Transforming Energy Access (TEA)

Health and Safety Support Service Design Phase

State of the Sector Report

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D.2 State of the Sector			
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PRESENTATION

This document presents the second output of the project and seeks to consolidate the results of a desk research and literature review, and to provide insights from interviews conducted with various stakeholders of the TEA Platform and the wider Energy Access industry. The report seeks to offer a comprehensive overview of the current state of the occupational Health & Safety of the sector, by synthesising the available data and incorporating diverse perspectives from industry experts.

The authors of this report are Trama TecnoAmbiental S.L. (TTA) and Consultoría ECOS.

Disclaimers

UK Government Acknowledgement Disclaimer

This project was funded with UK aid from the UK government via the Transforming Energy Access platform.

This material has been funded by UK aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies.

Anonymity of Entities and People Interviewed

To protect the privacy of those involved, all entities and individuals interviewed for this report have been anonymised. Their names and other identifying information have been removed and cannot be traced back to them.

No Recordings Made

No audio or video recordings were made during any of the interviews conducted for this report. This was done to further ensure the privacy of those interviewed and prevent any potential misinterpretations or misrepresentations arising from comments taken out of context.

No Judgment or Details of Incidents

This report does not include any judgment or condemnation of any individual or entity. It also does not include any specific details of incidents that may have occurred. The focus of the report is on identifying patterns and trends aimed at understanding broader systemic issues rather than assigning blame to individuals or entities. These trends will be used in further stages to make recommendations for improvement.

No Legal Implications

The lessons learned and recommendations presented in this report are not intended to have any legal implications. This report does not provide or constitute legal advice. Given the limitations of its scope, this report concentrates on providing operational and strategic recommendations. It does not make any recommendations regarding national regulation, nor does it intend to influence political matters in any country.

Disclaimer of Liability

The authors of this report assume no liability for any actions or decisions taken based on the information presented in it. The report's purpose is to provide insights and recommendations, but it does not replace the need for professional guidance and decision-making processes.

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Acronyms

Table 1 Acronyms

Abbreviation	Explanation
AFSEC	African Electrotechnical Standardization Commission
BIS	Bureau of Indian Standards
CSO	Charging Station Operators
CSP	Charging Service Providers
EA	Energy Access
EPC	Engineering, Procurement, and Construction
EV	Electric Vehicles
FCDO	UK Foreign, Commonwealth and Development Office
GOGLA	Global association for the off-grid solar energy industry
H&S	Health and Safety
IEC	International Electrotechnical Commission
IEC - AFRC	IEC Africa Regional Centre
IEEE	Institute of Electrical and Electronics Engineers
ILO	International Labour Organisation
ISO	International Organization for Standardization
LAB	Lead Acid Batteries
LIB	Lithium-Ion Batteries
LPG	Liquid Petroleum Gas
NEC	National Electrical Code (United States)
NESC	National Electrical Safety Code (United States)
OPPS	Office for Product Safety and Standards
PIDG	Private Infrastructure Development Group
PPE	Personal Protective Equipment
SDG	Sustainable Development Goals
SHS	Solar Home Systems
TEA	Transforming Energy Access
UNECE	United Nations Economic Commission for Europe
WPT	Wireless Power Transfer

1. Executive Summary

The Transforming Energy Access Platform (TEA) is a flagship FCDO innovation platform that finances, supports, catalyses, researches, and develops new clean energy technologies and business models to accelerate access to affordable, clean, and modern energy for all (SDG 7). The Health and Safety Support Service Design Phase is part of the TEA Platform. It aims to improve health and safety in the energy access sector by developing an inclusive long-term adoption strategy based on actual project information and experiences. However, innovation in energy access solutions and technologies introduce potential health and safety risks, impacting communities and individuals working on and operating these solutions.

The report undertakes a comprehensive sector analysis to identify key challenges and develop a roadmap, guidelines, and recommendations. It also focuses on the challenges faced by vulnerable populations and disadvantaged groups, such as child labour, forced labour, migrant workers, and workers with disabilities. The report aims to develop a systematic approach to assessing health and safety risks and hazards and suggest measures to enhance H&S management across various energy access initiatives.

