

Introducing the Updated Energy Efficiency Requirements of the Refrigerators Standard SASO-2892 / Clothes washing machines Standard SASO-2885

December 17th , 2024

Disclaimer

Disclaimer

This presentation is intended to ensure that all relevant bodies are aware of the elements of the draft standards. This document and all presented information shall not be considered as an official reference.

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Agenda

Introduction of the Saudi Energy Efficiency Centre (SEEC)

Refrigerator/freezer standard update

Washing machine standard update

Discussion

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Introduction of the Saudi Energy Efficiency Centre (SEEC)

The Saudi Energy Efficiency Center (SEEC) was established in 2010 as the custodian of energy efficiency in Saudi Arabia

Description

Inter-agency effort to launch the Saudi Energy Efficiency Program (SEEP) in 2012

Vision & Mission

SEEC seeks to be an international reference in the field of energy efficiency, by working with local and international stakeholders.

Objectives

Rationalize and increase the energy efficiency in production and consumption in order to preserve the KSA natural resources and enhance the economic and social welfare of KSA population.

Developed ~100 initiatives at different stages (feasibility, design, execution) (2012-Now)

Industry

Scope:

Steel, cement, petrochemicals, and other industrial sectors



Next slide

Buildings

Scope:

Building envelope, ACs, white goods, lighting products



Transport

Scope:

Light Duty Vehicles (LDVs), and Heavy Duty Vehicles (HDVs)

