

READINESS AND PREPARATORY SUPPORT

MARKET ASSESSMENT OF WASHING MACHINES AND TELEVISIONS IN LEBANON – AN ASSESSMENT OF ENERGY DEMAND AND GHG EMISSIONS FOR THE IMPLEMENTATION OF MEPS AND LABELS

Lebanon, “*Development of Energy Efficiency Standards and Labelling program for electric motors, transformers, washing machines and TVs in Lebanon*”.

Grant Agreement Number: LBN-RS-002

Draft - Delivered on: 20 April 2023

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ABBREVIATIONS & ACRONYMS

BAU	Business As Usual
BUR	Biennial Update Report
CAGR	Compound Annual Growth Rate
CO₂eq	Carbon Dioxide Equivalent
COM	Council of Ministers
EDL	Electricité du Liban
EE	Energy Efficiency
EU	European Union
GEF	Grid Emission Factor
GHG	Greenhouse Gas
GWh	Gigawatt Hour
GWP	Global Warming Potential
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel on Climate Change
IRI	Industrial Research Institute
ISO	International Organization for Standardization
kW	Kilowatt
kWh	Kilo-watt Hour
LCC	Lifecycle Cost
LCEC	Lebanese Center for Energy Conservation
Libnor	Lebanese Norms Institution
MEPS	Minimum Energy Performance Standards
MIT	Mitigation
MOE	Ministry of Environment
MOP	Meeting of the Parties
MP	Montreal Protocol
MRV	Monitoring, Review, and Verification
MTCO₂eq	Metric Ton Carbon Dioxide Equivalent
NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
NCP	National Cooling Plan
NDC	National Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NOU	National Ozone Unit

Disclaimer

The data collection work in this report have been carried during April, May and June 2022. The quality of the obtained data from the industry is subject to the responsiveness of the industry and the accuracy of the shared data. Also, the authors of the report are still having clarifications on some of the obtained information. Particularly, there is a high degree of confidence on some subsectors, but a lower degree of confidence on the data for other subsectors (e.g., electrical motors). The newly incoming information and the results of the clarifications will be considered in the output files for the subsequent deliverables and under the final report. There will be a particular focus on the subsectors where a high degree of confidence could not have been obtained at this point of time.

1 BACKGROUND

MEPS (Minimum Energy Performance Standards) and Labels are a regulatory tool to prevent poor energy performing appliances to enter a market and to encourage markets to transition to high performing appliances. This is a tool that has been proven in many jurisdictions and its implementation in Lebanon would support GHG emissions reductions, reduce the stress on the electricity system, and reduce the cost of energy services to consumers.

This project focuses on generating the necessary documentation and advice for the government of Lebanon to implement MEPS regulations on four product classes: Television, Washing Machines, Electric Motors, and Distribution Transformers.

This report looks at the background policy and market environments to generate the necessary guidance, policy documents, and design the processes to support implementation and enforcement such as monitoring, verification, enforcement (MVE), communications and marketing, capacity building, and more. Specifically, this report will look at the following:

- Stakeholders – identify the key stakeholders needed for the development and implementation of MEPS regulations in Lebanon. Identify key responsibilities and opportunities.
- Legal and policy environment – Identify and assess existing policies to understand the possible relationships of MEPS and other tools, or existing processes.
- Market dynamics – To determine the levels of MEPS and labels for each product class and assess the market impact of the regulation in terms of potential energy savings and emissions reductions.

1.1 Key stakeholders

An assessment of current stakeholder looks at the government agencies, regulators, market participants, and possible elements from social and academic sectors based on the experience in other countries depending on the policy setup. In principle the focus will be on key government agencies that design and implement the policy and the needed look at participants to prevent a significant negative impact.

Other interested stakeholders will be enforcement agencies such as the customs department, supporting technical experts such as testing labs that could be private entities, universities, NGOs, or government owned. An initial assessment is provided in Table 1, but it could grow as the project to deliver MEPS advances.

Table 1: Overview of the identified stakeholders for the implementation of MEPS and labels in Lebanon.

Stakeholder	Roles and responsibility
LIBNOR	Lebanon's national standardization body that issues, publishes, and amends national standards and grant the Lebanese conformity mark. LIBNOR would also have purview over energy performance standards
Industrial Research Institute (IRI)	National authority for the testing of industrial equipment and appliances.
Lebanese Customs Authority	The authority in charge for controlling the imports of appliances. Providing data on imports and exports of appliances.
Ministry of Economy and Trade	The ministry of economy and trade has a consumer protection department, which is usually responsible for enforcing regulations and standards related to consumers.

EDL	The public electricity utility mainly in charge of the procurement of distribution transformers.
Manufacturers and assemblers	Local manufacturers and assemblers of electric motors, and transformers; they will be directly affected by MEPS enforcement.
Ministry of Environment (MOE) – National ozone unit (NOU)	The ministry is the host of Lebanon’s UNFCCC climate focal point and overseeing most of the climate change and environmental projects in Lebanon. The ministry is also the National Focal Point for the Montreal Protocol and activities carried out under it.
Order of Engineers and Architects	The national organizations hosting engineers and architects in Lebanon. The regularly publish reports and studies on energy performance in appliances and buildings.
Ministry of Energy and Water	Ministry responsible for the national electricity utility (EDL) and overseeing Lebanon’s energy sector.
LCEC	A centre within the Ministry of Energy and Water responsible for energy efficiency and renewable energy activities. Their role includes setting up national strategies, implementing RE&EE initiatives, and supporting LIBNOR on standards and MEPS, among others.
National Commission for Lebanese Women	The commission for Lebanese women that works on Implementing gender mainstreaming in public administrations through actions and mechanisms enforcing and institutionalizing Gender Focal Points’ (GFPs) network. National co-focal point of gender under the UNFCCC.
Sellers	Retailers and sellers of TVs, washing machines, electric motors, and transformers in both retail and wholesale.
Association of Lebanese Industrialists	The main national entity representing manufacturing companies operating in Lebanon.
End users	Households and other users buying and using TVs, washing machines, electric motors, and transformers. MEPS will have a direct impact on their energy consumption and maybe the cost of equipment.
Servicing companies	Companies performing aftersales service to TVs, washing machines, electric motors, and transformers.

1.2 Legal framework

Lebanon is signatory to several international treaties such as the Montreal Protocol and Paris Agreement and has implemented national actions to achieve national and international targets including policies and regulations looking to reduce GHG emissions and support sustainable economic and environmentally friendly development to the country. A summary of the key actions and objectives is presented below:

- **Climate Change** - Lebanon signed the Paris Agreement in April 2016 and ratified in March of 2019. Lebanon submitted its first Nationally Determined Contribution (NDC) in September 2015 (Ministry of Environment, 2015). In the latest NDC¹, Lebanon’s GHG are estimated to increase from 27 MTCO₂eq in 2019 to over 43 MTCO₂eq by 2030 under a business-as-usual scenario. Without international support,

¹ <https://unfccc.int/sites/default/files/NDC/2022-06/Lebanon%27s%202020%20Nationally%20Determined%20Contribution%20Update.pdf>

Lebanon has committed to lowering its emissions to 36 MTCO₂eq. With international support Lebanon has committed to lower the emissions by 2030 to about 30 MTCO₂eq. The NDC document identifies actions to reduce emissions and to support the electricity sector infrastructure faces when confronted with increased demand from a growing population, refugees' movement, and increased used of electric appliances. It is of note that the estimated GHG scenarios for the NDC in 2019 have now been invalidated due the compound crisis (political, economic, banking, etc) that has led Lebanon into a recession, and the expected emissions reductions that come with that. Despite this, the NDC commitments remain valid until they are updated.

- **Energy policies** - Lebanon has publishes several national policies aiming to improve the performance of the sector and to reduce the GHG emissions. Some of the key ones include:
 - **National Energy Efficiency Action Plan (NEEAP) 2016-2020.** The NEEAP addresses both primary and end-user-oriented energy savings. The decarbonization of the energy supply has been addressed through the National Renewable Energy Action Plan 2016-2020².
 - **Electricity Reform Plan:** The Electricity Reform Strategy aims to reform Lebanon's electricity sector, which has long suffered from high costs, inefficiencies, and blackouts. The strategy includes measures to improve the efficiency of the electricity sector, increase the use of renewable energy sources, and attract private investment.
 - **National Energy Policy:** The National Energy Policy aims to ensure the country's energy security, promote the use of renewable energy sources, and reduce greenhouse gas emissions. The policy includes measures to increase energy efficiency, diversify the energy mix, and develop renewable energy sources, such as solar, wind, and biomass.
 - **Green Building Code:** Lebanon is developing a Green Building Code, which aims to promote sustainable building practices and reduce energy consumption in buildings. The code includes requirements for energy-efficient lighting and HVAC systems and appliances, insulation, and the use of renewable energy sources.
 - **The Ministry of Energy and Water National Policy Statement for 2022³,** entitled “Setting Lebanon’s Electricity Sector on a Sustainable Growth Path”, outlines actions and strategies to improve the electricity sector in Lebanon. It is published by the Ministry of Energy and Water in March 2022, and is based on the Least Cost Generation Plan prepared by Électricité de France EDF in September 2021, and on “Lebanon Power Sector Emergency Action Plan” developed by World Bank in 2020. The plan rests on 5 main pillars, that are increasing supply hours while preparing to increase generation capacity on the grid increasing generation by commissioning three new power plants with the participation of the private sector, improving performance of the network, reducing losses, and enhancing collection, achieving financial sustainability, and addressing the regulatory and legislative frameworks, among which is proposing amendment to law 462.

² <https://lcec.org.lb/sites/default/files/2021-02/NEEAP%202016%202020.pdf>

³ https://energyandwater.gov.lb/mediafiles/articles/doc-100778-2022_03_31_10_22_46.pdf

- **The energy conservation law draft** was submitted to the council of minister and approved earlier this year, but still not ratified by the parliament. This law includes provisions to enhance energy efficiency, especially auditing environmental standards, applied by the industrial sector, related to energy efficiency of industrial products, among others.
- **Law 462/2002⁴** calls for the establishment of Electricity Regulatory Authority (ERA). However, political turmoil delayed the actual implementation and enforcement of the law. ERA has not yet been formed, as of 31 December 2022. The ministry of energy and water is working on preparing a draft law specifying the proposed amendments to this legislation.
- **Institutional development - Law reference 23-07-1962** for the establishment of a public entity called “The Lebanese Standards Institution” was enacted by the Lebanese Parliament and it covers the roles and tasks that LIBNOR has to undertake (Standardization, NL Conformity Mark, Training, Enquiries, etc.) and the composition of the Board of Directors and it nominates LIBNOR as the Representative of the Lebanese Republic in International and Regional standardization activities.

Within this context, while energy efficiency is envisioned to play a key role in the government’s climate and development objective, it has yet to implement MEPS and Labels regulations for energy consuming appliances. This is a tried and proven tool that ensures that poor performing appliances are not dumped in the Lebanese market as well as encouraging the market to aim for top performing appliances. This project aims to lay the foundational work needed to implement MEPS and labels for four key energy using appliances television, washing machines, distribution transformers, and electric motors. Further, once an overarching MEPS and Labels regulation is implemented and demonstrated with the four product classes targeted, it is relatively easy to expand it into other consuming products such as fridges, air conditioners, and more.

1.3 Sectors’ inventory survey

The market assessment requires relevant, up-to-date, data to support analysis to determine the dynamic flows, assess the impact of possible policies, enable the determination of the MEPS levels, and design the ancillary components of a MEPS policy. The first step of this process is to perform a data collection from the market with a focus on sales, operating stocks, and the technical specifications of the units in the market.

In Lebanon, there are few data sources to support this kind of analysis requiring the implementation of a hybrid approach that looked at both, bottom-up and top-down data options, to generate sufficient information and fill the gaps where possible.

1.3.1 Data collection process

The data for this inventory was collected from primary and secondary sources. This included field surveys collecting information directly from appliances sellers, interviews with market participants, and desk research looking at existing data sources such as customs data, previous research, national statistical sources, and academic papers.

<http://www.databank.com.lb/docs/Law%20No%20462%20Regulation%20of%20the%20Electricity%20sector.pdf>

1.3.1.1 Primary Data

For televisions and washing machines a comprehensive data collection was performed directly from key market participants including local retailers, designated showrooms, and major suppliers. The data collected can be summarized as follows:

- **Televisions:** 239 model entries were identified from 37 different brands from shops covering rural and urban areas, including Beirut, Tripoli, Saida, Akkar, Zahle, Nabatieh, Hazmieh, Sin El Fil, Bourj Hammoud, Daraya, Minieh, Dinniyeh, and Qaroun.
- **Washing Machines:** 234 models from 39 brands were identified from shops covering rural and urban areas, including Beirut, Tripoli, Saida, Akkar, Zahle, Nabatieh, Hazmieh, Baalchmay, Zouk, Sin El Fil, Bourj Hammoud, Daraya, Minieh, Dinniyeh, and Qaroun.



Figure 1: Samples of locations where data was collected.

The collection process involved surveyors visiting showrooms and other points of sale in person to collect information from each of the models available. The surveyors would take photos, collect the required information through inspecting nameplates, labels, and brochures, and enter the data into an MS Excel database.

In many cases, the information available at the showroom would not be complete, so the in-person collection would be complemented by desk research through reviewing online datasheets, technical specification sheets, and instruction manuals.

The data collection process is often hampered by market participants protecting their data considering it commercially sensitive. As such, the project received support from the government in the form of support or mandate letter issued by the Ministry of Environment.

