



4PEET

PEET Efficiency Trends Analysis

Status of Television & Displays Regulations

JULY 2022

Product Energy Efficiency Trends -
A project of the Energy Efficient End-use Equipment TCP

About 4E

The Technology Collaboration Programme on Energy Efficient End-Use Equipment (4E TCP), has been supporting governments to co-ordinate effective energy efficiency policies since 2008.

Fourteen countries and one region have joined together under the 4E TCP platform to exchange technical and policy information focused on increasing the production and trade in efficient end-use equipment. However, the 4E TCP is more than a forum for sharing information: it pools resources and expertise on a wide a range of projects designed to meet the policy needs of participating governments. Members of 4E find this an efficient use of scarce funds, which results in outcomes that are far more comprehensive and authoritative than can be achieved by individual jurisdictions.

The 4E TCP is established under the auspices of the International Energy Agency (IEA) as a functionally and legally autonomous body.

Current Members of 4E TCP are: Australia, Austria, Canada, China, Denmark, European Commission, France, Japan, Korea, Netherlands, New Zealand, Switzerland, Sweden, UK and USA.

Further information on the 4E TCP is available from: www.iea-4e.org

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Context

Since 2008, the Energy Efficient End-Use Equipment TCP (4E) has tracked the efficiency trends of major globally traded products and corresponding energy efficiency regulations. This enables 4E Members to identify whether their current policies are being effective, how these policies and the performance of products compares across different regions and opportunities for closer alignment.

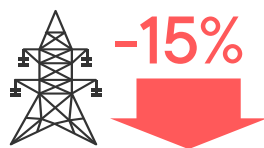
This process forms a multi-lateral exchange between regulators within 4E Member countries that accelerates the development of product policies and increases the level of energy savings, while also reducing regulatory and cost burdens on industry and consumers.

Within 4E economies, energy efficiency regulations, taken to include minimum energy performance standards (MEPS), mandatory and voluntary energy labelling in this report, are a key driver for product efficiency. Core elements of these regulations include:

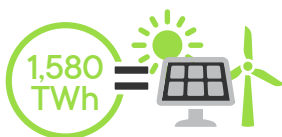
- › The methods used to test and measure product performance
- › The metrics used to define energy performance or efficiency
- › The performance thresholds required by regulations

Since 2020, the 4E Product Energy Efficiency Trends (PEET) project has been monitoring the status of these elements across regulations for major appliance and equipment types across 4E Member countries.

Joint analysis by the IEA and 4E into the global impacts of energy efficiency regulations¹ has shown that:



The longest running energy efficiency (EES&L) programmes are estimated to deliver annual reductions of around 15% of total current electricity consumption.



In the nine countries/regions for which data were available, these programmes reduced annual electricity consumption by a total of around 1,580 terawatt-hours in 2018 – similar to the total electricity generation of wind and solar energy in those countries.



On average, the energy efficiency of new major appliances in countries with EES&L programmes has increased two to three times the underlying rate of technology improvement.



The average purchase price of appliances covered by EES&L programmes declined at a rate of 2–3% per year.

¹ IEA/4E TCP (2021), Achievements of Energy Efficiency Appliance and Equipment Standards and Labelling Programmes, IEA, Paris (2021).
<https://www.iea.org/reports/achievements-of-energy-efficiency-appliance-and-equipment-standards-and-labelling-programmes>

Televisions & Displays

This latest PEET report summarises the status of energy efficiency policy measures for **televisions and electronic displays** within 4E economies.

Televisions have been a focus for energy efficiency standards and labelling (EES&L) programmes for many years. However, the rapid development in television and electronic display technologies and markets over recent years has blurred the distinction between traditional televisions and other display devices. At the same time, digital displays for advertising and signage of all sizes are becoming ubiquitous. How energy efficiency policies continue to evolve in order to meet these challenges is the subject of workshops, papers and discussions held between 4E Members, which are summarised here.

This summary condenses many highly technical regulatory documents. However, to gain a thorough understanding, it should not replace consideration of these regulations.

This report describes the main types of electronic displays and explains the coverage of EES&L programmes by display type within 4E economies. It concludes with a brief summary of the major trends and opportunities for the regulation of electronic display technologies.



Television and Display types

In this report, we focus on the following groups of display types that are the most prevalent within 4E economies.



