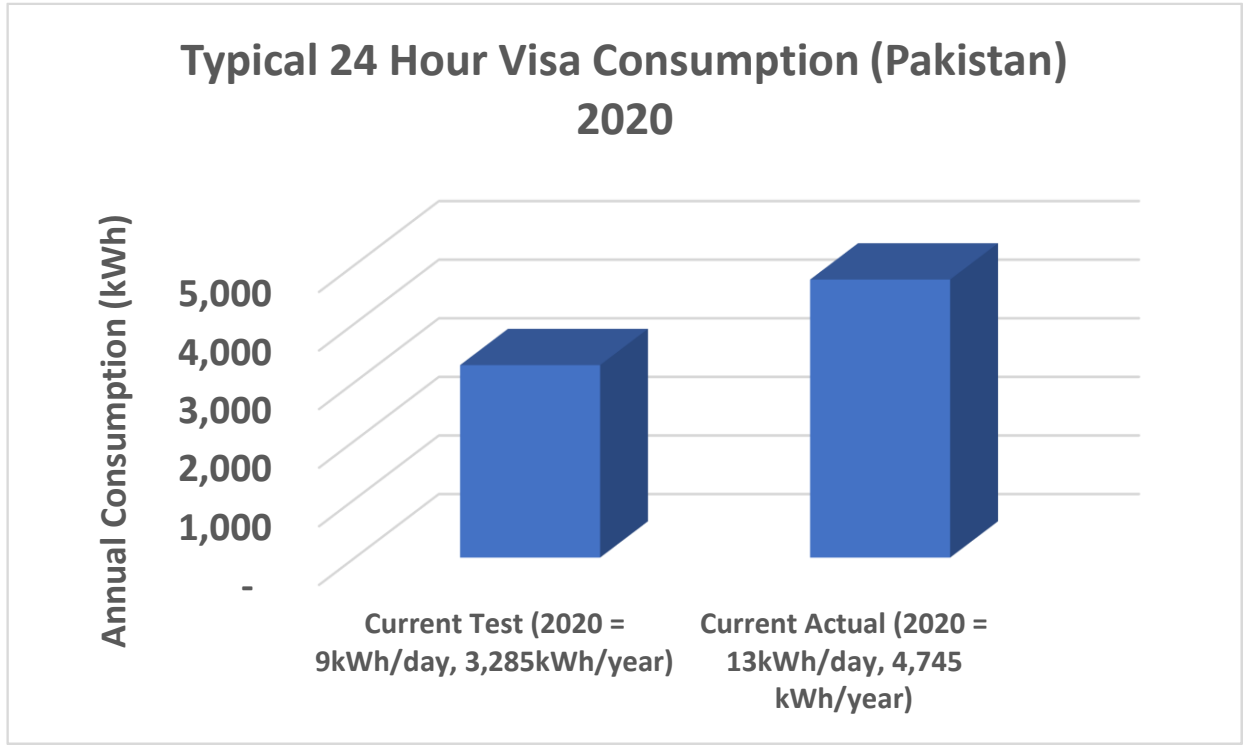
- Measurements with a simple energy meter in shops around Lahore
- Cabinets in normal use, with customers, door openings, etc
- Owners switch cabinets off at night (like with an EMD)
- Typical daily consumption around 5-7 kWh/day for 400 litre cabinet
  - Around 10 kWh/day to 15 kWh/day *when extrapolated to 24 hours operation*



Why extrapolate to 24 hours?

"Typical" Pakistan 400 litre Visi:

- In **24 hour** use: 12-15kWh/day
  ~ 4,500-5,000/year
- Under **24 hour** test conditions: approximately 9kWh/day
  ~ 3,285/year



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- In **24 hour** use: 12-15kWh/day
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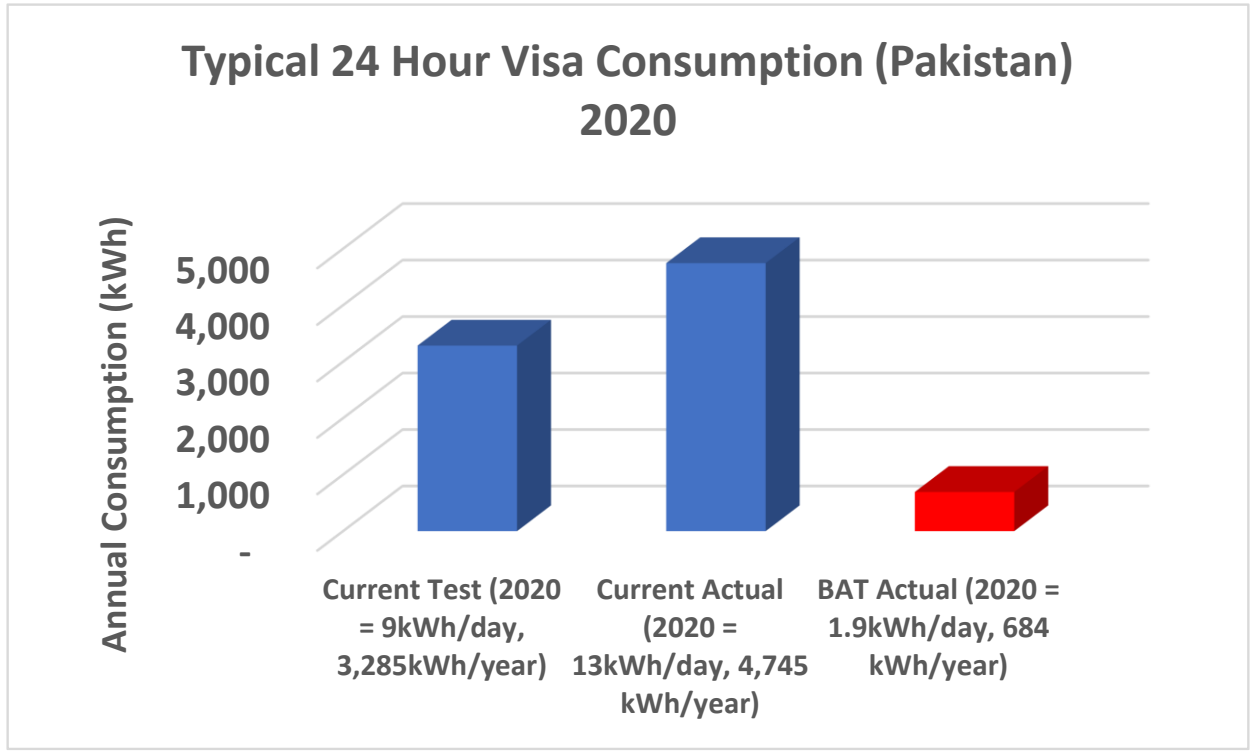
- Under **24 hour** test conditions: approximately 9kWh/day
  ~ 3,285/year

- Best available technology under 24 hour test conditions 1.9kWh/day
  ~ 684kWh/year



