

Output 3

Benchmark of international MEPS and label design best practice

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3 Benchmark of international MEPS and label design best practice

3.1 Aim of WP 3

Conduct research on experiences and best practice with MEPS target setting and label design.

In this output the team produced a list of indicated performance levels of six to ten relevant regional and international minimum energy performance standards and associated product labels of electric stoves. The examples chosen represent success cases that have caused measurable impacts and set the benchmark for international comparison.

In addition, a checklist of key criteria is provided for definition of the minimum performance level and an effective label. The goal was to guide the EEA in defining a performance level that is achievable in the local context yet demanding innovation. (More on this in part 3.4)

Another goal was to design and validate an informative product label that is understood and supported by key stakeholder groups and thus achieves its purpose. (More on this in part 3.5)

To enable performance standard setting, the research covered aspects such as defining efficiency ranges and updating schedules to ensure current market conditions are reflected.

At least the following indicators have been considered:

- the variance of energy performance of current market products,
- technical potentials to improve efficiency,
- saving potentials at national level,
- time estimates to adapt product design,
- potential technical barriers,
- cost effectiveness of technical improvements.

For the energy labels, the research and key features considered include general appearance, definition of efficiency categories, stakeholder engagement, etc.

3.2 Minimum energy performance standards, examples on MEPS of cooking appliances

Definitions

MEPS (Minimum Energy Performance Standard)

MEPS is a specification, containing a number of performance requirements for an energy-using device, that effectively limits the maximum amount of energy that may be consumed by a product in performing a specified task. MEPS can prohibit the sales of poor energy performing appliances as well as impose manufacturers/importers/suppliers to remove a poor energy performing appliance from the market (appliance cannot be sold at all).

A MEPS may include requirements not directly related to energy; this is to ensure that general performance and user satisfaction are not adversely affected by increasing energy efficiency.

A MEPS generally requires the use of a defined test procedure that specifies how performance is measured.

A MEPS is usually made mandatory by a government energy efficiency body.

Energy labelling programme

Energy labelling programme obliges product suppliers to have an energy test done and to present the results on the energy labels. The energy label is based on the same testing procedure as MEPS.

Combined, MEPS and energy labelling programmes can set the level of energy performance of appliances in the market and give consumers/buyers means to compare the appliances to make energy efficient choices.

More on energy labelling examples and energy labelling recommendations for the Ethiopian market in part 3.5.

3.2.1 Examples of MEPS for cooking appliances

A study was conducted to find relevant examples of Minimum Energy Performance Standards for cooking appliances to use as basis for the Ethiopian MEPS. The results of the study on MEPS are combined in table 1 (electric cooking appliances) and table 2 (biomass, other solid fuel fired and gas cooking appliances). NOTE: THESE ARE THE ONLY EXAMPLES THAT WERE FOUND FOR ELECTRIC COOKING APPLIANCES.

Table 1. List of indicated performance levels of relevant regional and international minimum energy performance standards for electric stoves or other cooking appliances

Origin	Product	MEPS	Tolerances	Measurement / test procedure	Label / scale	Tiers / Ranges for labelling	Additional information
EU	Electric hob	<p>EC_{electric hob} (Wh/kg)</p> <p>20.02.17: EC_{electric hob} < 200</p> <p>20.02.19: EC_{electric hob} < 195</p>	Values can be max 5 percent more than the EC _{electric hob} stated value.	Household electric hob (EC _{electric hob}) is measured in watt hours per heated kilograms of water with normalised measurement (Wh/kg), considering all cookware in standard testing conditions and rounded to nearest one decimal.	No labelling scheme for hobs	-	<p>Ecodesign for standby and off mode electricity consumption:</p> <p>Stand-by mode: 0,5 W</p> <p>Reactivation function and status display: 1.00 W</p> <p>Off mode: 0.5 W</p> <p>Best hobs in the market:</p> <p>EC_{electric cooking} = 169,3</p>
China	Household induction cooker	Minimum Energy Performance Requirement (MEPR): 86% thermal efficiency,		<p>GB 21456-2008</p> <p>GB 21456-2015</p> <p>Test method: Cookers tested at maximum power. Input power to the cooker is directly</p>	Yes, based on tiers	(More on these in part 3.5)	Draft regulation was in motion (in 2013) to tighten the MEPR and expand the regulation to up to 3400 W cookers (original was only up to 2800 W)

		2 W standby power		<p>measured, and the theoretical energy consumed by the mass of water within a standard test vessel is calculated via the temperature rise of the water/vessel.</p> <p>Thermal (energy) efficiency (η) is calculated by dividing the theoretical energy consumption by the measured input power.</p> <p>Stand-by power: off-mode standby: unit is connected to power supply but switched off.</p>			Problem with test method: testing does not represent normal operating conditions employed by consumers (likely to be in the range of 50-60% of maximum rated power).
South Africa	Household electric oven	Large Electric Ovens shall comply with SANS 941 and shall have a minimum energy efficiency rating of Class B. Small or Medium Electric Ovens shall comply with SANS 941 and		Test method: more information in bigee_south_africa_ovens_20150720.pdf	Yes	(More on these in part 3.5)	

		shall have a minimum energy efficiency rating of Class A.					
USA	No criteria for cooking appliances						
India	No criteria for cooking appliances						
New Zealand	No criteria for cooking appliances						
Australia	No criteria for cooking appliances						

Table 2. List of indicated performance levels of relevant regional and international minimum energy performance standards for biomass, other solid fuel-fired and gas cookstoves / cooking appliances

Origin	Product	MEPS	Tolerances	Measurement / test procedure	Label / scale	Additional information
Argentina	Gas stoves	Nominal yield 52%			YES, (More on these in part 3.5)	https://www.argentina.gob.ar/energia/ahorro-y-eficiencia-energetica
Brazil	Gas stoves / Stoves and ovens	Energy efficiency of cooktop: 56%		<p>The energy efficiency indices are defined separately for the cooking top and the oven.</p> <p>§ 1 The performance of a burner of the cooking top is defined, in percentage value, by the ratio between the amount of thermal energy effectively absorbed by the contents of a container positioned on the burner to cause a certain positive variation of the temperature of this content, and amount of thermal</p>		<p>IMPORTED GAS STOVES AND FURNITURE</p> <p>Article 10. The companies importing the equipment treated in this Regulation must prove the attendance to the Minimum Energy Efficiency Indices during the process of obtaining the Import License.</p> <p>Art. 11. In the process of importing the aforementioned equipment, INMETRO must be granted permission to grant the Import License, obtained prior to embarkation abroad.</p> <p>More on regulatory practices in Brazil:</p> <p>http://www.inmetro.gov.br/legislacao/rtac/pdf/RTAC002035.pdf</p> <p>http://www.inmetro.gov.br/qualidade/pdf/guia_ingles.pdf</p>

				<p>energy available by the complete combustion of the gas as a function of its calorific value.</p> <p>§ 2 The energy efficiency index of the cooking top is the arithmetical mean of the burner outputs whose nominal power is equal to or greater than 1,16 kW (1,000 kcal / h), calculated on the higher calorific value of the gas used.</p>		
Ghana	Cookstoves (wood, biomass, charcoal, LPG)	MEPS proposed thermal efficiency $\geq 20\%$			(More on these in part 3.5)	
Uganda	Cookstoves (mostly biomass)	Thermal efficiency wood stoves 24% other 35%		Based on IWA water boiling test		

3.2.1.1 Ways to depict cooking performance

Cooking performance can be measured with a range of metrics:

- **Efficiency:** A range of efficiency metrics are used in different reports, all of which consider the ratio of input energy to that supplied to the food.
 - An appliance is more energy efficient if it lasts longer or works better than a traditional version of the same appliance but uses the same amount of energy. It is also energy efficient if it delivers the same performance as the traditional version but uses less energy.
 - Energy efficiency means doing more with less: maximizing useful energy usage while minimizing the waste energy.
 - Energy efficiency in appliances is a balance between energy efficiency itself and user friendliness and usability for the purpose, such as time required for cooking.
 - Efficiency can be reported using thermal, specific and basic efficiencies which utilise different conditions and measures, making direct comparison difficult.
 - Values are typically tested during a simulated heavy-load cooking event, so do not factor in preheat or idle energy consumption.
- **Consumption rate:** This can be expressed in kWh/cycle or kWh/year; the latter may be a theoretical figure based on expected usage frequency, or an empirical measure based on real-life consumption data.
- **Effective useful lifetime:** This measure expresses the average lifetime of a product under normal operating conditions.

Performance comparisons are complicated by the fact that control tests may differ, and usage patterns vary significantly across the world.