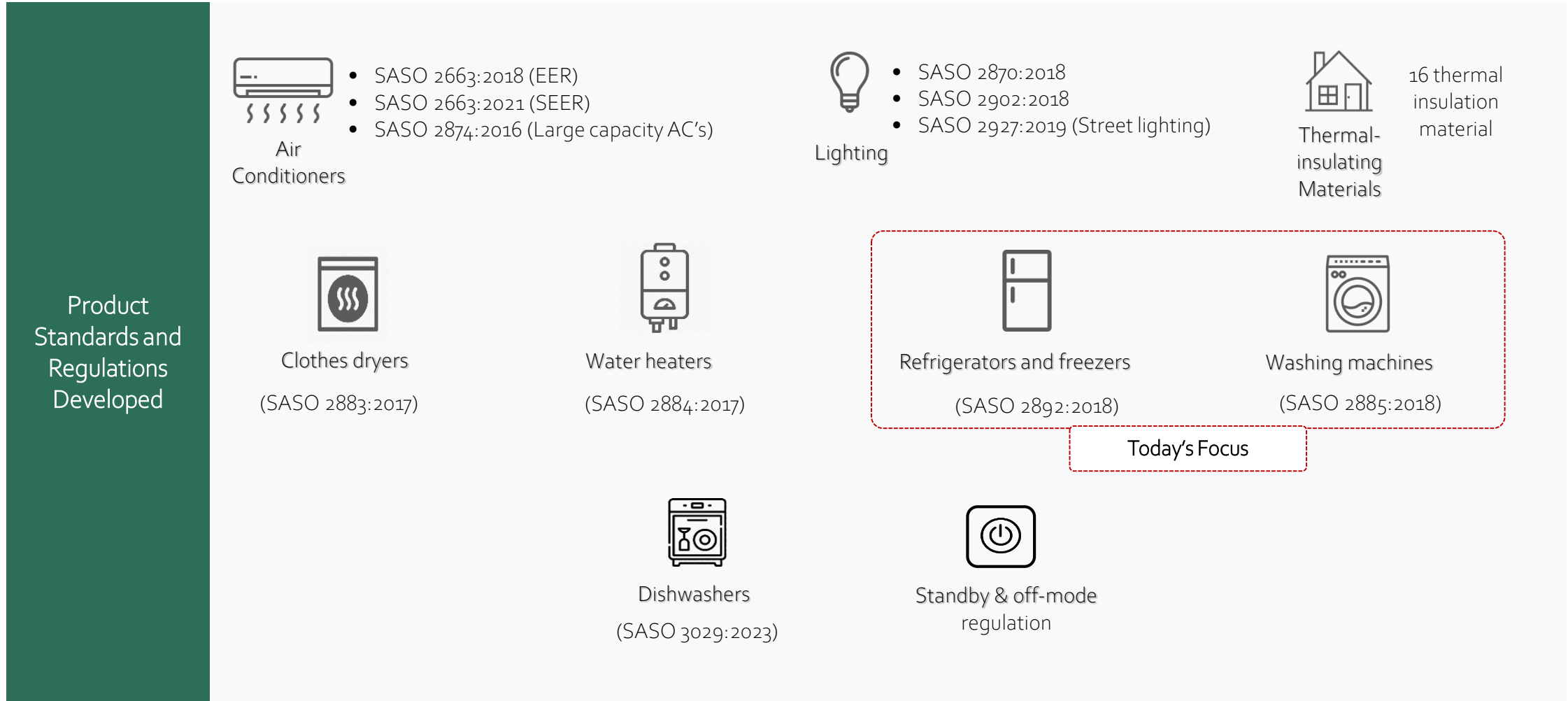


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The buildings' team has developed 28 energy efficiency standards and regulations

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History of development for the Refrigerators and Washing machines Standards

Voluntary standards:

- Both standards were optionally implemented

2007

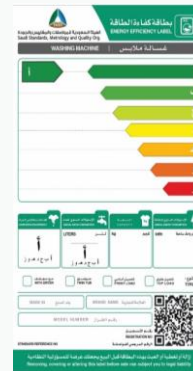


2013

Obligatory standards:

- Increase the Minimum Energy Efficiency Standard (MEPS)

2018



2021

Implemented stage II of the Minimum Energy Efficiency Standard (MEPS)

2024

Review and update the requirements of standards

Updating the standards:

- Replaced the Energy Efficiency labels
- Implemented stage I of MEPS

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Refrigerator/freezer standard update

Overview of the standard updates

Technical team members



Summary of major changes

- Expand the scope to cover capacity up to 1500 liter.
- Update the reference standards.
- Additional definitions.
- New Minimum Energy Performance Standard (MEPS) based on the updated Energy Efficiency Index (EEI) equation.

Updated Scope, reference standards and definitions

Scope

Refrigerators, refrigerator-freezers and freezers with a total capacity range from 10 – 1500 liter.

Exclusions:

- Refrigerators employing an **absorption refrigeration system** and **low noise refrigerating appliance**
- Refrigerating appliances that are primarily **powered by energy sources other than electricity**, such as liquefied petroleum gas (LPG), kerosene and bio-diesel fuels
- **Professional refrigerated storage cabinets** and blast cabinets, with the exception of professional chest freezers.
- Refrigerating appliances with a **direct sales function**.
- **Mobile** refrigerating appliances and **battery-operated** refrigerating appliances that can be connected to the mains through an AC/DC converter, purchased separately.
- Appliances where the primary function is **not the storage of foodstuffs through refrigeration**, such as stand-alone icemakers or chilled drinks dispensers

Reference standards

- IEC 62552-1:2015/AMD1:2020 "Household refrigerating appliances - Characteristics and test methods - 1: General requirements"
- IEC 62552-2:2015/AMD1:2020 "Household refrigerating appliances - Characteristics and test methods - 2: Performance requirements"
- IEC 62552-3:2015/AMD1:2020 "Household refrigerating appliances - Characteristics and test methods - 3: Energy consumption and volume"

Additional Definitions

- **Low noise refrigerating appliance:** A refrigerating appliance without vapour compression and with an airborne acoustical noise emission lower than 27 A-weighted decibel referred to 1 pico watt (dB(A) re 1 pW).
- **Door heat loss factor (D):** A compensation factor for combi appliances according to the number of different temperature compartments or the number of external doors, whichever is lower. For this factor, 'compartment' does not refer to sub-compartment.
- **Auxiliary energy (Eaux):** The energy used by an ambient controlled anti-condensation heater