Technical options to improve performance

Technical measure	Efficiency improvement %	Incremental cost US$	Incremental cost %	Comment
Use of Energy Management Device	20%	US$ 15	3%	Automatic switch off lights, fans compressor in quiet periods or allow product temperature to float upwards
Switch to hydrocarbon refrigerant with optimised charge size (R290 or R600a)	8%	US$ 30	6%	Assumes additional safety features needed
Efficient ECM or DC evaporator fan motor	10%	US$ 8	1.5%	Electronic or DC motors can halve fan power; extra savings from less heat load inside compartment
Improved fixed speed compressor	3%	US$ 5	1%	Example in shop: SECOP FR11G, has COP 1.51 and bottom 20% of SECOP range for this application. A good household fridge has COP 1.8 (20% better). Variable speed as further option to achieve best in class.
Electronic thermostat	3%	US$ 10	2%	Closer temperature control; less overshoot; less cycling
Improved design of evaporator and condenser	5%	US$ 25	5%	Larger heat exchange area; better fins for heat exchange. Higher scope for savings from evaporator design, with higher associated cost
Increased insulation of body	5%	US$ 30	6%	Add 1.25cm to thickness
Efficient ECM or DC condenser fan motor	0.7%	US$ 5	1%	Electronic or DC motors can halve fan power
Improved LED lighting	0.5%	US$ 5	1%	Extra savings by reducing heat load inside the cooled compartment
Better double glazing for door	TBD	TBD	TBD	K-glass; argon filled. Triple glazing is an option for best in class.

Sources: Various EU, US, U4E. Assumes cost of cabinet is US$ 500

Key variables when testing cabinets

Pictures from testing storage cabinets showing test-packs loaded and the automatic door opening machine.

The most important variables to know are:

- Storage temperature inside cabinet
- Ambient temperature outside cabinet (and humidity)
- If doors are opened during the energy test (humidity and defrost performance are important if so)
- If test packs are loaded inside the cabinet and what type
- How 'Energy Management Devices' are set during the test
- If performance is based on volume or display area (kWh/litre or kWh/m^2)

Also:

- There will be an Energy Test (usually over 24 hours)
- There might be Functionality Tests (temperature; pull-down etc)

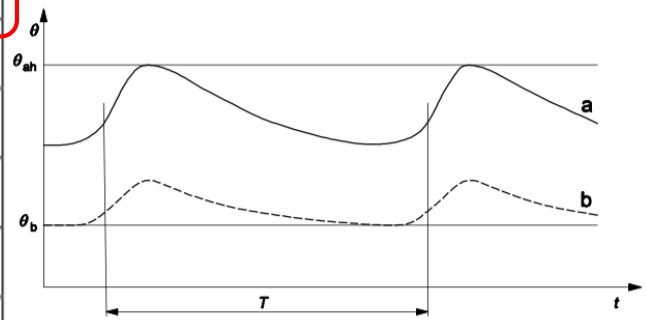
ISO 22044

Storage temperatures in ISO 22044

For beverage cabinets:

Table 1 — Classification according to temperature

Class	Highest temperature, θ_{ah}, of warmest M-Can colder than or equal to [°C]	Lowest temperature, θ_b, of coldest M-Can warmer than or equal to [°C]	Average temperature equal to or less than [°C]
K_1	+7,0	0,0	3,5
K_2	+6,0	-1,0	2,5
K_3	+1,0	- 3,5	-1,0
K_4	+9,0	1,0	+5,0
S	Special classification		
NOTE	The M-Can temperature class are measured with a tolerances of ± 0,5 °C.		



Key

θ	temperature
θ_{ah}	highest temperature of warmest M-Cans
θ_b	lowest temperature of coldest M-Cans t time
T	test period
a	temperature curve a of warmest M-Cans
b	temperature curve b of coldest M-Cans

Ambient (test room) temperatures in ISO 22044

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For beverage cabinets:

Table 3 — Test room Climate classes and half reload test

Test room climate class	Dry bulb temperature (° C)	Relative humidity (%)	max half reload recovery time (see 6.3.12.3) (hour)
CC1	25,0	60	≤13,0
CC2	32,2	65	≤16,0
CC3	40,6	75	≤20,0
NOTE All the tests need to be carried out at the same set point defined for the first test and product temperature class defined.			

Energy consumption increases by around 1.5% per ºC increase in temperature lift. Therefore, changing from testing at CC1 25ºC to testing at CC2 32ºC would increase energy consumption by around 11% (=1.015[7]).

(Source: IEC 62552 Part 3 Annex I.4, Calculating the energy impact of internal temperature changes)