- Efficiency also varies with the type and quantity of food, as well as appliance size.
- Real-life efficiency is strongly influenced by users' cooking habit.
- Findings suggest usage differences can produce a **variation in consumption of 30%** amongst users with the same equipment.¹

Information on the energy consumption and base energy consumption of domestic electric hobs / hotplates, shown in table 3, gives some comparison to the energy consumption of the locally manufactured stoves, information shown in table 4.

¹ Source: IEA ETSAP - Technology Brief R06 – June 2012

Table 3. Information on domestic electric hobs and hotplates (source data: International Energy Agency)

Domestic electric hobs / hotplates*		
	Hobs (4 zones)	Average (Hobs)
Technical performance		
Typical power rating (kW)	1-10 kW	7,4 kW
Average cycle duration (minutes)	No data	
Consumption per cycle (kWh/cycle)		
Solid	0,57 kWh/cycle	
Radiant	0,55 kWh/cycle	
Induction	0,43 kWh/cycle	
Base Energy consumption (kWh/y)		
Solid	250 kWh/y	
Radiant	240 kWh/y	
Induction	190 kWh/y	
Typical cooking efficiency (%)		
Solid	74 %	
Radiant	72 %	
Induction	84 %	
Technical lifetime, years	15-19 years	19 years
Costs		
Capital costs, euro/unit (2007)		
Solid	100-300 euro	137 euro
Radiant	150-650 euro	380 euro
Induction	300-1200 euro	810 euro
Estimated lifecycle costs	905 euro	

*Source: IEA ETSAP - Technology Brief R06 – June 2012

Table 4. Pre-test data and analysis from tests conducted in Ethiopia in 2019*

	Date	Date	1/2/2019	1/2/2019	1/2/2019	1/2/2019	4/2/2019	4/2/2019
	Test No.	No.	1	2	3	4	5	6
	Name of Stove	Name	Gogle SP1.4	Gogle SP1.4	A&H SP1.4	A&H SP1.4	Gogle SP1.4	Danas SP1.0
Analysis of Test Results	Time for Boiling	(min)	23.10	17.22	19.27	14.20	21.42	21.47
	Simmering Time	(min)	0.00	20.00	0.00	20.00	45.00	45.00
	Total Time	(min)	23.10	37.22	19.27	34.20	66.42	66.47
	HP Energy Input	(kWh)	0.553	0.41714	0.477	0.35376	0.51671	0.38287
	HP Energy Output	(kWh)	0.23	0.22	0.22	0.21	0.22	0.23
	HP Efficiency	(%)	42.0	53.0	45.7	59.3	42.5	59.1
	LP Energy Input	(kWh)		0.24		0.20	0.51	0.41
	LP Energy Output	(kWh)		0.14		0.14	0.29	0.30
	LP Efficiency	(%)		58.8		67.8	56.1	72.7
	Total Energy Input	(kWh)	0.553	0.660	0.477	0.558	1.027	0.790
	Total Energy Output	(kWh)	1.580	0.364	1.577	0.348	0.506	0.522
	Total Power Input	(kW)	0.02	1.06	1.49	0.98	0.93	0.71
	Total Power Output	(kW)	0.07	0.59	4.91	0.61	0.46	0.47
	Overall Efficiency	(%)	285.66	55.1	330.44	62.4	49.26	66.09
	HP-Time to Boil	(min/kg)	11.27	8.40	9.40	6.93	10.45	10.47
	HP-Specific Energy Consumption	(kWh/kg)	0.27	0.20	0.23	0.17	0.25	0.19

*Test data was incomplete and consists of only a few tested appliances. It is highly recommended that more testing is done before setting the MEPS and the Energy Labelling tiers for Ethiopian stoves. All initial testing data and analysis is included in the report for the testing procedure, 2 Test procedure for locally manufactured stoves.

3.3 Overall scheme for MEPS and energy labelling in Ethiopia

The overall scheme for MEPS and energy labelling for the Ethiopian market with relevant stakeholders is presented in table 5.

Table 5. Overall scheme for MEPS and energy labelling for Ethiopian market

Administration		Testing	MEPS and Energy labelling for stoves	Stakeholders	Retailer	Consumer
Ethiopian Standards Agency (Standards, product standards, other product requirements)	Ethiopian Energy Authority (Energy authority / market authority / MEPS and Energy labelling)	Testing facility (testing of products)	New product entering the market / Existing product approved for sale in the market (compliance)	Manufacturer/ producer/ (importer)	Wholesale and retail	Consumers, Households, Consumer associations etc.
	MEPS requirements		Must meet requirements set in MEPS (compliance)	Imported products (either test or MRA)		Needs confirmation that all products are safe, reliable, and legal
Other product requirements			Other product requirements set by market authority (technical documentation, product shield)	Imported products (either test or MRA)		
Requires documentation on testing	Requires documentation on testing	Conducts tests	Performance testing (MEPS) / Product testing (other requirements)	Must provide two samples for performance / type testing OR provide documentation of conducted tests Imported products (either test or MRA)		
	Energy label design, energy classes / tiers		Energy label based on MEPS, annual energy consumption of product	Must provide the energy label for the product on approval to the market	Must show the energy label on the product at the point of sale (showrooms, store)	Must have information on Energy label and its definition
	Spot checks for compliance		Market surveillance	Must provide products for MSA for spot checks when required.		
	Monitoring, evaluation and development of scheme with administration and stakeholders		Monitoring and evaluation	Must provide product data to MSA	Must provide sales data to MSA	

The phases of the scheme:

- New product entering the market / Existing product approved for sale in the market (compliance)
 - MEPS (compliance): Must meet requirements set in MEPS
 - Other product requirements: Must meet other product requirements set by market authority / standards agency (technical documentation, product shield)
 - Performance testing (MEPS)
 - Product testing (other requirements)
 - Energy label based on MEPS, annual energy consumption of product
 - Must provide energy label for products (set on product at production site or provided for retailer to set on product at point-of-sale)
- Market surveillance
 - Compliance checks (compliance testing, either set intervals, set number of spot checks per year, at random or onset by reports)
- Monitoring and evaluation of the scheme
 - Monitoring of the market (sales data)
 - Evaluation of the set definitions for MEPS and energy label

Stakeholders:

- Ethiopian Energy Authority (Energy authority / market authority / MEPS and Energy labelling)
- Ministry of Environment, Forest and Climate Change, Ethiopia – MEFCC
- Ministry of Water Irrigation and Electricity - MoWIE
- Ethiopian Standards Agency (Standards, product standards, other product requirements)
- Test laboratory (testing of products)
- Manufacturer/producer/importer
- Retailers / wholesalers
- Consumers

Timeframe of the MEPS programme:

Year	Administration	Manufacturers
Year 1-2: Laying the groundwork	Preparing regulations, testing products for setting the MEPS level	Participating in preparation of regulation, testing products
Year 3-4: Voluntary phase	Regulation is in force, but voluntary Programme launch	Performance testing of products, voluntary labelling
Year 5: Mandatory programme begins	MEPS in force Mandatory energy labelling	Performance testing of new products, MEPS in force, Mandatory energy labelling
Year 6-7: Monitoring the market	Market surveillance, Compliance checks (MEPS + Label) monitoring the market Developing the MEPS/Label	Must submit products for compliance testing by the market authority

3.4 MEPS for locally manufactured stoves in Ethiopia, recommendation

There are three types of locally manufactured electric stoves in the market:

- stoves with single cook top (cooking area) (flat),
- stoves with single cook top (concave/bowl type cook top, i.e. the coffee stove) and
- stoves with two cook tops (cooking areas) (flat).²

All stoves are constructed with exposed resistive coil (heating element).

3.4.1 Checklist of key criteria for definition of the minimum performance level, recommendation

Key criteria:

- **Energy performance:**
 - Thermal efficiency (%): $\geq 60\%$
 - Power output: 0,21 kW/kg
 - Power output is normalized to weight of water boiled
 - In testing of the energy performance, set amount of water is heated from 20°C to boiling temperature and then simmered at the temperature interval where the minimum simmering temperature is allowed to be 6°C under the boiling temperature (see test procedure in report 2 on Test procedure for locally manufactured stoves).
 - Effects of the MEPS (shown in table 6)

Table 6. Effects of the MEPS (see Annex 1)

MEPS at 60% efficiency	MEPS 2023-		Full electrification announced in 2025 (NEP)					
	2023	2024	2025	2026	2027	2028	2029	2030
Energy savings, GWh/a, new annual savings from new stoves	13	15	17	19	20	14	16	18
Energy savings, GWh/a, cumulative savings compared to baseline	13	29	45	64	85	99	114	132

MEPS at 63% efficiency	MEPS 2023-		Full electrification announced in 2025 (NEP)					
	2023	2024	2025	2026	2027	2028	2029	2030
Energy savings, GWh/a, new annual savings from new stoves	34	38	43	47	52	36	40	45
Energy savings, GWh/a, cumulative savings compared to baseline	34	72	115	163	215	250	291	336

MEPS at 67% efficiency	MEPS 2023-		Full electrification announced in 2025 (NEP)					
	2023	2024	2025	2026	2027	2028	2029	2030
Energy savings, GWh/a, new annual savings from new stoves	59	66	74	82	89	62	69	77
Energy savings, GWh/a, cumulative savings compared to baseline	59	125	199	281	370	432	501	578

² Source: Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017.

