EFFICIENCY FOR ACCESS

IKEA Foundation

UKaid from the British people

HOW CAN ENERGY ACCESS PROGRAMMES ADDRESS THE NEEDS OF PEOPLE WITH DISABILITIES?

AN INTRODUCTORY NOTE

MARCH 2021

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 off-grid 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, 16 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.

This report has been funded by the IKEA Foundation and was developed by the LEIA programme, which is funded by UK aid and the IKEA Foundation. The views expressed in this report do not necessarily reflect the official policies or the positions of the UK government or the IKEA Foundation.

Author: Richa Goyal, Senior Insight Manager, Energy Saving Trust
This report has been accessibly designed

Acknowledgements

The author is extraordinarily grateful to the following peer reviewers listed in alphabetical order of their organisation name, for their time, expertise, and thoughtful comments on this report.

Reviewers: Foreign, Commonwealth & Development Office, UK Government: Anne MacKinnon, Chris Thompson, Harriet Knowles, Mansoor Ahmed and Richard Boden; GDI Hub: Catherine Holloway; Modern Energy Cooking Services (MECS) Programme: Melinda Barnard-Tallier; USAID: Katherine Guernsey and Michael Allen.

Last, the author is thankful to Sarah Hambly and Eleanor Wagner, Energy Saving Trust, for providing proof reading, design and communications support and Karen Smith, People Business Partner, Energy Saving Trust, for helping improve language sensitivity.

TABLE OF CONTENTS

FIGURES

ACRONYMS

AAC	Augmentative and alternative communication
APL	Assistive Products List
AT	Assistive Technology
BTE	Behind The Ear
CHAI	Clinton Health Access Initiative
CRPD	Convention on the Rights of Persons with Disabilities
DPOs	Disabled Peoples' Organisations
GDI Hub	Global Disability Innovation Hub
IoT	Internet of Things
LEIA	Low Energy Inclusive Appliances
MECS	Modern Energy Cooking Services
NGO	Non-Government Organisation
SDG	Sustainable Development Goal
UNESCO IITE	UNESCO Institute for Information Technologies in Education
USA	United States of America
USD	United States Dollar
W3C	World Wide Web Consortium
WAI	Web Accessibility Initiative
WCAG	Web Content Accessibility Guidelines
WG	Washington Group on Disability Statistics
WHO	World Health Organization

Disability

The UN Convention on the Rights of Persons with Disabilities (CPRD) adopted in 2006 recognises disability as "an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others". Such a recognition of disability helps shift the focus from a medical model of disability that focuses solely on the disability diagnosis of an individual to the attitudinal, environmental, and institutional barriers that prevent the inclusion of an individual with impairments in the society.

Assistive devices and technology:

According to the WHO, "Assistive devices and technologies are those whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall well-being. They can also help prevent impairments and secondary health conditions. Examples of assistive devices and technologies include wheelchairs, prostheses, hearings aids, visual aids, and specialised computer software and hardware that increase mobility, hearing, vision, or communication capacities."

Executive summary

This research note lays out key ways in which the energy access stakeholders, particularly those that are involved in enhancing access to off-grid appropriate appliances in resource constrained environments, can make their interventions disability-inclusive.

Why should energy access stakeholders care about including people with disabilities?

Globally, more than one billion people need one or more assistive products, which help them to lead a healthy and productive life. However, reports suggest that 90% of people who require assistive products lack access to them. People with disabilities are disproportionately represented in low-income countries, and particularly in low-income households. This geographical concentration of people with disabilities in low resource settings intersects with the focus of energy access practitioners.

People with disabilities have higher energy needs since they require assistive technologies for independent living, several of which need to be powered electrically. What's more, people with mobility impairments tend to spend more time indoors. According to UN estimates, 80% of the world's disabled populations live in developing countries. A study that examined data from 15 developing countries found that disabled populations were higher in rural compared to urban regions in 11 out of 15 surveyed countries[1].

What can energy access researchers do?

It is important to prioritise the inclusion of people with disabilities in consumer preferences research and user-centred design research used to inform product design. Since most households in this sector will be purchasing appliances for the first time, planning for inclusive designs now can help leapfrog this sector to inclusively designed appliances from the very start. Approaching Organisations for Persons with Disability (OPDs), organisations run by and for people with disabilities or non-government organisations (NGOs) that support people with disabilities can be particularly helpful. These organisations can help facilitate access to people with disabilities efficiently.

1 Mitra et al., Disability and Poverty in Developing Countries: A Multidimensional Study, 2013, https://www.sciencedirect.com/science/article/abs/pii/S0305750X12001465

EXECUTIVE SUMMARY

In rural off- and weak-grid developing country regions, energy access and disability stakeholders have a lot to benefit from collaborating in key strategic areas.

- Energy access programmes focussed on expanding access to off- and weak-grid appropriate appliances should encourage inclusively designed appliances. These approaches can also improve products' usability for a wide array of people in diverse contexts. They can also enable off-grid appliance manufacturers to expand their market and develop a new customer base.
- Any content created by off-grid solar product and appliance companies should aim to be accessible for people with disabilities. Examples of accessible content could include any digital or print-based collateral, copy published on an appliance's website or mobile application, any advertising or awareness-building collateral, and warranty, or manual cards. It is particularly important for manuals and warranty cards, web- or mobile-based services such as the internet or mobile banking to be designed in an accessible manner so that end-users with varying disabilities can make energy payments, use appliances, and access product warranty and manuals independently.
- Affordability, availability, and quality are key constraints in enhancing access to both electrical appliances, which energy access practitioners typically focus on, and assistive products. A similar suite of interventions can benefit both types of technologies, which creates opportunities for collaboration between energy access and disability-focused stakeholders.
- Off-grid appliance manufacturers could consider developing and adding assistive products to their suite of product offerings in collaboration with assistive product manufacturers, thus expanding their product portfolio and developing a newer market segment.
- Energy access stakeholders are encouraged to plan for the additional energy requirements for powering assistive products while enabling energy infrastructure in rural regions in developing countries. Several assistive products use use-and-throw batteries, which increase operating costs and e-waste. High operating costs are also one of the key causes for the discontinued use of assistive products in low-income settings. Using solar energy to power assistive products where possible should be explored with greater research and development (R&D) support. As an example, concerns about the need for energisation are particularly stark in the case of hearing aids. Hearing aids use zinc-air batteries that are non-rechargeable. A standard size battery costs US$0.17 – US $0.38 per battery and lasts between five – 10 days on average. More than 200 million people in developing countries have hearing impairments and more than 20 million products are required each year in this region. Hearing aids are a good example of the excessive amount of battery-related e-waste that could be avoided if hearing aids in developing countries were powered by clean energy.

EXECUTIVE SUMMARY

In general, there is a need for greater innovation in assistive products so they are off-grid appropriate and can be seamlessly integrated within existing solar home systems or mini-grids in off- and weak-grid environments. Collaboration between disability organisations and energy access practitioners should include the participation of disability experts in product development. Any such product development should meet and exceed established product quality standards.

Introduction

Alongside implementing interventions that enhance access to off-grid appropriate appliances[2], it is important to undertake research to ensure that these efforts remain inclusive. The Low Energy Inclusive Appliances (LEIA) programme developed this note to help integrate inclusive practices in energy access programmatic efforts. It provides broad guidelines to energy access practitioners on the ways in which their efforts can best address the needs of people with disabilities. In the past year, the LEIA programme also recruited a gender expert to assess the programme's efforts to maintain gender inclusivity and published a policy briefing note on the topic of role of appliances in achieving gender equality[3].

This research note lays out key ways in which the energy access stakeholders, particularly those that are involved in enhancing access to off-grid appropriate appliances in resource constrained environments, can make their interventions disability-inclusive. The note includes the following sections:

- A narrative on the considerations to observe while designing disability-inclusive research on energy access topics
- Guidelines for off- and weak-grid solar product and appliance companies to ensure that their business and product development practices are disability-inclusive
- A narrative on the types of electrical assistive products whose deployment in the coming years will benefit from reliable electrification, a key element in enabling their sustained use
- Recommendations to help energy access stakeholders design inclusive interventions
- A list of resources to help off- and weak-grid appliance manufacturers, researchers and other stakeholders mainstream the disability agenda in energy access programmes

2 For the purposes of this report, off-grid appropriate appliances refer to appliances that are designed to optimize energy performance, service delivery, and quality. This definition was first proposed in the 2019 State of the Off-Grid Appliance Market Report available at https://efficiencyforaccess.org/publications/2019-state-of-the-off-grid-appliance-market-report

3 Energia and LEIA, The role of appliances in achieving gender equality and energy access for all, 2020, https://efficiencyforaccess.org/publications/the-role-of-appliances-in-achieving-gender-equality-and-energy-access-for-all

Why should energy access stakeholders care about disability?

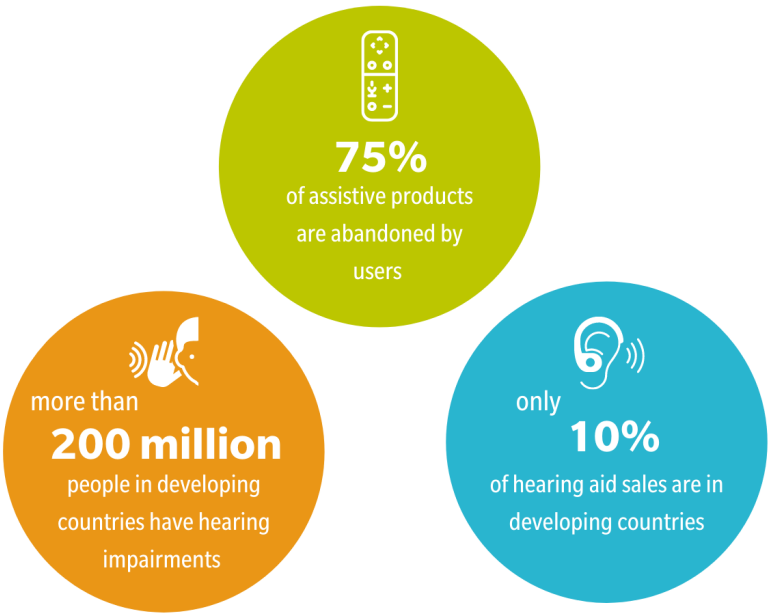
Globally, more than one billion people need one or more assistive products, which help them to lead a healthy and productive life. However, reports suggest that 90% of people who require assistive products lack access to them. It is expected that by 2030, more than 2 billion people will need at least one assistive product[4].

The UN Convention on the Rights of Persons with Disabilities (CPRD) adopted in 2006, specifies the need to ensure equal access to services and products. Many of these products need to be powered by electrical energy. Despite this, the Convention does not highlight the importance of energy access in enabling these goals. Similarly, while Sustainable Development Goal 7 (SDG7) on affordable and clean energy makes a reference to 'affordable, reliable, sustainable and modern energy for all', it does not explicitly mention access for people with disabilities.