The energy access sector faces numerous challenges in addressing health and safety, with occupational health and safety being often overlooked. Corruption in administrative processes, limited enforcement of occupational health and safety regulations, and a lack of commitment to safety are some of the main issues. Electrical risks for workers in the industry are a constant reality, leading to accidents such as electrocution, electric shocks, burns explosions, and fires. Economic constraints, limited access to resources, and limited access to technology pose significant risks. Cultural influences, such as a fatalistic culture, can affect employer and employee commitment to safety measures. Initiatives to raise awareness and incentivise workers are fragmented and often fail to bring about meaningful change. Barriers to implementing health and safety practices include a lack of resources, experience, tools, and guidelines, along with the complexity of an organisation. Potential measures include standardising processes, establishing project budgets, and implementing checkpoints. Practical tools can also help simplify tasks and encourage workers to be more attentive to safety procedures.

The gap between ideal and acceptable safety standards is significant in modern organisations, with many compromising between stricter guidelines and practices. Recognising this gap is the first step towards continuous improvement, and setting realistic goals to increase safety practices is essential. Organisations must continuously commit to bridging the gap and working towards more comprehensive safety practices, ensuring a safe and healthy work environment.

The H&S system faces several challenges in the workplace, including limited external influence, risk assessment, cultural factors, and lack of national standards. External influences can lead to negligence and outdated protocols, while cultural factors can influence attitudes towards safety. Organisations should set minimum safety measures and conduct on-site compliance audits to address these issues.

A safety-oriented culture can also be a challenge, as it can lead to resistance towards safety protocols. Additionally, the lack of specific energy sector regulations and the variety of available technologies can lead to alternative regulations that may not align with local realities. Local authorities should adopt safety standards and strategies tailored to their region's circumstances, and organisations can provide guidelines, recommendations, materials, tools, and resources to implement safety measures. Occupational risk assessments are crucial for identifying potential hazards and implementing measures to reduce their likelihood or minimise the consequences.

2. General Context

2.1. Introduction

The Transforming Energy Access Platform is a flagship FCDO innovation platform that finances, supports, catalyses, researches, and develops new clean energy technologies and the business models needed to deploy them – to accelerate access to affordable, clean, and modern energy for all (SDG 7). This includes power generation technologies (e.g., next-generation solar), demand solutions (e.g., efficient appliances, cooling, and modern cooking services), and smart delivery solutions (e.g., energy storage and hydrogen). It targets people and enterprises in sub-Saharan Africa, South Asia, and Indo-Pacific regions who have no or limited access to clean, modern energy services and limited opportunities to participate in or benefit from the energy sector through employment and its income-generating opportunities. The Health and Safety Support Service Design Phase is a project that is part of the TEA platform and aims to improve H&S in the energy access sector by developing an inclusive long-term adoption strategy based on real project information and experiences.

While innovations in energy access solutions and technologies offer numerous benefits to recipient communities, they also introduce potential health and safety risks, impacting both the communities themselves and the individuals working on and operating these solutions. Recognising that many energy access initiatives are implemented in resource-constrained countries with limited capacity for robust H&S standards and procedures, this report undertakes a comprehensive analysis of the sector to identify key challenges and develop a roadmap, guidelines, and recommendations. This initial report is intended for stakeholders, including funding institutions, cooperatives, multilateral organisations, and developers who implement or provide energy access solutions. It constitutes the foundation of a larger endeavour to delineate the sector's present condition, establish a systematic approach to assessing health and safety risks and hazards, and suggest measures to enhance H&S management across various energy access initiatives.