Other key criteria:

- **On/off switch:** product must have an on-off switch
 - o Feature should be a requirement for all stoves eligible to be on the market.
- **Safety requirements** for electrical cooking stoves:
 - o Sharp edges and points on the exterior surfaces
 - o Outside surface temperature of the stove's body
 - o Stability of the Cookstove during operation
 - o Electrical safety – earthing, appropriate electrical components (i.e. cable size, plugs)

Other criteria (suggested):

- **Power control:** Product must have a power on/off-cycle controlled by an electronic pulse width controller (power regulator).

More on the energy label, see part 3.5.

3.4.1.1 Imported hot plates, hobs, cook tops and cookers

There are many types of imported electric cooking appliances sold on the Ethiopian market. If the Ethiopian authorities wish to bring the imported appliances to adhere to the energy standards (MEPS) of Ethiopia, there are different approaches.

Imported appliances could be approved in two ways:

- 1) required information and testing according to the test procedure adopted for locally manufactured stoves OR
- 2) sign Mutual Recognition Agreement (MRA) to accept product information and test data according to set requirements in origin country (acknowledging EU, China etc. standards/requirements).

Importer of the appliance would be responsible for either delivering documentation on conducted tests and the required product information to market surveillance authority (compliance authority) as per MRA or submitting appliances for type testing.

To be included in the energy labelling scheme, the importer would be required to present information and testing according to the test procedure adopted for locally manufactured stoves and also be responsible for setting the energy label on all imported products on approval.

3.5 Energy labelling, examples of cooking appliances

The aim was to gather information on relevant energy label designs and labelling schemes to act as basis for the Ethiopian model. During the study a wide search was conducted to find information on energy labelling for cooking appliances (including hot plates, cookers, hobs, stoves, ovens, etc.) operating on either electricity, gas or biomass. The results of the research are gathered in Table 7.

The main observation was that there are very few examples of energy labelling for cooking appliances. Examples found are induction cookers, electric and gas ovens, gas stoves and biomass stoves. **NOTE: These are the only examples that could be found on these types of cooking appliances.**

There are also no energy labelling schemes for electric cooking appliances where the energy classes / tiers / ranges are based on actual energy consumption (measured energy consumption with calculations reflecting usage patterns). Most of the labelling schemes are based on calculated thermal efficiency (based on power rating) or calculated average yields (gas).

3.5.1 Energy labelling formats: comparative, endorsement and hybrid

Energy label can be comparative, endorsement or a hybrid of the two.³

Comparative labels allow consumers to form a judgement about the energy efficiency (or energy consumption) and relative ranking of all products that carry a label. The comparative labelling programs in OECD countries are primarily mandatory, however some comparative programs in other countries are voluntary. Endorsement and comparative labels can coexist and do so in many countries.

The most commonly used comparison labels use a scale with absolutely defined efficiency categories. This type of label allows consumers to easily assess the efficiency of a product in relation to an absolute scale, by means of a simple numerical or ranking system. The concept is that it is much easier for a consumer to remember and compare a simple ranking scale (such as 1, 2, 3 or 1-star, 2-star, 3-star or A, B, C) than to remember and compare energy consumption values.⁴

Essentially the visual designs of comparison labels in use around the world can be grouped into three basic types⁵:

1. **Dial Label:** This type of label has a “dial” or gauge, with greater efficiency linked to advancement along the gauge (more efficient represented by a clockwise arc). This type of label is used in Australia, Thailand, and Korea and is proposed for India. The number of stars or the “grading” numeral on the scale depends on the highest pre-set threshold for energy performance that the model is able to meet.

³ , Energy labelling and standards programs throughout the world, The National Appliance and Equipment Energy Efficiency Committee, Australia, 2004.

⁴ Energy labelling and standards programs throughout the world, The National Appliance and Equipment Energy Efficiency Committee, Australia, 2004.

⁵ Energy labelling and standards programs throughout the world, The National Appliance and Equipment Energy Efficiency Committee, Australia, 2004.

2. Bar Label: This type of label uses a bar chart with a grading from best to worst. All grade bars are visible on every label with a marker next to the appropriate bar indicating the grade of the model. This label is used primarily in Europe and South America. Mexico uses this concept for some products, but the format is different (although their label design is under consideration).

3. Linear Label: This label has a linear scale indicating the highest and lowest energy use of models on the market, locating the specific model within that scale. As energy is used as the comparator (rather than efficiency), it is necessary to group models into similar size categories for comparison. This model is used in North America.

Endorsement labels indicate that products belong to the “most energy efficient” class of products or meet a predetermined standard or eligibility criteria. Products generally display a logo or mark which identifies they have met the standard or product class and the labels generally contains little or no comparative energy efficiency information. This type of label merely informs the consumer that the product meets the required standard. Endorsement labelling programs are mostly of a voluntary nature. An endorsement label may be specifically for energy efficiency or it may be an “Eco” label. Eco label programs endorse products that have low impact across a wide range of environmental factors, with energy consumption levels often having a high priority (but not always)⁶.

Hybrid format combines the comparative label with an endorsement element⁷.

⁶ Energy labelling and standards programs throughout the world, The National Appliance and Equipment Energy Efficiency Committee, Australia, 2004.

⁷ Energy labelling and standards programs throughout the world, The National Appliance and Equipment Energy Efficiency Committee, Australia, 2004.

Table 7. Comparison of energy labels for stoves, cookers, cook tops, hobs and ovens (electric, gas and biomass appliances)-

Country	Label type (comparative, endorsement, hybrid)	Appearance of label	Definitions of efficiency categories	Stakeholder engagement																
China (induction cooker)	Comparative	The label shows basic identification information of the product, the five Energy Efficiency Tiers (EET) defined in the Energy Efficiency Standard, plus absolute values for the thermal efficiency and standby power consumption of the cooker.	<p>Five energy efficiency tiers based on thermal efficiency</p> <table border="1"> <thead> <tr> <th>Energy Efficiency Tier</th> <th>Energy Efficiency (thermal efficiency, η, %)</th> <th>Stand-by Power (W)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>90</td> <td rowspan="2">2</td> </tr> <tr> <td>2</td> <td>88</td> </tr> <tr> <td>3</td> <td>86</td> <td rowspan="3">5</td> </tr> <tr> <td>4</td> <td>84</td> </tr> <tr> <td>5</td> <td>82</td> </tr> </tbody> </table> <p>(Tier 5 label is still used, although no tier 4 and 5 products are available)</p>	Energy Efficiency Tier	Energy Efficiency (thermal efficiency, η , %)	Stand-by Power (W)	1	90	2	2	88	3	86	5	4	84	5	82		
Energy Efficiency Tier	Energy Efficiency (thermal efficiency, η , %)	Stand-by Power (W)																		
1	90	2																		
2	88																			
3	86	5																		
4	84																			
5	82																			
EU (oven)	Comparative	<p>Two types: electric and gas</p> <ul style="list-style-type: none"> Supplier's name or trademark Supplier's model identifier The energy efficiency class of the cavity Usable volume of the cavity in litres (L) Energy consumption per cycle expressed in kWh/cycle: heating function (conventional) 	<p>Seven energy efficiency classes (lower grades E-G not in the market)</p> <table border="1"> <thead> <tr> <th>Energy Efficiency Class</th> <th>Energy Efficiency Index (EEI_{cavity})</th> </tr> </thead> <tbody> <tr> <td>A+++ (most efficient)</td> <td>$EEI_{cavity} < 45$</td> </tr> <tr> <td>A++</td> <td>$45 \leq EEI_{cavity} < 62$</td> </tr> <tr> <td>A+</td> <td>$62 \leq EEI_{cavity} < 82$</td> </tr> <tr> <td>A</td> <td>$82 \leq EEI_{cavity} < 107$</td> </tr> <tr> <td>B</td> <td>$107 \leq EEI_{cavity} < 132$</td> </tr> <tr> <td>C</td> <td>$132 \leq EEI_{cavity} < 159$</td> </tr> <tr> <td>D (least efficient)</td> <td>$EEI_{cavity} \geq 159$</td> </tr> </tbody> </table>	Energy Efficiency Class	Energy Efficiency Index (EEI_{cavity})	A+++ (most efficient)	$EEI_{cavity} < 45$	A++	$45 \leq EEI_{cavity} < 62$	A+	$62 \leq EEI_{cavity} < 82$	A	$82 \leq EEI_{cavity} < 107$	B	$107 \leq EEI_{cavity} < 132$	C	$132 \leq EEI_{cavity} < 159$	D (least efficient)	$EEI_{cavity} \geq 159$	<p>Manufacturer / supplier provides the label for the product (either included in the packaging or printed on the package (lamps))</p> <p>Retailers must present label on products in showrooms</p>
Energy Efficiency Class	Energy Efficiency Index (EEI_{cavity})																			
A+++ (most efficient)	$EEI_{cavity} < 45$																			
A++	$45 \leq EEI_{cavity} < 62$																			
A+	$62 \leq EEI_{cavity} < 82$																			
A	$82 \leq EEI_{cavity} < 107$																			
B	$107 \leq EEI_{cavity} < 132$																			
C	$132 \leq EEI_{cavity} < 159$																			
D (least efficient)	$EEI_{cavity} \geq 159$																			