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Testing requirements to meet Minimum Energy Performance Standard (MEPS)

Testing requirements	<ul style="list-style-type: none"> Product shall be tested at an ambient temperatures of 16 °C and 32 °C 								
MEPS	<table border="1"> <thead> <tr> <th>Total Volume</th> <th>≤ 500 liter</th> <th>> 500 liter</th> </tr> </thead> <tbody> <tr> <td>EEI</td> <td>≤ 110</td> <td>≤ 125</td> </tr> </tbody> </table>			Total Volume	≤ 500 liter	> 500 liter	EEI	≤ 110	≤ 125
Total Volume	≤ 500 liter	> 500 liter							
EEI	≤ 110	≤ 125							
Functional requirements	<ul style="list-style-type: none"> Any fast freeze facility once activated by the end-user according to the manufacture, the importer or authorized representative's instructions, automatically reverts to the previous normal storage conditions after no more than 72 hours. Each compartment shall be marked with the appropriate identification symbol. For the frozen compartments this shall be the number of stars of the compartment. For the chilled and unfrozen compartments, this shall be an indication, chosen by the manufacturer, the importer or authorized representative, of the type of food that should be stored in the compartment. For 2-star sub-compartments or 2-star sections: <ul style="list-style-type: none"> <input type="checkbox"/> a 2-star sub-compartment or 2-star section is separated from the 3-star or 4-star volume by a partition, container, or similar construction. <input type="checkbox"/> the volume of the 2-star sub-compartment or 2-star section does not exceed 20 % of the total volume of the containing compartment. For 4-star compartments, the amount of fresh foodstuffs that can be frozen in a freezer compartment in 24 h, shall not be lower than 4.5 kg per 24 h per 100 liters of volume of the freezer compartment, with a minimum of 2.0 kg/24h. 								

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Energy Efficiency Index (EEI) Calculation

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

$$AEC = 365 \times (E_{\text{daily}}/L) + E_{\text{aux}}$$

$$E_{\text{daily}} = (E_{16} + E_{32})/2$$

Where:

- AEC: annual energy consumption
- E_{daily} : Calculated based on testing at an ambient temperatures of 16 °C and 32 °C.
- L : The load factor (L = 0.9) for refrigerating appliances with only frozen compartments and (L = 1.0) for all other appliances.

EEI Calculation

$$SAE = C \times D \times \sum_{c=1}^n A_c \times B_c \times \left[\frac{V_c}{V} \right] \times (N_c + V \times r_c \times M_c)$$

Where:

- SAE : Standard annual energy consumption
- c : the index number for a compartment type ranging from 1 to n, with n the total number of compartment types.
- V_c : Compartment volume in liters
- V : Total Volume in liters
- r_c, N_c, M_c and C : modelling parameters specific to each compartment.
- A_c, B_c and D : the compensation factors.

Values presented next slide

The values of the modelling parameters per compartment type

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THE VALUES OF THE MODELLING PARAMETERS PER COMPARTMENT TYPE					
compartment type	$r_c^{(1)}$	N_c	M_c	C	
Pantry	0.35	75	0.12	between 1.15 and 1.56 for combi appliances with 3-star or 4-star compartments ⁽²⁾	
Specific beverage (1)	0.60				
Specific beverage (2)	0.60				
Fresh food	1.00				
Chill	1.10	138	0.12	1.15 for other combi appliances 1.00 for other refrigerating appliances	
0-star & ice-making	1.20				
1-star	1.50				
2-star	1.80				
3-star	2.10				
Freezer (4-star)	2.10	138	0.15		

⁽¹⁾ $r_c = \frac{(T_a - T_c)}{20}$ with $T_a = 24$ °C and T_c with values as set out in Table 5.

