



Standardised Impact Metrics for High-Performing Appliances: Fans and TVs



Executive Summary
October 2020



About



Efficiency for Access Coalition

Efficiency for Access is a global coalition working to promote high-performing appliances that enable access to clean energy for the world's poorest people. It is a catalyst for change, accelerating the growth of appliance markets to boost incomes, reduce carbon emissions, improve quality of life and support sustainable development.

Efficiency for Access consists of 15 Donor Roundtable Members, 10 Programme Partners, and more than 30 Investor Network members. Current Efficiency for Access Coalition members have programmes and initiatives spanning 44 countries and 22 key technologies.

The Efficiency for Access Coalition is coordinated jointly by CLASP, an international appliance energy efficiency and market development specialist not-for-profit organisation, and UK's Energy Saving Trust, which specialises in energy efficiency product verification, data and insight, advice and research.

www.efficiencyforaccess.org.

The Low Energy Inclusive Appliances (LEIA) programme is the flagship programme of Efficiency for Access. Funded by the UK's Foreign and Commonwealth Development Office and the IKEA Foundation, LEIA is a research & innovation programme that aims to accelerate the availability, affordability, efficiency, and performance of a range of low energy inclusive appliances particularly suited to developing country contexts.



GOGLA

GOGLA is the global association for the off-grid solar energy industry. Established in 2012, GOGLA now represents over 180 members as a neutral, independent, not-for-profit industry association. Its mission is to help its members build sustainable markets, delivering quality, affordable products and services to as many households, businesses and communities as possible across the developing world. The products and solutions that GOGLA members sell transform lives. They improve health and education, create jobs and income opportunities and help consumers save money.

To find out more, go to www.gogla.org

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Introduction

Why Impact Metrics Matter

Affordable, high-performing appliances¹ can deliver significant economic, health, education and quality of life benefits for households worldwide. They can also reduce greenhouse gas emissions and help communities adapt to the effects of climate change. To ensure that energy access decision-makers understand the transformative impact of high-performing appliances, a standardised framework for impact measurement is needed.

The Efficiency for Access Coalition and the GOGLA Impact Working Group have joined forces to propose the standardised approach presented in this publication. It provides a harmonised industry standard for measuring social impact, designed to attract investment, working capital, and regulatory support for the high-performing appliances sector. The metrics help build the evidence base for the many benefits that high-performing appliances unlock for people previously living in energy poverty. These include improved quality of life, and using the appliance to work, study or spend time with family.

Individual organisations can use these metrics to estimate the impact of their products, services or market support activities. The LEIA Programme will use these metrics to support high-performing appliance companies and members of the Efficiency for Access Donor Coalition will use it in their impact reporting. GOGLA will also use the metrics to calculate the impact of those members, IFC Lighting Global Associates and companies engaging with the LEIA Programme, that are participating twice yearly in the off-grid solar sales and impact data collection. This will help demonstrate the impact of high-performing appliances to key decision-makers.

Background

High-performing appliances help rural communities in off- and weak-grid areas to enjoy improved quality of life and the benefits associated with access to modern energy services. Appliances have the potential to help accelerate progress towards many of the Sustainable Development Goals (SDGs) as shown in Figure 1.

Figure 1. SDGs Impact by High-performing Appliances (Efficiency for Access Coalition)



**High-Performing Appliances Help Achieve
the UN Sustainable Development Goals**



¹ High-quality and efficient off-grid appliances that are intentionally designed for end-users living in energy-constrained environment and advertised for use with a PV module or a solar home system. Efficiency for Access Coalition (2019). State of the off-grid appliance market.

Introduction

Since 2018, the partnership between GOGLA and the Efficiency for Access Coalition has allowed sales data to be collected for a range of key high-performing appliances as part of the Global Off-Grid Solar Market Data Collection process. Along with reporting unit volumes and revenues generated by the sale of products, a high value is also placed on communicating the estimated impact that these products make throughout their serviceable lifetimes. For lighting products (including solar home systems or SHS), the GOGLA ‘Standardised Impact Metrics for the Off-Grid Solar Energy Sector’² have been in place since 2015 widely adopted across the sector as the accepted measure for estimating the social, economic and environmental impact of off-grid solar lighting products consistently and comparably. **Each impact estimate, updated in the Global Off-Grid Solar reporting that takes place each half-year, is based on a calculation using the number of products sold or deployed to end-users.**

As part of a broader impact framework, the creation of similar impact metrics for appliances will provide a valuable and cost-effective opportunity to create global impact estimates that can help engage relevant policymakers, investors and development stakeholders. At the same time, the incorporation of impact measurements into the sales data reporting process would increase the value of participation to reporting companies by providing them with a third-party generated measure of impacts which showcases their work and efforts to their investors and other stakeholders.