1.3.1.2 Primary data collection for Televisions

For televisions, the market survey focused on the technical performance of the available stock of NEW models available in the market. The data collected included the following parameters for each of the surveyed items:

- Shop name, city, brand, model number, type, screen type, screen size, screen width, average power (in-use), maximum power (in-use), standby power, availability of energy label, energy rating, price, country of origin, year of manufacturing, energy consumption (annual energy consumption or energy/1000hrs).

A total of 25 shops and points of sale were visited during the market survey period, as a result, a total of 239 entries were collected resulting in 37 different brands. Among the 239 surveyed televisions, only 14 had energy labels visible to buyers, under 6% of all the surveyed models.

The geographic distribution is presented in Table 2 and Figure 2, and with the major shops visited including but not limited to the following major shops:

- Abed Tahan
- Aghasarkissian
- Carrefour Lebanon
- Electro Skafi
- Hajj Electronics
- Kotob City
- Mohammad El Baba Trading Est
- Spinneys
- Vestel Electronics
- Zahramen Electronics
- Tripoli Home

Table 2: Televisions survey geographic distribution

District/City	Shops/Showrooms	Total Entries
Beirut	2	43
Baabda	1	13
Metn	2	37
Saida	5	62
Tripoli	4	24
Zahle	1	13
Nabatieh	2	11
Chouf	1	5
Akkar	3	15
West Bekaa	2	5
Minieh Dinnieh	2	11

Total	25	239
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Figure 2: Televisions survey geographic distribution

1.3.1.3 Primary data collection for washing machines.

Similar to the televisions, the collection for washing machines focused on the technical performance of the available stock of NEW models available in the market. The data collected included the following parameters for each of the surveyed items:

- Shop, City, Brand, Model Number, Type, Washing Capacity (kg), Drying Capacity (kg), Power (W), Annual Energy Consumption Washing (kWh), Cycle Energy Consumption Washing (kWh), Annual Energy Consumption Washing & Drying (kWh), Cycle Energy Consumption Washing & Drying (kWh), Annual Water Consumption Washing (lit), Cycle Water Consumption Washing (lit), Annual Water Consumption Washing & Drying (lit), Cycle Water Consumption Washing & Drying (lit), Availability of Energy Label, Energy Rating, Price, Country of Origin, Year of Manufacturing.

A total of 30 shops and points of sale were visited during the market survey period resulting in 234 model entries from 39 different brands collected. Among these models, only 54 had complete energy labels visible to buyers, around 23%. It was very common for washing machines to see energy classes mentioned on the advertising panel, without the presence of an energy label. This case made a share of 15%, with a total of 35 cases noted.

The geographic distribution is presented in Table 3 and Figure 3, and with the major shops visited including but not limited to the following major shops:

- Abed Tahan
- Agha Sarkisian
- Akiki Electronics
- Beytech
- Carrefour
- Electro Skafi
- Hajj Electronics
- Hedam Electronics
- Hleihel Electronics
- Kotob City
- Rawass Home
- RJ Group
- Tlase Electronics
- Tripoli Home
- Vestel Electronics
- Zahramen Electronics

Table 3: Washing machines survey geographic distribution.

District/City	Total Entries	Shops/Showrooms
Beirut	34	3
Baabda	3	2
Metn	17	2
Keserouan	4	2
Saida	90	5
Tripoli	19	4
Zahle	6	2
Nabatieh	10	2
Chouf	7	1
Akkar	29	5
West Bekaa	8	2
Minieh	11	2
Total	234	30



Figure 3: Washing machines survey geographic distribution.

1.3.1.4 Secondary data

Secondary data included review of different open sources that rely mainly on customs data and other available reports and studies to include:

1. **Market statistics** from the Central Administration of Statics (CAS) including any existing information on appliance sales, ownership, and use.
2. **Customs data** on the imports of appliances into the country. The customs data for the relevant projects was found to have some difficulties such as measuring imported television in tons or USD value instead of number and type of units.

The HS codes considered are:

- **Televisions:** HS Code 852872 - Reception apparatus for television, colour, whether or not incorporating radio-broadcast receivers
- **Washing Machines:** HS Code Product: 8450 - Household or laundry-type washing machines, incl. machines which both wash and dry; parts thereof

3. Other **macro statistics** from CAS or international sources such as the World Bank including population, household size, GDP growth, and energy supply.
4. **Existing research** and **reports** providing information on previously collected information and analysis carried to provide information on the Lebanese market and emerging patterns.
5. Internationally accepted modelling default values associated with appliance lifecycles and energy efficiency potential.
6. The United Nations U4E (United for Efficiency) programme model regulation provided methodologies to provide annual energy consumption for appliances at different energy efficiency values.

Current and historical data are based, where available, on factual data from the sources listed above. Future projections are based on statistical data for population and economic growth projections.

The following challenges were encountered during the data collection work from the primary data sources:

- Reluctance to provide information or willingness to provide only partial information due to the confidentiality policy of some companies.
- Lack of statistical information at suppliers' and dealers' level.
- The recent economic crisis the country is going through made finding representative data very difficult, especially with the drastic changes to purchase behaviour.

1.3.2 Modelling parameters

For the analysis of this inventory, the modelling parameters derived from primary and secondary data collection as shown in section 1.3.1, were applied. The modelling parameters are derived from questionnaires and information from interviews where possible. Gaps were filled with values from HEAT's expert judgement and similar assessments in other countries, with special consideration to the case of Lebanon.

According to recent World Bank data, the Lebanese economy suffered due to the recent instability in 2019. According to **Fehler! Verweisquelle konnte nicht gefunden werden.**(a), the GDP grew at an average rate of 3.7% between 2012 and 2018. The Lebanese GDP between 2012 and 2018 can be expressed as a linear function with years as:

$$GDP = 1.725 \times year - 3426.004.$$

However, a recent prediction from the IMF as shown in Figure 4(b) depicts that the Lebanese economy will continue to contract at the rate of 0.5% under the status quo scenario and may be able to expand at an average rate of 2.82% in the case of reformed policies scenarios. As such, the prediction carried assumed low, medium, and high CAGR based on -0.5%, 1.5%, and 3% economic growths.

Table 4 Key selected indicators 2021-2027, Status Quo Scenario (Source: Lebanese authorities & IMF Staff estimates and projections).

Key selected indicators under the Status Quo Scenario (2021-27)	Act/Estimate			Projections			
	2021	2022	2023	2024	2025	2026	2027
Growth (%)	-10.0	0.0	-0.5	-0.5	-0.5	-0.5	-0.5
Consumer Prices (% average)	154.8	171.2	296.1	152.6	135.1	169.0	207.3
Nominal GDP (Billions of USD)	20.5	21.8	13.7	13.2	12.8	12.5	12.3
REER (cumulative since 2019)	-31.8	-26.5	-53.7	-55.1	-56.1	-56.9	-57.6
Current account (% of GDP)	-17.3	-29.0	-20.0	-19.1	-9.6	-7.2	0.2

Overall fiscal balance (% of GDP)	1.2	-5.2	-9.2	-8.7	-6.7	-6.7	-6.3
Primary fiscal balance (% of GDP)	2.4	-4.3	-5.5	-5.4	-4.9	-5.4	-5.6
Public gross debt (% of GDP)	349.9	282.3	512.0	453.2	485.3	516.7	547.5

Table 5 Key selected indicators 2021-2027, Reform Scenario (Source: Lebanese authorities & IMF Staff estimates and projections).

Key selected indicators under the Reform Scenario (2021-27)	Act/Estimate			Projections			
	2021	2022	2023	2024	2025	2026	2027
Growth (%)	-10.0	0.0	-0.5	3.9	4.5	3.2	3.0
Consumer Prices (% average)	154.8	171.2	296.1	148.7	75.1	33.6	12.1
Nominal GDP (Billions of USD)	20.5	21.8	16.2	18.2	24.7	26.7	27.9
REER (cumulative since 2019)	-31.8	-26.5	-46.1	-41.9	-24.5	-20.7	-20.2
Current account (% of GDP)	-17.3	-29.0	-12.5	-12.2	-11.0	-9.3	-6.0
Overall fiscal balance (% of GDP)	1.2	-5.2	-6.9	-19.9	-3.5	-2.0	-1.7
Primary fiscal balance (% of GDP)	2.4	-4.3	-3.5	-16.3	-0.6	0.7	0.9
Public gross debt (% of GDP)	349.9	282.3	509.3	110.0	91.5	83.6	80.9

Finally, it is important to find or estimate the ratio between the market growth/expansion and typical replacement use in the different sectors. The macro-economic data based on the proposed model was used assuming that all imports/GDP in 2020 (most significant GDP disruption) were used to focus on replacement. In this case, the replacement ratio was calculated as the ratio of the 2020 actual GDP/2020 BAU GDP as shown below:

$$\begin{aligned}
 \text{Replacement Ratio} &= \text{Percent}_{\text{Replacement,2020}} \times \frac{\text{2020 Actual GDP}}{\text{2020 BAU GDP}} \\
 &= 100\% \times \frac{26.2}{1.725 \times 2020 - 3426.004} = 44.79\%
 \end{aligned}$$

Lebanese GDP, Billion USD

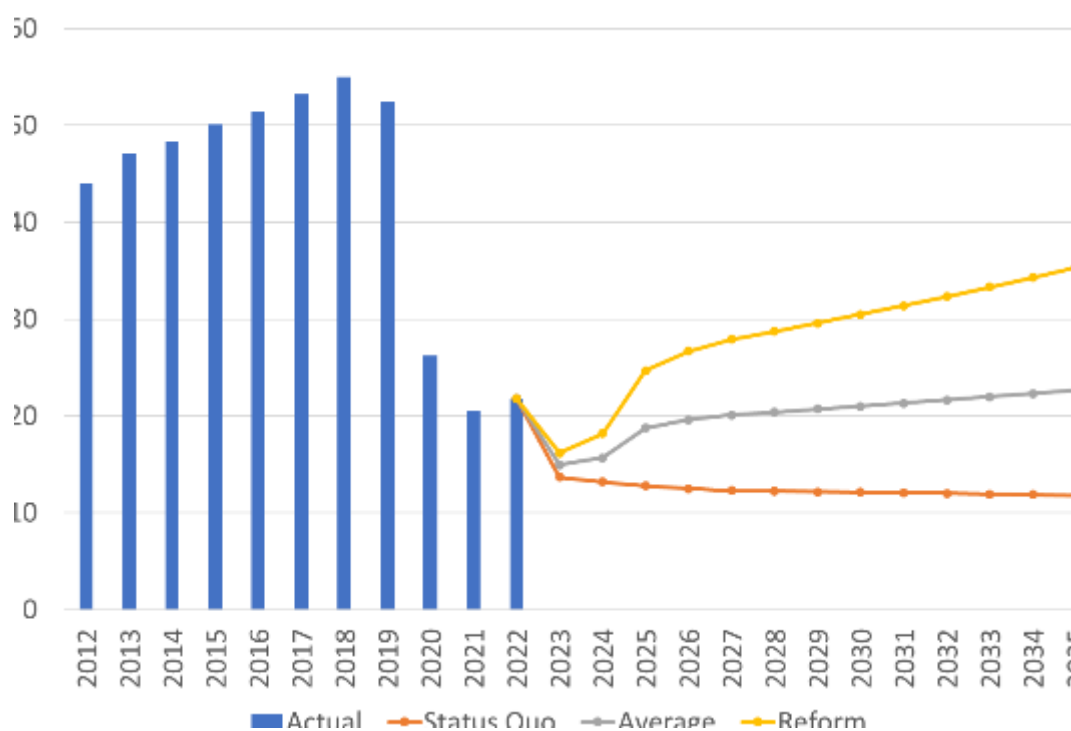


Figure 4: Proposed GDP forecast model with Low, BAU, and High economic growth scenarios.

Specific modelling parameters were developed based on local market survey, U4E Country Savings Assessments Methodology and Assumptions, and other best practices for the different import categories of electric motors (EMs) and distribution transformers (DTs) as shown in.

Table 6: Modelling parameters for the BAU scenario

Equipment type	Size	Lifetime [years]	Stock in 2022 (est.)	Market Size in 2022	BAU unit energy cons., kWh/yr
Televisions	2020: 50 Inches 2040:60 Inches	10	3.26 mill	322k	88
Washing Machines	7 kilos	15	1.46 mill	75k	275

1.3.3 Key factors driving future demand for appliances

The population growth in Lebanon is summarized in Table 7. It shows that there would be a slight decline in population in the 2020-29 decade followed by a steady population level thereafter. Further, the size of households continues to decrease meaning an increased total number of households for the available population. As many appliances' ownership is based on the household unit rather than the individuals, this is also placing increased demand on appliances.

Table 7: Population and household growth assumptions⁵

	Compound Annual Growth Rates (CAGR)				
	2018	2010-19	2020-29	2030-39	2040-49
Population	6,848,925	3%	-1%	0%	0%
Households	1,349,470	3%	-1%	1%	0%

Lebanon already has a very high urbanisation rate which currently stands at 88.6% (see Table 8). The Urbanisation will remain at a very high level until 2050 and slightly increase towards 93.4%.

Table 8: Current and projected urbanization⁶ growth

	Proportion of population in urban environments				
	2018	2020	2030	2040	2050
Urbanisation	88.6%	88.9%	90.6%	92.1%	93.4%

As mentioned in the modelling parameters section, the Lebanese economic growth will be a major driver for a still increasing demand for appliances. The economic growth assumptions for the three assumed growth scenarios status quo, intermediate, and intervention are: -0.5 %, 1.5% and 3.0% respectively.