⁽²⁾ C for combi appliances with 3-star or 4-star compartments is determined as follows:

where **frzf** is the 3-star or 4-star compartment volume V_{fr} as a fraction of V with $frzf = \frac{V_{fr}}{V}$:

- if $frzf \leq 0.3$, then $C = 1.3 + 0.87 \times frzf$
- if $0.3 < frzf < 0.7$, then $C = 1.87 - 1.0275 \times frzf$
- else $C = 1.15$.

Table 5 – STORAGE CONDITIONS AND TARGET TEMPERATURES PER COMPARTMENT TYPE					
Group	Compartment type	Note	Storage conditions °C		T_c °C
			T_{min}	T_{max}	
Unfrozen compartments	Pantry	⁽¹⁾	+14	+20	+17
	Specific beverage (1)	⁽²⁾ ⁽⁶⁾	+5	+20	+12
	Specific beverage (2)	⁽¹⁾	+2	+14	+12
	Fresh food	⁽¹⁾	0	+8	+4
Chill compartment	Chill	⁽³⁾	-3	+3	+2
Frozen compartments	0-star & ice-making	⁽⁴⁾	N/A	0	0
	1-star	⁽⁴⁾	N/A	-6	-6
	2-star	⁽⁴⁾ ⁽⁵⁾	N/A	-12	-12
	3-star	⁽⁴⁾ ⁽⁵⁾	N/A	-18	-18
	freezer (4-star)	⁽⁴⁾ ⁽⁵⁾	N/A	-18	-18

⁽¹⁾: T_{min} and T_{max} are the average values measured over the test period (average over time and over a set of sensors).

⁽²⁾: The average temperature variation over the test period for each sensor shall be no more than ± 0.5 kelvin (K). During a defrost and recovery period the average of all sensors is not permitted to rise more than 1.5 K above the average value of the compartment.

⁽³⁾: T_{min} and T_{max} are the instantaneous values during the test period.

⁽⁴⁾: T_{max} is the maximum value measured over the test period (maximum over time and over a set of sensors).

⁽⁵⁾: If the compartment is of the auto-defrosting type, the temperature (defined as the maximum of all sensors) is not permitted to rise more than 3.0 K during a defrost and recovery period.

⁽⁶⁾: T_{min} and T_{max} are the average values measured over the test period (average over time for each sensor) and define the maximum allowed temperature operating range.

The values of the compensation factors per compartment type

THE VALUES OF THE COMPENSATION FACTORS PER COMPARTMENT TYPE								
Compartment type	A _c		B _c		D ⁽¹⁾			
	Manual defrost	Auto-defrost	Freestanding appliance	Built-in appliance	≤ 2	3	4	> 4
Pantry	1.00		1.00	1.02	1.00	1.02	1.035	1.05
Specific beverage (1)								
Specific beverage (2)								
Fresh food								
Chill				1.03				
0-star & ice-making	1.00	1.10		1.05				
1-star								
2-star								
3-star								
Freezer (4-star)								
⁽¹⁾ number of external doors or compartments, whichever is lowest.								

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Refrigerators/freezer Energy Efficiency Index (EEI) classifications and label

(EEI) Classification			
Bar color	Energy efficiency class (Arabic)	Energy efficiency class (English)	EEI
Dark green	أ	A	$EEI \leq 50$
Green	ب	B	$50 < EEI \leq 65$
Light green	ج	C	$65 < EEI \leq 80$
Yellow	د	D	$80 < EEI \leq 95$
Orange	هـ	E	$95 < EEI \leq 110$
Red	و	F	$110 < EEI \leq 125$
Dark red	ز	G	$EEI > 125$

Total Volume \leq 500 L

Total Volume $>$ 500 L

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Washing machines standard update

Overview of the standard updates

Technical team members



Overview of the major changes

- Expand the scope to cover Wash and dry cycle of the Washer dryer (complete cycle).
- Update the reference standards.
- Additional definitions.
- Increase the Minimum Energy Performance Standard (MEPS) requirements.
- Increase the water consumption index (WCI).
- Increase the washing efficiency (Iw).
- Require program time limits for the washing cycle.
- Update the Energy Efficiency levels and the additions of the energy efficiency classes of the complete cycle.