11.10

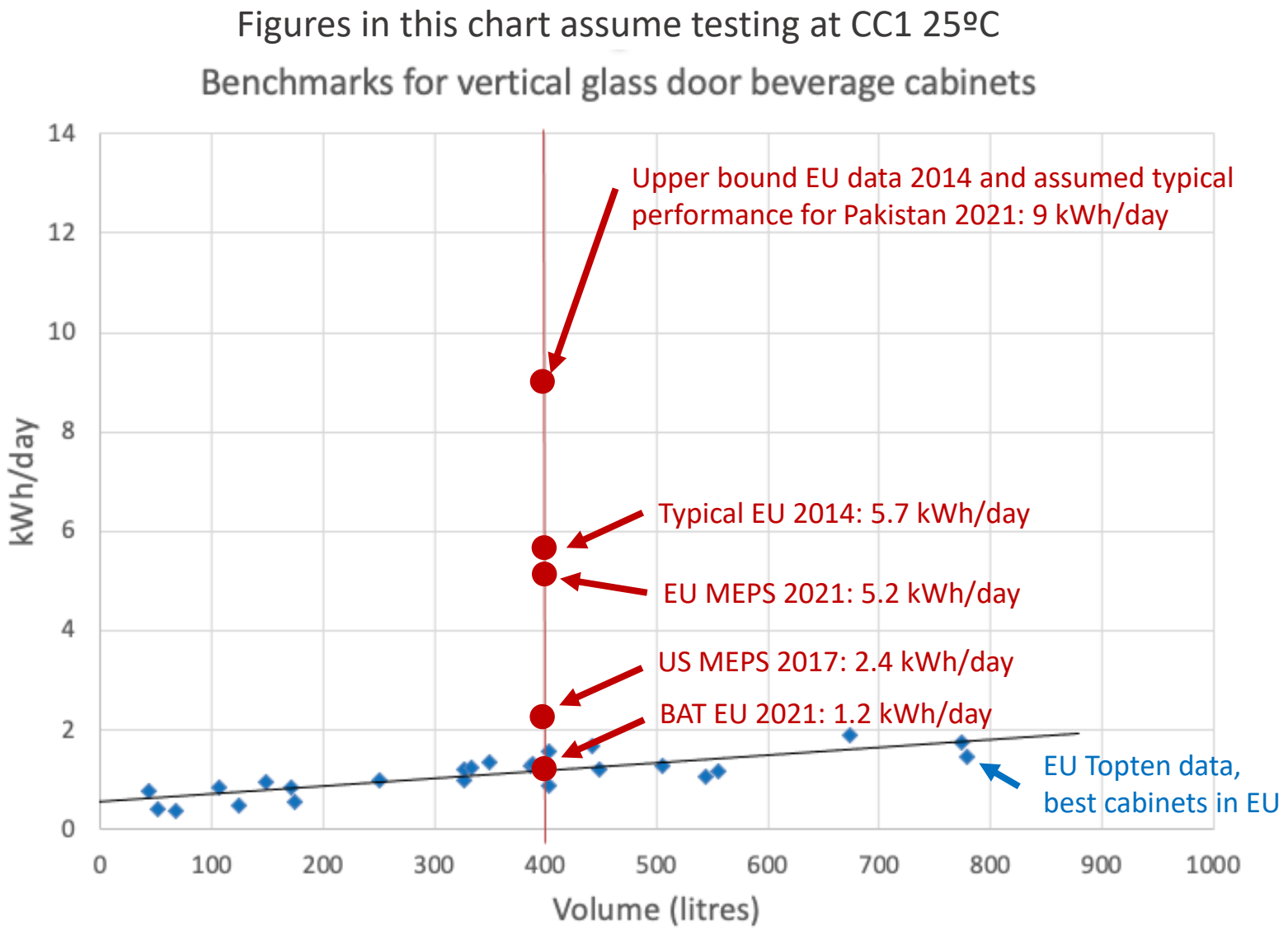
Proposals

Proposed energy label for beverage cabinets in Pakistan

For beverage cabinets:

- Test method:
  PS ISO 22044:[2022] *Commercial beverage coolers — Classification, requirements and test conditions*
- Ambient temperature class for test: *CC2 (32°C) or CC3 (40°C)*
- Storage temperature class: *K1 (average 3.5°C, +7 to 0)*

Proposed efficiency requirements for Pakistan (Part 1)



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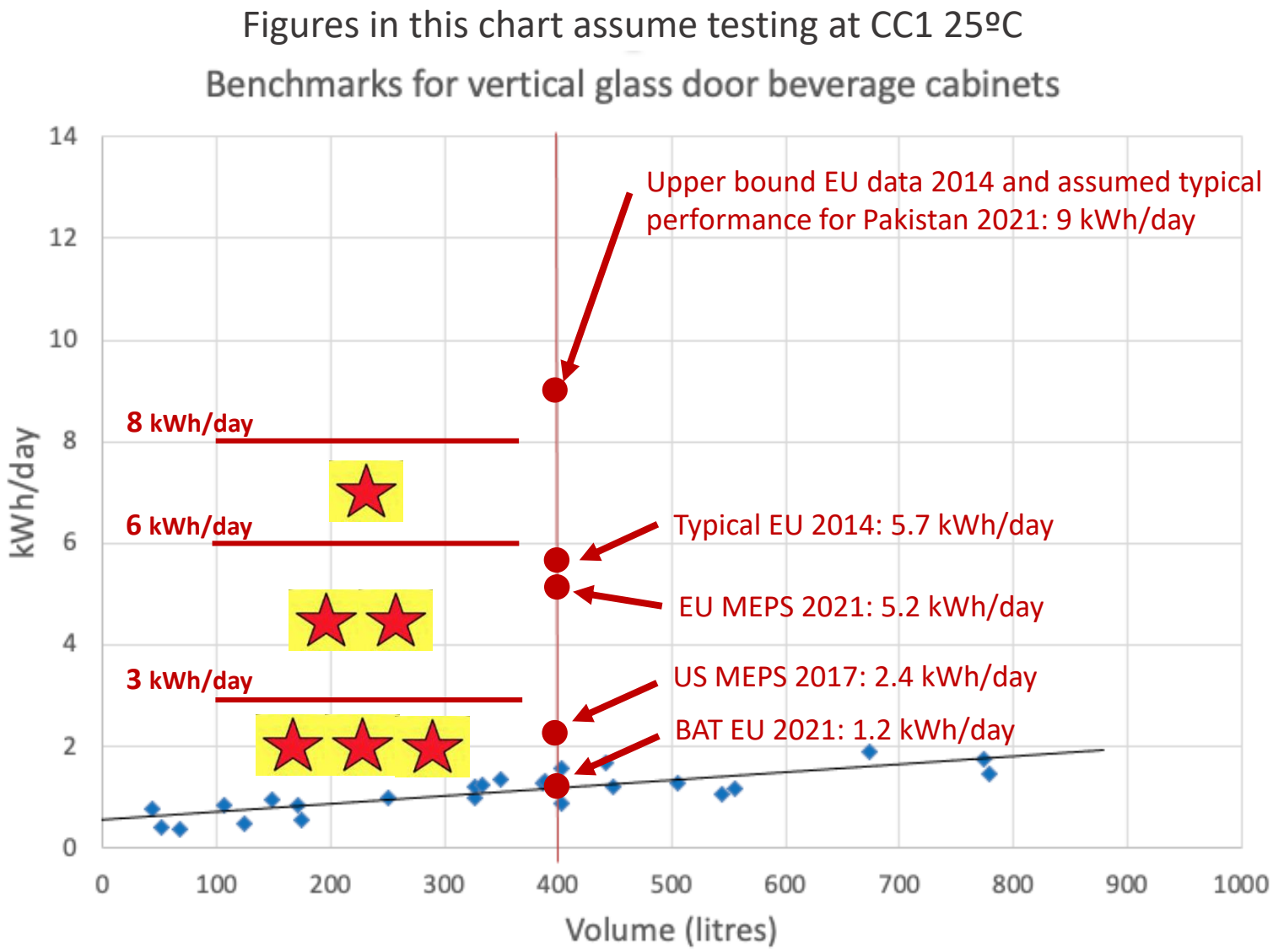