2 TELEVISION AND WASHING MACHINES MARKETS

The market and demand for home appliances worldwide is on the increase. With the growing population and increased economic development, the number of operating appliances is set to explode, and with it, the related energy demand and GHG emissions. This is a growing concern in developing countries as they aim to

⁵ Data taken from <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=IN>.

⁶ See <https://population.un.org/wup/Country-Profiles/>

develop and provide sufficient energy for all their population for comfort and development. At the same time, countries look to meet climate targets to avert the worst impacts. In this context, the implementation of energy efficiency to reduce the impact of this growth is essential for the climate as well as supporting the poorer sectors of the population get on the energy ladder.

2.1 Market assessment of televisions and washing machines

This study uses a hybrid top-down and bottom-up approach to assess the characteristics and size of the market to estimate the energy demand and emissions. The process includes three key steps:

1. Estimating the **size of the market** - Ideally, this is estimated using sales statistics supported with secondary data. No sales statistics were made available for this study, so the key information comes from appliance ownership statistics published by the LCEC that indicated an ownership of 2.2 TVs per household in 2020 and 1 washing machine per household. With this information and based on the GDP per household increase, and international experience on saturation rates, a projection of ownership out to 2040 was developed.
2. Assessing the **TV and Washing machine characteristics** in the Lebanese market. The data collected provided a strong insight indicating an average TV screen size of around 51 inches with power inputs ranging between 31 watts for a 32-inch screen to 636 watts for an 85-inch screen and average of 113 for the sampled models. At the same time, washing machines present an average size of 9kg of washing capacities, although the 7 and 8kg models were by far the most common representing over 50% of the total sample.
3. **Energy and GHG modelling.** A methodology to estimate the average consumption per unit was developed using the formulae provided in the EU Ecodesign regulations and assumptions of the current levels of energy efficiency in the Lebanese Market. Given the low level of information on energy efficiency and its lack of cohesion, assumptions were made on the general state of the market to estimate final energy demand of these appliances. It is essential to note that these projections are estimations and **are indicative** and the trends and proportional changes are more important than the absolute numbers. As such, these projections are indicative of the of the potential growth of energy demand, and the benefits of MEPS implementation in this sector.

The estimations, in the relevant sections, assume that the electricity grid is stable supplying electricity to appliances as demanded. As such, these results may be an overestimation for energy and emissions, but the growth trends and the potential proportions for energy and emissions savings represent a strong bases for policy development as the actual size of the savings are commensurate to the electricity supply growth in Lebanon.

2.1.1 Televisions sales and stock

The data collections process did not render sales data, as such, the key figure used for the market assessment was the reported level of televisions ownership in Lebanese households in a survey carried by the LCEC published in 2020⁷. In this report, a TV ownership rate of 2.2 TV per household, and significant increase from the only other available data point of around 1.45 in 1997⁸. At the same time, the LCEC survey indicated that ownership of televisions tends to increase with household income with up to 3.5 ownership rates for the

⁷ https://lcec.org.lb/sites/default/files/2021-03/LCEC%20IEEHA%20REPORT%20E%20FOR%20WEB_1.pdf

⁸ <https://www.nationmaster.com/country-info/profiles/Lebanon/Media>

highest household income bracket assessed (>USD 3,500 per month). In terms of size, the survey performed for this project indicated an average of 51-inch screens across the market, although this is also a trend on the increase. While there is no Lebanon specific data, there is a marked trends for increasing sizes⁹ and this analysis reflects that with an exogenous assumption that sees screens increase to 60 inches in average by 2040.

Based on the modelling parameters described above, the stock of the operating TVs in Lebanon is estimated to have been 3.29 million televisions in 2020 with an average size of 50 inches. The stock increases to 3.39 million by 2040 (3% increase), after seeing a drop to 3.04 in 2030 (Figure 5). The key reasons for this drop centre of the stability of the total population of Lebanon, which saw a large influx of refugees during the last decade. As indicated in the population modelling assumptions, the refugee resettlement process, will see the population decrease until 2030 before stabilizing and resuming its longer-term trend.

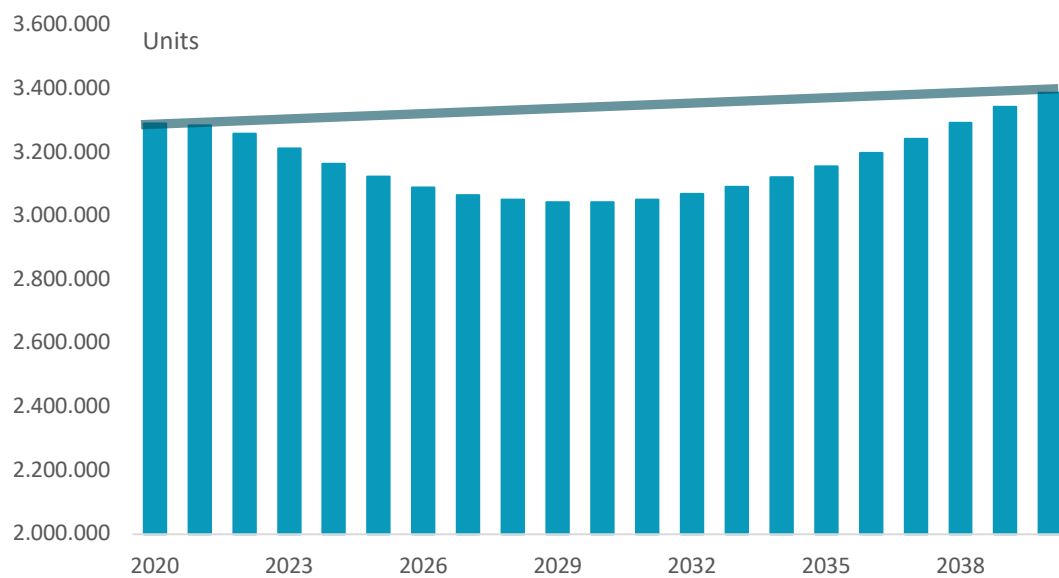


Figure 5: Stock of operating televisions (units) in Lebanon between 2020 and 2040. (Source: HEAT Analysis).

Following the stock patterns, the changes in population significantly impact annual sales, first pushing them as a new source of demand enters the markets, and then down as this demand leaves the market. The stock model used to estimate sales, is not capable of modelling precisely these effects (and other shorter-term events such as COVID-19), but it does indicate the sales required to achieve the estimated levels of stock. With this in mind, sales range between 284 thousand in 2030 and 355 thousand in 2039 (Figure 6), with the general trends stabilizing by the end of the modelling period as the population trends stabilize as well.

⁹ <https://www.forbes.com/sites/simonchandler/2019/08/27/why-tv-screens-are-getting-bigger-and-bigger/?sh=70a7c6ee4eec>

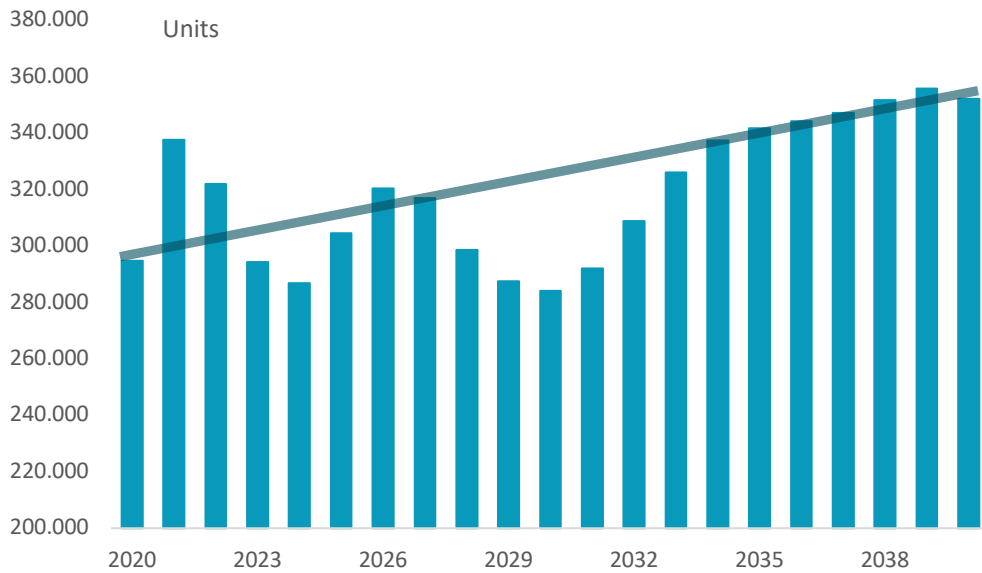


Figure 6: Annual sales of televisions (units) in Lebanon between 2020 and 2040. (Source: HEAT Analysis).

As population continues to grow after 2040 and the size of households tend to get smaller, it is expected that TVs sales will continue to grow (if slowly) after 2040.

2.1.2 Washing machines sales and stock

In the case of washing machines, the reported rate of ownership is 1 per household. Further, this seems to be a steady rate, as it stands to reason that more households have little to no utility derived from the ownership of a second washing machines. As such, the rate remains constant through the period. In terms of size, the assumed size for the analysis is 7 kilos as it is the most common size. Similarly, the size will remain constant through the period as the drivers for washing demand are relatively constant as well.

Based on the above, the total stock of washing machines is estimated at nearly 1.5 million units in 2020. The stock decreases to 1.35 million units in 2040 with a low point in 2032 with 1.29 million as result of population decrease (Figure 7). As it was the case with televisions, the stock grows towards the end of the period as population stabilizes.

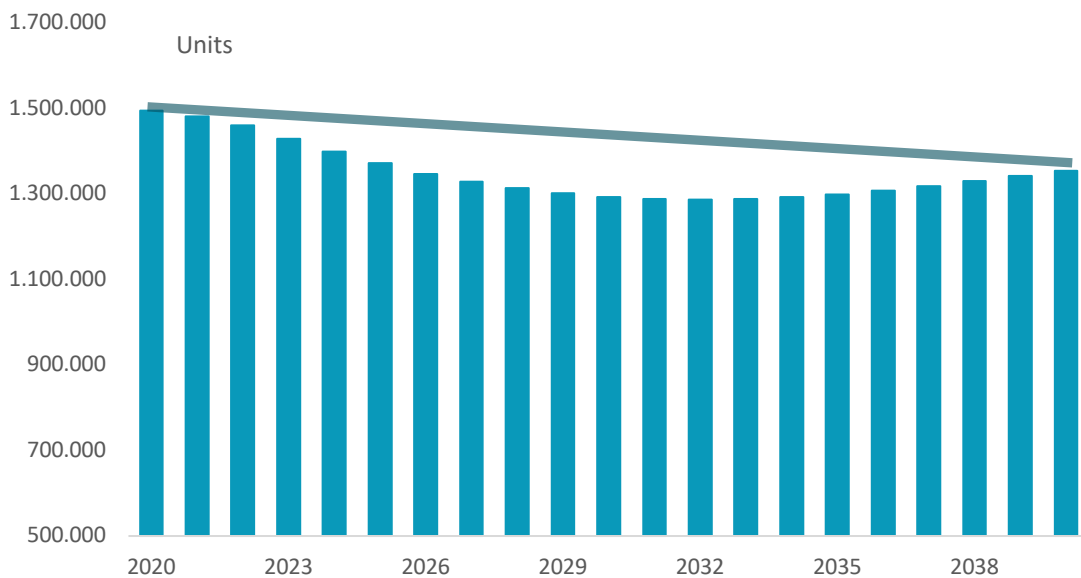


Figure 7: Stock of operating washing machines (units) in Lebanon between 2020 and 2040 (Source: HEAT Analysis).

Sales of washing machines fluctuate from a low of 64 thousand units in 2020, to a high of 100 thousand units in 2031. Again, part of this pattern is a result of the population statistics and the nature of stock and flow models in which the washing machines that entered the stock during 2013-2017 are being retired from the market in 2030 requiring replacement. A general trend of increase is observed (Figure 8), however, pointing towards increasing energy demand and the need to ensure more efficient operation into the future.

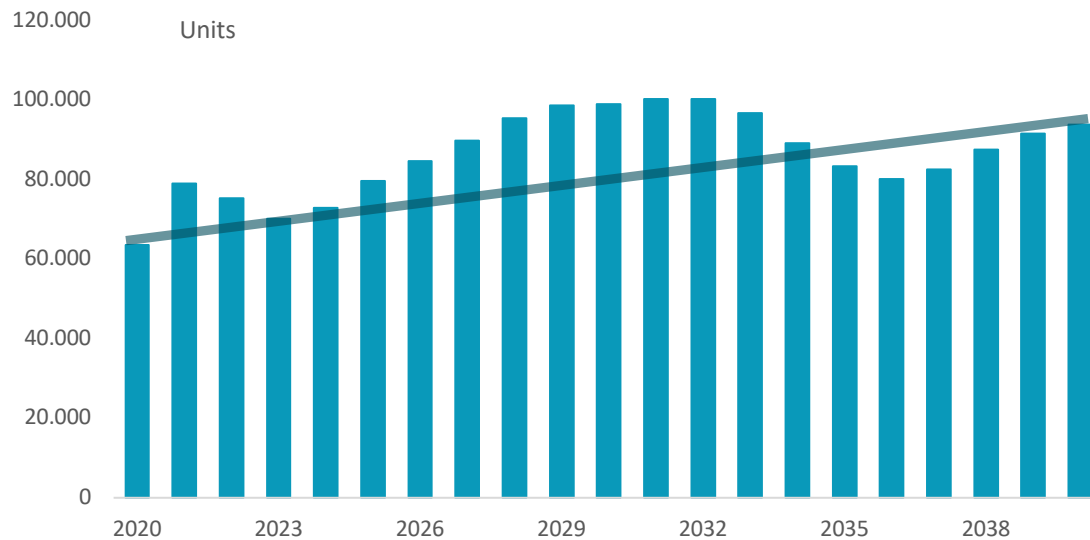


Figure 8: Annual sales of washing machines (units) in Lebanon between 2020 and 2040. (Source: HEAT Analysis).