Televisions:
for display of AV signal



Computer Monitors:
for close and single person viewing connected to a computer



Signage Displays:
for public and/or non-focused viewing, often long range



Specialist Displays:
for specific industry/professional applications



Integrated/combined Display:
where the display is integral to the primary function of a product but itself the primary function, such as smartphones, all-in-one desktop computers and conference calling

Within these groups there are a range of subgroups.

The technical differences between displays can be explained by the following factors:

- > Screen size
- > Sustained screen brightness
- > Screen technology
 - >> Screen resolution and pixel density
 - >> Colour gamut (and accuracy)
 - >> Peak brightness (for small regions and short periods of time) and ratio peak:sustained brightness
 - >> Native refresh rate
- > Lifetime

These factors effect energy consumption to a different extent. For example, energy consumption increases in proportion to screen area and is even more sensitive to screen brightness. Screen technology and pixel density tend to play a less important role. Overall, the growth in the size of displays has had the major influence on the energy consumption of display devices and this, together the increase in screen resolution, has eroded a major share of energy efficiency improvements.

A glossary is provided at the end of this report to explain the terminology used.

Coverage of Regulations

Table 1 shows the coverage of MEPS, mandatory labelling and the ENERGY STAR voluntary label² for the major display types in 4E economies.

- > All 4E economies have MEPS requirements in place for TVs except Canada and the USA
- > Australia/New Zealand, China and the European economies have MEPS requirements in place for computer monitors
- > Korea is the only 4E economy that has MEPS requirements in place for digital signage
- > All 4E economies have energy labels in place for TVs except Japan
- > Australia/New Zealand, Canada/USA, China and the European economies have energy labels in place for computer monitors

Table 1: Coverage of EES&L programmes for major display types within 4E economies

Rated Power (kW)	Televisions			Computer Monitor			Signage Displays		
	MEPS	Mandatory Label	ENERGY STAR	MEPS	Mandatory Label	ENERGY STAR	MEPS	Mandatory Label	ENERGY STAR
Australia	✓	✓		✓	✓				
New Zealand	✓	✓		✓	✓				
Canada			✓			✓			✓
USA		✓	✓			✓			✓
China	✓	✓		✓	✓				
EU	✓	✓		✓	✓			✓	
Switzerland	✓	✓		✓	✓			✓	
UK	✓	✓		✓	✓			✓	
Japan	✓								
Korea	✓	✓					✓		

² See <https://www.energystar.gov>

Within these major categories, there are large number of display sub-categories which may or may not be defined and within the scope of regulations or programme requirements. This information is summarized in Table 2.

Table 2: Display sub-categories defined and within scope for in EES&L programmes within 4E economies

	Television (with tuner)	Television (no tuner) ¹	Television (other)	Computer Monitor	Signage Displays	Other
Australia	✓	✗	ND	✓	✗	✗
New Zealand	✓	✗	ND	✓	✗	✗
Canada	✓	✓	✓ ²	✓	✓	✗ 7 types defined
USA	✓	✓	✓ ²	✓	✓	✗ 7 types defined
China	✓	✓	ND	✓	ND	✗ 4 types defined
EU	✓	✓ ³	ND	✓	✓	✗ 14 types defined
Switzerland	✓	✓ ³	ND	✓	✓	✗ 14 types defined
UK	✓	✓ ³	ND	✓	✓	✗ 14 types defined
Japan	✓	✗	ND	✓	ND	✗ 3 types defined
Korea	✓	✗	ND	ND	✓	ND

Notes

✓ = defined within regulation and in scope of regulation

✗ = defined within regulation but not in scope of regulation

ND = not defined and not in scope

1 Sometimes called TV monitors or home theatre displays

2 Including hospitality television

3 No distinction is made between TVs with tuner and without

Television Technologies Coverage in Regulations

The most common screen sizes, technologies and resolutions currently found in the market within the scope of EES&L programmes in 4E economies, are shown in Table 3.

However, differences in scope centre around the treatment of new and emerging technologies, particularly MicroLED, OLED and 8k televisions. Opinions differ on whether the exclusion of new technologies from the scope will enable them to reach higher efficiency levels as they mature; or whether their market share will grow sufficiently quickly to cause a growth in overall energy consumption unless they are covered by EES&L programmes. The latter view also depends on how confident EES&L programmes are that they can monitor the market and update requirements in response within a reasonable time period.

