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Projected Effects of Implementation of New Energy-Efficiency Standards and Labelling Requirements in the Eurasian Economic Union

UNDP-RTF Regional Project

Regulatory Framework to Promote Energy Efficiency in Countries of the Eurasian Economic Union

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Introduction

Since mid-2018, I have been working under contract to the United Nations Development Programme (UNDP) in Armenia on a project, funded by the Russian Trust Fund, on standards and labeling for energy efficiency (EE) of appliances and equipment in four countries of the Eurasian Economic Union (EAEU) – Kazakhstan, Kyrgyzstan, Belarus, and Armenia. My task in this project has been to lead a project team in determining energy savings and emissions reductions resulting from project activity. This report presents the results of my work.

The project seeks to ensure and enhance the implementation of energy efficiency standards and labeling, thereby reducing energy consumption and associated emissions of greenhouse gases. The project pursues these outcomes in several ways. The main focus of the project is support for development, adoption, and implementation of a Technical Regulation of the EAEU (hereinafter referred to as "TR" – widely known in Russian as a Технический Регламент) on minimum energy performance standards (MEPS), high-efficiency performance standards (HEPS), and requirements for energy performance rating and labeling across numerous categories of equipment and appliances. Notably, this work on developing the TR includes a specific focus on harmonization with national requirements. The project also seeks to develop testing capacity in the given countries for implementation of this TR and national EE standards and labeling programs. Finally, the project also promotes EE technology via outreach and awareness-raising among consumers.

I have worked in this project under the supervision of Project Manager Suren Gyurjinyan, with the assistance of another international consultant, Anatoly Shevchenko. Mr. Shevchenko, who is based in Moscow, is himself a former UNDP project manager, with close familiarity with energy efficiency standards for lighting, appliances, and equipment, including the standards of the EAEU.

The new EAEU Technical Regulation on energy efficiency

In August 2019, the Eurasian Economic Council adopted a new TR entitled "On Energy Efficiency of Power Consuming Devices." This regulation applies to a wide range of devices that consume electricity, as follows.

- Refrigeration equipment
- Asynchronous electric motors
- Television sets
- Television set-top boxes
- Computers and servers
- Household washing machines
- Household clothes dryers
- Household dishwashers
- Various types of lamps, including fluorescent, high-pressure discharge, and LED, plus related ballasts
- Fans and blowers
- Water pumps
- Vacuum cleaners

The TR sets minimum performance requirements for these devices. Furthermore, for some devices, the TR also specifies requirements for provision of labels and technical sheets on energy performance. These labels and technical sheets will reflect classes (rating categories), to be developed and then verified in approved testing laboratories. Products will be allowed on the EAEU market only when compliance is verified. Entry into force will be carried out in phases starting in 2021.

The TR was developed with the active participation of experts responsible for developing and implementing analogous requirements of the European Union (EU) for eco-design and labelling of energy-consuming devices. The TR's requirements vary in stringency, up to EU but also less stringent for some devices. See the relevant regulations themselves for more details.

Methodology

In 2018, I prepared a proposed methodology for collecting and processing data in order to define baseline energy consumption, projected energy savings, and associated avoided GHG emissions from the EAEU TR and the supporting activity of the project.

Determining energy savings according to any methodology essentially involves the calculating the difference between baseline energy consumption and reduced consumption after project activities yield their effects. In turn, calculating these levels of energy consumption requires information on the stock, energy performance, and hours of operation of relevant types of equipment, plus projections of how the markets and performance parameters for these equipment types will change over time.

I developed my methodology based on one developed by the Scientific and Technical Advisory Panel of the Global Environment Facility (GEF STAP). This method requires estimating the average wattage (W or kW) of equipment within a given category (such as refrigerators or air conditioners), then multiplying this wattage by the estimated hours of operation, and then by the size of the stock, to obtain an estimate of overall energy consumption. Then to estimate energy savings, we would estimate the reduced wattage resulting from the onset of standards and labeling. This simple approach, combined with methods for estimating a "dynamic baseline" (overall market growth and increased market share of energy-efficient devices, even without standards and labeling), would lead to an estimate of savings. All this is contained in a spreadsheet with embedded default values and calculation macros, developed by the GEF STAP. More details are available at https://www.thegef.org/sites/default/files/publications/GEF_EE_Methodology_v1.0_2.pdf.