It is expected that the sales trends will further stabilize should the projection look further into the future as the population growth trends stabilize.

2.2 Overview and projections of energy demand and GHG emissions

Assessment of the energy demand of televisions and washing machines required assumptions of level of energy demand per appliance. For this, we used the EU Ecodesign methodology to determine the annual energy demand for mid-point of each energy efficiency bracket of the labelling mechanism and apply an estimation of the proportion of the market that falls within each bracket. The estimation of the market that falls within each bracket is an extrapolation of the data that was collected tempered by the consultants' experience in similar projects that includes the following factors:

- In countries without a MEPS programme, there tends to be a high proportion of poor performing appliances that would not meet a mild MEPS, let alone a strong one.
- For the appliances that did have energy efficiency information from other jurisdictions, there tends to be a bias to only place information on appliances that would benefit from it (i.e., only higher performing appliances).
- In the absence of data, the assumptions are rounded to the nearest 10% for the beginning year of the estimation (2020).

After the initial market allocation to the different brackets of energy efficiency was completed, assumptions of progress were made under a Business-as-Usual (BAU) scenario that no actions are taken by the relevant authorities in Lebanon to improve energy efficiency. This key factor influencing the assumptions of progress included:

- Energy efficiency will improve overtime due to influence on global production from existing MEPS and labels in large markets such as the EU, US, Japan, and Korea.

- The progress however will be very slow, as countries with no MEPS tend to be targeted by industry to dump appliances that can't be sold in other jurisdictions due to MEPS or other regulatory requirements.

Another factor impacting the energy demand of appliances is their change in size. While washing machines are assumed to constant during the period, televisions are currently increasing in size responding the availability (and affordability) of larger screens in recent years. Based on the average size of survey models (51 inches in 2022) the model assumes a size change from 50 inches in 2020 to 60 inches in 2040.

In terms of emissions, the model uses a constant factor of 650 grCO_{2eq}/kWh for Lebanon as quoted by the Institute for Global Environmental Strategies (IGES)¹⁰, the recognized source of factors for CDM projects. This factor remains constant through the period. It is acknowledged that while Lebanon is looking to strengthening its electricity system including the implementation of renewable energy, it is not known when the impacts will be reflected on the emissions patterns.

2.2.1 Televisions BAU energy demand and emissions

Under the BAU assumption indicated above, total energy demand for televisions in 2020 was estimated at 309 GWh for the entire operating stock (Figure 9). This results from an average consumption per unit of 88 kWh per year. By end of the period, total energy demand from televisions decreases by 8% by 2040 largely due to the decrease in population towards 2030 and the slow improvement in energy efficiency over the period. It is important to note that a while an overall decreased in observed in the period, the lowest demand is observed in 2031 at 265GWh (a 14% decrease from 2020) and increases consistently to 283 GWh by 2040 (a 7% increase from 2031). To prevent this growth from 2031, it is essential to implement MEPS soon.

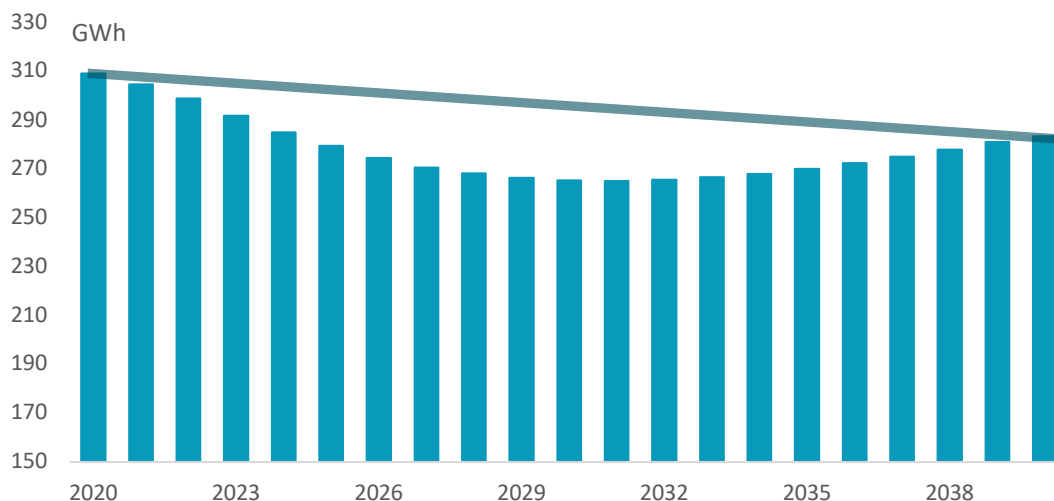


Figure 9: Energy demand from televisions (GWh) in Lebanon between 2020 and 2040. (Source: HEAT Analysis).

The average energy demand per unit decreases by 7% to under 82 kWh per year largely caused by the fact that many televisions in the Lebanese market come from countries that have active MEPS policies in place.

In terms of emissions, total emissions from TVs are estimated at 0.201 MtCO_{2eq} in 2020 and they follow the energy consumption pattern described above, decreasing by 8% over the period. As the grid emission factor used remains constant through the modelling period, emissions from TVs are also lowest in 2031 and

¹⁰ <https://www.iges.or.jp/en/pub/list-grid-emission-factor/en>

increase consistently until the end of the period. Aside from increases in energy efficiency in these appliances, an increase in the deployment of renewable energy in the electricity would support a much greater reduction in emissions. This would cause the savings from energy efficiency gains of TVs to be smaller in absolute terms, but it would also cause the over electricity consumption of electricity by TVs to be less GHG intensive and therefore reduce overall emissions.

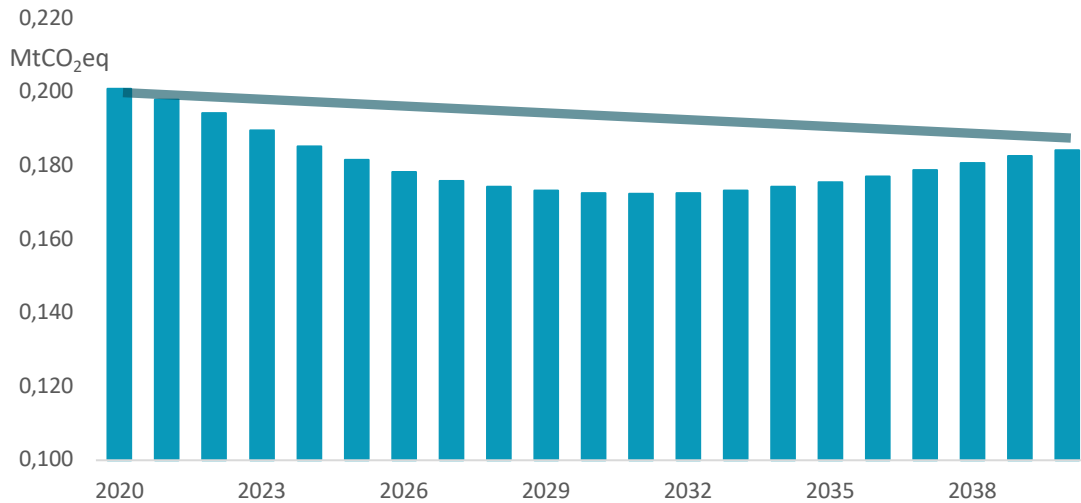


Figure 10: Emissions from television use (MtCO₂eq) in Lebanon between 2020 and 2040 (Source: HEAT Analysis).

2.2.2 Washing machines BAU energy demand and emissions

Energy demand for washing machines is estimated at 276 GWh for 2020 from the nearly 1.5 million units in the market. Following the overall of decrease of units in the market, energy demand reduces by 26% to 204 GWh following the 9.5% reduction of the operating stock and the modest energy efficiency improvement observed due international MEPS policies affecting the global supply of washing machines (Figure 11). As observed with televisions, the reduction momentum is lost towards the end of the modelling period and the annual increase in operating stock overrides any efficiency gains observed and begins to increase again. It is also worth noting that some of the reductions in the early years of the projection are due in part to the retirement of old highly inefficient models.

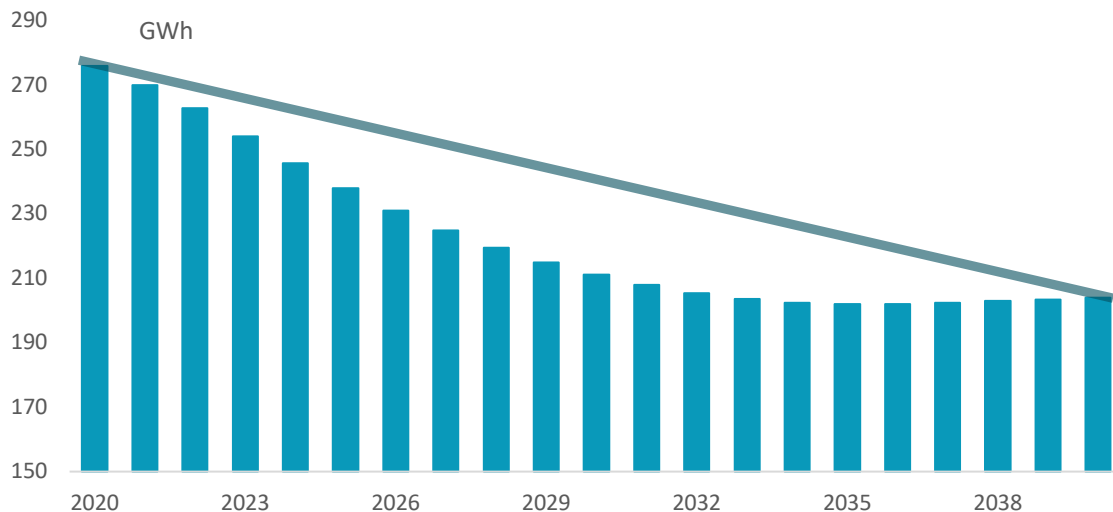


Figure 11: Energy demand from televisions (GWh) in Lebanon between 2020 and 2040. (Source: HEAT Analysis).

The emissions path for washing machines mirrors the energy demand path starting with 0.179 MtCO_{2eq} in 2020 and decreases to with 0.133 MtCO_{2eq}, a 26% decrease largely achieved in the early years of the modelling period due to the population decrease and modest efficiency gains. During the latter years of the period the increasing annual stock overrides any efficiency gains causing an increase in demand and emissions this is likely to accelerate if the projections we extended.

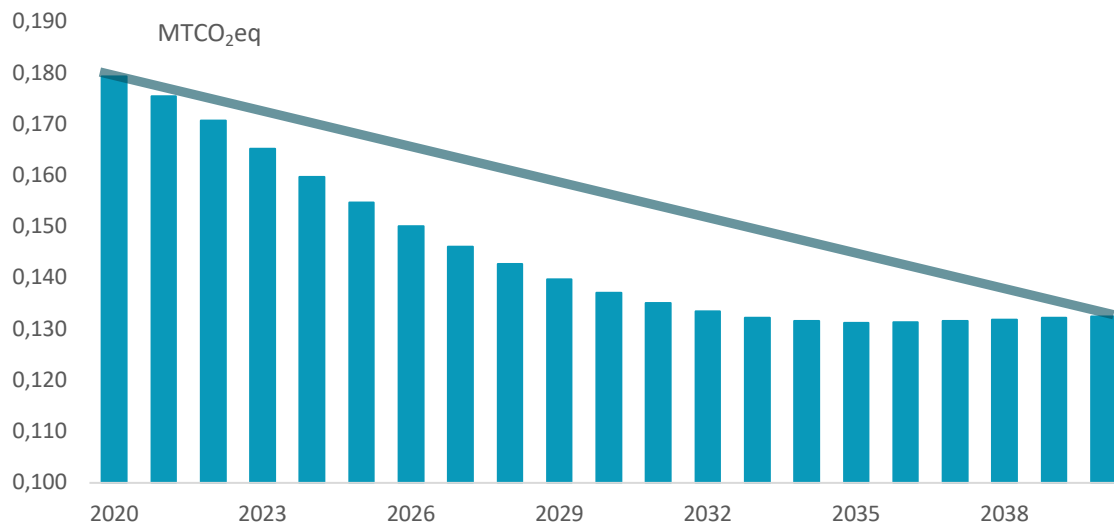


Figure 12: Emissions from washing machine use (MtCO_{2eq}) in Lebanon between 2020 and 2040 (Source: HEAT Analysis).