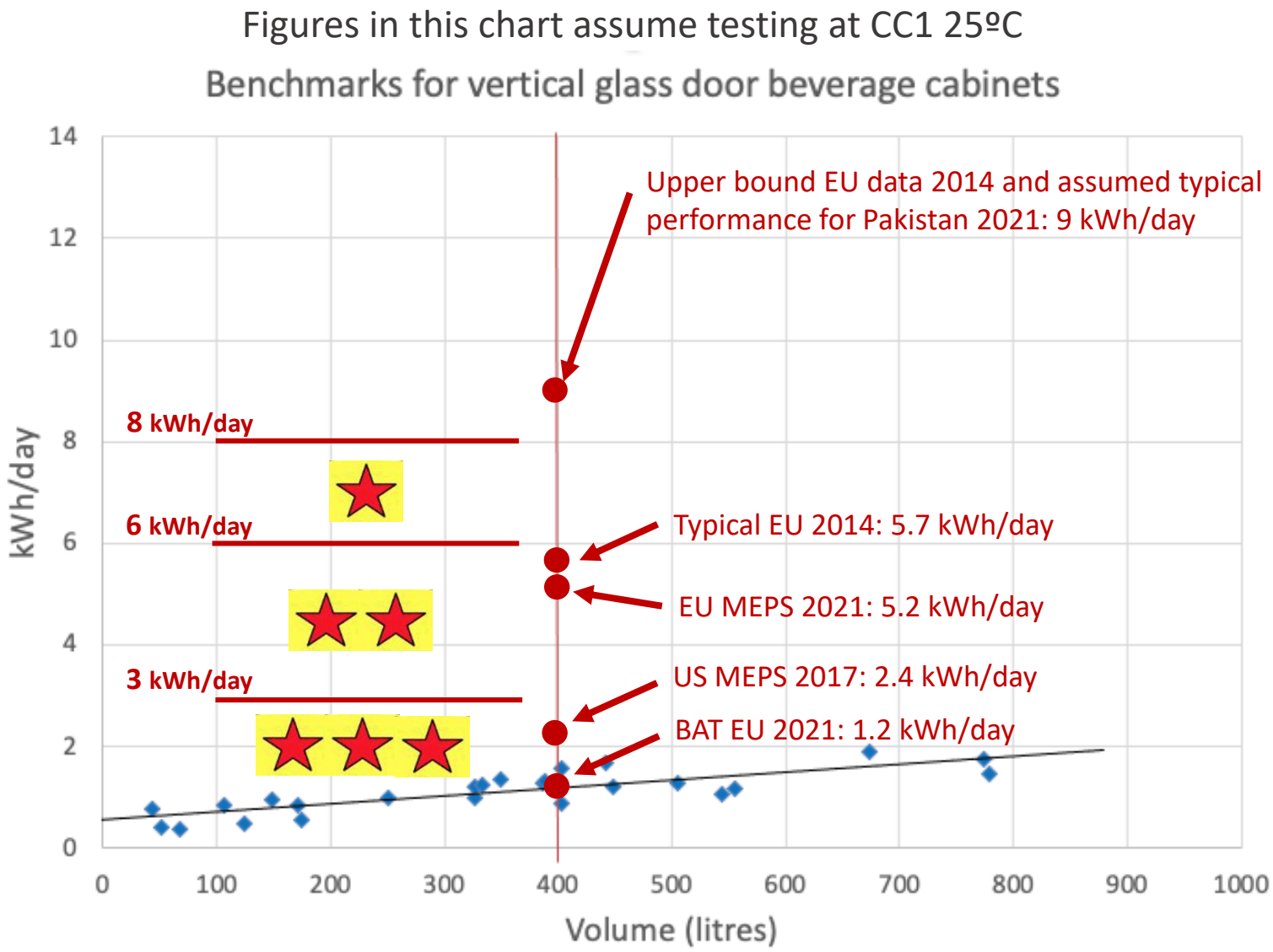
Proposed efficiency requirements for Pakistan

Adjusting the CC1 figures to CC2 means that proposed label thresholds for 400 litre cabinet tested to ISO 22044 at CC2 (32.2°C) are:

1 Star = 8.9 kWh/day

2 Star = 6.7 kWh/day

3 Star = 3.3 kWh/day



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1 Star = 8.9 kWh/day

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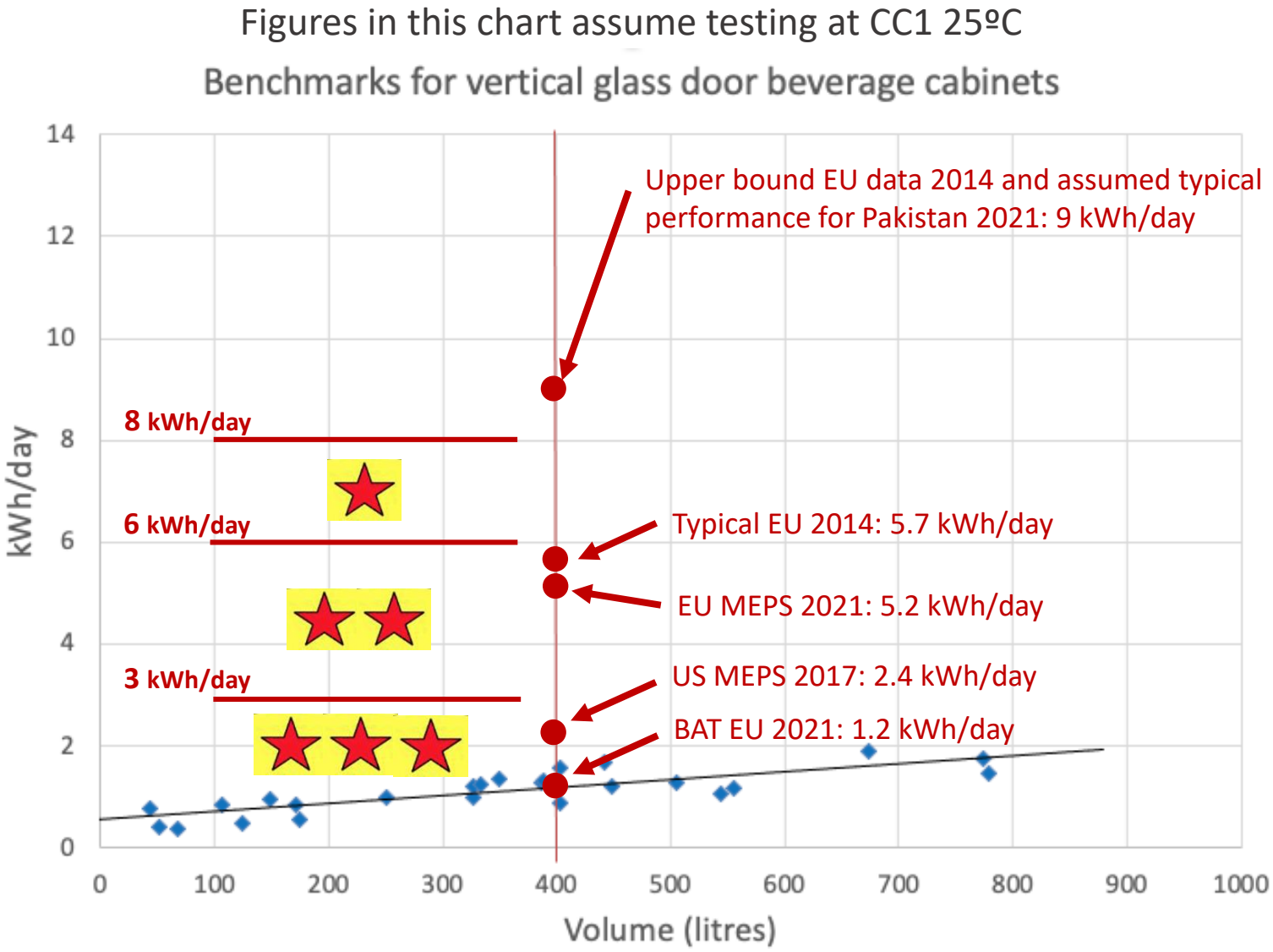
3 Star = 3.3 kWh/day

MEPS 2023 = 1 Star

MEPS 2026 = 2 Star

?? MEPS 2029 = 3 Star??