The UN Flagship Report on Disability and Development published in 2018 highlights four priority areas regarding energy access that are especially important to address for people with disabilities. These are "(i) access to energy for development; (ii) access to electricity to charge or operate assistive technology; (iii) access to modern forms of energy which are less polluting for the households where people with disabilities stay for longer periods of time; and (iv) affordable energy as many people with disabilities live in low-income households."

People with disabilities are disproportionately represented in low-income countries, and particularly in low-income households. This geographical concentration of people with disabilities in low resource settings intersects with the focus of energy access practitioners. This is because rural off- and weak-grid areas in sub-Saharan Africa and South Asia have the lowest levels of energy access in the world. Figure 1 taken from the 2018 UN Flagship Report shows the difference in electricity rates in households with and without people with disabilities. In 37 of 44 countries shown in Figure 1, households with people with disabilities had lower levels of electricity access. Furthermore, in 17 of these countries, less than 50% households with people with disabilities had electricity access. People with disabilities have higher energy needs since they require assistive technologies for independent living, several of which require to be powered electrically. What's more, people with mobility impairments tend to spend more time indoors[5]. Although the need for assistive products is higher in low- and middle-income countries, only 5–15% of people who require assistive products have access to them in these countries.

4 WHO, Assistive Technology – Key Facts, 2018, https://www.who.int/news-room/fact-sheets/detail/assistive-technology
5 Kajima, 5th Expert Group Meeting on Monitoring and Evaluation for Disability-inclusive Development, 2017, https://slideplayer.com/slide/14051153/



There is a strong association between disability and economic poverty and both are considered mutually reinforcing. This leads to greater vulnerability and exclusion of people with disabilities[6]. Discrimination and marginalisation, inadequate access to housing, education, nutrition, clean water and sanitation, healthcare and credit, and low participation in legal processes and workforce all contribute to this mutual reinforcing loop. According to UN estimates, 80% of the world's disabled populations live in developing countries. A study that examined data from 15 developing countries found that disabled populations were higher in rural than urban regions in 11 out of 15 surveyed countries[7].

> Affordability, availability and quality are key constraints in enhancing access to electrical appliances and assistive products.

In the energy access space, stakeholders involved in enabling access to off- and weak-grid appropriate appliances and disability stakeholders have a lot to benefit from collaborating in key strategic areas. Affordability, availability, and quality are key constraints in enhancing access to both electrical appliances, which energy access practitioners typically focus on, and assistive products.

A similar suite of interventions can benefit both types of technologies, which creates opportunities for collaboration between energy access and disability-focused stakeholders. See sub-point g. under section 'Recommendations: What can other energy access stakeholders do?' for more details. Furthermore, energy access stakeholders are encouraged to plan for additional energy requirements for powering assistive products while enabling energy infrastructure in rural regions in developing countries.

> Energy access programmes focused on expanding access to off- and weak-grid appropriate appliances should encourage inclusively designed appliances.

Energy access programmes focused on expanding access to off- and weak-grid appropriate appliances should encourage inclusively designed appliances. Disability-inclusive user interface solutions may also assist people in diverse circumstances. This would be consistent with approaches to inclusive design, which emphasise the absence of a 'typical user' and engage a range of people in the design phase. These approaches can also improve products' usability for a wide array of people in diverse contexts. They can also enable off-grid appliance manufacturers to expand their market and develop a new customer base.

6 GSDRC, Poverty and disability, n.d., https://gsdrc.org/topic-guides/disability-inclusion/the-situation-of-people-with-disabilities/poverty-and-disability/

7 Mitra et al., Disability and Poverty in Developing Countries: A Multidimensional Study, 2013, https://www.sciencedirect.com/science/article/abs/pii/S0305750X12001465

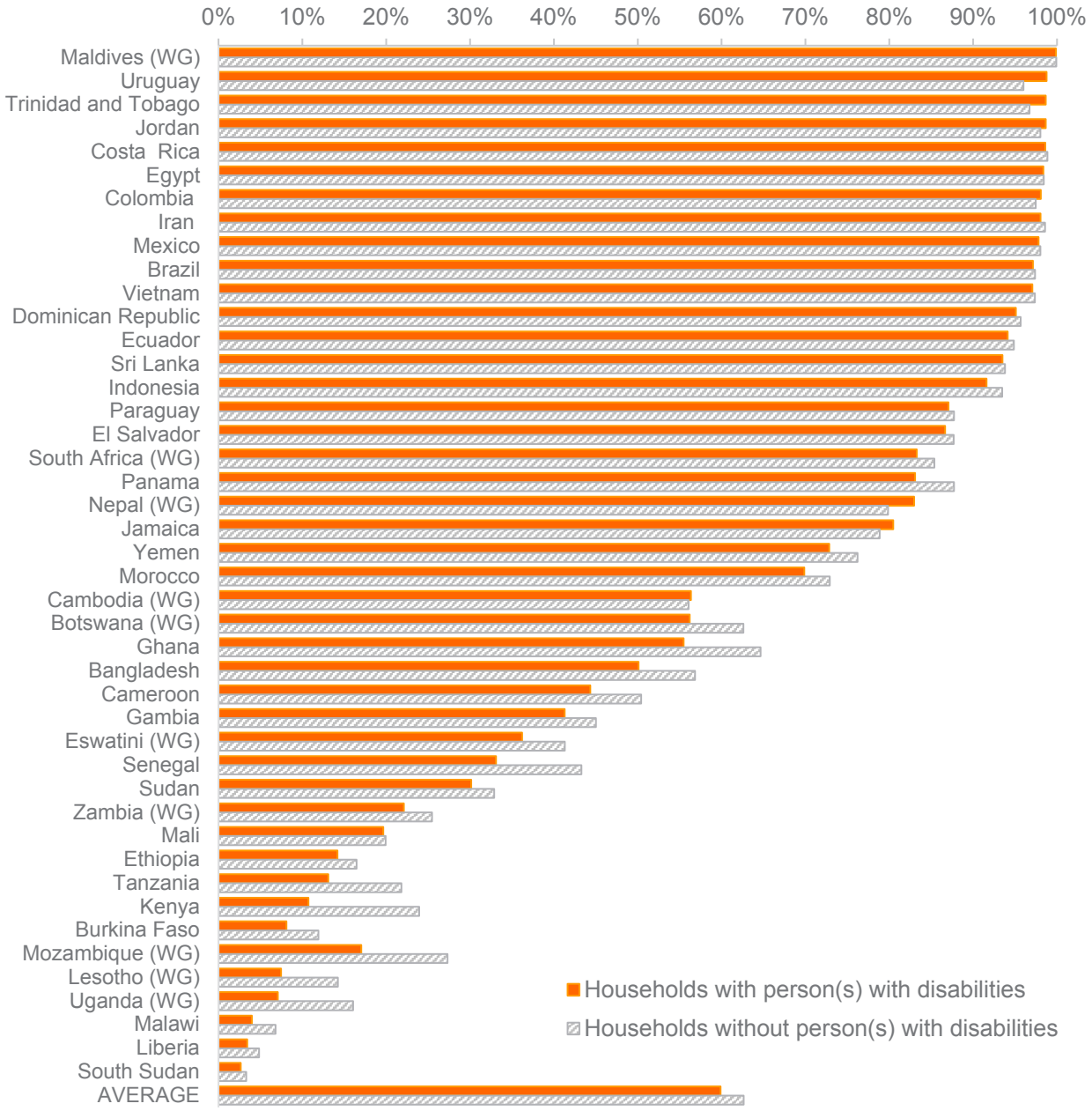


Figure 1: Percentage of households, with and without people with disabilities, with access to electricity in 44 countries, 2001-2015
Note: (MDS) identifies countries with data collected using the WHO Model Disability Survey. (WG) identifies countries with data collected using the Washington Group short set of questions. Source: ICF International, Minnesota Population Center, SINTEF, and WHO.

While there is a lot energy access stakeholders can do to make their efforts more inclusive[8], some interventions are benefiting people with disabilities alongside the general population already. Energy access stakeholders have started to prioritise enabling institutional energy access, especially health clinics and schools. Disruptions in the provision of medical care, such as through infrequent or fluctuating energy supplies, affect all people, particularly those who rely on frequent interventions for the management of long-term conditions.

Similarly, given that people with mobility impairments are likely to spend most of their time indoors, they are disproportionately affected by indoor air pollution in the use of traditional fuel for lighting and cooking.

8 See section, 'Recommendations and next steps'

Framework for mainstreaming disability agenda in energy access programmes

This report presents a framework that illustrates how various energy access stakeholders can help mainstream disability-inclusive practices in energy access interventions. This includes a broad set of recommendations aimed mainly at off-grid appliance manufacturers and broader energy access stakeholders including policy makers, donors and energy access programme managers. The framework also includes considerations for energy access researchers who wish to make their research design disability-inclusive, see Figure 2. Details and rationale for each of the interventions presented in the framework in Figure 2 are outlined in the next three sections of this report.

This framework is not expected to be a blueprint, but rather suggests pathways that can be used to progressively make energy access efforts accessible. Rather than reproduce content from other expert documents related to accessibility, this report points the reader towards links to various relevant resources throughout the document. The Annex to this report provides a non-exhaustive list to various resources of authoritative advice that can inform different ways in which disability sensitive practices can be mainstreamed in efforts related to achieving the energy access for all goal.