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Updated Scope, reference standards and definitions

Scope

Washing machines and **washing cycle** of Washer dryer and **complete cycle (wash and dry cycle)** of Washer dryer with capacity up to 25kg.

Exclusions:

- **Battery-operated** that can be connected to the mains through an AC/DC converter.
- Washing machines and washer-dryers **with a rated capacity lower than 2 kg.**

Reference standards

- EN 60456:2016/A12:2023
Clothes washing machines for household use – Methods for measuring the performance.
- EN IEC 62512:2020/A12:2023
Electric clothes washer-dryers for household use - Methods for measuring the performance

Additional Definitions

- **Complete cycle** :Washing and drying process, consisting of a washing cycle and a drying cycle.
- **Continuous cycle** :Complete cycle without interruption of the process and with no need for user intervention at any point during the program
- **Cupboard dry** :The status of treated textiles dried in a drying cycle to a final moisture content of 0 %.
- **Drying cycle** : Complete drying process as defined by the required program, consisting of a series of different operations including heating and tumbling.
- **Multi-drum machine** : Washing machines or washer-dryers that equipped with more than one washing drum, whether in separate units or in the same casing.

Minimum Energy Performance Standard (MEPS) requirements and limits

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MEPS	Type	Front load washing machines, Washer-dryer (washing cycle)	Top load and Twin tub washing machines
	EEI	< 41	< 68
Water Consumption Limit	Type	Front load washing machines, Washer-dryer (washing cycle)	Top load and Twin tub washing machines
	WCI	≥ 5.0	≥ 3.0
Washing efficiency Limit	Type	Front load washing machines, Washer-dryer (washing cycle)	Top load and Twin tub washing machines
	I_w	> 103	> 90
Water Extraction Limit	The Water Extraction Index (WEI) shall be less than or equal 81%		
Program time Limit	The program time of washing machines and washing cycle of the Front load washer-dryers shall not exceed 300 (min).		

Energy Efficiency Index (EEI) Calculations

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EEI Calculation

Washing machines, Washer-dryer
(Washing cycle)

Washer-dryer
(Complete cycle)

$$EEI = 100 \times \frac{AEC}{AEC_{ref}}$$

$$AEC_{ref} = 47.0 \times C_{rated} + 51.7$$

- AEC_{ref} : Standard annual energy consumption in (kWh)
- C_{rated} : the rated capacity

$$AEC = E_t \times 220 + \left[\frac{P_o \times \frac{525600 - (T \times 220)}{2} + P_t \times \frac{525600 - (T \times 220)}{2}}{60 \times 1000} \right]$$

- AEC : Annual energy consumption in (kWh)
- E_t : weighted energy consumption in (kWh)
- P_o : weighted power in 'off-mode' in (W), P_t : weighted power in the 'left-on mode' in (W);
- T_t : weighted program time in (minutes – min);

$$E_t = (3 \times E_{t,60,full} + 2 \times E_{t,60,half} + 2 \times E_{t,40,half}) / 7$$

- $E_{t,60,full}$: The weighted energy consumption per cycle of the standard 60°C cotton program in (kWh).
- $E_{t,60,half}$: The weighted energy consumption per cycle of the standard 60°C cotton program in (kWh).
- $E_{t,40,half}$: The weighted energy consumption per cycle of the standard 40°C cotton program in (kWh).

$$AEC_{ref} = 237.7 \times d_{rated} + 261.4$$

- AEC_{ref} : Standard annual energy consumption in (kWh)
- d_{rated} : The rated capacity of complete cycle

$$AEC = E_{WD} \times 220$$

- AEC : Annual energy consumption in (kWh)
- E_{WD} : Weighted energy consumption in (kWh)

$$E_{WD} = (3 \times E_{WD,60,full} + 2 \times E_{WD,60,half} + 2 \times E_{WD,40,half}) / 7$$

- $E_{(WD,60,full)}$: The weighted energy consumption per cycle of the washer-dryer for the wash (standard 60°C cotton program) and dry cycle at full load in (kWh).
- $E_{(WD,60,half)}$: the weighted energy consumption per cycle of the washer-dryer for the wash (standard 60°C cotton program) and dry cycle at half load in (kWh).
- $E_{(WD,40,half)}$: The weighted energy consumption per cycle of the washer-dryer for the wash (standard 40°C cotton program) and dry cycle at half load in (kWh).