Data collection

In the given EAEU project, UNDP engaged the services of a national consultant in each of the four focal countries, with the assignment of gathering data. Based on the methodology that I prepared, Mr. Shevchenko and I provided instructions and guidance to the consultants, noting that they should first rely on official sources such as records from national statistical agencies or customs offices, then on other published market research. In addition, recognizing that published data might simply not be available in many cases, I told the national consultants to develop their expert estimates where needed, with narrative justification of how the numbers were derived.

The national consultants collected and estimated data for their respective countries, and submitted these data to me and UNDP from December 2018 to February 2019.

Applying national data to GEF STAP methodology and other analytic methods

The task of calculating energy consumption for all equipment types has proven to be much more complicated than I originally foresaw based on the proposed GEF STAP methodology.

As noted above, according to the GEF STAP methodology, calculated baseline and enhanced energy efficiency levels are based on average energy consumption rates (W or kW) for a given appliance type. The TR, on the other hand, defines requirements mostly ***not*** in terms of energy consumption or wattage, but rather in terms of multiple parameters or a complex Energy Efficiency Index (EEI) parameter. For example, the EEI for refrigerators and washing machines depends on volume and type, and for televisions depends on screen size. For lighting, requirements for wattage are listed, but only in relation to light output in lumens.

This means that assessing the effect of the TR is not a simple matter plugging old and new wattage requirements into the GEF STAP tool, then calculating overall savings across the market. It is necessary first to translate the TR requirements into an equivalent effect on average wattage. This, in turn, requires a much more complex analysis, separate from the GEF tool, of how TR requirements will transform the current product mix into a new product mix by shifting products in various subcategories from one efficiency range into another.

Beyond matching of TR requirements with the GEF STAP tool's needs, there is also the larger, even more complex challenge of reconciling our national data with both the TR and the GEF STAP tool. Ideally, such data would allow show baseline EEIs and/or average wattages, plus market sizes, in the same equipment categories and subcategories as the TR. The actual data did not neatly fit this ideal scenario. Instead, we encountered several gaps and inconsistencies, as follows.

- **Categories within markets for given equipment types.** For most equipment types in all four countries, the main source for market data were national statistical reports, import data from customs agencies, and sometimes other official or nongovernmental reports on economic and social conditions. In many cases, these sources defined categories and subcategories inconsistent with those of the TR.

  Notably, much official data are presented by categories according to the Product Nomenclature of Foreign Economic Activity (Товарная номенклатура внешнеэкономической деятельности, or ТНВЭД). Even though the EAEU itself uses the ТНВЭД, its categories are not directly used in defining TR requirements.

- **Data on market sizes.** Within the given categories, our national consultants did find substantial data on sales volumes and/or import volumes. In many cases, however, these figures varied wildly from year to year (commonly, by a factor of two or more, without any clear pattern of growth or decline), in such a way that it is difficult to determine a meaningful average or even a median, nor to identify which years are "normal" and which are outliers. This variation makes it difficult to determine "baseline annual sales," which is a necessary parameter for the GEF STAP tool.

- **Energy performance data.** For essentially all equipment categories, there are no official national statistics on energy performance of appliances and equipment. It was therefore widely necessary for our national consultants to estimate wattages in the various equipment subcategories based on specifications of actual products in the market.

(I emphasize that these gaps arise not from lax effort by the national consultants, but simply from the inherent and unavoidable limitations of the data.)

In sum, the data from national experts, the categories defined in the TR, and the parameters required for use of the GEF STAP methodology do not neatly match up with each other. Reconciling all of these mismatches requires some combination of manipulation of data, flexibility of methodological approach, and/or significant use of assumptions in order to come up with any numbers at all. Applying these actions in turn greatly increases the uncertainty of the final results.

Chosen approaches

I have considered and indeed tried numerous different approaches for the various types of equipment, the market data for such equipment from each respective country, and the ways in which the TR might be expected to change the market. In the end, I applied the following general process for each equipment type.