Regulating EEI allows for ease of volume adjustment

Energy Efficiency Index (EEI) is based on the ratio of test lab measured annual energy consumption (AEC) to the reference annual energy consumption (RAEC) for a cabinet of that type and size.

$$EEI = \frac{AEC}{RAEC} \times 100$$

AEC is given by:

$$E24h \times 365$$

RAEC is given by:

$$(M + (N \times V_N)) \times 365$$

AEC is the refrigerated cabinet's annual energy consumption, in kWh per year

- E_{24h} is measured for each cabinet model (or extrapolated from measurements on a similar cabinet)

RAEC is the refrigerated cabinet's reference annual energy consumption, in kWh per year

- M and N are constants published in the regulation
- V_N is the net volume of the cabinet determined by the supplier

The EEI values corresponding to thresholds for energy label star classes will be published in the regulation.

The regulation will also include the maximum EEI permitted for cabinets placed on the market or set in use in Pakistan.

Other Mandatory Requirements:

- Product registration required with NEECA
- Registration supported by a test certificate
- Likely

Image shows the label for fans - a similar label would be made for beverage cabinets

Mandatory information to registered with NEECA be published by suppliers about each cabinet (provisional):

a) type of equipment (i.e., beverage cooler)

b) unique model number

c) family model name

d) country of manufacture

e) name and address of the manufacturer

f) name and address of the supplier

g) size of product (net volume or display area)

h) rated energy efficiency index (EEI)

i) energy-efficiency label class (number of stars)

j) Annual energy consumption in kWh

k) refrigerant and foam-blowing agent

Possible?

HEINEKEN Fridges – Standards, specifications and test protocols

5 HEINEKEN Green fridge efficiency standards from 2021 until 2030

Objective: Listing of the energy efficiency requirements for a fridge purchased by HEINEKEN

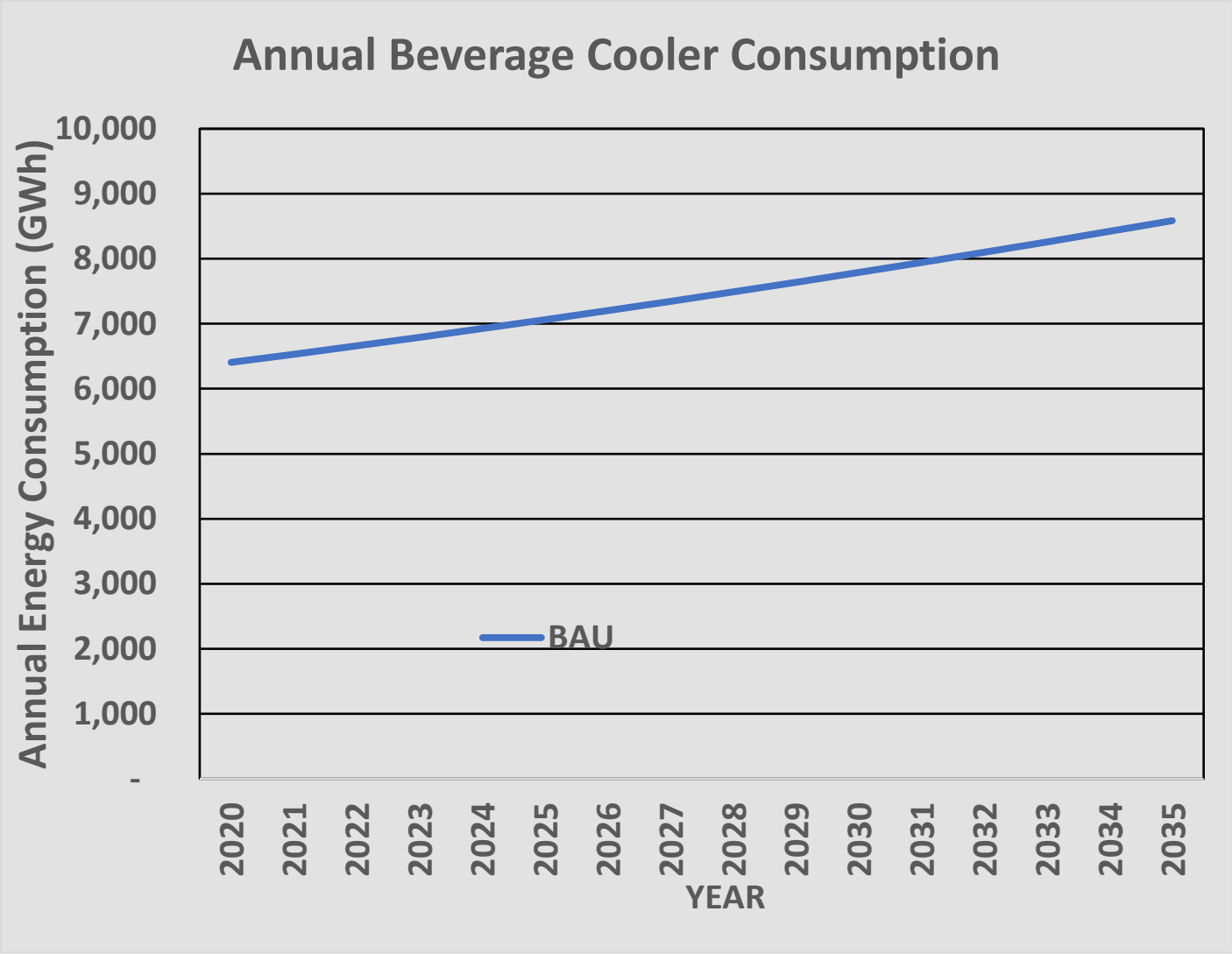
5.1 Conventional, continuous grid, fridges and glass freezers

Time frame		2021 - 2022	2023 - 2025	Provisional 2026 – 2028	Provisional 2029 – 2030
	Hydrocarbon refrigerant	EEI Limit	EEI limit	EEI limit	EEI limit
Horizontal fridges	Mandatory	< 40	< 25	< 15	< 10
Vertical fridges					
Open front fridges[5]					
Glass freezers		No requirement			