		<ul style="list-style-type: none"> Energy consumption per cycle expressed in kWh/cycle: Forced air convection 																				
Argentina (gas cooktop and oven, combined)	Comparative	<p>Based on previous EU label, combines both cooktop and oven parts</p> <ul style="list-style-type: none"> Product info Manufacturers name, Brand/product name, Model number Energy label classes Energy efficiency class: arrow with letter marking the energy efficiency class Average yield (%) 	<p>Cooktop label: Based on average yield (η), the levels are set in five categories:</p> <table border="1"> <thead> <tr> <th>Energy Efficiency Class</th> <th>Average yield</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$\eta \geq 56,0$</td> </tr> <tr> <td>B</td> <td>$54 \geq \eta \geq 56$</td> </tr> <tr> <td>C</td> <td>$52 \geq \eta \geq 54$</td> </tr> <tr> <td>D</td> <td>$50 \geq \eta \geq 52$</td> </tr> <tr> <td>E</td> <td>$\eta > 50$</td> </tr> </tbody> </table>	Energy Efficiency Class	Average yield	A	$\eta \geq 56,0$	B	$54 \geq \eta \geq 56$	C	$52 \geq \eta \geq 54$	D	$50 \geq \eta \geq 52$	E	$\eta > 50$							
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South Africa (oven)	Comparative	<p>The Energy Efficiency Classes of Ovens are determined for each usable volume category based on the rated Energy consumption, E, in kWh, for a standard load</p>	<p>Example of energy efficiency class for small volume ovens.</p> <table border="1"> <thead> <tr> <th colspan="2">Small volume (in litres): $12 \leq \text{volume} < 35$</th> </tr> <tr> <th>Energy Efficiency Class</th> <th>Energy Consumption, E, in kWh based on standard load.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>$E < 0.60$</td> </tr> <tr> <td>B</td> <td>$0.60 \leq E < 0.80$</td> </tr> <tr> <td>C</td> <td>$0.80 \leq E < 1.00$</td> </tr> <tr> <td>D</td> <td>$1.00 \leq E < 1.20$</td> </tr> <tr> <td>E</td> <td>$1.20 \leq E < 1.40$</td> </tr> <tr> <td>F</td> <td>$1.40 \leq E < 1.60$</td> </tr> <tr> <td>G</td> <td>$1.60 \leq E$</td> </tr> </tbody> </table>	Small volume (in litres): $12 \leq \text{volume} < 35$		Energy Efficiency Class	Energy Consumption, E, in kWh based on standard load.	A	$E < 0.60$	B	$0.60 \leq E < 0.80$	C	$0.80 \leq E < 1.00$	D	$1.00 \leq E < 1.20$	E	$1.20 \leq E < 1.40$	F	$1.40 \leq E < 1.60$	G	$1.60 \leq E$	
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G	$1.60 \leq E$																					

Ghana (biomass stove), draft	Hybrid: Comparative energy label with emissions endorsement label	No label design yet	<p>Proposed levels are set in tiers based on thermal efficiency. Emissions endorsement based on particle and CO emissions.</p> <table border="1" data-bbox="920 344 1702 775"> <thead> <tr> <th data-bbox="920 344 1111 451">Star</th> <th data-bbox="1117 344 1375 451">Thermal Efficiency</th> <th data-bbox="1382 344 1702 451">Eligibility of Endorsement Emission Mark</th> </tr> </thead> <tbody> <tr> <td data-bbox="920 456 1111 517">Five Star</td> <td data-bbox="1117 456 1375 517">≥60%</td> <td data-bbox="1382 456 1702 775" rowspan="6"> TC285 Tier 2: PM 2.5 < 137 mg/MJD (<6.3 mg/min) CO < 11g/MJD (<0.5 g/min) </td> </tr> <tr> <td data-bbox="920 521 1111 582">Four Star</td> <td data-bbox="1117 521 1375 582">≥50%</td> </tr> <tr> <td data-bbox="920 587 1111 647">Three Star</td> <td data-bbox="1117 587 1375 647">≥40%</td> </tr> <tr> <td data-bbox="920 652 1111 713">Two Star</td> <td data-bbox="1117 652 1375 713">≥30%</td> </tr> <tr> <td data-bbox="920 718 1111 778">One Star</td> <td data-bbox="1117 718 1375 778">≥30%</td> </tr> <tr> <td data-bbox="920 783 1111 801"></td> <td data-bbox="1117 783 1375 801"></td> </tr> </tbody> </table>	Star	Thermal Efficiency	Eligibility of Endorsement Emission Mark	Five Star	≥60%	TC285 Tier 2: PM 2.5 < 137 mg/MJD (<6.3 mg/min) CO < 11g/MJD (<0.5 g/min)	Four Star	≥50%	Three Star	≥40%	Two Star	≥30%	One Star	≥30%			
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Two Star	≥30%																			
One Star	≥30%																			

3.5.2 Elements of energy labelling

Energy efficiency

- Electricity consumption of electric stove during cooking food depends on
 - the power rating of the set
 - Power rating is not indicative of performance
 - voltage level
 - duration of cooking
 - Cooking times in Ethiopia are estimated to be 4-5 hours daily⁸ (three times a day: morning, day, evening, equals 4-5 hours)
 - The test method equals 45 minutes (if simmering period is 45 minutes as according to test method, phase 2 in part 2, Annex 3),
 - type of food to be cooked
 - Testing is done using water. The testing should be done using food stuffs commonly cooked with the stove. For this a comprehensive cooking study taking into consideration food stuffs and cooking habits should be conducted
 - the behaviour and experience of the user
 - User behaviour cannot be factored in the energy label, but it is beneficial to educate the consumer on efficient cooking methods and their effect on stove energy consumption.

Performance

A description of other measurements or separate tests that must be performed to establish the product's capacity (e.g., kilowatts of cooling capacity for air conditioners, litres of internal volume for refrigerators) or function/performance (e.g., a washing and drying index for dishwashers).

- Cooking performance can be measured with a range of metrics:
 - **Efficiency:** A range of efficiency metrics are used in different reports, all of which consider the ratio of input energy to that supplied to the food.
 - Efficiency can be reported using thermal, specific and basic efficiencies which utilise different conditions and measures, making direct comparison difficult.
 - Values are typically tested during a simulated heavy-load cooking event, so do not factor in preheat or idle energy consumption.
 - **Consumption rate:** This can be expressed in kWh/cycle or kWh/year; the latter may be a theoretical figure based on expected usage frequency, or an empirical measure based on real-life consumption data.
 - Cooking times per day, duration of cooking.

⁸ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017

- **Effective useful lifetime:** This measure expresses the average lifetime of a product under normal operating conditions.

Tolerance

Rules specified by regulators to ensure that values reported by tests are within acceptable error bands and to provide for retesting and resolving any apparent differences in results.⁹

- For instance, tolerances can be set at $\pm 5\%$ of set requirement.

Defining efficiency ranges and updating schedules

The energy efficiency tiers/ranges of the energy label classes should be defined and later updated to reflect the changes in the market.

At least the following indicators are considered:

- the variance of energy performance of current market products
 - test data as indicator of energy efficiency of products
- saving potentials at national level
 - updating the savings potential to follow the market development
- technical potential to improve efficiency, time estimates to adapt product design, cost effectiveness of technical improvements
 - cost of technological development should be taken into consideration
 - views of the manufacturers as well as policymakers are needed
 - potential technical barriers

⁹ Source: https://iea-etsap.org/E-TechDS/PDF/R06_Cooking_FINAL_GSOK.pdf (2012)

3.6 Energy labelling programme for locally manufactured stoves, recommendation

3.6.1 Recommendation for energy labelling programme

The programme should be mandatory. To ease manufacturers and retailers into the mandatory programme, a voluntary phase can be implemented before the mandatory programme is launched. The voluntary phase would be based on the actual demands of the mandatory programme.

The energy labelling programme for locally manufactured stoves should be set up as follows:

- **Phase 1:** Energy label based on thermal efficiency (%)
 - The labelling can be coupled with power output (normalised with weight of water boiled), for more definition, see table 8 and Figure 1.