- **Examining the TR requirements.** Determine categories of equipment, indices and required levels of energy performance, and other requirements.
- **Examining national data.** Determine how national data are broken out by subcategory, and whether these categories match with those of the TR. Determine whether national data include energy consumption information, and if so, what kinds (wattage, EEI, rating category, etc.).
- **Defining baseline energy consumption levels.** If possible, calculate a weighted average energy consumption rate in W or kW for the baseline market, across the whole equipment category. Apply this average wattage to the GEF STAP tool. If not possible, then use default values provided by the GEF STAP tool, or set that category aside for other analysis.
- **Defining enhanced energy performance levels.** Consider the effects of the TR on the baseline market. If subcategories in national data match with the subcategories of the TR, determine expected changes within each subcategory with regard to market size and/or energy performance. Then recalculate the weighted average consumption and apply it to the GEF STAP tool. If subcategories do not match, apply a conservative estimated figures overall percentage savings relative to baseline, using default values from the GEF STAP tool where necessary.
- **Defining annual sales volume.** Where possible, use the most recent annual sales figures as inputs into the GEF STAP tool. If such figures seem wildly inconsistent with sales figures from other recent years, apply judgment to determine most plausible and/or conservative figure for sales.
- **Defining other parameters.** Generally, use GEF STAP defaults for other parameters, including market growth for both the whole market and the share of energy-efficient product within that market, hours of operation, measure lifetime, and so on, unless national data present well-justified alternative figures.

Use of other methodologies and notable adjustments

In some cases, it was necessary or preferable to use methodologies besides the GEF STAP approach, as described below.

- **Refrigerators, washing machines, and air conditioners**. For refrigerators, washing machines, and air conditioners, instead of using the GEF STAP tool, I applied the Policy Analysis Modeling System (PAMS) methodology and tool developed by Lawrence Berkeley National Laboratory and CLASP. Like the GEF STAP tool, PAMS uses user-submitted input data, embedded formulae, and some default values to project energy savings from standards and labelling. This tool is somewhat simpler to use than the GEF STAP tool, but with essentially the same level of rigor. The same issues of categories and data quality apply for PAMS as for the GEF STAP methodology as described above.

- **Motors.** For motors in Belarus, Armenia, and Kyrgyzstan, I applied the GEF STAP methodology. For Kazakhstan, I did not calculate any new figures but rather simply use figures calculated for the current UNDP-GEF project on appliance and equipment standards. The UNDP-GEF project in Kazakhstan is closely aligned with this UNDP-RTF project in the EAEU, with the specific goal of supporting harmonization of standards.

- **Lighting**. Markets for lighting are extremely complex because of the large variety of equipment types – incandescents, fluorescent tubes, CFLs, gas-discharge lamps, halogen lamps, and LCDs, across a range of sizes, brands, and use types in an extremely dynamic market. Considering market transformation compounds this complexity exponentially because of highly dynamic and variable nature of market changes for each equipment type. Therefore it is unrealistic to try to conduct a conventional baseline-vs-enhanced comparison of scenarios using all the data, type by type, and brand by brand.

  I calculate weighted average wattage levels and total annual lamp sales for each country. Then I assessed baseline levels of market penetration of energy-efficient lighting such as LEDs, plus market growth trends. With such figures and assumptions, I used the GEF STAP tool to execute a rough calculation of energy savings.

  For Kazakhstan, the recently-concluded UNDP-GEF project on EE lighting has set a high baseline of energy performance for all types of lighting in the country. Some savings opportunities remain with particular technologies. Otherwise, specific market data are absent. I estimated savings for Kazakhstan based on analogous projected savings for Belarus, which has a similarly highly efficient baseline, with an adjustment for population size.

- **Fans and blowers.** I applied the GEF STAP tool to fans and blowers in Armenia, Belarus, and Kyrgyzstan. In all three countries (especially the latter two), savings estimates came back very high because of high annual sales figures. The savings figures should therefore be considered with a certain degree of skepticism, even beyond recognition of the high uncertainty that applies to all these calculations;.

  For Kazakhstan, market data on fans were absent. I estimated energy savings for fans and blowers in Kazakhstan based on figures for Armenia, adjusted by relative population size.