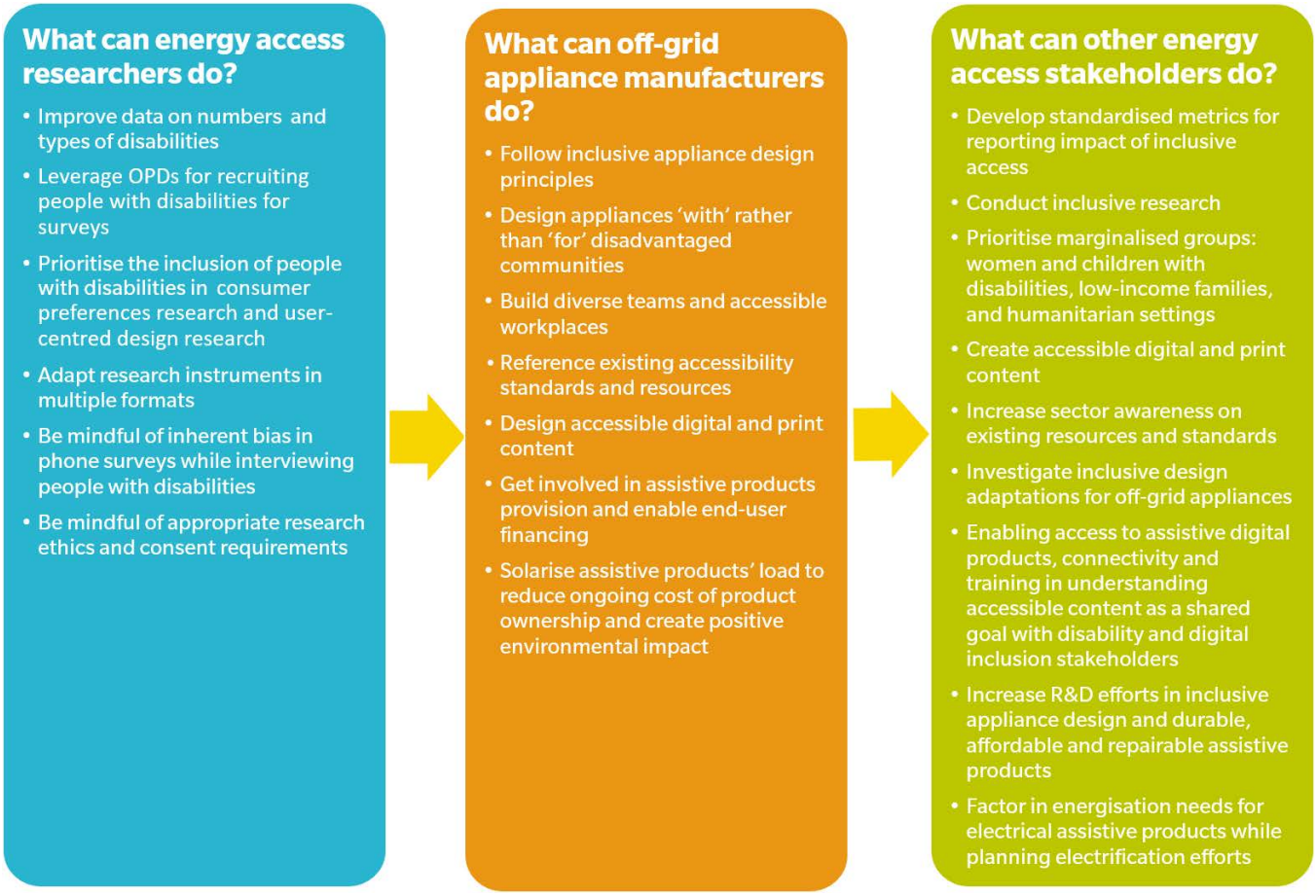


Figure 2: Framework to help the energy access sector address the needs of people with disabilities

Considerations for disability research

It is important to include people with disabilities as respondents in research projects that focus on energy access. There is little to no research available especially for low-income, developing country settings about the challenges that people with disabilities may face in accessing appliances. It is vital to incorporate questions in energy access surveys that capture basic data on how people with disabilities use appliances and access energy, what they would like to change, and adaptations needed for existing designs. Inclusively designed surveys can serve as quasi-capability assessments for people with disabilities. Here is a broad set of guidelines that energy access practitioners can follow to ensure that their research projects are disability-inclusive.

a. **Data on numbers and types of disabilities is sparse:** Including harmonised disability questions in energy access surveys can enable household level disability identification for future research requirements. Harmonised questions can also help to create comparable and high-quality disability-related datasets.

   To this end, the Washington Group on Disability Statistics' questionnaires on disability can serve as a useful resource. The Washington Group on Disability Statistics (WG) is a body whose main function is to promote and coordinate international cooperation on collecting basic and comparable statistics on disability for national surveys. The WG has developed several data collection tools on survey questions related to disability that can be easily incorporated into existing surveys. Using the WG Short Set on Functioning – Enhanced (WG-SS Enhanced) is an easy way to incorporate questions in disabilities in surveys that focus on other topics[9].

   At the same time, it is important to investigate and document the functional needs of people with disabilities that are not being met. Two people with the same disability may benefit from different accessibility features, and two people with different disabilities may benefit from similar accessibility features. Diverse cross-disability representation is of course helpful in obtaining a broad spectrum of input.

b. **Prioritise the inclusion of people with disabilities in consumer preferences research and user-centred design research used to inform product design:** For certain types of research such as consumer preferences research, including people with disabilities is especially important. This will help ensure that the off- and weak-grid sector can benefit from inclusively designed appliances. Most households in this sector will be purchasing appliances for the first time, and planning for inclusive designs now can help leapfrog this sector to inclusively designed appliances from the very start.

   User interface solutions that work for people with disabilities are also apt to assist people in diverse circumstances. This would be consistent with approaches to inclusive design that recognise the absence of the 'typical user' and importance of engaging a range of users in the design phase to enhance the usability of products in diverse contexts.

c. **Using 'aids' and adapting research instruments in multiple formats:** In consumer preference studies, respondents with learning disabilities, visual impairments, or people with communication challenges can be asked to draw with physical shapes. To capture consumers' product preferences, visual aids that contain different design mock-ups can be used. Researchers can also ask respondents to use 'plasticine' to create different shapes for physical features in an appliance such as the shape
   of a button, type of handle or a user-friendly knob. Sometimes, a sign language interpreter may be required to translate surveys in a language that people with disabilities can understand. Often, researchers may need to work with a family member who knows how to sign. Research instruments may also need to be adapted in multiple formats e.g., text, spoken or recording based.

d. **Observation studies:** Observation studies, in which researchers observe people with disabilities using an appliance in their native environment, can be particularly powerful. However, researchers must ensure that they get informed consent from their respondents, as asking respondents to do something in an interview could lead to ethical issues. However, such studies require complex considerations in observing vulnerable individuals cross-culturally and would benefit from involving a qualitative researcher trained to carry out observation studies and trained in or familiar with conducting surveys with people with disabilities.

9 Resources developed by the WG can be accessed here: https://www.washingtongroup-disability.com/question-sets/wg-short-set-on-functioning-%E2%80%93-enhanced-wg-ss-enhanced/

e. **Conducting interview 'dyads':** In addition to interviewing people with disabilities, in certain contexts talking to caregivers or family members to get them to offer their unique perspective can be useful especially with people who have communication difficulties. Conducting two sets of interviews or interview dyads per household first with the people with disabilities and latterly with caregivers can lead to richer insights. However, this should be done with sensitivity, and deference to people with disabilities should be given over the opinions of caregivers or family members. This can often be done with a small increase in the fieldwork budget, as the cost of undertaking an additional interview in a household that is already included in field research is low.

f. **Recruiting respondents with disabilities:**

- Approaching Organisations for people with disabilities (OPDs), organisations run by and for people with disabilities or non-government organisations (NGOs) that support people with disabilities can be particularly helpful. These organisations can help enable access to people with disabilities efficiently. There are 'umbrella' OPDs that cover a range of different disabilities, as well as organisations that focus on specific impairments.
- Engaging people with disabilities in research exercises can be challenging at first and may need more time from researchers. Certain groups, such as women with disabilities, may be harder to reach due to discriminatory attitudes around disability and gender in communities. One potential solution is to engage with OPDs that work specifically with women with disabilities, which can also help to ensure an adequate gender split in research studies. Such OPDs can be umbrella organisations, or represent groups of people with specific impairments.
- Including respondents with all types of disabilities in a research design may seem like an overwhelming challenge. Different types of disabilities can be geographically dispersed; women with disabilities often face double discrimination, given the prevalence of traditional gender roles. As a result, they may be withdrawn and harder to recruit for participation in a survey. In such cases, focusing on a smaller sample size and conducting longer, patient interviews maybe helpful.
- Categorising different disabilities and recruiting respondents accordingly will be crucial, as customised adaptations will be needed for different impairments. For example, audio cues would be required for people with hearing impairments, and no other adaptation may be necessary. Someone with a physical impairment may need an implement to adjust the height at which an appliance is used.
- In large scale surveys or longitudinal surveys that are conducted at periodic intervals with the same group of respondents, people with disabilities and their impairments could be pre-identified. This can be done via snowball sampling or conducting a short census survey with households of interest before the more detailed survey.
- Where available, using a recent household survey or census that includes the WG short set of questions would be helpful too. Organising different disabilities into broad categories such as visual impairments, mobility impairments, and hearing impairments will be key. Instead of recruiting respondents with every disability, researchers could try to recruit 5–10 people, which is a typical sample number in observational studies, among key types of disability groups. Focusing on a smaller sample size and conducting longer, slower-paced interviews may be helpful.

g. **Things to be mindful of during phone surveys:**
In certain contexts, phone interviews can advantageous. It can help keep survey costs low and can help improve the response rate from people who have difficulties in speaking face to face[10]. On the other hand, there are two key biases to be mindful of when conducting phone interviews with people with disabilities. In developing country rural contexts, phone ownership tends to be lower. Studies suggest that within households that own a phone, people with disabilities have limited access to a phone[11]. Given the difficulty in ensuring representation from people with hearing and communication difficulties, a second bias may emerge[12]. In such cases, face to face interviews are preferable.

10 Washington Group, Using the Washington Group Short Set in a Telephone Survey, 2020, https://www.washingtongroup-disability.com/wg-blog/using-the-washington-group-short-set-in-a-telephone-survey-267/
11 Ibid.
12 Ibid.

h. **Research ethics:**

- Consent forms need to be adapted in a variety of formats. Verbal consent is also valid and there may not be a need for researchers to restrict themselves to written consent[13].
- Researchers also need to inform interview participants that they can withdraw consent at any time. For people with learning disabilities, a lack of engagement could be an indicator that the survey is inaccessible. In other cases, where the respondent is particularly disengaged, it should be interpreted as a withdrawal of consent from research.
- There may be context and country-specific requirements for obtaining interview consent, photographing and recording interviews. For example, in some countries researchers may need to get consent from family members for people with learning disabilities. Easy-read consent forms should be designed and explained to the individual in simple language.

13 Personal communication with team at the Modern Energy Cooking Services (MECS) programme.

What can off- and weak-grid solar product and appliance companies do?

There are various measures that off-grid and solar product appliance companies can take to make their business and appliance design practices more disability-inclusive.

a. **Design changes in the current suite of appliances:** It is important to design accessible appliances. It is also important to adapt the built environment in which appliances are used to ensure that people with disabilities can use appliances most efficiently. However, adaptations in the built environment are likely to be outside the control or purview of current energy access programmes (the way they are currently designed) and will require broader stakeholder participation.

   While it is advised that off-grid solar product and appliance companies and other energy access stakeholders conduct research to identify the most suitable adaptations required to make appliances accessible, certain design changes can be easily implemented. Examples include options for remote control where feasible and designing for both visual and audio cues for different types of hearing and vision impairments. Some of this is described below. Such adaptations for inclusive design would benefit from an investigation into the implications for product affordability.