2.2.3 Emissions mitigation scenario

To showcase the ability of a properly implemented MEPS and Labels programme, this section presents the results of a scenario modelled simulating the effective implementation of modest ambition. The implementation would achieve results in the following ways:

- The MEPS stops the sale of the worst performing appliances available in the market. This is of special significance, and the Lebanese market could not be targeted to dump substandard appliances causing damage to the electricity system.
- At the same time, the Labels enable better informed choices by consumers drawing attention to higher performing appliances.
- The labels also make the top performing appliances more attractive in the market.

These effects are called push/pull policy tools that look to make gains at both ends of the market performance. An increased focus on renewable energy would further improve the results of energy efficiency policy by reducing the grid emissions factor applied to energy demand.

The MEPS assumptions for this implementation in the televisions market results in a reduction of GHG emissions of over 39,000 tCO_{2eq} by 2040 compared to 2020, that is a reduction of 19%. Compared to BAU, the reduction is 22,300 tCO_{2eq} or over 12% (Figure 13). The reduction on the average demand per unit is 15% by 2040. It is to note that greater savings are possible if the MEPS are implemented aggressively and earlier, even if the actual MEPS levels are not raised compared to this scenario. In terms of a contributing to meeting the Lebanon NDC,

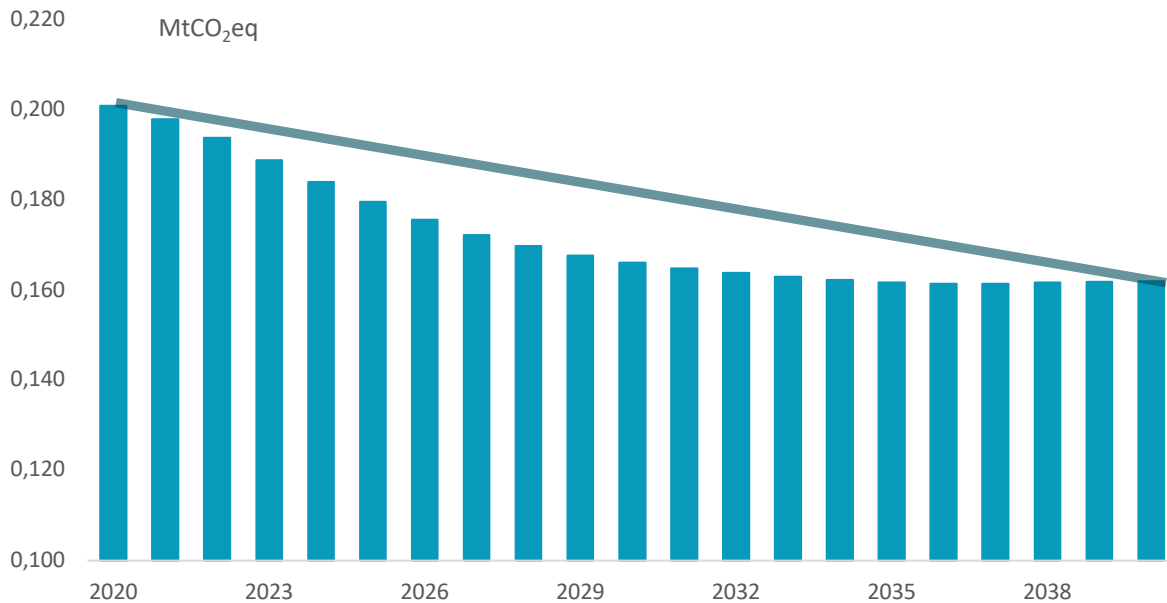


Figure 13: Emissions from TVs use (MtCO₂eq) in Lebanon between 2020 and 2040: MIT Scenario (Source: HEAT Analysis).

For washing machines, the MIT Scenario generates an additional energy saving of 30 GWh compared to BAU or a 41% increase in the energy demand reduced. In terms of emissions, the MIT Scenarios results an additional 20,000 tCO₂eq of savings (Figure 14).

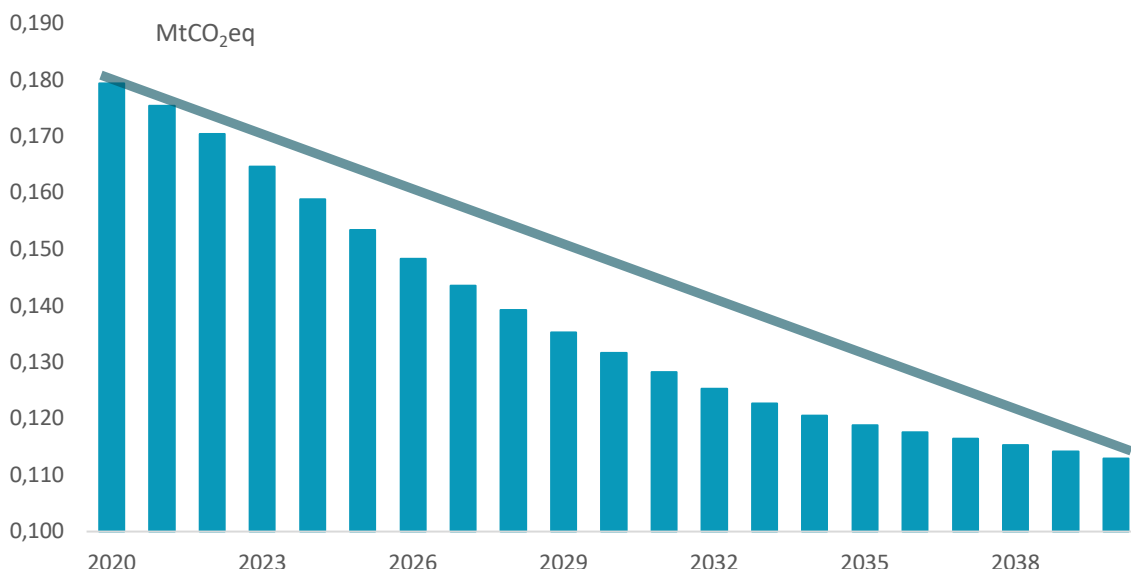


Figure 14: Emissions from washing machines (MtCO₂eq) in Lebanon between 2020 and 2040: MIT Scenario (Source: HEAT Analysis).

3 LEBANON'S ELECTRICITY SYSTEM AND THE PROPOSED MEPS

The Lebanese electricity sector has been facing many challenges since the 1970s, with year 2018 recording a deficit of more than 30% in EDL's (Electricité du Liban) power supply network. EDL is the national power utility monopolizing the electricity sector. It is an autonomous state-owned company under the control of the Ministry of Energy and Water (MEW), that officially controls over 90% of the Lebanese electricity sector, leaving 10% to hydroelectric power plants owned by other public companies and concessions.

In 2018, EDL's installed capacity was 2,449 MW, meeting 66% of the country's increasing demand that was reported to be 3,669 MW that year. As demand for power increases, the gap between demand and EDL's limited supply capacity further widens.

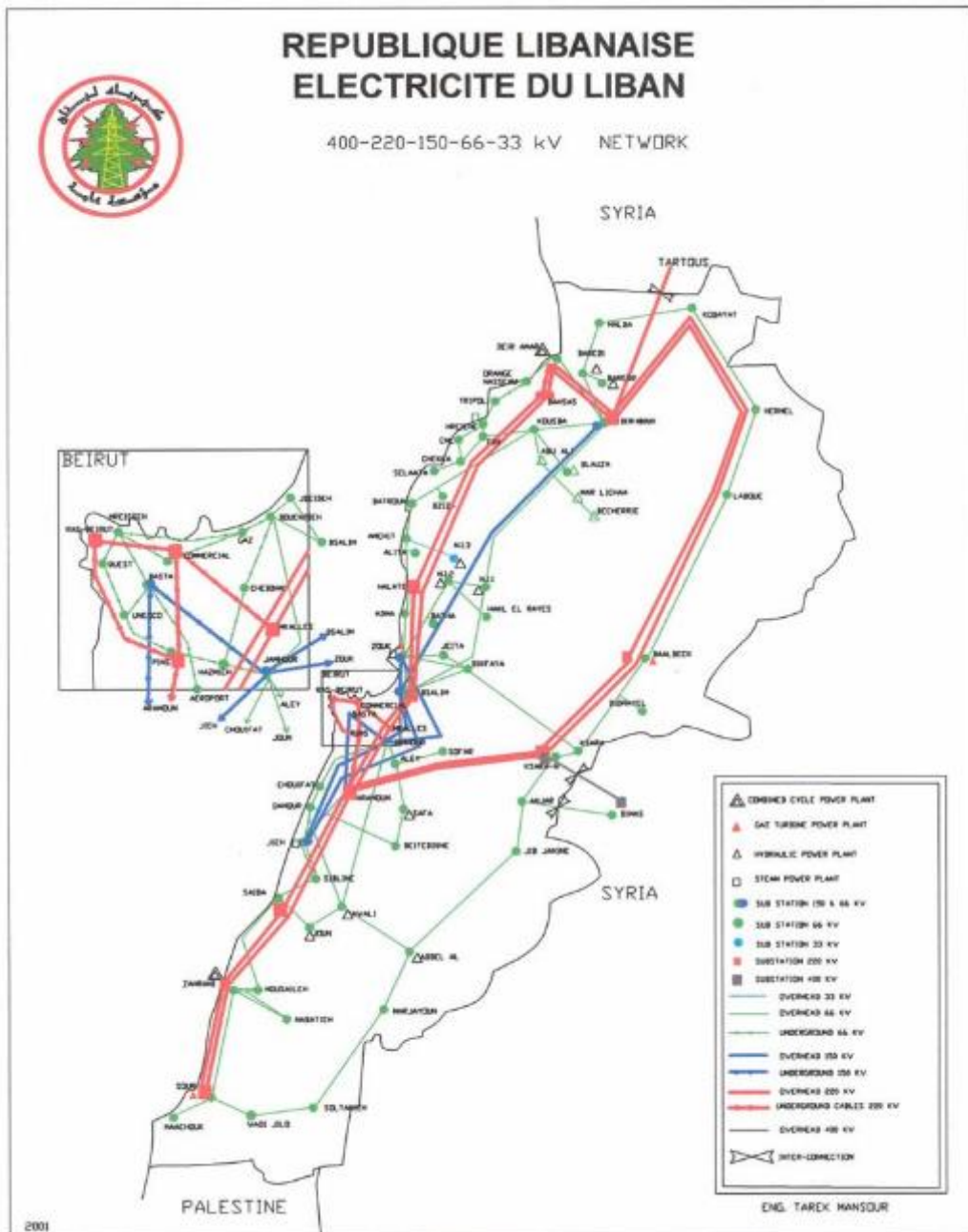


Figure 15: The high voltage electricity network in Lebanon¹¹

The electrical grid in Lebanon is distributed to consumer at 230 V, 50Hz alternating current. The EDL transmission network is part of regional network first established in 1988, that includes the older 66-kV grid and some 150-kV transmission lines in certain areas. The newer 220-kV transmission line spreads over the coastal areas and expands to the inner areas of Bekaa. The network currently suffers from transmission

¹¹ http://www.geni.org/globalenergy/library/national_energy_grid/lebanon/lebanesenationalelectricitygrid.shtml

losses of 5.7%¹². EDL is responsible for the transmission network and its transmission directorate is mandated to operate and maintain the transmission grid including substations.

In 2017, a transmission Master Plan was developed and approved to update the existing network, add new transmission lines, eliminate the 150 kV lines, expand the 220 kV lines, and cater for the expected injection of renewable energy power plants, yet this plan is still on hold to date.

The country relies heavily on fossil fuels, with more than 95% of electricity coming from heavy fuel oil and diesel production plants. In recent years, EDL has relied on imports from Syria and offshore privately-owned electricity barges to meet the demand it is unable to meet due to its limited aging plant. The observed capacities of the Syrian imports and electricity barges are 69 MW and 390 MW respectively. Yet, it remained incapable of providing 24/7 electricity, making room for privately-owned distributed generators to bridge the gap.

Indirect emissions are generated by the electrical generation plants, where electricity is produced to be used for the in-scope sectors, considering the annual electricity consumption and Lebanon's grid emission factor (GEF).

The grid emission factor (GEF) is a measure of the CO₂ emission intensity per unit of generated electricity in the total grid system. In the present study the GEF of 0.695¹³ has been used (it's a combined grid/generators emission factor). As there are no future predictions of a potential GEF which can be implemented in the model, the data presented in this report uses the same GEF for the BAU and the MIT scenario.

3.1 The rationale for EE regulations for the in-scope sectors

As a member party to the Paris Agreement, Lebanon has committed itself to attain climate targets, i.e., net GHG neutrality latest by 2050. This goal can be supported through the implementation and strengthening of sectoral goals such as the reduction of energy demand from appliance usage. The 2030 (National Determined Contribution) NDC's unconditional target for Energy Efficiency (EE) is currently a 3% reduction in electricity demand through the implementation of energy efficiency measures such as MEPS compared to the Business as Usual (BAU) scenario (this target increases to 10% with international support)).

Further, an effective implementation of MEPS can help to unlock economies of scale for products that save energy, reduce end-users' energy costs, reduce air pollution, and cut GHG emissions from power generation.

With this in mind and added to the stated difficulties faced by the electricity system in Lebanon, the implementation of MEPS becomes an increasingly important tool, and is less of an optional policy and more of a necessity to support improvement in different sectors.

3.2 The process for setting up safety and performance standards in Lebanon for energy consuming and energy related equipment.