2.2. Theory of Change

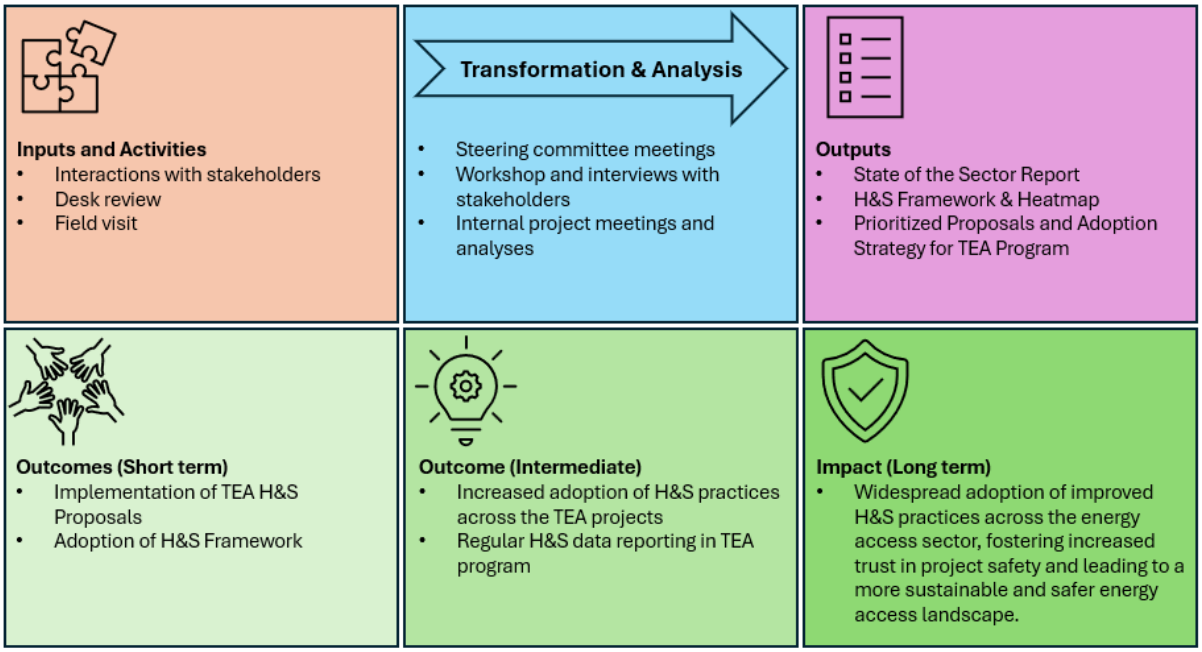

Figure 1 Theory of Change of H&S TEA Support Service Design Phase

This Theory of Change outlines the project's strategy, activities, and expected outcomes. It clarifies the pathway from project activities to achieving the long-term goal of improving H&S practices across the sector.

The project will leverage stakeholder engagement through interviews and workshops to gather valuable insights and real-world experiences. This collaborative approach will culminate in the production of several key deliverables, each playing a vital role in achieving the project's long-term goals.

The first output of this project is the State of the Sector Report. This comprehensive report will serve as a foundational resource, providing a clear and concise picture of the current H&S landscape within the energy access sector. Through an in-depth analysis of stakeholder perspectives, the report will identify key challenges and barriers related to H&S practices. This initial report will act as a springboard for the development of the H&S framework, heatmap and targeted recommendations that will shape future project activities and pave the way for lasting improvements in the safety of everyone involved in energy access projects.

2.3. Energy Access Sector

Seven main technology categories were identified in the TEA platform to be representative of the specific potential challenges that are faced in the energy access sector:

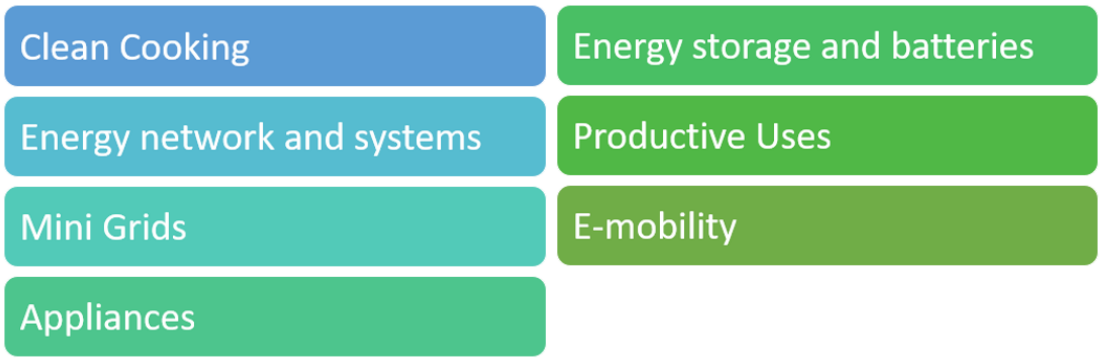

Figure 2 Technological categories of projects in the TEA Platform

There are several evident overlaps between these categories, and they are not treated throughout the report separately. For example, building a mini grid to power a rural village includes an energy network and systems component, but it could also include an energy storage and batteries component, a productive uses component and even an e-mobility component. Nevertheless, the associated hazards and risks from each of the categories will be analysed separately as they are specific to that component of the full project.

It is worth noting that although the majority of the stakeholders consulted for this research were from the TEA platform, non-TEA-associated stakeholders were also interviewed to complement the vision of certain categories and other geographies. While most of the projects are considered "off-grid," some are located in weak-grid and on-grid areas where that specific category still contributes to an improvement in energy access (i.e., clean cooking projects in urban areas or back-up systems using energy storage in peri-urban areas).

This comprehensive approach and a broader explanation of the methodology utilised to choose the interviewed stakeholders, as well as the questionnaire taken into account during the interviews, can be found in the Annexes of this report.

2.4. Vulnerable Populations and Disadvantaged Groups

Throughout the project, the definition of vulnerable populations and disadvantaged groups from the International Labour Organisation (ILO) will be used. The ILO classifies vulnerable worker groups as child labour, forced labour, migrant workers, and workers with disabilities.[1] Additionally, the project has considered other vulnerable groups identified during stakeholder interviews. These groups are vulnerable because of their inability to demand better H&S conditions or because they have a higher perceived risk than the ILO classified groups. This may be due to their relationship with their employer, a lack of knowledge about better conditions, a desperate need for a source of income, or the systemic and cultural perception of these groups' rights. This definition will help to accurately identify and address the challenges that these vulnerable groups face.

[1] International Labour Organisation. Module 9: ILO Curriculum on Building Modern and Effective Labour Inspection Systems.

Child labour:
Defined by the ILO as work that deprives children of their childhood, their potential and their dignity, and that is harmful to their physical and mental development. It refers to work that[2]:

- is mentally, physically, socially or morally dangerous and harmful to children; and/or
- interferes with their schooling by: depriving them of the opportunity to attend school; obliging them to leave school prematurely; or requiring them to attempt to combine school attendance with excessively long and heavy work.

Interviews revealed instances where children were reportedly hired by other organisations or by subcontracted works to transport heavy materials or perform repetitive tasks on construction sites. This practice is considered frequent and is more prevalent in certain cultures where hiring an adult worker is more expensive. Additionally, it is also seen as a means of generating additional income for families.

Forced labour:
Defined by the ILO as "all work or service that is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily."

Although this category was not identified during the interviews, it will be kept since it is a recognised issue reported by First Solar, a US PV manufacturing company[3].

Migrant Workers:
The ILO acknowledges that immigrants, whether they have documents or not, are more likely to be mistreated and exploited by their employers, including human trafficking. Such migrant workers are often hesitant to demand improved workplace health and safety measures, exposing themselves to hazardous conditions.

This trend is particularly prevalent in countries where low-cost labour is in demand and a neighbouring country faces economic difficulties. These workers are at a higher risk of encountering health and safety hazards since they may not always adhere to the same standards as other workers and are often deemed second-class employees.

From the interviews, this was not highlighted or identified directly. It's a complex issue that requires first-hand information through an audit or verification. The issue has shed light on the renewable energy access sector, after First Solar reported through an audit that several migrant workers were subjected to forced labour by their subcontractors in manufacturing facilities located in Malaysia. This is not an isolated case, and it emphasises the importance of addressing forced labour against migrant workers.