The Impact Metrics for Appliances Project

The focus of this project is the development of a set of standardised impact metrics that capture the impacts that high-performing appliances have on end-users. This set aims to encompass metrics for each of the following identified impact areas unlocked by the appliances: appliance access, economic activity, environmental sustainability and social impact. Metrics are defined for each specific appliance category, subject to the availability of reliable research and robust data. The focus of the first metric development effort, outlined in this document, are fans and TV appliances. These are developed with the support (and through the mechanism) of the GOGLA Impact Working Group (WG),³ where companies, academic observers and other relevant stakeholders partake in discussions and approve the metrics. For the WG to represent the different target companies and company profiles, for whom the framework is intended, a number of appliance companies from the LEIA network have joined to partake in the discussions and the metric development.

The target users of these metrics are appliance companies (manufacturers/distributors), investors and financiers, as well as advocacy groups and development partners involved in the sector and working with government and policymakers.

² GOGLA (2020). Standardised Impact Metrics for the Off-Grid Solar Energy Sector, version 4.

³ The GOGLA Impact WG has as primary objective to revise and expand the standardised impact metrics for the off-grid solar sector. It also aims to improve the adoption of these metrics as well as gather evidence on social impact. The WG usually consists of GOGLA Members, academic observers and development partners.

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Limitations when using the metrics

Specific metrics or coefficients apply to specific appliances. Each appliance type has its own set of metrics and variables. Only use those metrics or variables that relate to the relevant appliance/product(s). For example, a certain metric or variable might be specific to elements of TV use, while different metrics and variables should be used for measuring the impact of fan use. Please ensure you review the metrics carefully and only use those metrics or variables that relate to the relevant appliance/product(s).

These metrics apply to high-performing appliances. The metrics have been created using data and evidence from high-performing appliances products. As such, it is advised that these metrics should only be used to calculate the impact of companies or organisations selling products that adhere to the eligibility criteria outlined in the section above.

The metrics apply to high-performing appliances sold in off- and weak-grid environments in a developing countries context. Therefore, only off-grid solar products sold in the developing world should be included when using the metrics to measure impact. It should be noted that while the appliances framework applies to weak and off-

grid environments, it is agnostic to the associated energy supply source.

Results calculated using these metrics should be described as estimates. It is important to note that, while these metrics have been created using the best available data, results created using the metrics should always be referred to as estimates as the data represents insights from research done with specific companies or organisations. As such, these estimates may not be representative for specific contexts that other companies (outside of the datasets from considered research) operate in. Additionally, most data is self-reported. Please see details of the limitations for each metric's variables for specific limitations and/or details on each metric for more information on how these should be used and described.

Metrics should not be used when it is clear that specific products and services do not have the estimated impact. While applicable in most cases, there may be instances where a specific product type, location or use-case may not lead to a commonly observed impact. For example, a company selling appliances specifically to households powered by a (weak) grid, should not use the current metric to estimate the amount of

Eligibility criteria for TVs and fans to use metrics suggested in this report

The following criteria, shown in Table 1, have been selected and adopted as a minimum standard, set up to be applicable and consistent across appliances. The selection is based on preliminary criteria that would not require testing and are focused on consumer protection.

The rationale for keeping the selected criteria limited to access to warranty and

user manual is that including appliance performance criteria would lead us into the work field of establishing a full quality assurance framework for all different types of appliances, which at present is too early for the impact framework. All companies should be able to use the impact framework as long as the consumer protection criteria shown in Table 1 are met and limitations below are taken into account.