Updated Washing machine / New Washer-dryer Energy Efficiency Index (EEI) classifications

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Updated Washing machines, Washer-dryer (Washing cycle) (EEI) Classification			
Bar color	Energy efficiency class (Arabic)	Energy efficiency class (English)	EEI
Dark green	أ	A	$EEI < 20$
Green	ب	B	$20 \leq EEI < 26$
Light green	ج	C	$26 \leq EEI < 33$
Yellow	د	D	$33 \leq EEI < 41$
Orange	هـ	E	$41 \leq EEI < 59$
Red	و	F	$59 \leq EEI < 68$
Dark red	ز	G	$EEI \geq 68$

New Washer-dryer (Complete cycle) (EEI) Classification			
Bar color	Energy efficiency class (Arabic)	Energy efficiency class (English)	EEI
Dark green	أ	A	$EEI_{WD} < 14$
Green	ب	B	$14 \leq EEI_{WD} < 24$
Light green	ج	C	$24 \leq EEI_{WD} < 34$
Yellow	د	D	$34 \leq EEI_{WD} < 44$
Orange	هـ	E	$44 \leq EEI_{WD} < 54$
Red	و	F	$54 \leq EEI_{WD} < 64$
Dark red	ز	G	$EEI_{WD} \geq 64$

Water Consumption Index (WCI)

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Water Consumption Index (WCI)

$$WCI = 1 + \frac{\text{Log}_e \left(\frac{W_{t,60,full}}{30 \times c_{rated}} \right)}{\text{Log}_e (1 - F)}$$

- $W_{t,60,full}$ = The water consumption of the washing machine or of the washing cycle of a washer-dryer at full rated washing capacity and rounded to one decimal place in (liters).
- 30 = Base water consumption per kg of capacity.
- c_{rated} = The rated capacity of the washing machine or the rated washing cycle capacity of the washer-dryer.
- F = The water reduction factor (0.30).

Water consumption index (WCI) Classification

Item color	Water consumption index (Arabic)	Water consumption index class (English)	WCI
Dark green	أ	A	$6.0 \leq WCI$
Green	ب	B	$5.5 \leq WCI < 6.0$
Light green	ج	C	$5.0 \leq WCI < 5.5$
Yellow	د	D	$4.5 \leq WCI < 5.0$
Orange	هـ	E	$3.5 \leq WCI < 4.5$
Red	و	F	$3.0 \leq WCI < 3.5$
Dark red	ز	G	$WCI < 3.0$

Water Extraction Index (WEI)

Water Extraction Index (WEI)

$$WEI = (3 \times WEI_{60,full} + 2 \times WEI_{60,half} + 2 \times WEI_{40,half}) / 7$$

- WEI = The weighted Water Extraction Index per cycle of washing machines and the washing cycle of washer-dryers rounded to one decimal place.
- $WEI_{60,full}$ = The weighted Water Extraction Index per cycle of the standard 60°C cotton program at full rated washing capacity and rounded to one decimal place.
- $WEI_{60,half}$ = The weighted Water Extraction Index per cycle of the standard 60°C cotton program at half rated washing capacity and rounded to one decimal place.
- $WEI_{40,half}$ = The weighted Water Extraction Index per cycle of the standard 40°C cotton program at half rated washing capacity and rounded to one decimal place.