[2] International Labour Organisation Definition. Retrieved in November 2023, from: https://www.ilo.org/ipec/facts/lang--en/index.htm
[3] Groom, N. (2023, August). First Solar audit reveals forced labor at Malaysia factory. Reuters. Retrieved December 15, 2023, from https://www.reuters.com/business/energy/first-solar-says-audit-found-unethical-labor-practices-malaysia-factory-2023-08-15/

Workers with disabilities:[4]

The ILO defines individuals with recognised physical, sensory, intellectual, or mental impairments whose chances of securing, returning to, retaining, and advancing in suitable employment are substantially reduced as people with disabilities. Despite being a significant group, these individuals remain unnoticed because of the attached stigma and a lack of regulation in place to ensure employment equality.

The team observed that no organisations are taking a stand or leading the way in incorporating H&S considerations for workers with disabilities into their operations within the platform. Furthermore, no inclusive apprenticeship platforms were identified, and people with disabilities remain underrepresented in the clean energy workforce.

There are a few initiatives, for example, the Partnership on Inclusive Apprenticeship[5] and the Global Disability Innovation Hub[6] in the UK, targeting the inclusion of people with disabilities into the energy sector workforce and tailoring innovative energy solutions to be more inclusive. Nevertheless, existing H&S practices often fall short of providing adequate protection and support for this vulnerable group. Traditionally, disability inclusion has been addressed primarily through published guidelines(e.g. Employees with Disabilities)[7]. However, this project recognises the gap between these guidelines and their practical implementation.

Other vulnerable groups

Stakeholder interviews, consultations with international organisations, and a literature review identified additional vulnerable groups disproportionately impacted by H&S risks. These groups include:

- Younger and older workers: Lack of experience or age-related limitations can increase susceptibility to accidents and injuries in hazardous environments.
- Women in the workforce: Inadequate access to properly-sized personal protective equipment and the potential for working during late pregnancy expose women to additional safety risks.
- Heat-stressed workers: Communities living and working in areas with high average temperatures face unique health and safety challenges.
- Marginalised ethnic or racial groups: Depending on the local context, some groups may face discriminatory practices or a disregard for their specific safety needs, putting them at a significant disadvantage.

[4] International Labour Organisation. In Declaration on Fundamental Principles and Rights at Work (ILO) Retrieved in November 2023 from: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_098461.pdf

[5] Partnership on Inclusive Apprenticeship.

[6] Global Disability Innovation Hub

[7] Health and Safety Authority from the Republic of Ireland. In Employees with Disabilities. Retrieved in November 2023, from: https://www.hsa.ie/eng/publications_and_forms/publications/safety_and_health_management/employees_with__disabilities.html

This project will propose corrective H&S measures and strategies specifically designed to address the needs of these vulnerable communities. Furthermore, all future recommendations will be developed with these groups in mind, ensuring a truly inclusive approach to H&S within the energy access sector.

2.5. Health and Safety Policies and Procedures

2.6.1 Striving for Occupational Safety: Between the Ideal and the Acceptable

Safety and occupational health are fundamental pillars in any workplace, aiming to protect workers from inherent risks in their daily tasks. However, the gap between the ideal and the acceptable safety standards is significant in modern organisations.

The ideal in occupational health and safety manifests in a deeply ingrained safety awareness and commitment culture. In this scenario, every employee becomes an active advocate for safe practices, near misses are opportunities for improvement, and proactive management supports the implementation of rigorous standards, constantly prevents, identifies, and mitigates risks, and offers ongoing training and optimal protective equipment. This ideal vision represents a horizon of perfection in terms of workplace safety.

However, in many organisations, the actual situation is a compromise between the ideal and the acceptable. Most organisations tend to comply with minimal national safety regulations and laws and will abide by what is strictly mandated. With few a exceptions, the vast majority will not go the extra mile to comply with stricter H&S guidelines, standards, and practices.

It has been found that in certain contexts, such as developing countries, initial efforts to implement H&S best practices are often supported by external resources (e.g., CAPEX support from funding organisations). These initiatives may provide workers with training and personal protective equipment. This initial support can be crucial for raising awareness and establishing a foundation for safety improvements. However, a key challenge lies in ensuring the long-term sustainability of these practices. Without continued commitment from stakeholders, including employers and employees, and potentially ongoing external support, these initial gains can be difficult to maintain.