   The use of Internet of Things (IoT) based applications is rapidly growing in the off-grid sector given the need for smart metering, remote monitoring of energy consumption and appliance performance, collection of energy payments et cetera. However, since most IoT use focuses on enabling remote operations for the energy service providers, it is challenging to make a case for remotely operating appliances by members of the household with disabilities using an appliance.

This is due to constraints, which include low levels of digital inclusion, internet connectivity and access, low levels of appliance ownership rates among people with disabilities, and the cost implications for making these changes.

The Policy Toolkit for Persons with Disabilities[14], which was developed by the International Telecommunication Union (ITU) and the Global Initiative for Inclusive ICTs (G3ict) includes best practices from around the world on ICT accessibility for implementation on the ICT dispositions of the CPRD. The toolkit contains valuable information on inclusive product development and design of ICT technology areas such as television equipment and broadcast services, remote consoles, radios, websites, personal computers and so on. The toolkit also points the user to a large number of resources that are of great practical use to product designers of ICT technology areas.

Unassisted, independent mobility may be a constraint for people with disabilities. In such cases, the ability to remotely control an appliance is key to help an individual with a disability to access the appliance. Remote operations can be done via mobile-based applications that can control smart appliances or via an external remote control.

It could be valuable to include an external remote control that is inclusively designed for some appliances such as televisions (TVs). Disability-friendly remotes are widely available[15] and can be low-cost. While these remote controls do not contain the full set of features, many buttons are required seldom. This option can help an individual become more independent in operating a TV and not depend on carer to operate the appliance for them. The e-accessible Policy Toolkit includes several resources of best practices for developing and designing remote consoles and handhelds for controlling smart appliances.

For visual impairments, use of tactile marking on buttons and textured materials to tell one component or surface area apart from others can be considered. Similarly, the use of high contrast colours from a colour-blind friendly palette is encouraged. In some cases, use of different shapes alongside use of different colours can help.

14 ITU and G3ict, The e-accessibility Policy Toolkit for Persons with Disabilities, 2010, http://www.e-accessibilitytoolkit.org/toolkit

15 Atvisor.ai is a platform that helps consolidates options for commercially available assistive technologies for various tasks. For inclusively designed remote controls, see: https://www.atvisor.ai/en/catalog/category/electronics-and-accessories/remote-controls/remote-controls-751

While gesture technology is still considered a 'horizon' technology and remains expensive, appliances can be adapted to talk or 'speak' to inform people with visual impairments about different functions. Speaking appliances already exist and are low-cost. There are various examples of talking watches, talking thermometers, and other appliances in the Global North. Similarly, for people with hearing impairments, light indicators could be implemented alongside speech output.

b. Design 'with' excluded communities:

There is little to no research available for low income, developing country settings about the challenges that people with disabilities may face in accessing electrical appliances. There is a need to include people with disabilities as respondents in consumer research and other research undertaken to inform appliance design. People with disabilities should be included among respondents with whom researchers conduct a user needs assessment before product design takes place, or with whom product prototypes are tested for incorporating user feedback. While developing products, consultation with people with disabilities is especially necessary, as this user group's needs are not always well understood in a design context. In other words, appliance manufacturers should strive to design 'with' disadvantaged communities rather than 'for' disadvantaged communities. Planning to recruit people with common impairments as research respondents is a great starting point. Many of the design adjustments needed to address the needs of people with visual or hearing impairments are relevant for certain kinds of learning disabilities. Similarly, several design adjustments for accessibility are also relevant for making appliances accessible to women. Designing appliances that favor people with bigger height or that require larger upper body strength for operation may not be accessible to both women and people with certain impairments such as mobility impairments.

This approach has been proven to add value and is a cornerstone of work of organisations such as the GDI Hub[16], which included inclusive design principles for creating and continuing the Paralympic legacy inclusion success, and companies such as Microsoft[17] in improving product quality and reach.

c. Building diverse teams and accessible workplaces:

As off-grid solar product and appliance companies hire more staff, they should consider changing their hiring policies to create more diverse teams. Staff should represent diverse cultural backgrounds, people with disabilities, and different gender profiles. This can help overcome design biases and inform more inclusive design and business practices.It should also be acknowledged that very small businesses may encounter difficulties in creating more diverse teams. In addition to encouraging a human resource policy based on diversity, it is also important to build accessible workplaces, ensuring that information and communications, including systems and technologies, meetings and events, online and in-person, are accessible to all persons with disabilities. The Accessibility GO!
A Guide to Action[18] developed by the World Blind Union and the CBM Global Disability Union gives practical advice on how to deliver a whole-of-organisations approach towards accessibility.

d. Using existing accessibility standards and resources:

There are various country or region-specific disability or accessibility standards and technical specifications available that focus on a variety of disability sub-fields such as built environment, education, transport, products, web content et cetera. Some of these are useful references that can help make off-grid appliance businesses more disability-inclusive. The European Standard EN 17161:2019 'Design for All – Accessibility following a Design for All approach in products, goods and services – Extending the range of users'[19] enables organisations to use a consistent approach to address accessibility for people with disabilities. The requirements set out in this standard are generic and apply to all relevant parts of businesses.

For designing inclusive web content, resources from the Web Accessibility Initiative (WAIof the World Wide Web Consortium (W3Care valuable. The WAI develops web accessibility guidelines and education resources to help make web content disability-accessible.

16 GDI Hub, Inclusive Design Standards updated for 2019, 2019, https://www.disabilityinnovation.com/news/inclusive-design-standards-updated-for-2019

17 Microsoft, 'We are at a crossroads' – How Microsoft's Accessibility team is making an impact that will be felt for generations, 2019, https://news.microsoft.com/on-the-issues/2019/09/25/accessibility-supportability-anne-taylor/

18 World Blind Union, CBM Global Disability Union, The Accessibility GO! A Guide to Action, 2020, https://cbm-global.org/wp-content/uploads/2020/10/Accessibility-GO-A-Guide-to-Action-WBU-CBM-Global.pdf

19 European Committee for Standardization, EN 17161:2019 'Design for All - Accessibility following a Design for All approach in products, goods and services - Extending the range of users', 2019, https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ID:62323,2301962&cs=1D28CFDC66E7CEF3CE441294CAA9FEABE

The Web Content Accessibility Guidelines (WCAG)[20] developed by WAI are a great place to start to ensure that users are not excluded from accessing web content based on their disability. The W3C and UNESCO Institute for Information Technologies in Education (UNESCO IITE launched a free online training programme, 'Introduction to Web Accessibility'[21], on the edX platform in early 2020. This course also serves as a valuable resource alongside the WCAG.

However, it should be stressed that simply designing for W3C is not enough and only when designing with people with disabilities will the products be truly accessible.

e. **Designing accessible content:** Any content created by off-grid solar product and appliance companies should ideally aim to be accessible for people with disabilities. Examples of such content could include any digital or print-based content, content published on an appliance's website or mobile application, any advertising or awareness-building collateral, and warranty, or manual cards. Content should be easily adaptable for voice, sign language, or pictograms. It is particularly important for manuals and warranty cards, web- or mobile-based services such as the internet or mobile banking to be designed in an accessible manner so that end-users with varying disabilities can make energy payments, use appliances, and access product warranty and manuals independently. This could require content creators who are trained in understanding accessibility features and creating accessible content.

   Often off-grid solar product and appliance companies tend to have lean teams, as they are small businesses, and hiring appropriately skilled content creators may be beyond their financial means. To address this, companies could train in-house content creators in designing inclusive content. As discussed in the 'Capacity Building' section above, there are valuable resources that can be consulted. Energy access stakeholders such as donors and programmes could also develop a standardised web-based, self-paced inclusive design course in collaboration with inclusive design experts and make this freely available to off-grid solar product and appliance companies. This could help give companies a head start in understanding inclusive design.

   Audiences for content created by solar home system and off-grid solar product and appliance companies go beyond end-users. People with disabilities within the broader stakeholder groups such as company staff and other energy access stakeholders also need to understand this content. Content may need to be adapted to meet the needs of the audiences that solar product and appliance companies are trying to reach.

   It should be noted that simply designing accessible content alone cannot lead to increased consumption of content by people with disabilities. Other important enablers need to operate in parallel such as awareness of accessible content among end-users, suppliers, policy makers and other stakeholders. Especially for end-users, availability of the mobile network, internet connectivity and access to digital products such as mobile phones, as well as appropriate training in comprehending accessible content are key.

   For instance, not all end-users with visual impairments may be trained in braille. Access to digital products and internet and awareness and training in understanding accessible content need to be continually improved. The Mobile Internet Skills Training Toolkit (MISTT)[22] developed by the GSMA Connected Society programme is a great resource that can help address gaps in digital literacy. This toolkit includes a set of short lessons in PDF format to promote digital literacy developed using a 'train the trainer' approach.

f. **Off-grid appliance manufacturers could pursue the provision of assistive products and enter a new market segment:**

> Off-grid appliance manufacturers could consider developing and adding assistive products to their suite of product offerings in collaboration with assistive product manufacturers, thus expanding their product portfolio and developing a newer market segment.

   Assistive products[23] that need to be powered electrically have similar barriers to use as off-grid electrical appliances in last-mile areas. These include a lack of sufficient demand.

20 W3C Web Accessibility Initiative, Web Content Accessibility Guidelines (WCAG) Overview, n.d., https://www.w3.org/WAI/standards-guidelines/wcag/
21 W3C, UNESCO IITE, Introduction to Web Accessibility, 2020, [MOOC] edX, https://www.edx.org/course/web-accessibility-introduction
22 GSMA, GSMA Mobile Internet Skills Training Toolkit: A guide for training people in basic mobile internet skills, 2016, https://www.gsma.com/mobilefordevelopment/resources/mobile-internet-skills-training-toolkit/
23 WHO defines assistive devices and technologies as, "those whose primary purpose is to maintain or improve an individual's functioning and independence to facilitate participation and to enhance overall well-being". See: https://www.who.int/disabilities/technology/en/

On the supply side, primary limitations include low availability, affordability, appropriate design, assured quality and standards, a need for greater investment in innovation and challenges in bringing products to market[24]. This, in turn, has led to low levels of participation from assistive product manufacturers in off- and weak-grid markets. Where their participation exists, it is patchy and often concentrated in more affluent regions and at high price points[25].

Consequently, similar interventions are required for domestic and productive use off-grid appliances and electrical assistive products. Off-grid appliance manufacturers could consider developing and adding assistive products to their suite of product offerings in collaboration with assistive product manufacturers, thus widening their product portfolio and developing a newer market segment. The following section 'Assistive products that need to be powered' helps shed light on key types of assistive products that energy access stakeholders can consider incentivising.