- **Standby mode**. The TR has a cross-cutting section that sets new requirements for many devices to have a low-energy standby mode when not in operation. These requirements are not taken separately into account here because calculations for all devices already are based on estimated annual hours of operation, with assumed zero energy consumption outside of those operating hours. Furthermore, for certain specific devices (for example, television set-top boxes and power supplies), the TR sets specific standby requirements, such that a separate calculation for the cross-cutting standby requirements would be redundant.

Electricity emissions factors

I determined electricity emissions factors (CO_{2eq} emissions reductions per unit of saved electricity) from the most recent and credible sources I could find, as shown in the table below.

Electricity Emissions Factors for Selected EAEU Countries

Country	Electricity emissions factor (kg CO2eq/kWh or tonnes CO2eq/MWh)	Source
Armenia	0.243	Covenant of Mayors for Climate and Energy. *CoM Default Emission Factors for the Eastern Partner countries - Version 2017* https://jeodpp.jrc.ec.europa.eu/ftp/jrc-opendata/COM-EF/dataset/come/JRC-CoM-EF-CoME-EF-2017.pdf
Belarus	0.441	Covenant of Mayors for Climate and Energy. *CoM Default Emission Factors for the Eastern Partner countries - Version 2017* (see link in cell above)
Kazakhstan	0.919	Project Document for the UNDP-GEF project *Energy Efficient Standards, Certification, and Labelling for Appliances and Equipment in Kazakhstan.* 2017.
Kyrgyzstan	0.060	*Third National Communication of the Kyrgyz Republic Under the UN Framework Convention on Climate Change.* https://unfccc.int/sites/default/files/resource/NC3_Kyrgyzstan_English_24Jan2017.pdf. 2017.

Results

Annex I contains a summary of estimated energy savings and avoided emissions by country and by equipment category through 2030. The overall estimated effect of the implementation of the TR requirements is a savings of about 38 TWh of electricity, leading to approximately 21 million tonnes of avoided CO_2 emissions.

Raw data, calculations, and notes about assumptions and limitations are to being submitted separately with this report to the UNDP project team.

I emphasize again that these results are highly uncertain because of limitations of both data and calculational methodology. Still, this exercise does suggest that the implementation of the TR regulations as supported by the UNDP-RTF project will have a powerful impact in terms of energy savings and avoided GHG emissions.

Annex I

Summary of Calculated Estimates of Energy Savings and GHG Emissions Reductions By Country and Equipment Type

	Calculations by Country								TOTAL FIGURES	
	Belarus		Armenia		Kyrgyzstan		Kazakhstan			
Type of Equipment	Electricity savings through 2030 (GWh)	Avoided emissions (10^3 tonnes CO_{2eq})	Electricity savings through 2030 (GWh)	Avoided emissions (10^3 tonnes CO_{2eq})	Electricity savings through 2030 (GWh)	Avoided emissions (10^3 tonnes CO_{2eq})	Electricity savings through 2030 (GWh)	Avoided emissions (10^3 tonnes CO_{2eq})	TOTAL electricity savings through 2030 (GWh)	TOTAL avoided emissions through 2030 (10^3 tonnes CO_{2eq})
Motors	4,638	2,045	185	45	139	10	4,848	4,455	9,810	6,556
Televisions	463	204	93	23	28	2	710	652	1,294	881
Computers	82	36	15	4	10	0.8	181	166	288	207
Refrigerators	837	369	636	155	321	24	1,865	1,714	3,659	2,262
Air Conditioners	800	353	380	92	787	59	1,257	1,155	3,224	1,659
Washing Machines	71	31	8	2	60	5	109	100	248	138
Fans	6,045	2,666	142	35	790	59	854	785	7,832	3,545
Lighting	2,258	996	926	225	1,183	89	2,258	2,075	6,625	3,385
Pumps	2,541	1,121	26	6	68	5	103	94	2,738	1,226
Dishwashers	-	-	2.4	0.6	0.8	0.06	2	2	6	3
TV Set-top Boxes	366	161	671	163	372	28	372	342	1,781	694
Power Supply	31	13	77	19	183	14	-	-	290	46
Clothes Dryers	2	0.7	0.8	0.2	-	-	1	1	3	2
Vacuum Cleaners	26	12	5	1.2	4	0	15	14	50	27
TOTAL	**18,159**	**8,008**	**3,167**	**770**	**3,946**	**296**	**12,575**	**11,557**	**37,847**	**20,630**