Table 8. Test data depicting energy efficiency of locally manufactured stoves.

Stove Label	Efficiency (%)	*Power Output (kW/kg)	Power Rating (kW)
G1	55,1	0,3	1,4
A1	62,4	0,30	1,4
G2	49,26	0,22	1,4
D1	66,09	0,23	1,05
H1	64,44	0,21	0,8
HY	63,93	0,22	0,8

* Power output is normalized to weight of water boiled

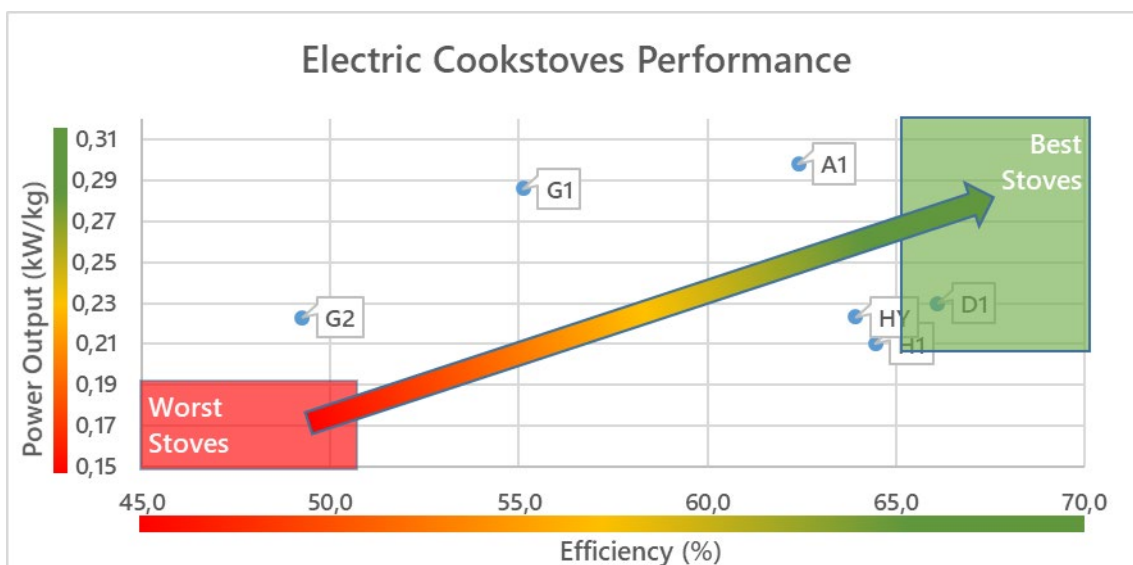


Figure 1. Energy performance of cook stoves based on test data.

Phase 2: Energy label based on measured consumption and energy efficiency based on kWh/kg (water boiled) and kWh/year based on the actual usage times of stoves in households.

- Phase 2 will need more test data as basis for labelling tiers as well as a comprehensive usage study as basis for usage times of stoves taking cooking habits as well as actual cooked dishes (wot, etc. as compared to just water boiled) into consideration.
- The development in China should be followed, as they are the only other country in the world to have an energy labelling for electric hobs/stoves (induction cooker).

3.6.2 Energy label for locally manufactured stoves

The energy label presented here is to be implemented only to locally manufactured electric stoves.

The energy label is set separately for cookstoves with single cook top (flat), single cook top (bowl), and two cook tops (flat).

- A clear product definition of a locally manufactured stove with either one or two flat cook tops and stove with one bowl type cook top should be developed.
- The development of stoves should be monitored and evaluated as the market develops.
 - If there are significant changes in the product scope, then a change in the definition as well as an overall change in the energy labelling scheme is needed.

A typical locally manufactured electric stove consists of¹⁰:

- a) A framework predominantly made from mating parts of 4mm thick galvanized iron sheet, steel or aluminium sheet metal;
- b) Single or multiple cook tops;
 - One or two cook tops / cooking areas
 - Flat or concave (bowl) type
- c) Single heating electric resistor;
- d) Flat or bowl type clay plate weighing about 1.2 to 2.0 kilograms, over/in which the open electric resistor is placed. Groove depth varies from 10 to 12 mms
- e) Round bar pot rest of 4 to 6 mm diameter made in concentric circle style for pot mounting and having height of 10 to 25 mm above heating element,
- f) Switch or circuit breaker or for turning on or off the unit; cable, connector, and plug.

¹⁰ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017

Phase 1 Comparative labelling (see Figure 2)

The Ethiopian energy label is proposed to be based on the European Categorical Energy Label (bars) and colours with bar size modified along with Arabic numbers.¹¹ The energy label and energy classes are set separately for stoves with one or two cooking areas.

The design is simple, and the comparison is done using the bars with arrow depicting the energy class of the stove. The label can be made even more simple, if the diameter of the cooking area is not deemed necessary. The label would depict only the information of the appliance itself and its energy class based on the classification. Recommended energy label designs are shown in Figure 2. Optional designs are shown in Figure 3.

The more efficient grade is marked with bigger sized Green arrow and number 1. The grade numbers assigned indicate the most efficient or very good product as 1 and least efficient or not so good as 5.

The colours assigned are

- Dark Green (1) indicates most efficient, environment friendly and greener product,
- Light green (2),
- Yellow (3),
- Light red (4) and
- Red (5) least efficient, energy wasting product.

The size of the label is proposed to be 10 cm (height) x 7.5 cm (width).¹²

Information and calculations displayed on the label:

EEA logo

- Depicts that the energy label is official, and information presented on it is according to set regulations.
- The logo should be of the institution responsible for issuing regulation for energy labelling.

Manufacturers name / Brand name

- This information should be on the product to start with (see part Product shield)

Model No.

- This information should be on the product to start with (see part Product shield)

Diameter of cooking area:

- If the stove has two cooking areas, the diameter of both cooking areas is presented (labels for stoves with one or two cooking areas are set as separate label designs).




Regulation no.

- The regulation according to which the demands/criteria are set is shown on the energy label.

¹¹ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017).

¹² Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017).

Energy Label for stove with one cooking area

 Energy ኃይል		Stove ጥቅጽ	
Manufacturer name		HILAWE	
Model nro		12345678	
			
Diameter of cooking area, cm		22 22	
Type of cook top		Bowl	
EEA regulation nro			

Definitions

EEA logo
 Energy (English and Amharic)
 Stove (English and Amharic)
 Manufacturers name
 Model nro
 Colour bars with arabic numbers
 Arrow with corresponding numbers

Diameter of cooking area, cm

Type of cooking area, flat / bowl
 Text or pictogram



Energy Label for stove with two cooking areas







 Energy ኃይል		Stove ጥቅጽ	
Manufacturer name		HILAWE	
Model nro		12345678	
			
Diameter of cooking area, cm		22	
Diameter of cooking area, cm		16	
Type of cook top		Flat	
EEA regulation nro			

Figure 2. Proposed energy label design, stove with one cooking area (left), stove with two cooking areas (right). If needed, the stove type can be shown on the label: flat / bowl type with either text or a pictogram.

Energy Label for stove with one cooking area

 Energy ኃይል		Stove ምድቻ	
Manufacturer name Model nro		HILAWE 12345678	
			
Diameter of cooking area, cm		22	
Annual energy consumption, kWh Annual CO ₂ emissions, kg		250 40	
EEA regulation nro			

Definitions

EEA logo
Energy
Stove
Manufacturers name
Model nro
Colour bars with arabic numbers
Arrow with corresponding numbers

Diameter of cooking area, cm

Annual energy consumption, kWh

Annual CO₂ emissions, kg

Energy Label for stove with two cooking areas




 Energy ኃይል		Stove ምድቻ	
Manufacturer name Model nro		HILAWE 12345678	
			
Diameter of cooking area, cm		22	
Diameter of cooking area, cm		-	
Annual energy consumption, kWh Annual CO ₂ emissions, kg		250 40	
EEA regulation nro			

Figure 3. Energy label designs (optional) with calculated energy consumption, kWh and annual CO₂ emissions (kg). This type of label can be used when more accurate information on the stove energy consumption and the cooking habits (cooking times etc) is available (in phase 2 of testing procedures).

3.6.3 Imported appliances

Imported appliances are not included in the energy labelling scheme for locally manufactured stoves.

Imported stoves (cooktops, hobs, hot plates etc). could enter the scheme in two ways:

- 1) Importer provides required information and testing according to the test procedure adopted for locally manufactured stoves OR has their appliances tested accordingly in the local test facility and the provide the documentation.
 - o Limitations, as energy label for only stoves with one or two cook tops
 - o Energy label for single cook tops could be used for single hot plates
 - o Energy label for two cook tops could be used for hobs with two cooking areas
 - o Hobs/cook tops with more than two cooking areas not eligible
- 2) sign Mutual Recognition Agreement (MRA) to accept product information and test data according to requirements set in origin country (acknowledging EU, China etc. standards/requirements).
 - o Approved for sale in the market, no energy label

Importer of the appliance would be responsible for either delivering product documentation with documentation on conducted tests and the required product information to market surveillance authority (compliance authority) as per MRA or submitting appliances for type / performance testing.