Affordability of assistive products

- Designing off- and weak-grid appropriate and affordable assistive products: A simultaneous focus on product affordability and appropriate financing plans alongside provision on assistive products will help ensure a sustainable market for assistive products in low-income settings. Currently, there is a dearth of durable, affordable, and high-performing assistive products appropriate for low-income rural settings among commercially available assistive products. There is an urgent need to design and deploy electrical assistive products that are low-cost, maintained, repaired and accessed locally, and meet or exceed established product quality standards. Off-grid solar product and appliance companies have substantial expertise in designing and distributing affordable off-grid appropriate appliances that are designed to perform in harsh climates and environments. This experience can be valuable in the provision of affordable assistive products.
- Enabling consumer financing options: Furthermore, Pay-As-You-Go financing plans have played a key role in improving the affordability of off-grid energy solutions. A similar approach for assistive products is recommended. Engaging OPDs and leverage group-based lending via OPDs could also serve as a promising solution. An assessment of consumer financing needs is required.

g. Clean energy access to power assistive products:

> A coordinated approach between disability-inclusive interventions targeting low income setting and energy access programmes is required.

A coordinated approach between disability-inclusive interventions targeting low-income settings and energy access programmes is required given the common need to power electrical assistive products and off- and weak-grid appliances, the services associated with provision of assistive devices also require electricity access. An example includes screening tools in a health centre required for to diagnose impairments and prescribe an appropriate assistive product.

Several assistive products use use-and-throw batteries, which increase operating costs and e-waste. High operating costs are also one of the key causes for the discontinued use of assistive products in low-income settings. Using solar energy to power assistive products where possible should be explored with greater research and development (R&D) support. Please refer to point h. iii. Powering assistive products with clean energy and associated environmental benefits under section 'Recommendations and next steps' for more detail.

24 WHO, Global Perspectives on Assistive Technology Report, 2019, https://apps.who.int/iris/bitstream/handle/10665/330372/9789240000261-eng.pdf
25 Ibid

Assistive products that need to be powered

What types of assistive products can energy access programmes incentivise?

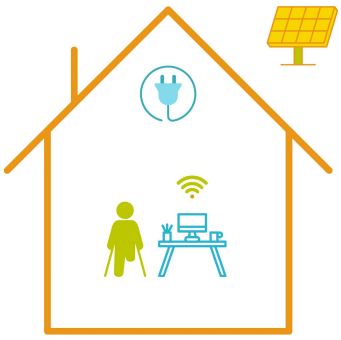
This sub-section describes the types of assistive products that energy access practitioners could consider including in their programmes and interventions.

ATvisor.ai is a platform that consolidates options for various commercially available assistive products. This platform does not capture all products, especially those appropriate for off-grid/ weak-grid environments. However, it serves as a useful reference point for an energy access focussed organisation seeking to diversify its electrical appliance offerings, so that they address the needs of people with disabilities in off- and weak-grid settings.

DID YOU KNOW... that at least 22 of the priority products on the WHO's assistive products list are electronic or digital products that require replaceable batteries or need to be charged electrically?

World Health Organization (WHO) priority assistive products list (APL): The WHO published the priority assistive products list, which is intended to provide WHO member states with a model to develop their national assistive products lists. WHO defines priority assistive products as "products that are highly needed, an absolute necessity to maintain or improve an individual's functioning and which need to be available at a price the community/state can afford"[26]. The WHO APL includes 50 priority assistive products selected based on the impact they can have on an individual's life. At least 22 of these 50 priority products or 44% listed products are electronic or digital products that need a replaceable battery or be charged electrically[27]. Examples include electric wheelchairs, hearing aids, alarm signallers, audio players and braille displays. Some of these products depend on the regular replacement of disposable batteries for continued use, which accounts for a large component of on-going operating costs.

For example, hearing aids primarily use zinc-air batteries that on average deplete every 5-10 days and can cost between US $0.17 –US$0.38 per battery[28]. Powering these devices using a renewable power source such as solar energy, which is a one-time cost, can help reduce the cost of ownership significantly, with additional environmental co-benefits. However, given low levels of access to power supply in off- and weak-grid rural settings, it is unclear how people with disabilities will be able to power their products reliably.



Priority assistive products under the AT2030 and ATscale programmes: Under the AT2030 programme and in partnership with ATscale the new Global Partnership on Assistive Technology, five priority product areas from the WHO's Assistive Product List were identified. These are hearing aids, prostheses, wheelchairs, eyeglasses and assistive digital products and software[29]. The Clinton Health Access Initiative (CHAIled the development of these product narratives with technical support from GDI Hub to create detailed market analysis for each of these five product areas in reports that are called product narratives. These narratives help define a sustainable market approach to low-cost, high-quality AT in low and middle-income countries and serve as great references for energy access practitioners who seek to increase their focus in enabling access to these products. Among these five priority product areas, hearing aids, electric wheelchairs and assistive digital products are the obvious electrical products that would require energisation and hence find an overlap between disability inclusion goals and SDG7.

26 WHO, Priority Assistive Products List, n.d., 5, https://apps.who.int/iris/bitstream/handle/10665/207694/WHO_EMP_PHI_2016.01_eng.pdf?sequence=1

27 UN, Flagship Report on Disability and Development, 2018, https://www.un.org/development/desa/disabilities/wp-content/uploads/sites/15/2018/12/UN-Flagship-Report-Disability.pdf

28 AT2030 and ATscale, A Market Landscape and Strategic Approach to Increasing Access to Hearing Aids and Related Services in Low and Middle Income Countries, 2020, https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5e7205cf4d66ee1209da58f0/1584530898163/ATscale_PN-HearingAids-a11y.pdf

29 ATscale, Access to Assistive Technology Benefits All, n.d., https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5e57dcc2ae1bb87ab7824e91/1582816473964/ATscale_AccesstoATBenefitsAll_final-2.pdf

While electric prosthetics are also available, they remain unaffordable for low-income rural settings. Digital assistive products, particularly smartphones, deserve a special mention, given that many energy access programmes already focus on digital inclusion and mobile phone access.

The product narrative on assistive digital products and software[30] covers the use of mobile phones with accessibility features and applications, screen readers and augmentative and alternative communication (AAC) products for enhancing people with disabilities' independence and productivity. Screen readers are software programmes meant primarily for people with visual impairments and/or learning disabilities and converts screen content into accessible formats such as speech, braille, or both. Given that screen readers are software-based solutions, they have been deprioritised for this report. AAC is a type of method or system that helps replace or supplement natural speech and can be aided or unaided.

Aided AAC requires external tools which could be low-tech paper-based solutions to high tech digital solutions. Examples of electronically powered AAC include digital products with touch screen options or pointing tools, mouse/mouse alternatives such as a joystick, eye gaze systems and switches. It is critical to accurately match the type of AAC device best suited for communication impairments, as providing unsuitable products can result in several negative outcomes. Accurate AAC feature matching may require experts who can diagnose communication impairments and recommend suitable products. This may not be a widely available skill in low-income countries and especially lacking in rural settings. Given the specialised nature of communication products, disability specialists are best suited for the provision of such products, and off-grid solar product and appliance companies may be unable to play a key role. Among the products covered in this narrative, mobile phones are perhaps the most important area where energy service companies can make an important contribution. The relevance of mobile phones in creating disability inclusive off-grid societies and the cross overs between disability and energy access interventionists is explained below.

Mobile phones as assistive products: The product narrative on assistive digital products makes an important case for mobile phones as assistive technology for people with disabilities.

Mobile phones connected with a data network can help reduce barriers between the physical and social environment of an individual with disability, democratise access to information, and help them to be more productive and independent. Mobile phones can enable access to government services, disability rights networks, and skills-building and education for people with disabilities.They can also help foster greater civic engagement and enable greater levels of peer interaction.

People with disabilities can download disability-inclusive third-party applications. Smartphones can also be connected with external products through Bluetooth and replace some types of traditional assistive products such as braille readers or switches in some cases. While they are not a complete substitute for all types of digital assistive content products, their use cases expand with the ability to connect to and be interoperable with other products, especially if the phones have been designed with good usability and accessibility in mind.

The affordability of smartphones is a key concern and energy access stakeholders can make an important contribution to address this: The International Telecommunications Unit (ITU) and the Global Initiative of Inclusive ICTs (G3ict) advocate for universal design principles to be incorporated in early mobile phone development stages, which will promote accessibility.

However, universal design and accessibility features is generally focussed on higher-end smartphones, which cost between USD 100 – USD 1000+ in African markets. The models come from key players such as Apple, Samsung, Huawei and Transsion.

DID YOU KNOW... when people with disabilities have access to mobile phones, they use their phone more than their non-disabled peers?

Feature phones are more power efficient, but they are often less accessible for people with disabilities as they lack features such as screen readers for people with visual impairments and video calling for people with hearing impairments. Technology such as mobile phones are often used within social networks which help disabled people navigate accessibility challenges[31].

30 AT2030 and ATscale, A Market Landscape and Strategic Approach to Increasing Access to Digital Assistive Technology in Low- and Middle- Income Countries, 2020, https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5fbb59132b4bfe31fd87053a/1606113563455/roduct_Narrative_Digital_Assistive_Technology_a11y.pdf

31 AT2030, The Social Network: How People with Visual Impairment use Mobile Phones in Kibera, Kenya, 2020, https://at2030.org/the-social-network:-how-people-with-visual-impairment-use-mobile-phones-in-kibera,-kenya/

When people with disabilities have access to mobile phones, they use their phone more than their non-disabled peers[32].

Prices remain steep especially for people with disabilities. The majority of the last-mile access to mobile phones in rural Africa is enabled by mobile network operators who also work with global suppliers that source products. They often purchase in low volumes and rely on independent retailers to sell products and subscription plans who often impose steep premiums. This is compounded by industry and import taxes that are passed on to end-users.

Until accessibility features become ubiquitous across mobile phone categories, energy access interventionists could help enable greater access to appropriate smartphone technology at affordable price points for people with disabilities in rural areas.

The energy access sector has played a phenomenal role in improved access to mobile charging services as part of solar lanterns, lighting kits and larger systems. Given the synergistic role between Pay-As-You-Go solutions enabled by mobile phone, and energisation of mobile phones enabled by solar systems, there is an added incentive for energy access service providers to provide mobility services.

32 AT2030, Understanding the mobile disability gap (executive summary), 2019, https://at2030.org/understanding-the-mobile-disability-gap/

Recommendations: What can other energy access stakeholders do?