2023: 1.17 kWh/day
2026: 0.70 kWh/day

The Benefits

What's that mean in practice - nationally



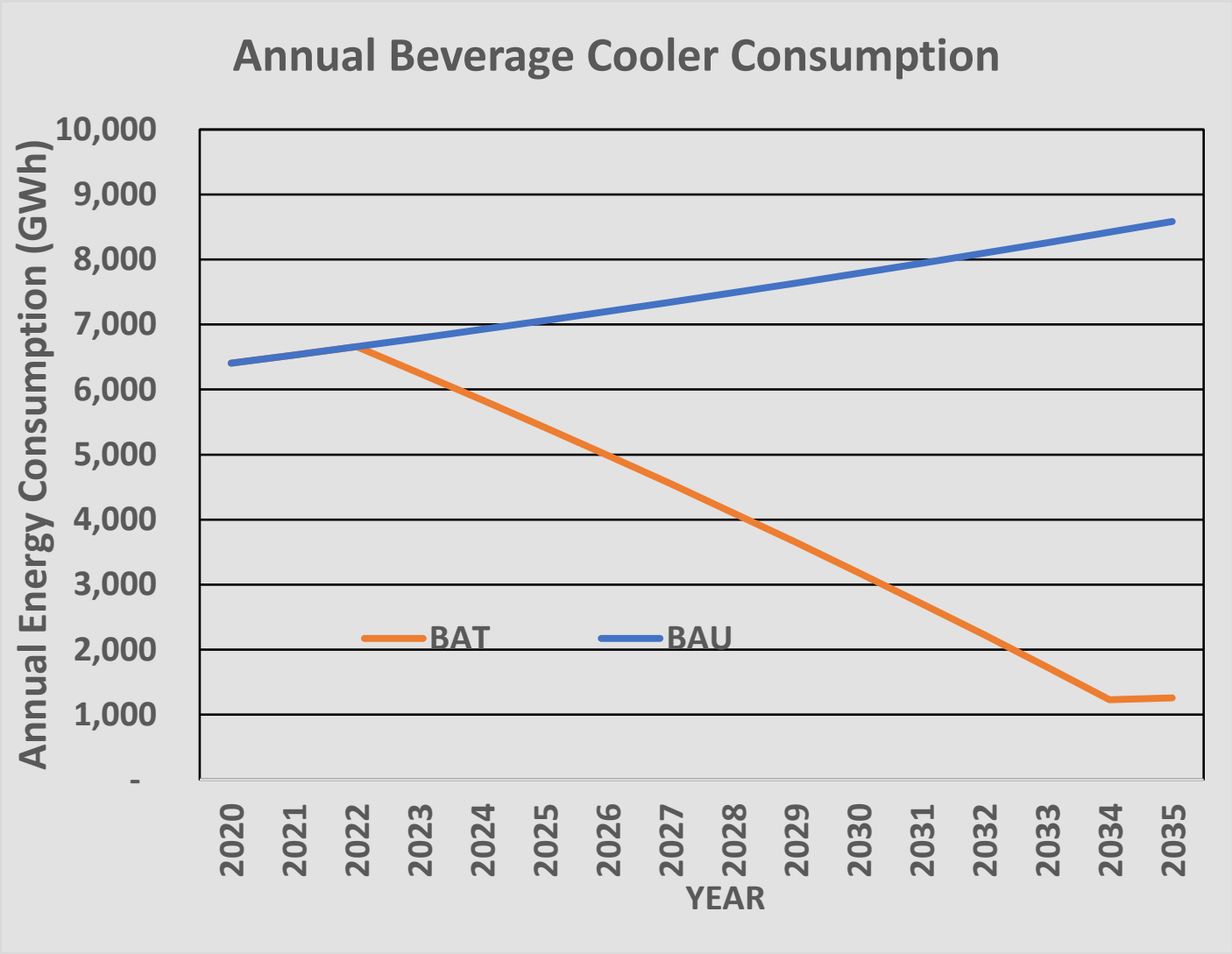
2020

- BAU = 6,404 GWh/year

2035

- BAU = 8,586 GWh/year

What's that mean in practice - nationally



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2035

- BAU = 8,586 GWh/year
- BAT = 1,255 GWh/year

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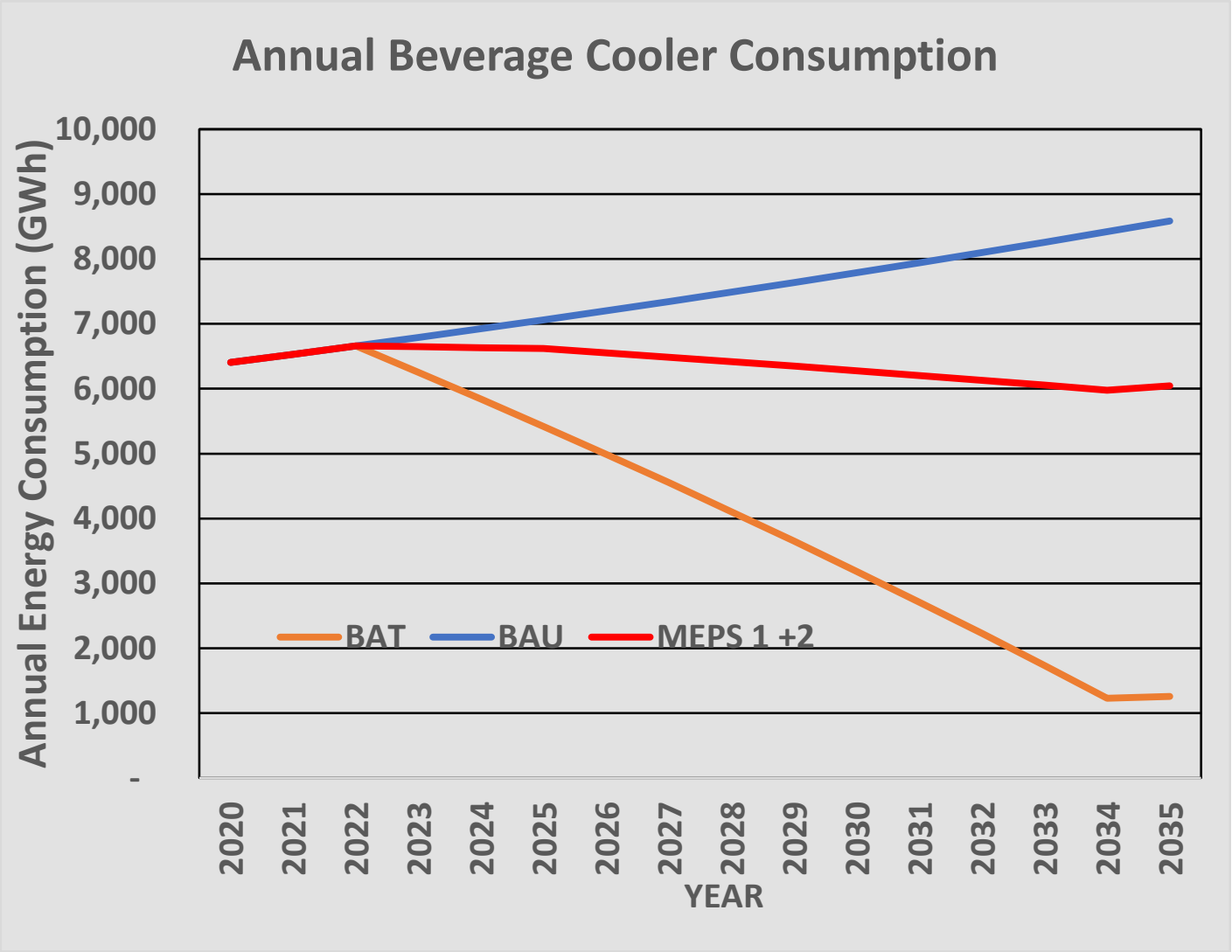