The importer would be responsible for setting the energy label on all imported, approved products on arrival, so that the energy label is either within the package of the product or already on the product as it enters the point of sale.

3.6.3 Technical documentation

Manufacturer/producers are required to present technical documentation on the products for market approval.

- *List of required technical information, example of technical documentation, can be added if needed. This should follow the demands of the product standard.*
- The technical documentation of the product (example technical information for electric hobs in EU):
 - Model identification
 - Type of hob
 - Number of cooking zones and/or areas
 - Heating technology (induction cooking zones and cooking areas, radiant cooking zones, solid plates)
 - For circular cooking zones or area: diameter of useful surface area per electric heated cooking zone, rounded to the nearest 5 mm
 - For non-circular cooking zones or areas: length and width of useful surface area per electric heated cooking zone or area, rounded to the nearest 5 mm
 - Energy consumption per cooking zone or area
 - Energy consumption for the hob
 - Short title or reference to the measurement and calculation methods used to establish compliance with the above requirements;
 - Information relevant to users in order to reduce total environmental impact (e.g. energy use) of the cooking process.
 - The technical information can contain information relevant for non-destructive disassembly for maintenance purposes and information relevant for dismantling, in particular in relation to the motor, if applicable, and any batteries, recycling, recovery and disposal at end-of-life.

Product shield

The product information should also be marked on the product (product shield / value shield, figure 4), so the consumer/buyer/authority can make certain that the energy label is assigned to the correct product.

The requirement of a product shield should be implemented in the product standard / required for all electronics on the market.


Manufacturer:	HILAWE
Model nro	12345678
Power rating, kW	2000
Diameter of stove, cm	22
	

Figure 4. Product shield / Value shield (optional design)

3.6.4 Defining efficiency ranges and updating schedules

The energy efficiency tiers/ranges of the energy label classes should be defined and later updated to reflect the Ethiopian market.

At least the following indicators are considered:

- the variance of energy performance of current market products
 - o pre-test data as indicator of energy efficiency of current products
- saving potentials at national level
 - o updated savings potential is shown in Annex 2 (original savings potential¹³).
- technical potentials to improve efficiency, time estimates to adapt product design, cost effectiveness of technical improvements.
 - o views of the manufacturers as well as policymakers are needed
- potential technical barriers,
 - o cost of power control regulators, effect of the current grid status

Defining energy efficiency tiers / ranges

The definition of the energy efficiency tiers or ranges should steer the market and product development towards more efficient products. If the standards result in a large proportion of the products to qualify for the higher efficiency levels (tiers/ranges), with little apparent difference in efficiency, it means that consumers do not have the opportunity to preferentially select the most efficient products at the point of purchase. It also limits the incentive for manufacturers to develop higher efficiency products.

Definition of energy efficiency tiers can be done purely based on energy performance or setting additional efficiency requirements.

- Tier 1 requirements: efficiency level of the best performing appliance in the market at that time, creating the equivalent of a Top Runner target: i.e. the top 5% of products in terms of energy efficiency.
- Tier 2 requirements: only 10% of efficient appliances are eligible at the time the standard is introduced
- Remaining tiers: products to be evenly distributed across remaining labelling categories (MEPS products in the last tier).

Energy label tiers, recommendation

At the start of the programme, the tiers should be set based on a basic curve: most products in tiers 5 and 4, some products in tiers 3 and 2 and no products in the best tier, tier 1.

¹³Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, 2017).

The tiers (categories, energy classes) are normally set so as to encourage product development and to follow the market development. As the market develops the tiers should be revised.

Revision of energy efficiency tiers

Automatic revision of the Tier/Range requirement should be initiated when 10% of products in the market achieve Tier 1 performance, or 25% of products achieve Tier 2 performance. This is to ensure that higher efficiency products are continually differentiated from other appliances on the market.

Such a strategy would allow consumers to choose higher efficiency products and allow policymakers to effectively pursue other policy support measures that target the best performing products (such as subsidies or promotional activities).

It is also possible to set the tiers so, that they are gradually tightened by a certain percentage per year (for e.g. 5% / year).

3.6.4.1 Energy Efficiency tiers / ranges, phase 1, recommendation

The proposed energy efficiency classes can be set as follows as shown in table 9.

The energy efficiency classes (tiers) should be determined after more samples of products have been tested and their efficiencies determined. Market data is also needed to define the tiers properly per market saturation.

Table 9. Recommended energy labelling tiers for Ethiopia, in phase 1

Energy Efficiency Class	Thermal Efficiency, %
1	$\geq 77,5$
2	72,5-77,5
3	67,5-72,5
4	62,5 – 67,5
5	$\leq 62,5$

The energy label classes 1, 2, 3, 4 and 5 can be rated according to the thermal efficiency, based on the measurement done for MEPS (water boiling + simmering), see figure 5.

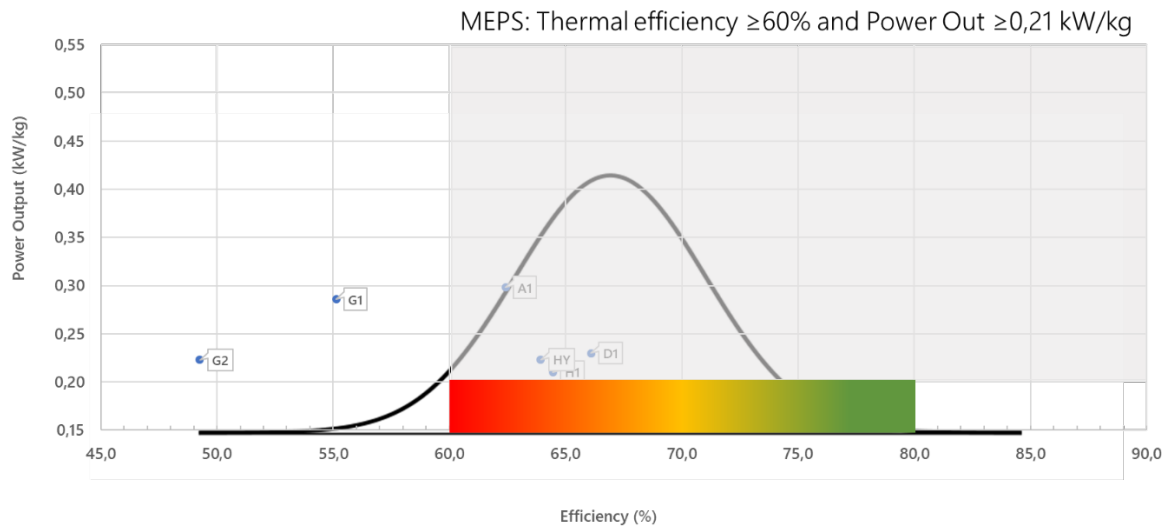


Figure 5. Setting the tiers for the energy label. In the starting phase, the market share of products in the different energy classes should coincide with curve: most products in the lower two energy classes and with only a few (if any) in the third and second class, and none in the best class.

The range of the energy efficiency classes should be evaluated after more data on the energy consumption as well as sales volumes of locally manufactured stoves is available.

- To ensure that the energy efficiency is continuously developed, the demands should be tightened over the years. For example:
 - voluntary for 1-2 years (range stay the same)
 - mandatory after 2 years (range stay the same)
 - ranges are tightened gradually over the years or a revision is done after 5-8 years after mandatory phase begins.

3.7 Monitoring and evaluation of the programme

The market of cookstoves and the labelling programme should be monitored and evaluated.

Market monitoring

- **Monitor the market: collect cookstove market and performance data**

- Market and stove performance data is valuable as the bases for any revision of the labelling programme
 - **Product registration database** is a good basis for product information (models, sizes, power ratings, consumption data etc.)
 - **Sales data** is the other key: collect sales data from manufacturers / set up a monitoring system for sales figures
 - Sales figures by model to be reported yearly
 - Collection of market / sales data
To have a good view of the market and the efficiency level of the products, it is recommended that policymakers require that suppliers (manufacturers and importers) register their products for sale in the Ethiopian market and to supply annual sales figures for all appliances registered for sale.
 - This will enable the policymaker to develop the energy efficiency standards and associated energy saving projections more accurately and help product development.
 - Market data is usually gathered by market analysis organisations such as GfK that collected data from manufacturers as well as merchants. Market analysis can be done in other ways: for e.g. the manufacturers association can do the data collection themselves and provide overall information on the sales of appliances in different energy classes (number of products in different energy classes overall, not by manufacturer).
 - Conduct cost studies (price of electricity, make up of electricity production, product costs (manufacturing, distribution, sales prices))
- **Consumer behaviour** (cooking habits, usage, consumer selection preferences etc.)
 - **Usage of cooking appliances:**
How consumers use a product in real life in their homes directly impacts several factors used in the development of energy efficiency standards. It affects projections of energy consumption and saving potentials, the accuracy and relevance of test methods, and determines the actual energy used by the consumer in their household. If the information is not publicly available, initiating a research programme to establish how appliances are typically used by households and with what frequency (usage patterns).