Table 1. Selected criteria to products for which metrics are applied

Aspect	Requirements
Warranty (one year)	Warranty is accurately specified and consumer-facing, with a minimum coverage of one year
Availability of User Manual	The user manual must present instructions for use and basic electrical safety

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GHG emissions offset since that pertains only to the replacement of diesel generators. Another example is that a fridge developed and sold for vaccine storage is not likely to lead to household access or avoidance of food waste. A common-sense approach should be taken to use and apply the impact metrics.

Guidance on using the Metrics

The high-performing appliances sector is still at a nascent stage, and the availability of research, particularly socio-economic impact research is limited. This initial framework of measuring impact in the high-performing appliances sector, and the metrics within it, presents the first effort of its kind. We have fully taken the utmost care to use the available data as effectively as possible, while still keeping a conservative approach. Please be mindful that this is an iterative approach, as new research projects are commissioned and more data and evidence become available, a revision to these metrics will be made available.

Funding and support is needed to carry out new research and obtain more data. If you would like to help us uncover other data and research useful for impact metric development and improve assumption accuracy, you can:⁴

- share relevant data
- (co) fund research
- join the impact working group

The overview of formulas and variables in the tables at the beginning of each appliance section summarizes the harmonized framework detailed in the rest of this document. **Red** coefficients are to be inputted by users of the metrics (e.g. companies) whilst **Blue** coefficients have default values that have been established through this work. Defaults should be used where appropriate, unless companies or other users have more accurate and specific inputs from their own, robust and reviewed, research.

Please note that the primary basis used for counting and scaling estimates of social impact is the number of products sold or deployed to end-users (product specifications are also used for certain metrics). In some cases, it makes sense to count all products ever sold [S], while in others the estimated number of currently operating systems [S_L] (i.e., within the lifetime of the product) is a more appropriate basis.

The values of the default coefficients are based on three different types of sources:

- Company information – direct input from companies active in the sector, via the GOGLA Impact Working Group
- Primary research
- Secondary research/literature

Where possible, data sets have been averaged and where input and/or outcome took the form of a possible data-range, the most conservative value was adopted. When company information was a leading input, a particularly conservative approach has been adopted for validating and establishing the coefficient. In the sections that detail each coefficient, Sections 4 and 5, the sources are described, referenced and are available upon request.

For sales and deployment estimates, sales numbers should be discounted by a channel loss discount factor [D_L] that is the fraction of products that are damaged or lost and never reach end-users.

⁴ Please contact the Efficiency for Access Coalition at info@efficiencyforaccess.org and GOGLA at info@gogla.org

At a Glance

Impact Metrics – Overview of Formulas

Metric	Appliance Type	Formula
1. Appliance Access/Household Access		
1a	Fan TV	$S \times (1 - D_{R-Access}) \times (1 - D_L) \times H$
1b	Fan TV	$S_L \times (1 - D_{R-Access}) \times (1 - D_L) \times H$
2. Economic Activity		
2a	Fan TV	$S_L \times (1 - D_L) \times E$
2b	TV only	$S_L \times (1 - D_L) \times IG$
3. Environmental Sustainability		
3a	Fan TV	$S \times D_{R-GHG} \times (1 - D_L) \times G \times P_L$



At a Glance

Impact Metrics – Overview of Coefficients

Variables (input by user)		Fan	TV
S	Number of units sold (cumulative i.e. ever)		
S_L	Number of units sold which are estimated to currently be in use (based on the products estimated lifespan being [1.5 x warranty] period)		
P_L	Estimated product lifespan (1.5 x warranty)		