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- MEPS 1+2 = 6,044 GWh/year

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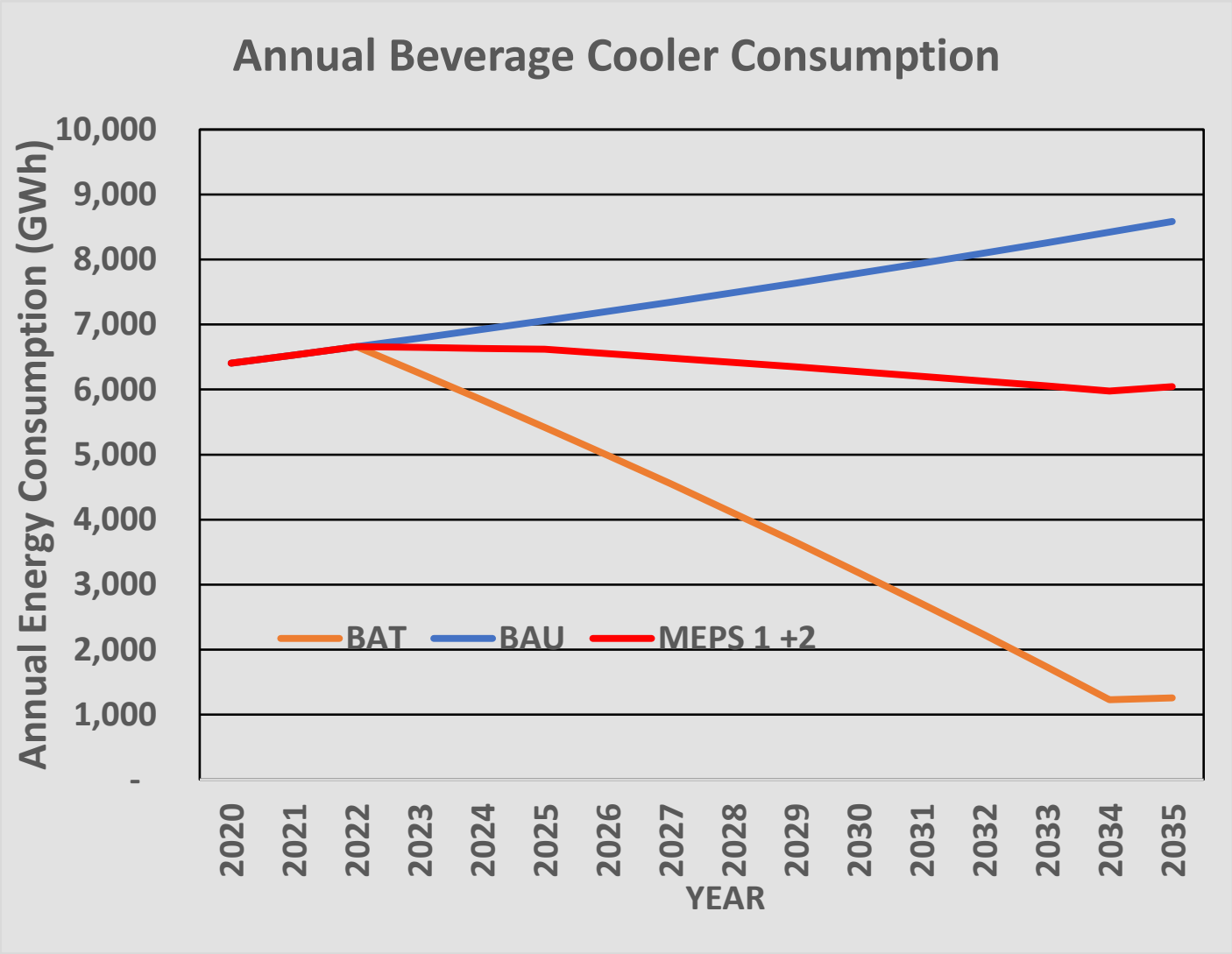

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Cumulative Savings to 2035

17,155 GWh

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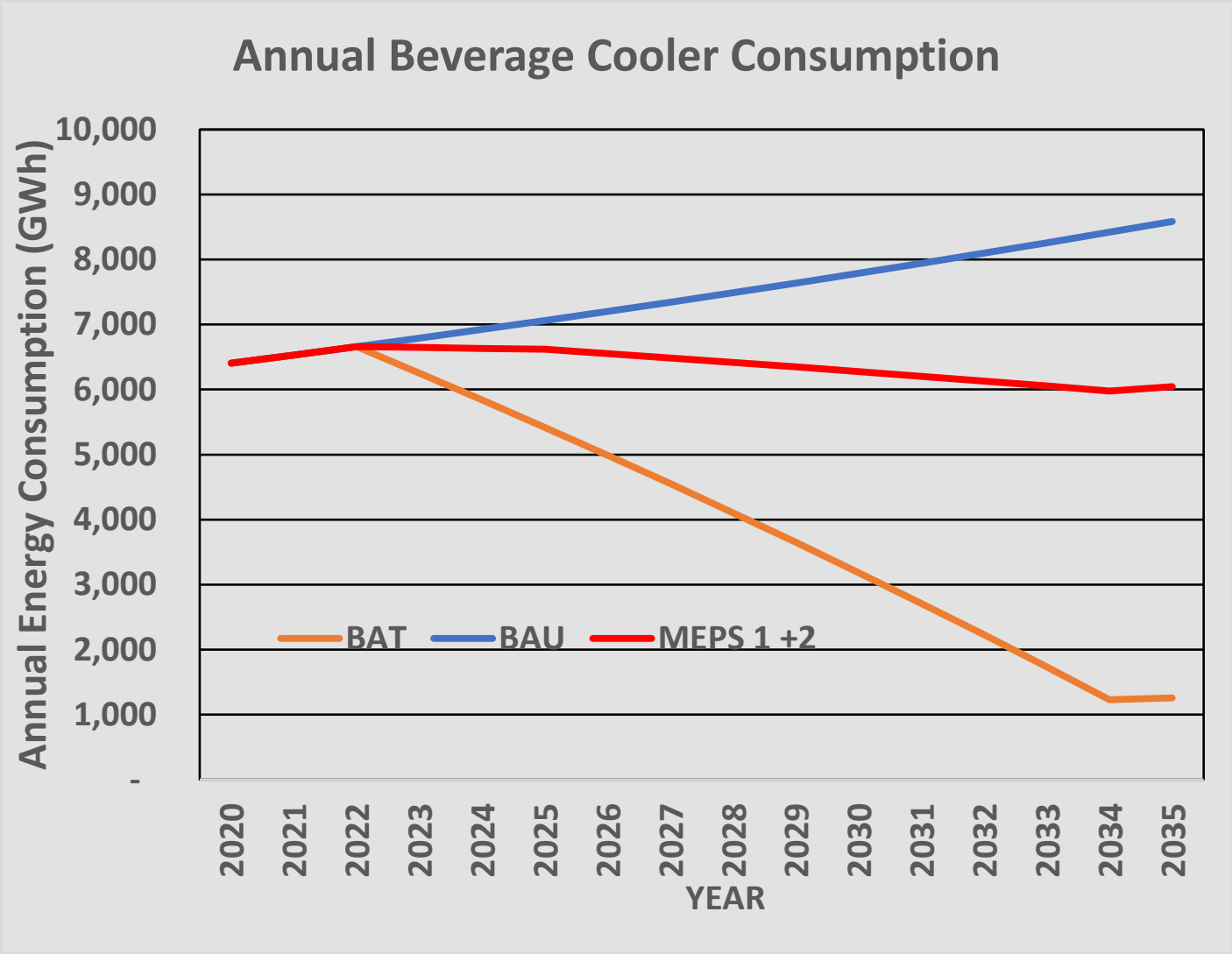