-
- **Revise the labelling programme and requirements** as more data and information is available
 - o Is there a noticeable change in the energy consumption of stoves?
 - o Is there noticeable change in the sales of locally manufactured stoves (more imports or more local products in the market)
 - **Consult national stakeholders**
 - o energy labelling programme should be developed with both the manufacturers/importers/suppliers/producers as well as the product end-users: form a steering group that meets regularly to evaluate the need for revision, enhanced dissemination / communications, needs for training of focus groups, etc.

Evaluation criteria

Evaluation of the programme can be done using a variable of criteria that are based on the programme elements.

Examples of evaluation criteria:

- Involvement of producers/manufacturers (number of active entities in lieu of participation in training, interaction with administration, number of appliances in database etc): all participating, only a few, a percentage of manufacturers participating etc. To have good coverage, at least the all the major players should participate.
- Production data / Sales data: number of sold stoves within energy classes: how many A, B, C, D, E -class stoves are produced / sold? What is the market share of for e.g. C-class stoves?

3.7.1 Market surveillance procedures

Market surveillance is defined as the activities carried out and measures taken by public authorities to ensure that products comply with the applicable requirements and do not endanger health, safety or any other aspect of public interest protection.¹⁴

There are two distinct types of market surveillance:

- Proactive market surveillance - planned market surveillance activity
- Reactive market surveillance - in response to an outside event

¹⁴ Good practice for Market Surveillance, AdCo (EU Market Surveillance Authorities), 2017.
<http://ec.europa.eu/DocsRoom/documents/23041/attachments/1/translations/en/renditions/pdf>

3.7.1.1 Proactive market surveillance - planned market surveillance activity

a) Knowledge of the market

It is recommended that Market Surveillance Authorities perform a market screening exercise to identify which Economic Operators are active in a particular sector; what products are available and where e.g. in store or online.

Market Surveillance Authorities are advised to cooperate with industry to identify supply chains and market share and conduct market research among end users. At the end of the market screening exercise the Market Surveillance Authority should have an intelligence led overview of:

- the overall size of the national market, i.e. the amount and type of products supplied on the market
- the names and market share of the Economic Operators supplying given products
- the type of Economic Operator (e.g. manufacturers, importers, distributors) and main channels of sales (e.g. online or retail premises).

b) Planning activities

Proactive market surveillance refers to activities which are specifically planned, organised and implemented by the Market Surveillance Authority.

Proactive market surveillance activities are important because they have the potential to prevent non-compliance from taking place. It is more cost-efficient than reactive market surveillance because the resources and the parameters needed to carry out these activities can be defined in advance. These activities can also include long-term planned actions for specific products, product groups or sectors such as raising awareness through communication activities or with Economic Operators involved in compliance schemes when they exist.

Proactive market surveillance can relate to either the targeting of Economic Operators (based on criteria such as history of non-compliance, results of audits, market share, distribution of products and/or users, etc.) or the targeting of products, both of which can be conducted as part of a focussed market surveillance campaign.

c) Implementation of market surveillance campaigns

After having defined scope (e.g. which and how many products or Economic Operators to target) of a specific market surveillance campaign, the Market Surveillance Authority will still need to:

- Define objectives to verify that products are compliant with the applicable legislation in order to guarantee consumer protection and to stop unfair competition
- Define the depth of the compliance evaluation to be carried out
- Determine the period during which the campaign will be performed

- Conduct a feasibility study to evaluate if there is sufficient resource to meet the defined scope and objectives of the campaign
- Determine which procedures to follow e.g. by developing a code of practice which will enable the effectiveness of a campaign and facilitate the preparation of a standardised report.

In the course of the campaign the Market Surveillance Authority will evaluate the noncompliance and risk and take the necessary measures against the Economic Operator.

3.7.1.2 Reactive market surveillance

Not all market surveillance activities can be planned in advance. Reactive market surveillance is normally triggered by an outside event and in relation to a specific suspected offence. This could include incidents and accidents, notifications from other authorities (e.g. customs, labour inspectorate, police, social inspector, transport authority) or notifications from external sources (e.g. consumer complaints, Economic Operators, Notified Bodies, press releases, consumer reports)

Information received by a Market Surveillance Authority relating to a product suspected to be non-compliant or to present a risk must be followed up in accordance with the principle of proportionality. Although reactive market surveillance can create a sense of urgency (as the product might be suspected of having caused an accident) and may attract media interest, Market Surveillance Authorities should act proportionately and reach a considered and justifiable decision.

ANNEX 1 Impact assessment of different MEPS settings

Impact assessment of the MEPS for locally manufactured stoves in Ethiopia was done under the following assumptions and data:

	Stoves in the market now	
Input power, W	920	Average for four stoves measured in the lab (announced input power ratings are much higher)
Average efficiency	58,2 %	Average of four stoves measured in the lab
Time of use, hours/day	3,5	Danas report (2017), page 29 ¹⁵
Energy consumption, kWh/a	1175	
	MEPS level stoves	
MEPS efficiency requirement	60 %	
Input power, W	892	Estimated using improved efficiency
Time of use, hours/day	3,5	
Energy consumption, kWh/a	1140	
Savings, kWh/stove, a	35	Savings at annual lever per stove
Equipment lifetime, years	5	Equipment lifetime has an impact on replacement investments

National Electrification Program (NEP)¹⁶

There are investments to more efficient biofuel stoves: 9 million replacements have been made and 12 million more will be replaced in next year, i.e., almost everyone using biofuel will get a more efficient stove.

Network reliability issues may work to the same effect. Therefore, electric stove volumes need to be kept moderate.

Stove imports:

It is assumed that imported stoves must fulfil MEPS requirements and similar savings take place. Danas Report (2017)¹⁷ estimated the proportion of imports at 10%.

Electricity generation is based on renewable energy sources (mainly hydro) and is expected to do so in the future. Imports are insignificant. Therefore, using more efficient electric stoves does not reduce GHG emissions from power generation and supply.

¹⁵ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, (2017).

¹⁶ National Electrification Program 2.0 - Integrated Planning for Universal Access - Lighting to All. Ministry of Water, Irrigation & Electricity, 2019.

¹⁷ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, (2017).

Indirect effect (NEP-report):

Traditional fuel consumption has been estimated to account for 46 percent of annual forest loss and, in turn, forest degradation for 37 percent of total CO₂ emissions. Federal Democratic Republic of Ethiopia (2011). Ethiopia’s Climate-Resilient Green Economy Strategy, Addis Ababa.

I.e., if use of biomass declined due to more appealing electric stoves, it can have a positive effect on deforestation.

Multiple benefits: Access to electricity services will lead to fuel substitution away from biomass sources, with attendant health benefits, reduced time spent on traditional fuels gathering, and mitigation of climate change and deforestation.

Time Period		Total Households	Grid Conn. Added	Cumul. Grid Conn.	Grid Access Rate	Off-Grid Conn. Added	Cumul. Off-grid Conn.	Off-Grid Access Rate	Total Conn. Added	Total Cumul. Conn.	Total Access Rate
Program	Year	(millions)	(millions)	(millions)	(pct)	(millions)	(millions)	(pct)	(millions)	(millions)	(pct)
GTP II	2017	19.9	0.2	6.6	33%	0.0	2.2	11%	0.2	8.8	44%
	2018	20.4	0.3	6.9	34%	0.0	2.2	11%	0.3	9.1	45%
	2019	20.7	0.5	7.4	36%	0.1	2.3	11%	0.6	9.7	47%
	2020	21.1	0.7	8.1	38%	0.5	2.8	13%	1.2	10.9	52%
	2021	21.6	0.9	9.0	42%	0.7	3.5	16%	1.6	12.5	58%
GTP III	2022	22.0	1.3	10.3	47%	0.9	4.4	20%	2.2	14.7	67%
	2023	22.4	1.5	11.8	53%	1.0	5.4	24%	2.5	17.2	77%
	2024	22.8	1.6	13.4	59%	1.2	6.6	29%	2.8	20.0	88%
	2025	23.2	1.7	15.1	65%	1.5	8.1	35%	3.2	23.2	100%
GTP IV	2026	23.6	1.8	16.9	72%	-1.4	6.7	28%	0.4	23.6	100%
	2027	24.0	1.8	18.7	78%	-1.4	5.3	22%	0.4	24.0	100%
	2028	24.4	1.9	20.6	84%	-1.5	3.8	16%	0.4	24.4	100%
	2029	24.8	1.9	22.5	91%	-1.5	2.3	9%	0.4	24.8	100%
	2030	25.2	1.8	24.3	96%	-1.4	0.9	4%	0.4	25.2	100%

Figure 6. NEP targets and timetable. National Electrification Program 2.0, summary/page xx.¹⁸

The following tables (9-11) show the impacts calculated at different levels set of efficiency requirements for locally manufactured stoves.