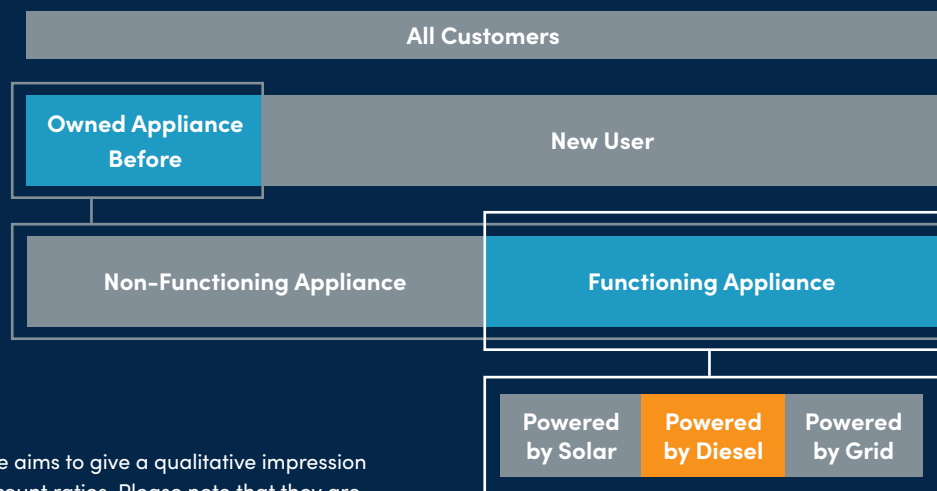
Variables (standard value)		Fan	TV
$D_{R-Access}$	Discount for repeat sales for estimating new access impact	5%	16%
D_{R-GHG}	Ratio capturing sales replacing a diesel genset powered appliance for estimating GHG emissions	3%	6%
D_L	Discount for loss: products not working or not in use, excluding loss in supply chain	3%	7%
H	Household Size	5.5	5.5
E	The percentage of customers using products to support enterprise (including those that have opened a new business)	3%	9%
IG	Percentage of customers/households creating additional income	-	4%
G	Average amount of greenhouse gases avoided per appliance, in kg CO ₂ e/year, ⁵ due to diesel displacement	0.084	0.059

Details on literature, definitions, assumptions and limitations for standard variables values can be found in Section 4 for fans, and Section 5 for TVs.

A note on $D_{R-Access}$ and D_{R-GHG}

For correctly estimating impact of those who have new access to an appliance, we should only take into account new users, or those whose TV was not functional. This means that the discount ratio $D_{R-Access}$ specifically accounts for those who owned a working appliance before.

For correctly estimating environmental impact, we should only look at replacement of working TVs in regular use, powered by diesel generators. This means that the discount ratio D_{R-GHG} specifically accounts for those who used diesel generator as power source to power their appliance.



The image aims to give a qualitative impression of the discount ratios. Please note that they are not representative of actual numbers.

⁵ CO₂-equivalent (CO₂e) emissions include the Kyoto gases carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), but exclude fluorinated gases. CO₂e emissions are calculated based on 100-year Global Warming Potential (GWP₁₀₀) values from the IPCC Second Assessment Report (CO₂ = 1, CH₄ = 25, N₂O = 298). Note that because the metric is in metric tons, the values (84 kg/year for fans and 59 kg/year for TVs) are converted.

Standardised Guidelines

In addition to the standardised metrics, companies are often requested to report on sector-specific parameters, such as transport emissions. Standardised guidelines are developed to encourage companies, investors and stakeholders within the sector to take a common approach to reporting on those impact areas where it's not yet feasible to create metrics.

Transport Emissions

One component of the embodied energy of a high-performing appliance is the number of emissions that stem from the transport of the product. The below is a simplified approach to model the transport emissions involved in shipping appliances from manufacturer to market, developed by the LEIA M&E team, EST and GOGLA. This indicator might be used in two different ways: to showcase avoided emissions when manufacturing locally; or for companies calculating their actual transport-related emissions.⁶

Company consultations showed that the main production location is in China; and that transport is nearly always done via cargo shipping, in 20 feet containers, to three main regional markets: South Asia, East Africa and West Africa.

Based on that knowledge, three standardised shipping routes have been defined (see Table 4), starting at Guangzhou, China, and arriving at the main port of each of the three main markets. Although there are multiple ports in China from

Table 4. Overview of distances (in nautical miles) for the three standardised shipping routes.

Route	Distance (nm) ⁷
1. Guangzhou (CN) – Dakar (SE)	9968
2. Guangzhou (CN) – Mombasa (KE)	5528
3. Guangzhou (CN) – Mumbai (IN)	3978

Note that For Guangzhou (CN) – Dakar (SE) the shortest route through the Suez Canal has been selected.

where products are shipped, we opted for Guangzhou/Shenzhen as reference port since products are most frequently shipped from there. A similar reasoning is applied when selecting the reference port in the destination regions, going for the most popular route and port.