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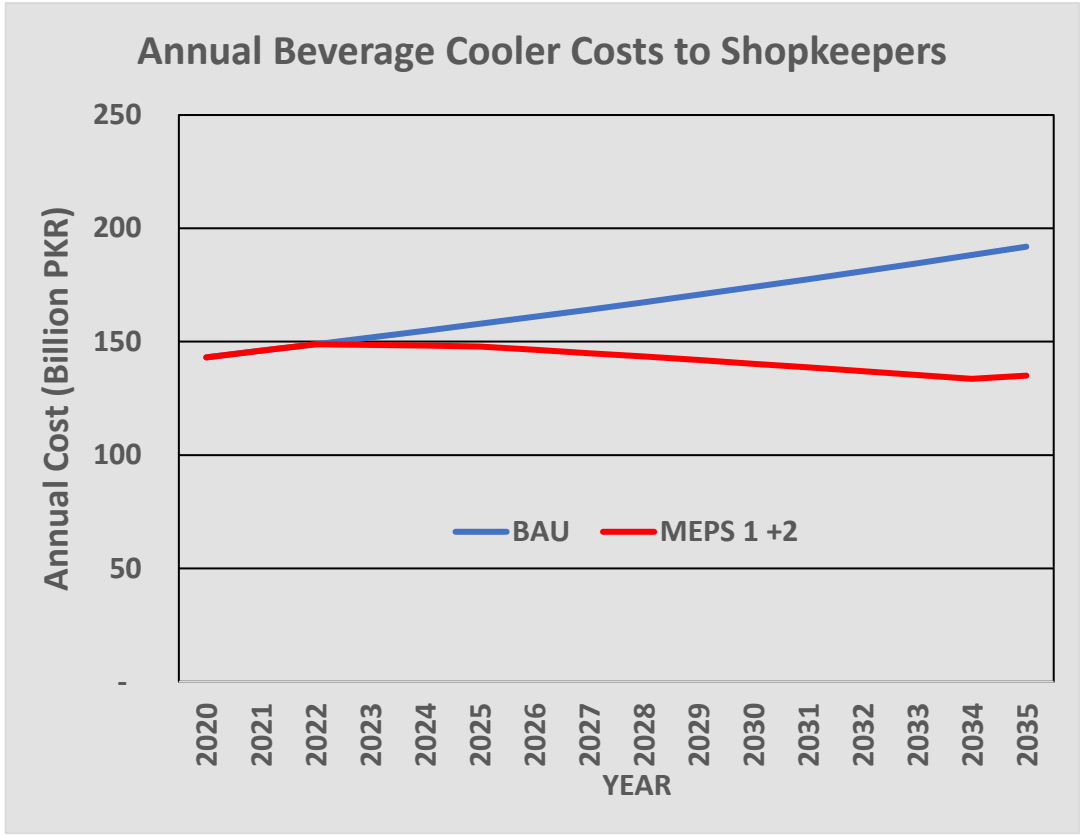
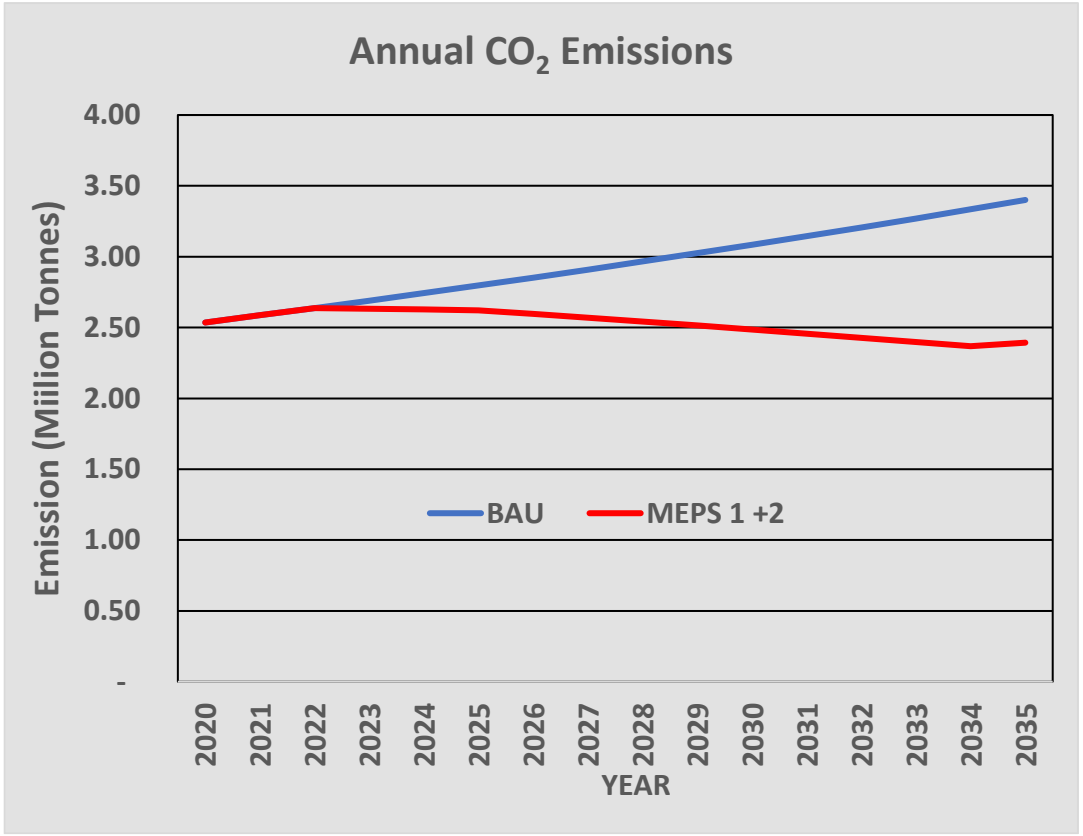
Cumulative Savings to 2035

~~**17,155 GWh**~~

8,577 GWh

And for the CSR Family





By 2035: ~~PKR 383 Billion~~

PKR 192 Billion

By 2035: ~~6.35m Tonnes CO_2~~

3.4m Tonnes CO_2

Recap and next steps…

Proposed principles for beverage cabinet regulations in Pakistan

1. To firstly focus on beverage cabinets
   - *Soon consider freezers, maybe display cabinets, …*
2. To base regulations on ISO test standards
3. To have energy regulations (MEPS, Label thresholds, registration requirements, ….) available by end 2021
   - *Notified early 2022*
4. Requirements to come into force:
   - *Phase 1: 2023 (no refrigerant requirement)*
   - *Phase 2: 2026 (likely with refrigerant requirement)*
5. Consultations November and December
   - *Workshop ~14th December*

Our questions now and over the next couple of weeks..

- Views on proposed test method, package and ambient temperatures?
- Are our proposals challenging enough – several stakeholders think we should be *significantly* more aggressive (and that some of your products are well past the 2* levels)
  - Any current or historic test data you have – to *any* recognised standard (published or supplier)?
- Where the "unaccounted for" products go, and for how long do they live?
- …..

Thank you – Questions?