¹⁸ National Electrification Program 2.0 - Integrated Planning for Universal Access - Lighting to All. Ministry of Water, Irrigation & Electricity, 2019.

Table 9. Impact calculated with 60% thermal efficiency set as MEPS for locally manufactured stoves

	2011 estimate	2017 estimate	2018-2022 estimated based on 2011-2017 development					MEPS 2023-		Full electrification announced in 2025 (NEP)					
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Number of households, million		19,9	20,4	20,7	21,1	21,6	22,0	22,4	22,8	23,2	23,6	24,0	24,4	24,8	25,2
Non-household users excluded from the estimate															
Number of electric stoves, million	0,28	0,71	0,78	0,86	0,94	1,04	1,15	1,30	1,50	1,75	2,05	2,40	2,80	3,25	3,75
New users of electric stoves, million/a			0,07	0,08	0,085	0,095	0,11	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50
Replacement investments, million/a								0,23	0,23	0,23	0,23	0,23			
Annual sales of new efficient stoves, million/a								0,38	0,43	0,48	0,53	0,58	0,40	0,45	0,50
Total number of new efficient stoves, million								0,38	0,81	1,29	1,82	2,40	2,80	3,25	3,75
Energy savings, GWh/a, new annual savings from new stoves								13	15	17	19	20	14	16	18
Energy savings, GWh/a, cumulative savings compared to baseline								13	29	45	64	85	99	114	132

Estimates for 2011 and 2017: source DANAS report (2017), pages 28 and 29, estimates for 2018-2020 based on historical sales volumes.¹⁹

Replacement investments after 2027: All non-MEPS stoves replaced in 5 years. No savings expected from replacement investments after 5 years unless a more stringent MEPS level will be introduced.

¹⁹ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, (2017).

Table 10. Impact calculated with 63% *thermal efficiency set as MEPS for locally manufactured stoves.*

	2011 estimate	2017 estimate	2018-2022 estimated based on 2011-2017 development					MEPS 2023-		Full electrification announced in 2025 (NEP)					
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Number of households, million		19,9	20,4	20,7	21,1	21,6	22,0	22,4	22,8	23,2	23,6	24,0	24,4	24,8	25,2
Non-household users excluded from the estimate															
Number of electric stoves, million	0,28	0,71	0,78	0,86	0,94	1,04	1,15	1,30	1,50	1,75	2,05	2,40	2,80	3,25	3,75
New users of electric stoves, million/a			0,07	0,08	0,085	0,095	0,11	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50
Replacement investments, million/a								0,23	0,23	0,23	0,23	0,23			
Annual sales of new efficient stoves, million/a								0,38	0,43	0,48	0,53	0,58	0,40	0,45	0,50
Total number of new efficient stoves, million								0,38	0,81	1,29	1,82	2,40	2,80	3,25	3,75
Energy savings, GWh/a, new annual savings from new stoves								34	38	43	47	52	36	40	45
Energy savings, GWh/a, cumulative savings compared to baseline								34	72	115	163	215	250	291	336

Estimates for 2011 and 2017: source DANAS report (2017), pages 28 and 29, estimates for 2018-2020 based on historical sales volumes.²⁰

Replacement investments after 2027: All non-MEPS stoves replaced in 5 years. No savings expected from replacement investments after 5 years unless a more stringent MEPS level will be introduced.

²⁰ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, (2017).

Table 11. Impact calculated with 67% *thermal efficiency set as MEPS for locally manufactured stoves.*

	2011 estimate	2017 estimate	2018-2022 estimated based on 2011-2017 development					MEPS 2023-		Full electrification announced in 2025 (NEP)					
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Number of households, million		19,9	20,4	20,7	21,1	21,6	22,0	22,4	22,8	23,2	23,6	24,0	24,4	24,8	25,2
Non-household users excluded from the estimate															
Number of electric stoves, million	0,28	0,71	0,78	0,86	0,94	1,04	1,15	1,30	1,50	1,75	2,05	2,40	2,80	3,25	3,75
New users of electric stoves, million/a			0,07	0,08	0,085	0,095	0,11	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50
Replacement investments, million/a								0,23	0,23	0,23	0,23	0,23			
Annual sales of new efficient stoves, million/a								0,38	0,43	0,48	0,53	0,58	0,40	0,45	0,50
Total number of new efficient stoves, million								0,38	0,81	1,29	1,82	2,40	2,80	3,25	3,75
Energy savings, GWh/a, new annual savings from new stoves								59	66	74	82	89	62	69	77
Energy savings, GWh/a, cumulative savings compared to baseline								59	125	199	281	370	432	501	578

Estimates for 2011 and 2017: source DANAS report (2017), pages 28 and 29, estimates for 2018-2020 based on historical sales volumes.²¹

Replacement investments after 2027: All non-MEPS stoves replaced in 5 years. No savings expected from replacement investments after 5 years unless a more stringent MEPS level will be introduced.

²¹ Project document On Locally manufactured electric stoves, DANAS Electrical Engineering, (2017).

Table 12 Impact on deforestation

CALCULATION FOR REPLACEMENT OF BIOMASS STOVES, REDUCED DEFORESTATION																
Yellow marks for critical assumptions																
	2011 estimate	2017 estimate	2018-2022 estimated based on 2011-2017 development					MEPS 2023-		Full electrification announced in 2025 (NEP)						
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Number of households, million		19,9	20,4	20,7	21,1	21,6	22,0	22,4	22,8	23,2	23,6	24,0	24,4	24,8	25,2 million households	
Population using charcoal for cooking	2,8 %	https://www.cleancookingalliance.org/country-profiles/15-ethiopia.html						0,63	0,64	0,65	0,66	0,67	0,68	0,69	0,71 million households	
Population using wood for cooking	85 %							19,0	19,4	19,7	20,1	20,4	20,7	21,1	21,4 million households	
Population using electricity for cooking	0,2 %															
Non-household users excluded from the estimate																
Note! NEP: There are investments to more efficient biofuel stoves. 9 million replacements have been made and 12 million more will be replaced in next year. I.e, almost everyone using biofuel will get a more efficient stove.																
Network reliability and other supply issues may work to the same effect. Therefore, electric stove volumes need to be kept moderate.																
Replacement assumptions																
Charcoal users switching to electric stoves per year		1 %						0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01 million	
Wood users switching to electric stoves per year		1 %						0,19	0,19	0,20	0,20	0,20	0,21	0,21	0,21 million	
Total in 2023-2030																
New users of electric stoves, million/a								0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	2,6
This is not used in the calculation. This is just a reference number from the next pages to avoid discrepancy in the total numbers. I.e total switchin consumers about 1,7 million, increased population 0.9 million.																

Electrification figures, source: National Electrification Programme, summary/page xx

Background information and assumptions for calculation in Table 12:

CHARCOAL STOVES										
Charcoal consumption	180	kg/person/a	Reference value from Kenya	https://www.cleancookingalliance.org/resources_files/improved-household-charcoal.pdf						
Average family size in Ethiopia	4,6		https://population.un.org/Household/index.html#/countries/231							
Charcoal consumption	0,83	tonnes/family/a								
GHG-emissions from charcoal production	9	kg CO2eq per kg charcoal produced	FAO: The charcoal transition, 2017	http://www.fao.org/3/a-i6935e.pdf						Includes production of charcoal and deforestation
GHG-emissions from charcoal production	9	tonnes CO2 eq per tonne charcoal								
Avoided emissions from charcoal use			397 281	tonnes CO2eq/a in 2030						
			0,4	Mt CO2eq/a in 2030						
WOOD STOVES										
Wood consumption	0,67	m3/person/a	Cerrutti et al 2015							
Average family size in Ethiopia	4,6	persons								
Wood consumption	3,1	m3/family/a								
Density	1,4	m3/tonne	Average for tropical hardwood							
Wood consumption	2,2	tonnes/family/a								
GHG-emissions wood use	8,3	kg CO2eq per kg wood used		https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3392076/						
GHG-emissions from wood use	8,3	tonnes CO2 eq per tonne wood used								
Avoided emissions from wood use			29 606 802	tonnes CO2eq/a in 2030						
			29,6	Mt CO2eq/a in 2030						