This section highlights key strategies that energy access stakeholders working towards SDG7 could consider in the short to medium term.

a. **Reporting impact of enabling inclusive energy access:** Developing impact indicators that describe the impact of enabling energy access inclusively can help increase awareness of the need for inclusive energy delivery. More research needs to be undertaken to understand such impacts.

b. **Conducting inclusive research and disaggregating responses by people with and without disabilities:** It is important to incorporate people with disabilities as respondents in field research related to energy access. There is little to no research available especially for low-income country settings about the challenges that people with disabilities may face in accessing appliances. The sub-section 'Disability research best practices' presents a broad set of guidelines that energy access practitioners can follow to make their research projects more inclusive.

c. **Sector prioritisation:** Women and children with disabilities, low-income families, and humanitarian settings have the greatest need for energy service delivery. Men are often more likely than women to have assistive technologies, and adults are generally more likely to have them than children[33]. Similarly, people from low-income families and or those living in humanitarian settings rely on charitable donations for assistive products. While many charitable organisations focus on providing quality products, many focus on substandard or used products that may not be appropriate for that context or be locally repairable. These donations may be not followed up by services to ensure continued use[34].

d. **Creating accessible content:** Creating accessible digital and print-based content may require off-grid solar product and appliance companies to employ content creators who can create accessible content. Off-grid solar product and appliance companies often tend to have lean teams, as they're small businesses, and hiring appropriately skilled content creators may beyond their financial means. To help address this, energy access programmes, donors and governments could provide access to a free web-based training module on creating accessible content for off-grid manufacturing company content designers.

e. **Capacity building:** It is early to consider building disability appropriate design as a formal requirement in standards or procurement policies for off-grid appliances. The sector needs capacity building, and more data and evidence to prioritise disability-focused energy interventions.

   i. In the near term, energy access programmes and other off-grid systems and appliance stakeholders can help distribute existing resources on best practices on inclusive design within the energy access community. This can help raise awareness and start the dialogue on the need to make energy access interventions disability-inclusive. The European Standard EN 17161:2019 on Design for All, WCAG and online course on web accessibility offered by W3C and UNESCO IITE, resources from the Washington Group on Disability Statistics[35], are valuable resources that can already help shape the disability narrative within the energy access community.

   ii. In the mid-to long-term, it would be helpful to plan more research and development efforts to investigate how off-grid appliances can be designed more inclusively, document the challenges including appliance affordability implications in doing so, plan solutions, and disseminate these results. Donors and programme managers could consider developing a standardised web-based, self-paced inclusive design toolkit for solar product and appliance companies in collaboration with inclusive design experts. Such a course could be provided free of charge to off-grid solar product and appliance companies. This could help give companies a head start in understanding and planning for inclusive design in their businesses.

33 Borg & Östergren, Is centre-based provision of hearing aids better than community-based provision? A cluster-randomized trial among adolescents in Bangladesh, 2017, https://www.tandfonline.com/doi/citedby/10.1080/17483107.2017.1332110?scroll=top&needAccess=true

34 Rohwerder, B., Assistive technologies in developing countries, 2018, 10, https://gsdrc.org/wp-content/uploads/2018/03/Assistive_technologies_in_developing_countries.pdf

35 See sub-section 'Disability research best practices'

Such a course could include modules that cover inclusive design practices for both disability and gender-appropriate design. There are several universities and other organisations that already offer similar courses for companies. I have included a few notable examples of work on this topic from within the academic sector for reference.

The Academic Research Center on Disability housed within University College London, which partners with the Global Disability Innovation (GDI) Hub, is another notable example. The Engineering Design Centre at the University of Cambridge has developed an inclusive design toolkit and works with businesses to make their products and services more inclusive.

f. **Access to digital products, connectivity and training in understanding accessible content:** It should be noted that simply designing accessible content alone cannot lead to increased consumption of content by people with disabilities. Other enablers are needed in parallel, such as awareness of accessible content among end-users, suppliers, policy makers and other stakeholders. The availability of mobile network, internet connectivity and access to digital products like mobile phones, as well as appropriate training in comprehending accessible content is key, especially for end-users. For example, not all end-users with visual impairments may be trained in braille. Access to digital products and internet, and awareness and training in understanding accessible content need to be continually improved. The effort for this recommendation does not fall under the purview of the energy access community alone and would require a multi-stakeholder effort between energy access, digital inclusion focussed stakeholders such as the GSMA and disability programmes.

g. **Opportunities for research and development (R&D) and collaboration between off-grid appliance and assistive device manufacturers:** Affordability, availability and quality are key constraints in enhancing access to both electrical appliances, which energy access practitioners typically focus on, and assistive products. A similar suite of interventions can benefit both types of technologies. Given the similar interventions required to achieve these goals, there are opportunities for collaboration between energy access and disability-focused stakeholders. Some of these are listed below.

i. To date, most R&D on assistive products has focused on high-income contexts and high-tech solutions with optimum functionalities[36]. Many countries, especially developing countries, produce AT on a small scale. In addition, it primarily focuses on products suitable for high-income countries which are available at a premium price. For example, major multinational hearing aid manufacturers that comprise 90% of global sales of hearing-aids, are based in developed countries, with most of their manufacturing operations based in developing countries. These products cater to the needs of high-income markets and are re-directed for sale there[37].

There is little effort to develop durable, affordable, and high-performing assistive products and a need to design and deploy electrical assistive products that are low-cost, can be maintained, repaired and accessed locally, and meet and exceed established product quality standards. Off-grid solar product and appliance companies have substantial expertise in designing and distributing off-grid appropriate appliances that are designed to perform in harsher climates and environments. Furthermore, there is a need to encourage more inclusive businesses to pioneer models for the provision of off-grid appropriate AT and disability-friendly appliances in low-income settings.

36 Director-General WHO, Improving access to assistive technology - Report by the Director-General 2017, 4, https://apps.who.int/gb/ebwha/pdf_files/EB142/B142_21-en.pdf

37 WHO, Preferred profile for hearing-aid technology suitable for low- and middle-income countries, 2017, 1, https://apps.who.int/iris/bitstream/handle/10665/258721/9789241512961-eng.pdf?sequence=1

Assistive device and off-grid solar products manufacturers can benefit from collaboration with solar product companies in increasing access to electrical assistive products. Likewise, energy access stakeholders can play an important role in encouraging off-grid solar product and appliance manufacturers to designing disability-friendly appliances. Manufacturers that are looking to expand the suite of appliances they retail could be encouraged to help enable access to electrically powered assistive products.

ii. Repair remains a key issue.

DID YOU KNOW... a lack of repair services is an additional challenge in the provision of assistive products in developing countries? A survey conducted by UNICEF found that 75% of respondents reported that either repair services had limited availability or were unavailable. Furthermore, as many as 75% of assistive products are abandoned by users.

A lack of repair services is an additional challenge in the provision of assistive products in developing countries. A survey conducted by UNICEF found that 75% of respondents reported that either repair services had limited availability or were unavailable[38]. Furthermore, as many as 75% of assistive products are abandoned by users[39]. One of the primary causes of abandonment is the dearth of local repair services or high costs for replacement parts such as batteries. In the off-grid appliance space, repair has also started to gain more recognition and Efficiency for Access' recent paper 'Pathways to Repair in the Off-Grid Solar Sector' has helped spark a lot of urgently needed conversations on repair[40]. As the agenda for the repair of off-grid appliances takes shape and gains traction, aligning repair for electrical assistive products and wider off-grid appliances could benefit from combining efforts.

h. Powering assistive products with clean energy and associated environmental benefits: A systematic review is required to understand the assistive technology needs in off- and weak-grid rural settings that could benefit from reliable electrification. Energy access stakeholders have a key role to play in planning the adequate provision of powering needs for electrical assistive technologies. Several assistive products use use-and-throw batteries and powering these devices with clean energy can help avoid substantial amount of e-waste.

Furthermore, the services which are associated with assistive devices can also require electricity access. For instance, many screening tools put forward in the hearing product narrative and digital manufacturing systems, which are proposed as a solution to address prosthesis availability, will all require electrically powered technology. This is another area that can benefit from clean energy access.

38 Ibid

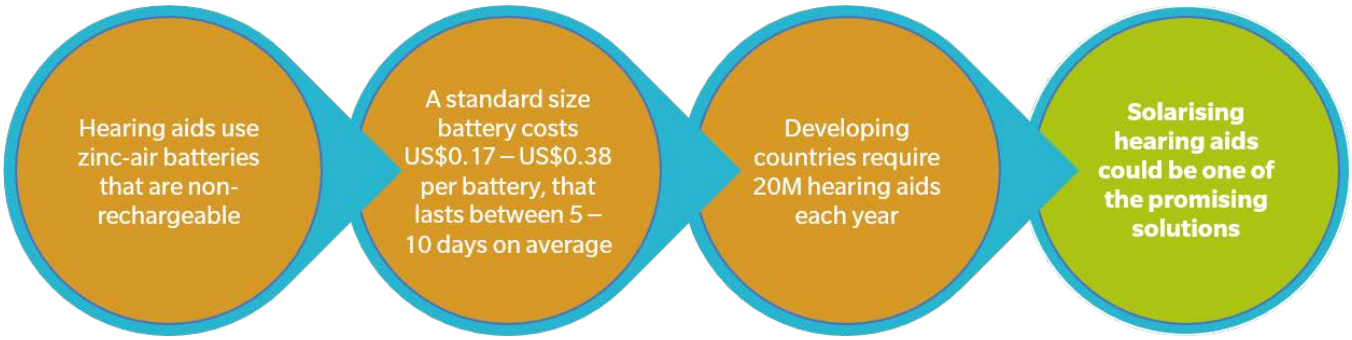
39 Director-General WHO, Improving access to assistive technology - Report by the Director-General 2017, 4, https://apps.who.int/gb/ebwha/pdf_files/EB142/B142_21-en.pdf

40 Efficiency for Access & University of Edinburgh, Pathways to Repair in the Global Off-Grid Solar Sector, 2020, https://efficiencyforaccess.org/publications/pathways-to-repair-in-the-off-grid-solar-sector

Exploring the benefits of solarising assistive products: A case study on hearing aids

Concerns about the need for energisation are particularly stark in the case of hearing aids. Hearing aids use zinc-air batteries that are non-rechargeable. A standard size battery costs US$0.17 – US$0.38 per battery and lasts between 5–10 days on average[41].

Hearing aids are a good example of the excessive amount of battery-related e-waste that could be avoided if hearing aids in developing countries were powered by clean energy. More than 200 million people in developing countries have hearing impairments and more than 20 million products are required each year in this region[42]. If a 100% deployment of hearing aids powered by zinc-air batteries were available, it could lead to the use and disposal of a billion batteries a year at a consumption rate of one battery a week per device.



While such a high deployment rate is an unlikely scenario in the near term given that only one million batteries reach developing countries annually, the potential for ecological battery-related e-waste remains substantial. Apart from the environmental impact of use and throw batteries, battery replacement is an important ongoing cost, which makes assistive products unaffordable for many end-users. This may increase the rates at which assistive products are abandoned in low-income settings. Replacing zinc-air batteries with rechargeable batteries and enhancing access to solar chargers could enable the sustained use of assistive products, reduce environmental impact and increase affordability.

SolarEar's work is noteworthy in this regard. The company developed the first solar-powered rechargeable hearing aid that includes the option to purchase a solar charger and universal rechargeable batteries[43]. See Image 1. In the USA, the prices for hearing aids start at around US$500.