Table 3: Scope of televisions covered in EES&L programmes within 4E economies

	Screen Technology						Screen Size		Screen Resolution
	CRT	LCD	OLED	MicroLED	Indirect/ projection	Plasma	MEPS	Mandatory Label	
Australia	✓	✓	✓	✓	✗	✓	no limit	no limit	no limit
New Zealand									
Canada	✓	✓	✓	✓	✗	✓	no limit	no limit	no limit
USA									
China	✗	✓	✓	✗	✗	✗	no limit	no limit	no limit
EU				✓					
Switzerland	✓	✓	✓	MEPS in 2023	✗	✗	100cm ^{squared}	no limit	8k excluded until 2023
UK									
Japan	✗	✓	✓ ¹	✓ ²	✗	✗	10 inch dia. visible display	no limit	8k excluded
Korea	✗	✓	✓	✗	✗	✗	47 cm dia.	216 cm dia.	<4320 vertical resolution ³

Notes

- ✓ = defined within regulation and in scope of regulation
- ✗ = defined within regulation but not in scope of regulation
- ND = not defined and not in scope
- 1 No requirements until 2026
- 2 Included in scope but no requirements set
- 3 Excludes 8k

Test Methods

The test for television on-mode power is the same across all 4E economies, with IEC 62087-3:2015 being the most widely used method of test³.

The setup of the unit under test is similar in the 4E economies and becoming more aligned⁴. The main points of difference across test procedures are the processes used to measure the screen brightness and the illuminance level used to disable Automatic Brightness Control (ABC).

All methods use display patterns to measure the screen brightness and most jurisdictions specify minimum screen brightness levels when testing to prevent manipulation. However, the Chinese test method no longer sets absolute screen brightness levels but requires brightness and contrast adjustment to ensure basic greyscale levels can be distinguished. The IEC 62087 display pattern is shifting from a large static white screen to a dynamic screen.

As shown in Table 4, the illuminance level used to disable ABC⁵ varies.

Table 4: Screen illuminance and ABC test settings for televisions in 4E economies

	Test standard	Screen luminance	ABC test levels	HDR enabled
Australia	IEC 62087:2012	50% of brightest mode	ABC disabled (or 300lx)	
New Zealand				
Canada	Appendix H to Subpart B of 10 CFR Part 430 Uniform Test	65% of brightest mode if brightest mode is <350cd/m ² , otherwise 228cd/m ²	100lx, 35lx, 12lx, 3lx	Enabled if an option in default mode
USA				
China	GB 24850-2020	Brightness and contrast adjusted to show clear greyscale pattern	ABC disabled (or 300lx)	
EU	Transitional methods for 2021/2019 (similar to draft IEC 62087)	220cd/m ² or at least 65% of peak white luminance	ABC disabled (or 120lx). Also tested for ABC allowance: 60lx, 35lx, 12lx	
Switzerland				
UK				
Japan	IEC 62087:2015	65% of brightest mode if brightest mode is <350cd/m ² , otherwise 228cd/m ²	ABC disabled (or 300lx) and 0lx	
Korea	IEC 62087 (most recent)	65% of brightest mode if brightest mode is <350cd/m ² , otherwise 228cd/m ²	ABC disabled (or 300lx)	

³ This is currently in the process of being updated

⁴ Some but not all methods require a Wi-Fi or LAN connection to be enabled and connected but not to access the internet

⁵ If this cannot be achieved through the control menu

Energy Efficiency Metrics

Both ENERGY STAR and the new EU regulation use an energy efficiency metric to reflect the non-linear relationship between screen area and power consumption.

The Top Runner efficiency metric in Japan has also been substantially simplified, with the number of functional allowances reduced to nine.

The core features that are covered in the energy efficiency metrics for televisions are summarised in Table 5.