The process for the development of standards in Lebanon related to testing and measuring the efficiency of energy use and the safety of equipment is illustrated in Figure 16. Some of the key preconditions for the realization of MEPS are the adoption of the most current international standards on safety, quality,

¹² https://energyandwater.gov.lb/mediafiles/articles/doc-100778-2022_03_31_10_22_46.pdf

¹³ <https://pub.iges.or.jp/pub/list-grid-emission-factor> here applied as average operating margin emission factor.

performance etc. Some of the relevant international standards for televisions are the IEC 62368-1 and IEC IEC62087 series and the international standards relevant for washing machines are the IEC 62512 series.

After defining the most relevant references, the second step is the formation of a technical committee for the development of the related standards. Libnor has already a Technical Committee which includes different members from public and private sectors.

The committee through its continuous meetings can develop safety standards and performance standards for the needed equipment in a consensus-based approach.

When the standards are approved by the committee members, a two months' trial period is set before publishing the standard in the national gazette.

Following the approval of LIBNOR's board of directors, these standards can become mandatory through decrees issued by the Council of Ministers (COM).

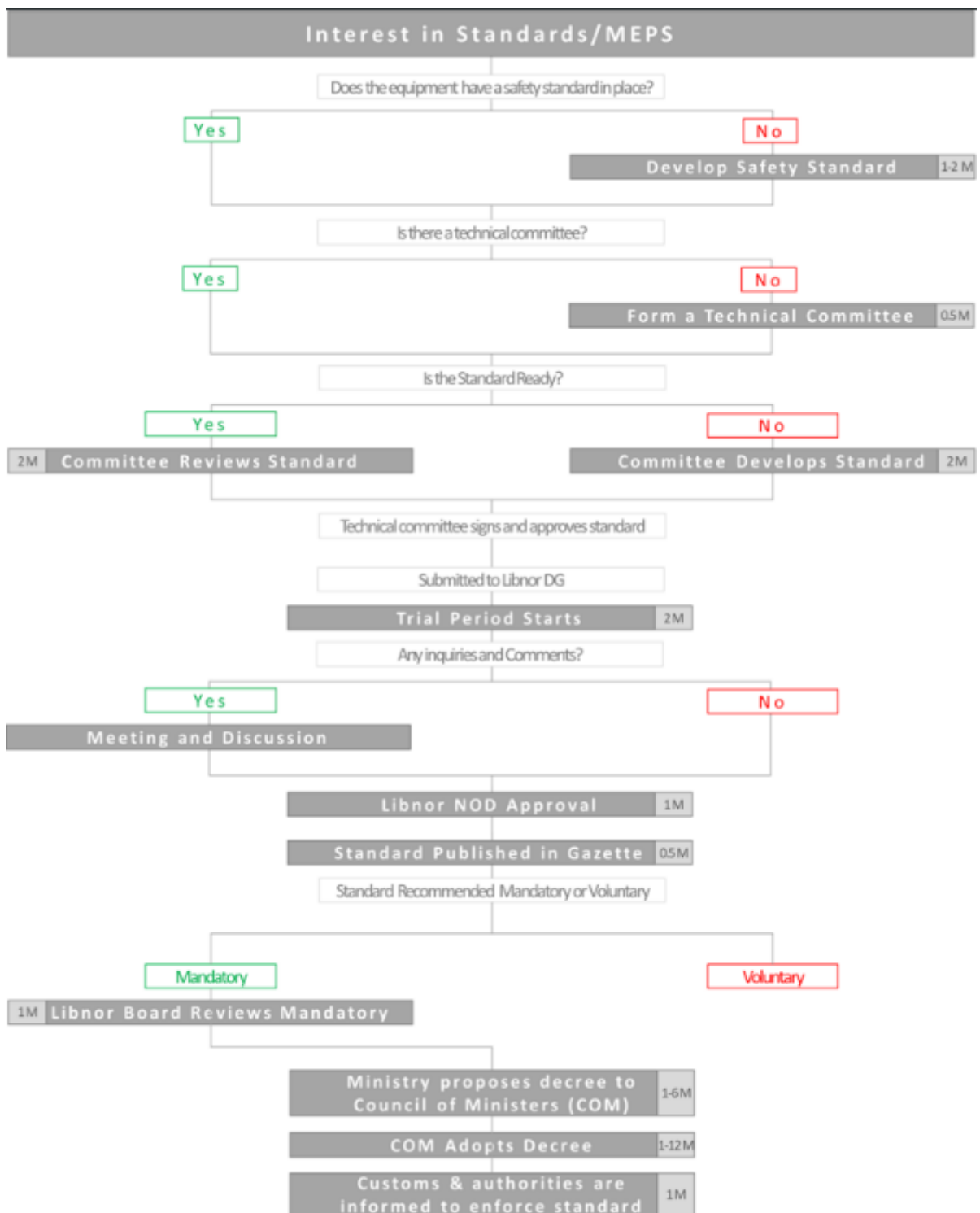


Figure 16: Process showing the adoption of MEPS and labels in Lebanon (Source: LIBNOR).

Figure 17 and Figure 18 show the process for the adoptions of international and non-international standards in Lebanon.

National Implementation of International Standards

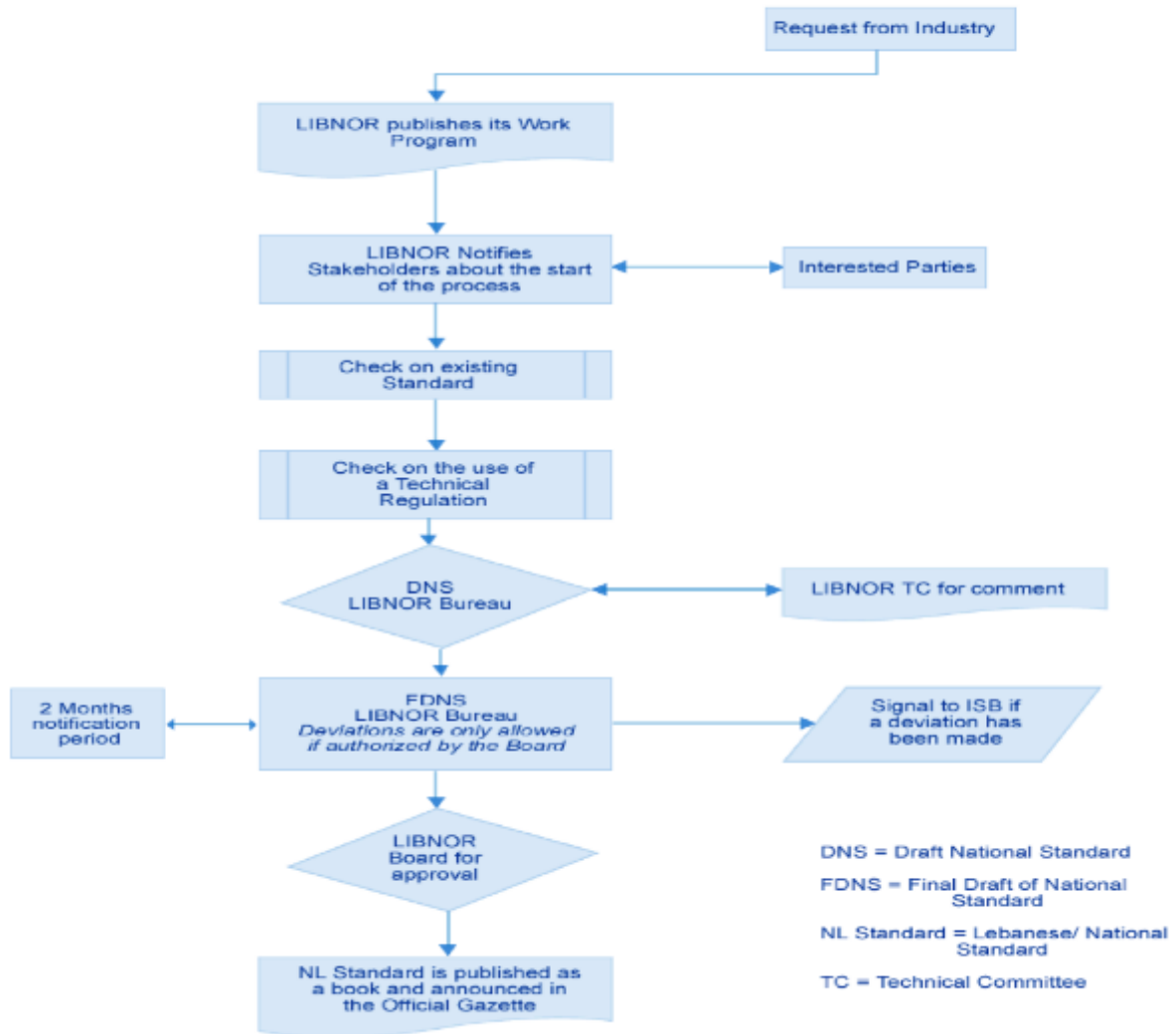


Figure 17: Process showing the adoption of international standards (Source: LIBNOR).

Elaboration of Lebanese Standards not based on International Standards

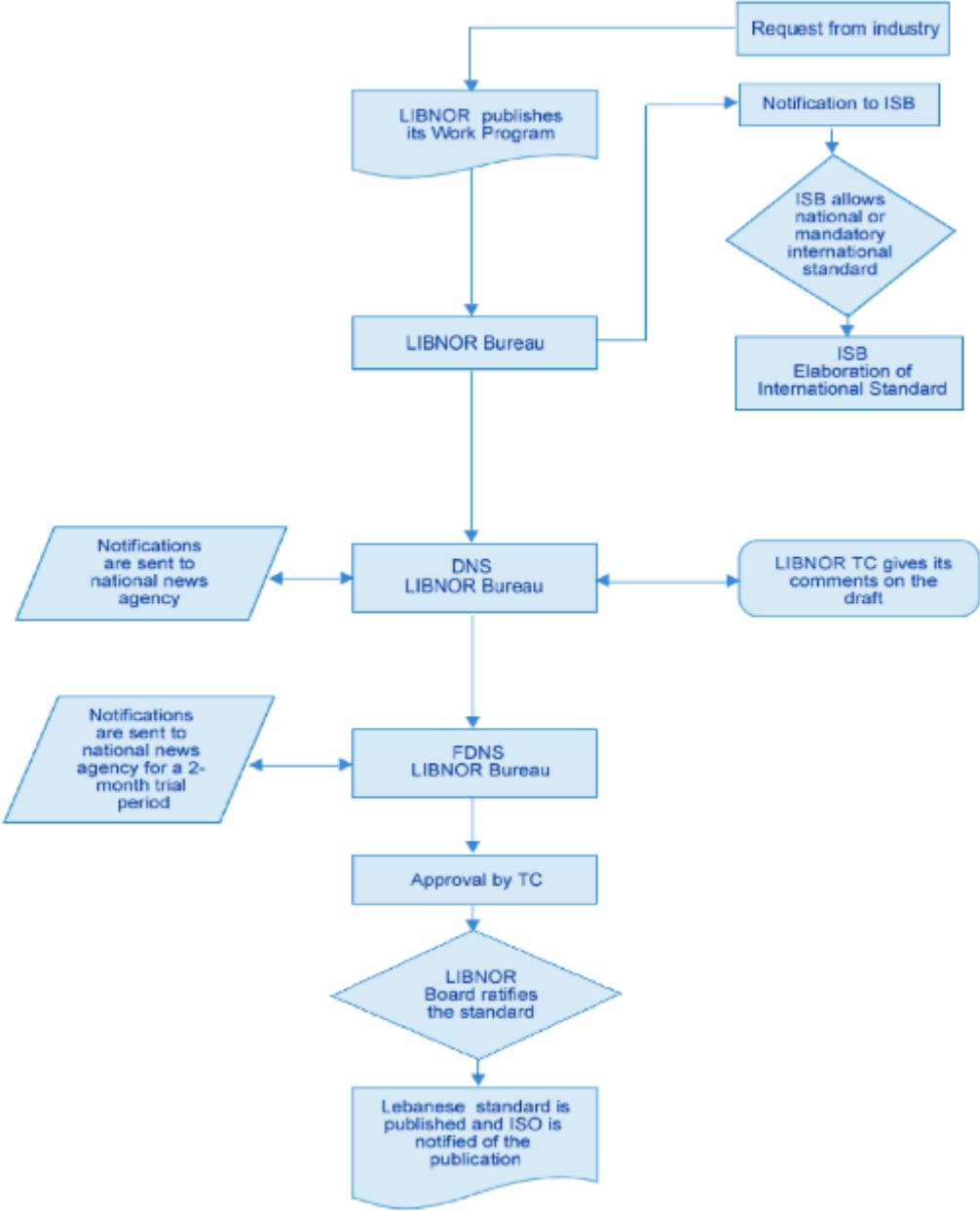


Figure 18: Process showing the adoption of national standards (Source: Libnor).

3.3 Proposed MEPS for the sectors

3.3.1 Televisions

The proposed regulatory framework for Minimum Energy Performance (Ecodesign) and Energy Labelling Requirements for Televisions (TVs), as part of Electronic Displays, in Lebanon is inspired by the relevant European regulatory framework.

Considering that all TVs in Lebanon are imported (most of them are from EU Member States or other countries implementing regulatory framework like the EU regulatory framework), and to avoid unwanted technical barriers to trade (TBT), it is proposed to adopt a framework spousing the same principles to set minimum and/or maximum limits and intervals of Energy Efficiency classes.