The average retail price of hearing aids sold in 2009 was US$1942, and the average price for advanced mini-behind the ear (BTE) models was US$2957[44]. In comparison, SolarEar's hearing aids cost between US$75 – 225 with an additional US$59 US for a solar charger. They have been designed for use in off-grid settings in low to middle income countries and are affordable in comparison to models built for use in high income countries. The design also protects the hearing aid from moisture in humid environments, which are common in low to middle income countries.

In general, there is a need for greater participation by players such as SolarEar and greater innovation in assistive products so they are designed for off-grid appropriateness and can be seamlessly integrated within existing solar home systems or mini-grids in off- and weak-grid environments.

41 AT2030 and ATscale, A Market Landscape and Strategic Approach to Increasing Access to Hearing Aids and Related Services in Low and Middle Income Countries, 2020, https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5e7205cf4d66ee1209da58f0/1584530898163/ATscale_PN-HearingAids-a11y.pdf

42 Digital Development Debates, Deaf People Help Each Other: Solar Powered Hearing Aids in Botswana and Brazil, Issue 06, http://www.digital-development-debates.org/issue-06-innovation--health--solar-powered-hearing-aids-in-botswana-and-brazil.html

43 For product catalogue see here: http://solarear.com.br/products/

44 WHO, Preferred profile for hearing-aid technology, 1

Collaboration between disability organisations and energy access practitioners should include the participation of disability experts in product development. Any such product development should meet and exceed established product quality standards.

Image 1: Solar powered rechargeable hearing aids developed by SolarEar. Image from Issue #06 Innovation, Digital Development Debates
http://www.digital-development-debates.org/issue-06-innovation--health--solar-powered-hearing-aids-in-botswana-and-brazil.html

Next steps

This section highlights strategies that the LEIA programme will undertake in the near term to make its interventions disability-inclusive.

a. **Disability disaggregated data in field research:** The researchers involved in the programme will seek to disaggregate data by disabled and non-disabled respondents to the extent possible in field research undertaken by the programme.

b. **Encouragement to inclusive design in off-grid appliances:**

   i. Through the Efficiency for Access Research and Development Fund and the Efficiency for Access Design Challenge, a competition that invites university students to create affordable, high performing off-grid appliance and supportive technologies[45], we will encourage applicants to embed inclusive design principles into their projects. The LEIA programme will distribute this research note to help raise awareness on this topic among applicants and other stakeholders.

   ii. Last year, the LEIA programme conducted a webinar on 'Gender, Disability, and Social Inclusion'[46], for students participating in the Efficiency for Access Design Challenge and others, to introduce them to the topic of disability and the need for inclusive design of off-grid appliance technologies. The LEIA programme will continue to raise awareness of participating students each year on this topic, so the students could consider inclusive design criteria in their project submissions.

   iii. The LEIA programme will also plan to undertake further research in the coming years on inclusive design best practices that could be applicable off-grid appliances. Such a research project will seek to identify a standard set of design adaptations in off-grid appliances to enable their use by as many people as possible with a focus on people with disabilities.

c. **Creating accessible content:** The programme will incorporate accessible design principles in the digital content developed by the Efficiency for Access and LEIA programme including webinars and research reports, as far as feasible.

The author of this report recognises that implementing disability-inclusive energy access interventions will require persistent and continuous efforts and that the strategies highlighted here are by no means sufficient. The LEIA programme will continue to investigate further interventions as necessary and identify opportunities to collaborate with other programmes both to raise awareness and increase stakeholder participation in the 'inclusive' energy access agenda.

45 For more information on the LEIA R&D fund and Design Challenge, see here: https://efficiencyforaccess.org/leia
46 Efficiency for Access Design Challenge Webinar - Gender, Disability and Social Inclusion, 2020, https:/vimeo.com/475010401

Annex: International best practices on accessibility

Resources to help off- and weak-grid appliance manufacturers, researchers and other stakeholders mainstream embed disability-inclusive practices in energy access programmes.

About this list

Below are links to authoritative advice on different ways in which disability sensitive practices can be mainstreamed in efforts related to achieving the energy access for all goal. This list is designed to help provide manufacturers, researchers, programme managers, donors and policy makers with additional background on the best practices for inclusive energy access efforts with a focus on people with disabilities. It should be noted that this list is not exhaustive, and resources mentioned here will direct readers to other relevant resources.

A comprehensive resource on accessible ICT

The e-accessibility Policy Toolkit for Persons with Disabilities[47] and its companion handbook[48] include best practices from around the world on ICT accessibility for implementation on the ICT dispositions of the CPRD. The toolkit contains valuable information on e-accessibility basics, inclusive product development and design, product procurement best practices, interventions related to promotion of assistive technologies. The toolkit also points the user to a large number of resources that will be of great practical use to product designers of ICT technology areas such as television equipment and broadcast services, remote consoles, radios, websites, personal computers and so on.

Resources for researchers

The Washington Group on Disability Statistics (WG) is a body whose main function is to promote and coordinate international cooperation on collecting basic and comparable statistics on disability for national surveys. The WG has developed several data collection tools on survey questions related to disability that can be easily incorporated into existing surveys. Using the WG Short Set on Functioning – Enhanced (WG-SS Enhanced) is an easy way to incorporate questions in disabilities in surveys that focus on other topics[49].

Resources for creating accessible workplaces and designing accessible content

Accessibility-GO!-A Guide to Action[50] developed by the World Blind Union and the CBM Global "aims to provide practical support on how to deliver a whole-of-organisation approach towards accessibility." It describes how to progressively achieve seven core accessibility commitments across built environments, information and communications, procurement of goods and services, training and capacity development, programmes, meetings and events, recruitment and human resource (HR) management.

Library of Accessibility Resources[51] developed by The Washington State Board for Community and Technical Colleges (SBCTC) provides a range of publicly available micro-courses on creating accessible Microsoft documents, PDF files and emails.

The Web Accessibility Initiative (WAI)[52] of the World Wide Web Consortium (W3C) develops web accessibility guidelines and education resources to help make web content disability-accessible. The Web Content Accessibility Guidelines (WCAG)[53] developed by WAI are a great place to start to ensure users are not excluded from accessing web content based on their disability.

47 ITU and G3ict, The e-accessibility Policy Toolkit for Persons with Disabilities, 2010, http://www.e-accessibilitytoolkit.org/toolkit

48 ITU, The Centre for Internet & Society, G3ict, The Hans Foundation, e-Accessibility Policy Handbook for Persons with Disabilities, 2010, https://g3ict.org/publication/e-accessibility-policy-handbook-for-persons-with-disabilities

49 Resources developed by the WG can be accessed here: https://www.washingtongroup-disability.com/question-sets/wg-short-set-on-functioning-%E2%80%93-enhanced-wg-ss-enhanced/

50 World Blind Union, CBM Global Disability Union, The Accessibility GO! A Guide to Action, 2020, https://cbm-global.org/wp-content/uploads/2020/10/Accessibility-GO-A-Guide-to-Action-WBU-CBM-Global.pdf

51 Washington State Board for Community and Technical Colleges (SBCTC), Library of Accessibility Resources, n.d., https://sbctc.instructure.com/courses/1578604

52 Web Accessibility Initiative, Making the Web Accessible, n.d., https://www.w3.org/WAI/

53 W3C Web Accessibility Initiative, Web Content Accessibility Guidelines (WCAG) Overview, n.d., https://www.w3.org/WAI/standards-guidelines/wcag/

ANNEX

Introduction to Web Accessibility, an online course on the edX platform: The W3C and UNESCO Institute for Information Technologies in Education (UNESCO IITE) launched a free online training programme, 'Introduction to Web Accessibility'[54], on the edX platform in early 2020. This course also serves as a valuable resource alongside the WCAG and provides hands-on information on designing accessible websites and apps that meet international standards and provide a better user experience for everyone.

It should be noted that simply designing accessible content alone cannot lead to increased consumption of content by people with disabilities. Especially for end-users, the availability of mobile networks, internet connectivity and access to digital products such as mobile phones, as well as appropriate training in comprehending accessible content are key. For this reason, the GSMA developed a training toolkit to help bridge the digital inclusion gap. See below.

GSMA Mobile Internet Skills Training Toolkit – A guide for training people in basic mobile internet skills. To address the 'usage gap' between access to mobile broadband coverage and ability to use, GSMA developed the Mobile Internet Skills Training Toolkit (MISTT) in 2016. GSMA describes the training tool as "The MISTT uses a 'train the trainer' approach and consists of short lessons in a PDF format that can be easily adapted to local needs and languages. MISTT modules consist of an introductory module that covers the basics of the internet, including internet safety and costs, as well as modules on WhatsApp, YouTube, Google, Wikipedia, Facebook, Online Safety, Mobile Money, Android, Accessibility Features and KaiOS. A number of MISTT modules have already been translated into 6 languages: English, French, Swahili, Hindi, Bengali and Kinyarwanda."[55]

Resources for assistive technologies

World Health Organization (WHO) priority assistive products list (APL)[56]: The WHO published the priority assistive products list, which is intended to provide WHO member states with a model to develop their national assistive products lists. The WHO APL includes 50 priority assistive products selected based on the impact they can have on an individual's life. At least 22 of these 50 priority products or 44% listed products are electronic or digital products with the need for battery replacement or another means of electric charging. Examples include electric wheelchairs, hearing aids, alarm signallers, audio players and braille displays.

AT Scale product narratives[57]: The Clinton Health Access Initiative (CHAI) with technical support from GDI Hub led the development of five assistive product narratives to create detailed market analysis for each of these product areas in reports that are called product narratives. These narratives help define a sustainable market approach to low-cost, high-quality AT in low and middle-income countries and serve as great references for energy access practitioners who seek to increase their focus in enabling access to these products. Among these five priority product areas, hearing aids, electric wheelchairs and assistive digital products are the obvious electrical products that would require energisation and hence find an overlap between disability inclusion goals and the SDG7.

Selection of Relevant Standards

The European Standard EN 17161:2019 'Design for All – Accessibility following a Design for All approach in products, goods and services – Extending the range of users'[58] enables organisations to use a consistent approach to address accessibility for people with disabilities. The requirements set out in this standard are generic and apply to all relevant parts of businesses.