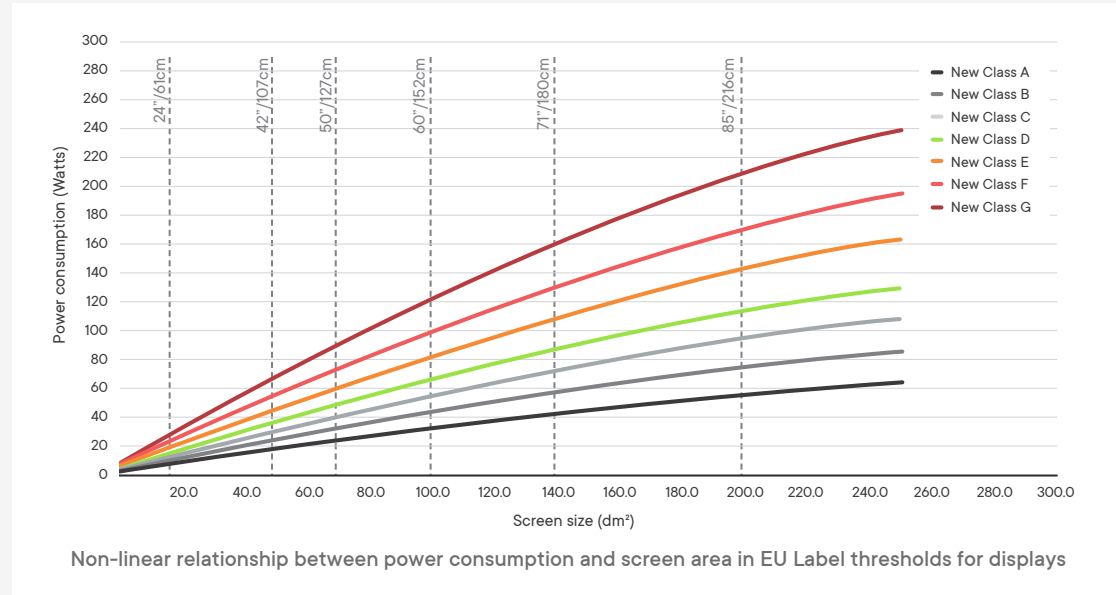


Table 5: Features considered in energy efficiency metrics for televisions applied in 4E economies

	ABC	Screen size	Screen technology	Screen resolution	Screen luminance	Video signal source	EPG	Standby	Other
Australia		✓					✓	✓	
New Zealand		✓					✓	✓	
Canada	✓	✓		✓					
USA	✓	✓		✓					
China		✓		✓	✓	✓			
EU	✓	✓		✓				✓ ¹	✓ ²
Switzerland	✓	✓		✓				✓ ¹	✓ ²
UK	✓	✓		✓				✓ ¹	✓ ²
Japan	✓	✓	✓	✓			✓	✓	✓ ³
Korea		✓	✓	✓					

Notes

- 1 Network standby
- 2 Allowances for extra functions
- 3 Japanese metrics include allowances for the following:
 - 2 or more tuners (2K, 4K)
 - Recording device (3.5" HDD, SSD)
 - Optical disc recorder (4K, <4K)
 - Video double speed (4K and above, less than 4K)

Trends

Screen sizes and sustained brightness levels are increasing across all consumer devices, as are screen resolutions for mid to high-end products. These factors are influencing the power demand of display devices.

At the same time, we are seeing the functionality of the most common types of display device converge, and this is increasingly reflected in regulations with a broader coverage, such as the European regulation. This approach is easier for industry to understand, reduces regulatory burden and eliminates loopholes and inconsistencies.

The rapid growth of signage displays is an important trend. These products differ from other displays since they are active for longer periods of the day and a significant proportion are purchased by institutional buyers. As a result, we note that ABC requirements are crucial to reducing energy consumption and the role of labelling programmes to assist the procurement of more energy efficient signage. Labelling may also be usefully applied to more niche products, such as high-end graphical displays and industrial displays.

The physical labelling of TVs and other displays has caused problems over the years, and many EES&L programmes now allow for the digital display of the label on the screen as an overlay in 'shop' mode.

Electronic displays are becoming integrated into other products such as whitegoods where they are replacing buttons. Since these cannot readily be tested alone, some regulators are considering how best to include these within specific requirements for whitegoods and other relevant products.

Some regulations now include measures to facilitate recycling, repairability and end-of use disposal for display technologies as part of efforts to support the circular economy. While these topics are not always within the current legislative mandate of energy efficiency agencies, they are sufficiently important that governments need to consider whether they are best addressed within energy efficiency regulation or elsewhere.

Glossary

The following terminology is used in this report.

ABC	Automatic brightness control
AV	Audio-visual
EPG	Electronic programme guide
HD	High definition
HDR	High dynamic range
IEA	International Energy Agency
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
MEPS	Minimum energy performance standard
NA	Not available (or applicable)
PEET	Product Energy Efficiency Trends project under the 4E TCP
Rating	The set of rated values and operating conditions
Rated value	A quantity value assigned, generally by a manufacturer, for a specified operating condition
TR	Top Runner Programme in Japan
UEC	Unit energy consumption
VOIP	Voice over Internet Protocol