From the selected ports onwards to their final destination, goods are assumed to be transported over land. Transport over land has been left out of the approach.

The CO₂e footprint per product unit for each route is dependent on the number of appliances units of a certain kind that can fit into a 20ft container. Table 5 provides a quick reference matrix which can be used to determine how much kg CO₂e emissions can be assigned per product unit. Estimated CO₂e emissions for the journey have been calculated with an online tool developed by EcoTransIT.⁸

⁶ Both use cases have a different definition of a conservative estimate: for the local manufacturing use-case, the shortest route is most conservative; while for estimating emissions made, the longest route is most conservative. The approach described herein is taking a middle ground, based on most popular routes and ports. Companies are advised to produce their own estimates as outlined in this section should a precise number be needed.

⁷ Nautical miles were determined using the following online tool: <https://sea-distances.org/>

⁸ Estimated CO₂e emissions were calculated using the following online tool: <https://www.ecotransit.org/>

Standardised Guidelines

Table 5. Quick reference matrix table to determine how much kg CO₂e of transport emissions can be assigned per product unit, on a specific route. (Estimates given in kg CO₂e emissions/unit).

Nr of units in a 20 ft container	Route 1 China to West Africa	Route 2 China to East Africa	Route 3 China to India
1500	0.989	0.548	0.466
1200	1.237	0.685	0.582
1000	1.484	0.822	0.699
900	1.649	0.913	0.776
800	1.855	1.027	0.874
700	2.120	1.174	0.998
600	2.474	1.369	1.165
500	2.968	1.643	1.398
400	3.711	2.054	1.747

Assumptions: One container is filled with product units of a similar kind. During the transport journey, no in-between stops are made. Transport over land has been left out of the approach.

Calculating Transport Emissions

If you need to calculate your CO₂e transport emissions in more detail, the online tool developed by EcoTransIT¹³ will help you produce your own estimates. We advise using the standard calculation method for one 20ft container (1 TEU), selecting

only sea ship to ensure you cover marine transport. The total Well-to-Wheel (WTW) provides you with the most accurate CO₂e estimate in tonnes. The following formula will then provide you with the estimated kg CO₂e emissions per unit:

$$\frac{\text{Emissions output}}{\text{nr of appliances in 1 TEU}} * 1000 = \text{kg CO}_2\text{e emissions per unit}$$

Contributors

These metrics were developed through the mechanism of the GOGLA Impact Working Group, a body of industry practitioners from the lighting and high-performing appliances sector, and academic observers. The development was led by the Working Group Chairs, GOGLA's Outreach and Impact Manager and EST's Senior Insight Manager. GOGLA and Efficiency for Access Coalition would like to express its thanks to the Working Group Chairs, peer-reviewers and contributing members and observers noted below.

Working Group Co-Chair: Nabeela Khan, CDC Group, October 2017 – present

Nabeela leads on Impact for Energy Access and Efficiency within CDC Group, the UK government's development finance institute. It is a major investor in energy infrastructure, including distributed energy, on the continent. She joined CDC to design and execute the Impact Accelerator, a direct investment fund focusing on businesses with challenging risk-return profiles to prepare them towards commercial investors. Over the last three years, Nabeela has helped steer the GOGLA Impact Working Group, bringing with her years of experience in impact investment, measurement and reporting.

Working Group Co-Chair: Yomi Jegede, Greenlight Planet, December 2019 – present

Yomi Jegede is Operations Manager for Greenlight Planet in Nigeria. He joined as co-chair of the Working Group at the end of 2019. He brings with him over four years' operational experience and knows first-hand of the challenges consumers and agents face, and how their solar products create impact.

Research Design: The broader impact assessment framework for appliances, under development by the Efficiency for Access Coalition, encompasses the development of the metrics. We would like to take this opportunity to kindly acknowledge the work and people involved. Key literature review was performed by Gillian Davies, E Feng Tan Loh, Bex Paffard and James Wakelin at Energy Saving Trust and Makena Ireri at CLASP. Richa Goyal, Joseph Thomas, Gillian Davies and E Feng Tan Loh at Energy Saving Trust have worked on creating the transport emissions guideline. Yau Ben Or and Josephine Tumwesige at Rural Senses have supported and advised on reviewing data to make the proposed assumptions and values more

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