The proposed regulatory framework will allow suppliers (manufacturers, importers, or authorized representatives) to place on the Lebanese market or put into service only TVs that have an Energy Efficiency Index (EEI) for on-mode of less than 0.90. The EEI is an index number for the relative energy efficiency of a TV. The lower the EEI, the more energy efficient the TV and the less electricity it uses. For more details on how the EEI is calculated, see section 4.3.1 (Energy efficiency metrics for TVs).

Table 9: Summary of TV units annual electricity consumption at each level of Energy Labelling. (Source: HEAT Analysis).

Screen size (inches):			32	42	50	55	65	75
Energy class	EEI range	EEI Average	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year	kWh/year
A	< 0.30	0.25	19	27	34	39	51	63
B	0.30-0.40	0.35	24	35	46	53	69	86
C	0.40-0.50	0.45	30	44	58	67	88	109
D	0.50-0.60	0.55	36	53	70	81	106	132
E	0.60-0.75	0.68	43	65	85	100	131	163
F	0.75-0.90	0.82	51	77	102	119	157	195
G	≥ 0.90	0.95	58	88	118	138	181	225

For the enforcement of this framework, the following tiered approach is proposed:

Table 10: overview of individual unit's annual electricity consumption at each level of Energy Labelling for TVs

	MEPS	Energy Labels
TVs	<p>As of January 2nd, 2025:</p> <ul style="list-style-type: none"> the Energy Efficiency Index (EEI) for TVs, as part of Electronic Displays, shall be lower than 0.90. 	<ul style="list-style-type: none"> As of 2nd January 2025, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through E will be allowed to be placed on the market or put into service. As of 2nd January 2026, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through D will be allowed to be placed on the market or put into service. As of 2nd January 2027, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through C will be allowed to be placed on the market or put into service.

3.3.2 Washing Machines and Washer-dryers

The proposed regulatory framework for Minimum Energy Performance (Ecodesign) and Energy Labelling Requirements for Household Washing Machines (WMs) and Household Washer-dryers (WDs) in Lebanon is inspired by the relevant European regulatory framework.

Considering that all WMs and WDs in Lebanon are imported (most of them are from EU Member States or other countries implementing regulatory framework like the EU regulatory framework), and in order to avoid unwanted technical barriers to trade (TBT), it is proposed to adopt A framework spousing the same principles to set minimum and/or maximum limits and intervals of Energy Efficiency classes.

The proposed regulatory framework will allow suppliers (manufacturers, importers, or authorized representatives) to place on the Lebanese market or put into service only products that have an Energy Efficiency Index (EEI_w) for household WMs and the washing cycle of household WDs of less than 91, as well as products that have an Energy Efficiency Index (EEI_{wd}) for the complete cycle (wash and dry) of household WDs of less than 88. The EEI is the ratio of the weighted energy consumption to the standard cycle energy consumption. The lower the EEI, the more energy efficient the WM/WD and the less electricity it uses. For more details on how the EEI is calculated, see section 4.3.2 (Energy efficiency and water metrics for WMs and WDs).

Table 11: Overview of individual unit's annual electricity consumption at each level of the Energy Labelling for household WMs and for the washing cycle of household WDs. (Source HEAT Analysis).

Wash capacity (kilos):				5.5	7	8
Energy class	EEI range	EEI Average	kWh/ year	kWh/ year	kWh/ year	kWh/ year
A	≤ 52	50	86	95	100	
B	52 - 60	56	96	106	112	
C	60 - 69	65	112	123	130	
D	69 - 80	75	129	142	150	
E	80 - 91	85	146	161	170	
F	91 - 102	96	165	182	192	
G	> 102	105	181	199	210	

For the enforcement of this framework, the following tiered approach is proposed:

Table 12: Proposed MEPS implementation timeline for washing machines.

	MEPS	Energy Labels
WMs and WDs	<p>As of 2 January 2025:</p> <ul style="list-style-type: none"> the Energy Efficiency Index (EEI_w) for household WMs and the washing cycle of household WDs shall be lower than 91. the Energy Efficiency Index (EEI_{wd}) for the complete cycle (wash and dry) of household WDs shall be lower than 88. 	<ul style="list-style-type: none"> As of 2 January 2025, only WMs and WDs with Energy Efficiency classes A through E will be allowed to be placed on the market or put into service. As of 2 January 2026, only WMs and WDs with Energy Efficiency classes A through D will be allowed to be placed on the market or put into service. As of 2 January 2027, only WMs and WDs with Energy Efficiency classes A through C will be allowed to be placed on the market or put into service.

Table 9 provides an overview of individual unit's annual electricity consumption at each level of Energy Labelling for household WMs and the washing cycle of household WDs.

4 MEPS AND LABELS

4.1 Overarching MEPS and Labels

For Lebanon, it is proposed that, considering the influence and proximity of the European Market and its impact on the availability of products in Lebanon, that the existing EU Ecodesign policies that implement MEPS and labels for televisions and washing machines be transposed to Lebanon. These policies are one of the most advanced in the world and the Lebanese market is already being influenced by them. As such, this step ensures a strong policy base for implementation and a form of continuity for the market.

The regulatory framework for **Minimum Energy Performance Standards (MEPS)** of appliances in the EU is **Directive 2009/125/EC** establishing a framework for the setting of Ecodesign requirements for energy-related products. The Directive empowers the European Commission to set Ecodesign requirements for specific products through "implementing measures (regulations)". This is supported by regulation **(EU) 2017/1369** which establishes a framework for the setting of **Energy Labelling** requirements for energy-related products and repealing Directive 2010/30/EU. Regulation 2017/1369 has been applied since 1 August 2017 and sets detailed requirements relating to the energy labels for specific product groups.

The legal framework for MEPS and energy labelling for appliances to be proposed should lead to (or accelerate) a market transformation towards more efficient products in Lebanon where:

- A horizontal framework MEPS Regulation¹⁴ and another horizontal framework Energy Labelling Regulation¹⁵ stand as a primary legislation or both horizontal MEPS and Energy Labelling requirements are covered by a single framework regulation (1st tier)
- Separate implementing regulations (rulebooks) for MEPS and Energy Labelling requirements for different appliance groups could be adopted as secondary legislation (2nd tier).
- Televisions and washing machines (and washer dryers) must be subject to both MEPS and energy labelling requirements, while power distribution transformers and electric motors must only be subject to MEPS requirements.

¹⁴ Horizontal framework MEPS regulation lays down the MEPS obligations, provisions and other requirements which are common and applicable to all product groups.

¹⁵ Horizontal framework Energy Labelling regulation lays down the Energy Labelling obligations, provisions and other requirements which are common and applicable to all product groups.

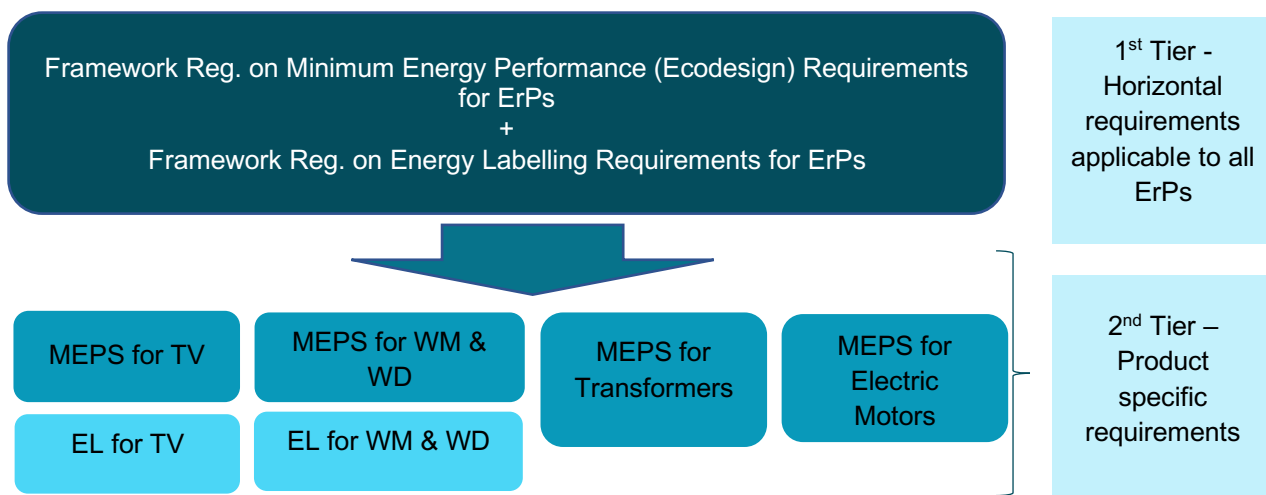


Figure 19: Framework regulation for MEPS and Labels.

For the proposed legal framework for MEPS and Energy Labelling for appliances, the same minimum and/or maximum limits as well as intervals of EE classes of the EU Ecodesign and Energy Labelling legal framework respectively are recommended to be adopted to avoid any unwanted technical barriers to trade considering all TVs, WMs and WDs are imported (most of them are from EU Member States or other countries which implement legislation identical or similar to the EU framework).

The following tiered approach is proposed for the enforcement of the MEPS and Energy Labelling legislation:

Table 13: Proposed phase-in of MEPS and Labels requirements in Lebanon for WM and TVs

	MEPS	Energy Labels
WMs and WDs	<p>As of 2 January 2025:</p> <ul style="list-style-type: none"> the Energy Efficiency Index (EEI_w) for household WMs and the washing cycle of household WDs shall be lower than 91. the Energy Efficiency Index (EEI_{wd}) for the wash and dry cycle of household WDs shall be lower than 88. 	<ul style="list-style-type: none"> As of 2 January 2025, only WMs and WDs with Energy Efficiency classes A through E will be allowed to be placed on the market or put into service. As of 2 January 2026, only WMs and WDs with Energy Efficiency classes A through D will be allowed to be placed on the market or put into service. As of 2 January 2027, only WMs and WDs with Energy Efficiency classes A through C will be allowed to be placed on the market or put into service.
TVs	<p>As of 2 January 2025:</p> <p>the Energy Efficiency Index (EEI) for TVs, as part of Electronic Displays, shall be lower than 0.90.</p>	<ul style="list-style-type: none"> As of 2 January 2025, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through E will be allowed to be placed on the market or put into service. As of 2 January 2026, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through D will be allowed to be placed on the market or put into service.

		<ul style="list-style-type: none"> • As of 2 January 2027, only TVs, as part of Electronic Displays, with Energy Efficiency classes A through C will be allowed to be placed on the market or put into service.
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As the legal framework aligns closer to the EU system, this provides higher benefit for the Lebanese consumers as they will have access to better products on the market and help the Lebanese government enforce a clear and consistent legal framework that aligns closely with one of the biggest trading partners and supporting an efficient enforcement environment.

The competent authority should continuously study and analyse the requirements in the exporting countries, especially EU countries, and adopt what it deems useful and commensurate with the objectives of the policy.

4.2 Analysis of future MEPS and label levels per sector

4.2.1 Televisions

The market survey showed that about 61% of the televisions offered for sale in the Lebanese market are not energy labelled, about 33% are energy labelled according to the EU Ecodesign and Energy Labelling legislation, and about 6% are energy labelled according to other international standards.

Under the EU old Ecodesign and Energy Labelling system, the lowest Energy Efficiency (EE) class observed on the Lebanese market is C (about 7%), and most of the televisions are at the top of the EE class scale and have an A (about 34%) and A+ (39%) EE class. Under the new Ecodesign and Energy Labelling system, most of the televisions are at the bottom of the scale in class G (about 65%) and the highest EE class observed is A (about 11%).

As described in section 2.2., a minimum ambition scenario would be to progress the market to adopt energy efficiency class A to E televisions by 2 January 2025, a medium ambition scenario would be to transform the market to adopt energy efficiency class A to D televisions by 2 January 2026, and a maximum ambition scenario would be to transform the market to adopt energy efficiency class A to C televisions by 2 January 2027.

Figure 20 shows the average energy demand reduction per unit in the scenario shown in section 2.1, an average reduction of 21% per unit by 2040 under the mitigation scenario. Under the maximum ambition scenario indicated above, the potential savings increase significantly.

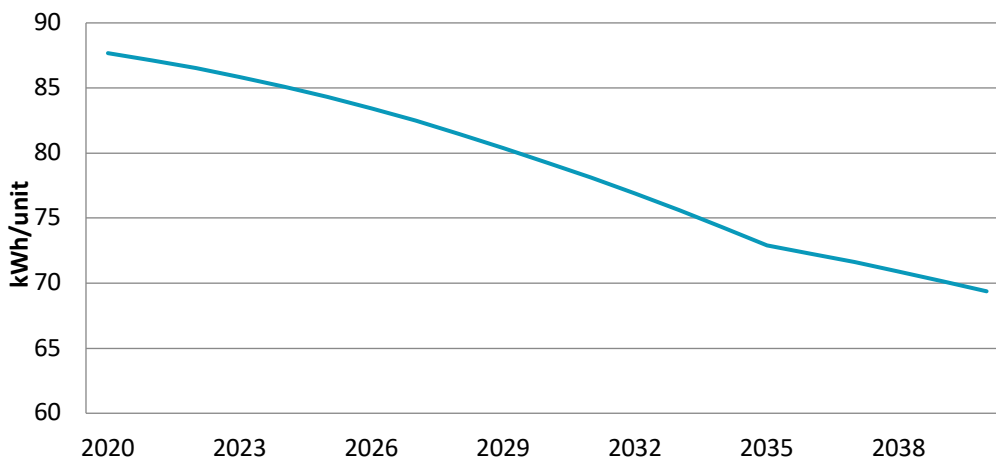


Figure 20: Average energy consumption of TV units over time.