Risk assessments are conducted periodically, although addressing identified issues might not always occur immediately. This highlights the need for ongoing efforts to strengthen the response mechanisms for identified safety hazards. While the development of a safety culture is underway, it's not yet fully integrated into the daily practices and mindsets of both employers and employees. Further efforts are required to cultivate a culture where safety is prioritised and becomes an intrinsic part of everyday work on the ground.

This gap between the ideal and the acceptable is a constant reminder of the challenges in implementing occupational safety standards. Recognising this gap is the first step towards continuous improvement. Setting realistic and achievable goals to elevate safety practices, such as improving training, providing adequate equipment, allocating the necessary resources (time and economic), and fostering a deeply-rooted safety culture, are essential to progress towards the ideal.

In summary, the path towards ideal occupational safety and health is an ever-evolving journey. Even if acceptable standards are achieved, a continuous commitment from organisations is necessary to bridge the gap and work towards more comprehensive safety practices, ensuring a safe and healthy work environment. This reflection on the ideal and the acceptable in occupational safety is a call to action to prioritise the safety and well-being of workers at all levels of the organisation and at all stages of a project.

2.6.2 Case Study Example: E-Scooter Battery Combustion Risks

The worldwide growing popularity of electric scooters (e-scooters) and motorcycles has also highlighted a safety gap between the ideal and the acceptable, particularly concerning the potential for lithium-ion battery explosions, which can cause serious injuries, fires, and property damage. While some countries have implemented minimal regulations, these often focus on basic requirements like speed limits, or protection equipment presence, or outdated battery regulations. However, they might not address the root cause of battery explosions – quality control issues, a lack of rigorous testing during manufacturing, limited user awareness, and potential misuse of the equipment.

This gap between minimal regulations and ideal safety practices can have serious consequences. Without strict manufacturing standards, faulty batteries are more prone to overheating, some domestic electrical installations might not be equipped to charge the devices, and explosions could occur. [89] Moreover, the absence of mandatory testing and certification allows potential defects in battery design or components to go undetected, further escalating the risk of incidents..

Another key issue lies in the lack of standardised battery and charger specifications. Without unified standards, the market is flooded with components of varying quality, some meeting safety benchmarks while others fall short. This inconsistency, coupled with a competitive market that hinders collaboration, jeopardises user safety and increases the likelihood of battery malfunctions and fires. This increases the risk of fires and explosions highlighting the need for a more comprehensive approach to e-scooter and motorcycle safety.

Beyond immediate safety risks, the rapid adoption of these vehicles raises long-term environmental concerns. The surge in battery waste could lead to health and environmental hazards due to improper disposal or recycling. Even with existing safety measures, severe accidents can expose toxic substances, exacerbating these issues.

While these challenges are global, addressing them effectively will require tailored, regional approaches that consider the specific infrastructure, regulatory frameworks, and user behaviors in different areas.

[8] Gibson, K. (2022, December 23). At least 19 killed this year in Hoverboard, e-scooter fires, Feds say. CBS News. Retrieved in January 2024 from: https://www.cbsnews.com/news/e-scooter-hoverboard-fires-deaths-injuries-feds/

[9] Waren J. (2023, October 16) E-bike fires can be devastating, burns unit warns, BBC News. Retrieved in January 2024 from: https://www.bbc.com/news/uk-england-london-67105735

2.6. Overarching Challenges

Geographical Scope

The vast geographical spread of energy access projects presents a significant challenge. Generalisations were necessary to capture a broad range of experiences, and in some instances, only the biggest risks or most impactful were analysed. As such, this approach may have overlook risks specific to certain regions or contexts.

This challenge also extends to the proposed H&S measures. While some recommendations are designed to be broadly applicable, successful implementation will require tailoring them to address the unique realities and risks of specific locations. The project acknowledges this need for adaptation and proposes high-level measures as a starting point. However, further work will be required to ensure that these measures are effectively adapted to specific contexts.

Local Context

The project recommendations aim for broad applicability across the energy access sector. However, a significant challenge lies in the varying national contexts in which projects operate. Regulatory frameworks, safety standards, local workforce, and enforcement mechanisms can differ significantly from country to country, creating a hurdle for the implementation and proposal of standardised H&S measures.