Water Extraction Index (WEI) classification

Water Extraction class (Arabic)	Water Extraction class (English)	WEI
أ	A	$WEI < 45$
ب	B	$45 \leq WEI < 54$
ج	C	$54 \leq WEI < 63$
د	D	$63 \leq WEI < 72$
هـ	E	$72 \leq WEI < 81$
و	F	$81 \leq WEI < 90$
ز	G	$WEI \geq 90$

Updated Washing machine / New Washer-dryer energy efficiency labels

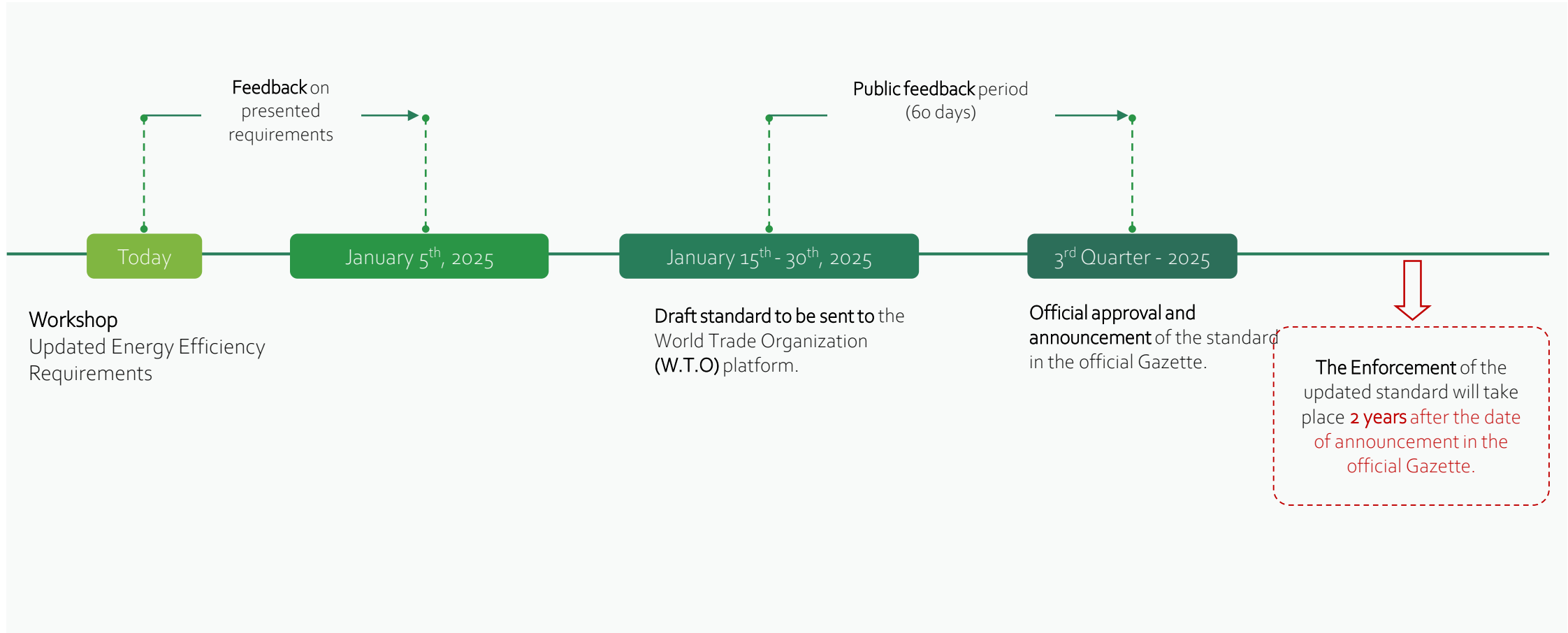
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Highlighted the annual water consumption. The colour is based on the Water Consumption Index (WCI) classification.

Additional information for complete cycle:

- Annual Energy Consumption (AEC)
- Capacity (kg)

Next steps



Discussion

Next steps

Kindly provide your comments and feedback to Amarer@seec.gov.sa, **no later than Jan 5th, 2025**, in the following format:

Company name	Slide number	Comment and justification

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Thank you