54 W3C, UNESCO IITE, Introduction to Web Accessibility, 2020, [MOOC] edX, https://www.edx.org/course/web-accessibility-introduction

55 GSMA, GSMA Mobile Internet Skills Training Toolkit: A guide for training people in basic mobile internet skills, 2016, https://www.gsma.com/mobilefordevelopment/resources/mobile-internet-skills-training-toolkit/

56 WHO, Priority Assistive Products List, n.d., 5, https://apps.who.int/iris/bitstream/handle/10665/207694/WHO_EMP_PHI_2016.01_eng.pdf?sequence=1

57 AT2030 and ATscale, Product Narratives, n.d., https://atscale2030.org/product-narratives

58 European Committee for Standardization, EN 17161:2019 'Design for All - Accessibility following a Design for All approach in products, goods and services - Extending the range of users', 2019, https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ID:62323,2301962&cs=1D28CFDC66E7CEF3CE441294CAA9FEABE

ANNEX

ANEC Accessibility Working Group and other resources[59]: ANEC, an organisation that represents the consumer voice in technical standards, has a dedicated working group on accessibility and consolidates and links to several documents related to accessibility standards, relevant efforts by ISO, IEC and ITU in this regard, and documents that outline thinking in design and accessibility by several other relevant organisations.

59 ANEC, Accessibility, n.d., https://www.anec.eu/priorities/accesibility

BIBLIOGRAPHY

AT2030 (2020) The Social Network: How People with Visual Impairment use Mobile Phones in Kibera, Kenya. Available at: https://at2030.org/the-social-network:-how-people-with-visual-impairment-use-mobile-phones-in-kibera,-kenya/

AT2030 (2019) Understanding the mobile disability gap (executive summary). Available at: https://at2030.org/understanding-the-mobile-disability-gap/

AT2030 and ATscale (n.d.) A Market Landscape and Strategic Approach to Increasing Access to Digital Assistive Technology in Low- and Middle- Income Countries. Available at: https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5fbb59132b4bfe31fd87053a/1606113563455/Product_Narrative_Digital_Assistive_Technology_a11y.pdf

AT2030 and ATscale (2020) A Market Landscape and Strategic Approach to Increasing Access to Hearing Aids and Related Services in Low and Middle Income Countries. Available at: https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5e7205cf4d66ee1209da58f0/1584530898163/ATscale_PN-HearingAids-a11y.pdf

ATscale (n.d.) Access to Assistive Technology Benefits All. Available at: https://static1.squarespace.com/static/5b3f6ff1710699a7ebb64495/t/5e57dcc2ae1bb87ab7824e91/1582816473964/ATscale_AccesstoATBenefitsAll_final-2.pdf

Borg & Östergren (2017) Is centre-based provision of hearing aids better than community-based provision? A cluster-randomized trial among adolescents in Bangladesh. Available at: https://www.tandfonline.com/doi/

Digital Development Debates (n.d.) Deaf People Help Each Other: Solar Powered Hearing Aids in Botswana and Brazil, Issue 06. Available at: http://www.digital-development-debates.org/issue-06-innovation--health--solar-powered-hearing-aids-in-botswana-and-brazil.html

Director-General WHO (2017). Improving access to assistive technology (WHO Executive Board 142nd session, provisional agenda item 4.5). Available at: http://apps.who.int/gb/ebwha/pdf_files/EB142/B142_21-en.pdf

Efficiency for Access Coalition & University of Edinburgh (2020) Pathways to Repair in the Global Off-Grid Solar Sector. Available at: https://efficiencyforaccess.org/publications/pathways-to-repair-in-the-off-grid-solar-sector

Engineering Design Centre, Engineering Department, University of Cambridge (n.d.) Inclusive Design Toolkit. Available at: http://www.inclusivedesigntoolkit.com/training/training.html

European Committee for Standardization (2019) EN 17161:2019 Design for All - Accessibility following a Design for All approach in products, goods and services - Extending the range of users. Available at: https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ ID:62323,2301962&cs=1D28CFDC66E7CEF3CE441294CAA9FEABE

Global Disability Innovation Hub (2019) Inclusive Design Standards updated for 2019. Available at: https://www.disabilityinnovation.com/news/inclusive-design-standards-updated-for-2019

Global Disability Innovation Hub (n.d.) Overview. Available at: https://www.disabilityinnovation.com/about

Global priority research agenda for improving access to high-quality affordable assistive technology. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

GSMA Connected Society Programme (2016) GSMA Mobile Internet Skills Training Toolkit: A guide for training people in basic mobile internet skills. Available at: https://www.gsma.com/mobilefordevelopment/resources/mobile-internet-skills-training-toolkit/

ITU and G3ict (2010) The e-accessibility Policy Toolkit for Persons with Disabilities. Available at: http://www.e-accessibilitytoolkit.org/toolkit

Kajima, Sae (2017) 5th Expert Group Meeting on Monitoring and Evaluation for Disability-inclusive Development. Available at: https://slideplayer.com/slide/14051153/

BIBLIOGRAPHY

Microsoft (2019) We are at a crossroads' – How Microsoft's Accessibility team is making an impact that will be felt for generations. Available at: https://news.microsoft.com/on-the-issues/2019/09/25/accessibility-supportability-anne-taylor/

Mitra S., Posarac A., Vick B.: World Development (2013) Disability and Poverty in Developing Countries: A Multidimensional Study. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0305750X12001465

Preferred profile for hearing-aid technology suitable for low- and middle-income countries. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

SolarEar (2020) Products. Available at: http://solarear.com.br/products/

United Nations (2018) Realization Of The Sustainable Development Goals By, For And With Persons With Disabilities - Flagship Report on Disability and Development. Available at: https://www.un.org/development/desa/disabilities/wp-content/uploads/sites/15/2018/12/UN-Flagship-Report-Disability.pdf

World Blind Union and CBM Global Disability Union (2020) The Accessibility GO! A Guide to Action. Available at: https://cbm-global.org/wp-content/uploads/2020/10/Accessibility-GO-A-Guide-to-Action-WBU-CBM-Global.pdf

World Health Organization (2018) Assistive Technology – Key Facts, 2018. Available at: https://www.who.int/news-room/fact-sheets/detail/assistive-technology

World Health Organization (2019) Global Perspectives on Assistive Technology Report. Available at: https://apps.who.int/iris/bitstream/handle/10665/330372/9789240000261-eng.pdf

W3C, UNESCO IITE (2020) Introduction to Web Accessibility [MOOC] edX. Available at: https://www.edx.org/course/web-accessibility-introduction

Washington Group (2020) Using the Washington Group Short Set in a Telephone Survey. Available at: https://www.washingtongroup-disability.com/wg-blog/using-the-washington-group-short-set-in-a-telephone-survey-267/

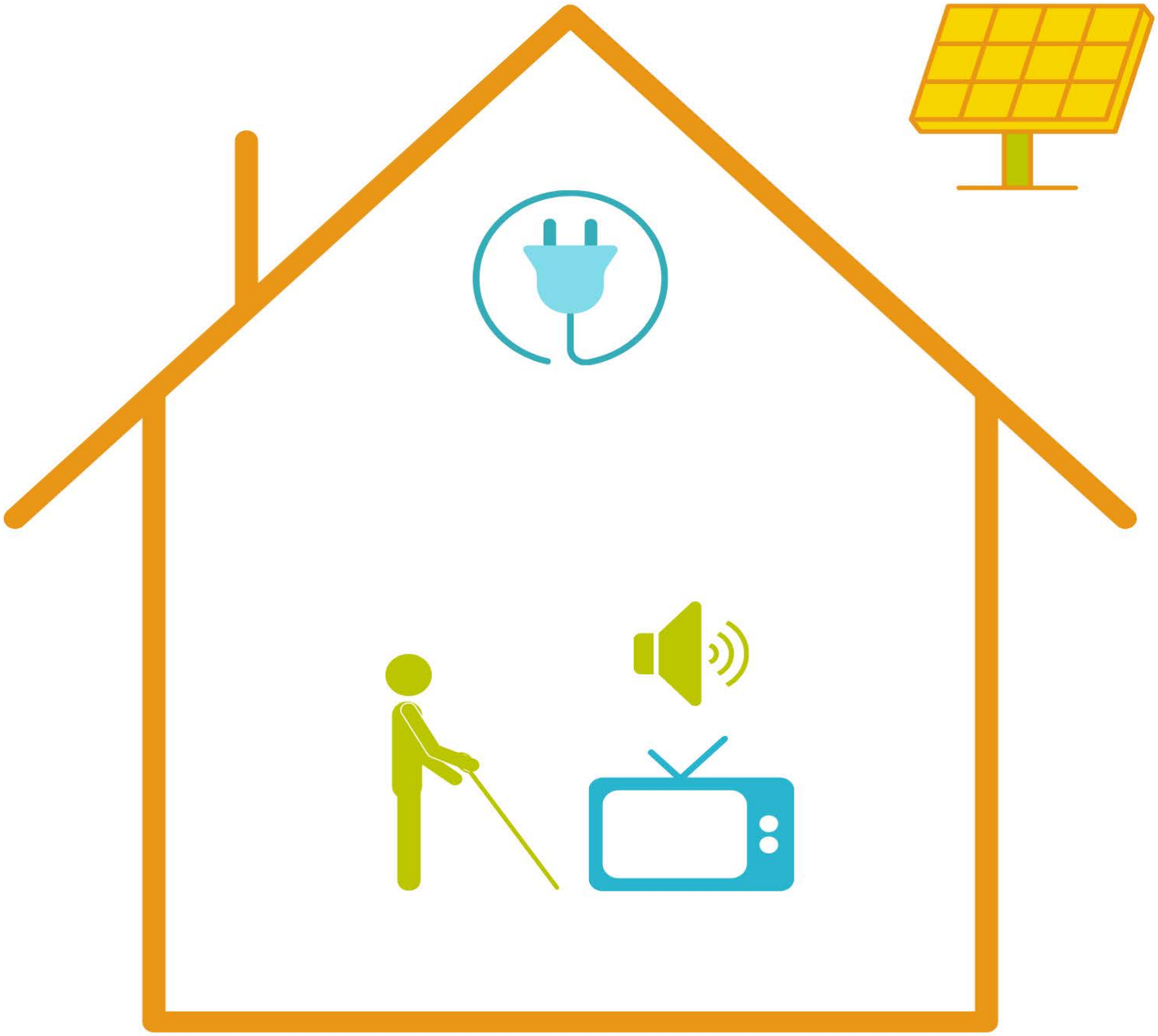
World Health Organization (n.d.) Priority Assistive Products List. Available at: https://apps.who.int/iris/bitstream/handle/10665/207694/WHO_EMP_PHI_2016.01_eng.pdf?sequence=1

W3C Web Accessibility Initiative (n.d.) Web Content Accessibility Guidelines (WCAG) Overview. Available at: https://www.w3.org/WAI/standards-guidelines/wcag/ID:62323,2301962&cs=1D28CFDC66E7CEF3CE441294CAA9FEABE citedby/10.1080/17483107.2017.1332110?scroll=top&needAccess=true

EFFICIENCY FOR ACCESS

IKEA Foundation

UKaid from the British people



Contact Us

efficiencyforaccess.org

info@efficiencyforaccess.org

@EforA_Coalition