4.2.2 Household washing machines and household washer-dryers:

The market survey showed that more than 70% of the household washing machines and household washer-dryers offered for sale are energy labelled according to the EU Ecodesign and Energy Labelling legislation.

Under the EU old Ecodesign and Energy Labelling system, the lowest Energy Efficiency (EE) class observed on the Lebanese market is B (about 2%), and most of the products are at the top of the EE class scale and have an A+++ EE class (68%). Under the EU new Ecodesign and Energy Labelling system, the lowest EE class observed is E (about 15%), and most of the products are at the top of the EE class scale and have an A EE class (59%).

As described in section 2.2, a minimum ambition scenario would be to progress the market to adopt energy efficiency class A to E products by 2 January 2025, a medium ambition scenario would be to transform the market to adopt energy efficiency class A to D products by 2 January 2026, and a maximum ambition scenario would be to transform the market to adopt energy efficiency class A to C products by 2 January 2027.

Figure 21 shows the average energy demand reduction per unit in the scenario shown in section 2.1, an average reduction of 37 % per unit by 2040 under the mitigation scenario. Under the maximum ambition scenario indicated above, the potential savings increase significantly.

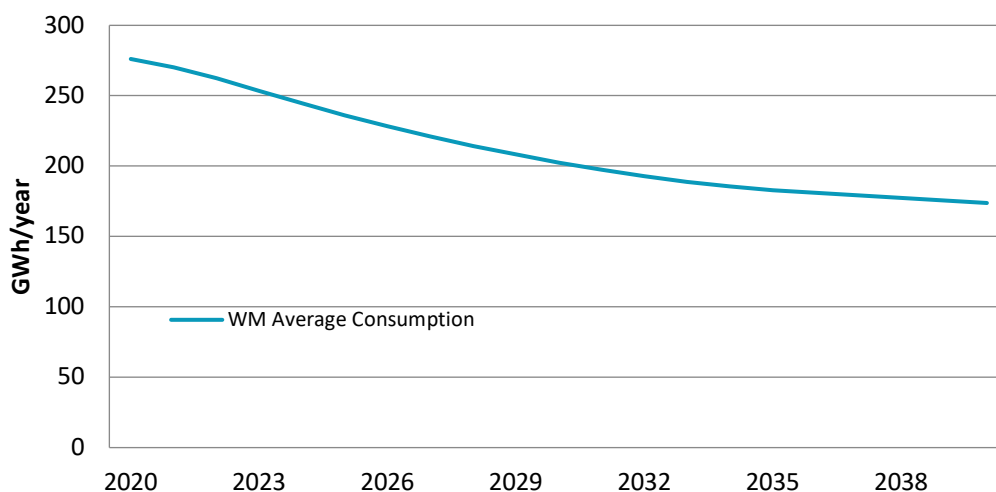


Figure 21: Average energy consumption of WM units over time.

EDL has recently developed new electricity pricing that would encourage and incentivize energy efficiency for residential sector as follows:

- Bracket 1: 0-100 kWh: 0.1 USD/kWh
- Bracket 1: >100 kWh: 0.27 USD/kWh

This increase in electricity price will also greatly encourage households to adopt higher energy efficiency televisions and washing machines & washer-dryers and ensure acceptable payback.

4.3 Metrics

As mentioned above, MEPS and Energy Labels for the in-scope equipment are based on international standards. The following parts of this chapter provide a preview on the MEPS and Energy Labelling development and the applicable metrics.

4.3.1 Energy efficiency metrics for TVs

The energy efficiency class of televisions shall be determined on the basis of its Energy Efficiency Index for labelling (EEI_{label}) as set out in Table 14.

Table 14: Proposed energy efficiency classes for televisions in Lebanon.

Energy Efficiency Class	Energy Efficiency Index (EEI_{label})
A	$EEI_{label} < 0.30$
B	$0.30 \leq EEI_{label} < 0.40$
C	$0.40 \leq EEI_{label} < 0.50$
D	$0.50 \leq EEI_{label} < 0.60$
E	$0.60 \leq EEI_{label} < 0.75$
F	$0.75 \leq EEI_{label} < 0.90$
G	$0.90 \leq EEI_{label}$

The EEI_{label} of a television shall be calculated using the following equation:

$$EEI_{label} = \frac{(P_{measured} + 1)}{(3 \times [90 \times \tanh(0.025 + 0.0035 \times (A - 11)) + 4] + 3)}$$

where:

A represents the viewing surface area in dm^2 .

$P_{measured}$ is the measured power in on mode in Watts in the normal configuration and set as indicated in Table 15.

Table 15: Measurement of $P_{measured}$

Dynamic Range level	$P_{measured}$
Standard Dynamic Range (SDR): $P_{measured}_{SDR}$	Power demand in Watts (W) in on-mode, measured when displaying standardised test sequences of moving picture from dynamic broadcast content. Where allowances are applicable according to the below (*), they should be deducted from $P_{measured}$.
High Dynamic Range (HDR): $P_{measured}_{HDR}$	Power demand in Watts (W) in on mode, measured as for $P_{measured}_{SDR}$ but with the HDR functionality

activated by metadata in the standardised HDR test sequences. Where allowances are applicable according to the below ^(*), they should be deducted from $P_{measured}$.

^(*): Televisions with automatic brightness control (ABC) shall qualify for a 10 % reduction in $P_{measured}$ if they meet all of the following requirements:

- ABC is enabled in the normal configuration of the television and persists in any other standard dynamic range configuration available to the end user.
- The value of $P_{measured}$, in the normal configuration, is measured, with ABC disabled or if ABC cannot be disabled, in an ambient light condition of 100 lux measured at the ABC sensor.
- If applicable, the value of $P_{measured}$ with ABC disabled shall be equal to or greater than the on-mode power measured with ABC enabled in an ambient light condition of 100 lux measured at the ABC sensor.
- With ABC enabled, the measured value of the on-mode power must decrease by 20 % or more when the ambient light condition, measured at the ABC sensor, is reduced from 100 lux to 12 lux.
- The ABC control of the display screen luminance meets all of the following characteristics when the ambient light condition measured at the ABC sensor changes:
 - The measured screen luminance at 60 lux is between 65 % and 95 % of the screen luminance measured at 100 lux.
 - The measured screen luminance at 35 lux is between 50 % and 80 % of the screen luminance measured at 100 lux.
 - The measured screen luminance at 12 lux is between 35 % and 70 % of the screen luminance measured at 100 lux.

4.3.2 Energy efficiency and water metrics for WMs and WDs

Energy efficiency metrics:

The energy efficiency class of a household washing machine and of the washing cycle of a household washer-dryer shall be determined on the basis of its Energy Efficiency Index (EEl_w) as set out in Table 16.

Table 16: Proposed energy efficiency classes for washing machines and the washing cycle of washer-dryers.

Energy Efficiency Class	Energy Efficiency Index (EEl_w)
A	$EEl_w \leq 52$
B	$52 < EEl_w \leq 60$
C	$60 < EEl_w \leq 69$
D	$69 < EEl_w \leq 80$
E	$80 < EEl_w \leq 91$
F	$91 < EEl_w \leq 102$
G	$EEl_w > 102$

The EEl_w of a household washing machine and of the washing cycle of a household washer-dryer shall be calculated using the following equation and is rounded to one decimal place:

$$EEl_w = (E_w / SCE_w) \times 100$$

where:

E_w is the weighted energy consumption of the household washing machine or the washing cycle of the household washer-dryer.

SCE_w is the standard cycle energy consumption of the household washing machine or the washing cycle of the household washer-dryer.

The SCE_w is calculated in kWh per cycle and rounded to three decimal places as follows:

$$SCE_w = -0.0025 \times c^2 + 0.0846 \times c + 0.3920$$

Where c is the rated capacity of the household washing machine or the rated washing capacity of the household washer-dryer for the eco 40-60 programme.

The E_w is calculated in kWh per cycle as follows and rounded to three decimal places:

$$E_w = A \times E_{w,full} + B \times E_{w,1/2} + C \times E_{w,1/4}$$

where:

$E_{w,full}$ is the energy consumption of the household washing machine or of the washing cycle of the household washer-dryer for the eco 40-60 programme at the rated washing capacity and rounded to three decimal places.

$E_{w,1/2}$ is the energy consumption of the household washing machine or of the washing cycle of the household washer-dryer for the eco 40-60 programme at half of the rated washing capacity and rounded to three decimal places.

$E_{w,1/4}$ is the energy consumption of the household washing machine or of the washing cycle of the household washer-dryer for the eco 40-60 programme at a quarter of the rated washing capacity and rounded to three decimal places.

A is the weighting factor for rated washing capacity and rounded to three decimal places.

B is the weighting factor for half of the rated washing capacity and rounded to three decimal places.

C is the weighting factor for a quarter of the rated washing capacity and rounded to three decimal places.

For household washing machines with a rated capacity lower than or equal to 3 kg and for household washer-dryers with a rated washing capacity lower than or equal to 3 kg, A shall be equal to 1; B and C shall be equal to 0.

For other household washing machines and household washer-dryers, the values of the weighting factors depend on the rated capacity according to the following equations:

$$A = -0.0391 \times c + 0.6918$$

$$B = -0.0109 \times c + 0.3582$$

$$C = 1 - (A + B)$$

Where c is the rated capacity of the household washing machine or the rated washing capacity of the household washer dryer.

The weighted energy consumption per 100 cycles of the household washing machine or of the washing cycle of the household washer-dryer is calculated as follows and rounded to the nearest integer:

$$E_w \times 100$$

The energy efficiency class of the complete cycle of a household washer-dryer shall be determined on the basis of its Energy Efficiency Index ($E_{EI_{WD}}$) as set out in Table 17.

Table 17: Energy efficiency classes of the complete cycle of a household washer-dryer

Energy Efficiency Class	Energy Efficiency Index ($E_{EI_{WD}}$)
A	$E_{EI_{WD}} \leq 37$
B	$37 < E_{EI_{WD}} \leq 45$
C	$45 < E_{EI_{WD}} \leq 55$
D	$55 < E_{EI_{WD}} \leq 67$
E	$67 < E_{EI_{WD}} \leq 82$
F	$82 < E_{EI_{WD}} \leq 100$
G	$E_{EI_{WD}} > 100$

The $E_{EI_{WD}}$ of the complete cycle of a household washer-dryer shall be calculated using the following equation and is rounded to one decimal place:

$$E_{EI_{WD}} = (E_{WD}/SCE_{WD}) \times 100$$

where:

E_{WD} is the weighted energy consumption of the complete cycle of the household washer-dryer.

SCE_{WD} is the standard cycle energy consumption of the complete cycle of the household washer-dryer.

The SCE_{WD} is calculated in kWh per cycle and rounded to three decimal places as follows:

$$SCE_{WD} = -0.0502 \times d^2 + 1.1742 \times d - 0.644$$

where d is the rated capacity of the household washer-dryer for the wash and dry cycle.

For household washer-dryers with a rated washing capacity lower than or equal to 3 kg, the E_{WD} is the energy consumption at rated capacity and rounded to three decimal places.

For other household washer-dryers, the E_{WD} is calculated in kWh per cycle as follows and rounded to three decimal places:

$$E_{WD} = [3 \times E_{WD,full} + 2 \times E_{WD,1/2}] / 5$$

where:

$E_{WD,full}$ is the energy consumption of the household washer-dryer for the wash and dry cycle at rated capacity and rounded to three decimal places.

$E_{WD,1/2}$ is the energy consumption of the household washer-dryer for the wash and dry cycle at half the rated capacity and rounded to three decimal places.

The weighted energy consumption per 100 cycles of the complete cycle of the washer-dryer is calculated as follows and rounded to the nearest integer:

$$E_{WD} \times 100$$

Water metrics:

The weighted water consumption (W_w) of a household washing machine or the washing cycle of a household washer-dryer is calculated using the following equation, in litres and rounded to the nearest integer:

$$W_w = (A \times W_{w,\text{full}} + B \times W_{w,1/2} + C \times W_{w,1/4})$$

where:

$W_{w,\text{full}}$ is the water consumption of the household washing machine or of the washing cycle of a household washer-dryer for the eco 40-60 programme at rated washing capacity, in litres and rounded to one decimal place.

$W_{w,1/2}$ is the water consumption of the household washing machine or of the washing cycle of a household washer-dryer for the eco 40-60 programme at half of the rated washing capacity, in litres and rounded to one decimal place.

$W_{w,1/4}$ is the water consumption of the household washing machine or of the washing cycle of a household washer-dryer for the eco 40-60 programme at a quarter of the rated washing capacity, in litres and rounded to one decimal place.

A, B and C are the weighting factors as described above.

For household washer-dryers with a rated washing capacity lower than or equal to 3 kg, the weighted water consumption of the wash and dry cycle is the water consumption at rated capacity and rounded to the nearest integer.

For other household washer-dryers, the weighted water consumption (W_{WD}) of the wash and dry cycle of a household washer-dryer is calculated using the following equation and rounded to the nearest integer:

$$W_{WD} = [3 \times E_{WD,\text{full}} + 2 \times E_{WD,1/2}] / 5$$

where:

$W_{WD,\text{full}}$ is the water consumption of the wash and dry cycle of a household washer-dryer at rated capacity, in litres and rounded to one decimal place.

$W_{WD,1/2}$ is the water consumption of the wash and dry cycle of a household washer-dryer at half of the rated capacity, in litres and rounded to one decimal place.