To address this challenge, the project team has established a set of core H&S principles that are universally applicable across diverse contexts and presented in the H&S Framework. These principles provide a strong foundation for safe work practices regardless of location. Recognising the limitations of a strictly standardised approach, the project also provides examples of how to adapt H&S measures to specific environments, locations, and contexts.

Reluctance to Share

Many stakeholders, including developers, financiers, and EPC companies, are hesitant to openly discuss their H&S experiences, especially when incidents involve physical or material damage. This reluctance extends to sharing details of incidents unless they are already public knowledge. Even with assurances of confidentiality through non-disclosure agreements and anonymity, scepticism persists about sharing details.

The project team made significant efforts to build trust and encourage open communication. Emphasis was placed on gathering lessons learned and practical insights from experiences rather than focusing on identifying specific stakeholders. This approach aimed to ensure anonymity and encourage participation.

Data Collection, Availability and Sharing

Representation

The project team interviewed key stakeholders like project developers, funders, and international organisations, however, the perspective of on-site workers who are directly involved in project implementation and face daily safety challenges, as well as the community members where the projects are being implemented, is missing. This perspective is important because it brings to light a different set of risks associated with the project implementation.

To address this gap, the project will conduct site visits to operational and under-construction project locations. These visits will allow for in-depth interviews with the workers and communities involved, gathering firsthand insights into their experiences and safety concerns.

3. Navigating H&S Challenges in the Energy Access Sector and Among Vulnerable Groups

3.1. Current State

An important gap exists -limited health and safety information is available from within the energy access sector which addresses the importance of taking steps to close this gap and start addressing this issue in more detail. Currently, H&S is typically seen as a secondary concern, overshadowed by the pressing need to implement energy solutions. For instance, a study on safety risk management in transmission line construction emphasises the need to prioritise safety and safety management throughout the process[10]. Furthermore, a lack of general reporting and monitoring of H&S indicators across the sector is not widely available. Addressing this lack of H&S data is crucial for establishing clear monitoring and reporting mechanisms, ultimately leading to better practices and safer working conditions by effectively identifying gaps and priorities.

In the administrative realm, one of the challenges is the prevalence of corruption in various processes, such as permitting, monitoring, and/or auditing. This corruption creates a hindrance to the implementation of proper occupational health and safety conditions in organisations. It emphasises the fact that when companies offer bribes or favours to officials or high-ranking individuals, it undermines the provision of services without adhering to basic measures.

During the research phase of this project, one of the challenges identified in maintaining occupational health and safety is the influence of culture both in society and within companies. In some organisations, a fatalistic culture prevails, which can affect the level of commitment from managers and employees to occupational safety. This means that safety measures or initiatives may not be executed or given the necessary importance. This situation is discussed in 'The Essentials of Safety

[10]Albert, A., & Hallowell, M. (2013). Safety risk management for electrical transmission and distribution line construction. *Safety Science*, *51*, 118–126. https://doi.org/10.1016/j.ssci.2012.06.011

Culture'[11], which explores the relationship between organisational culture and the effectiveness of safety practices[12].

Although most African countries have occupational health and safety regulations in place[13], the enforcement of these laws is limited or non-existent. This shows that a lack of monitoring of labour conditions exists and demonstrates challenges involved in addressing critical issues through corporate responsibility, as outlined in this document. This situation poses a significant threat to the region's occupational health. During the interviews, it became evident that companies often have a low commitment to H&S, prioritising the functioning of electrical solutions, funder indicators, and other apparent success factors over anything else.

According to the interviews and major documents reviewed, electrical risks for workers in the energy sector are a constant reality in the industry. These risks create differing situations where serious accidents can occur, such as electrocution, electric shocks, burns, explosions, and fires among others. These are just some of the prominent risks, However, in the field, the diversity of risks could present varied and multiple realities. In many situations, they can be avoided [14].

It has been observed that economic challenges often arise in many projects due to limited access to resources. This results in reduced availability to address crucial issues related to occupational health, impacting the ability of an employer to provide basic health and safety conditions for workers and society. These limitations include delivering essential health and safety training, providing adequate PPE to workers, and allocating sufficient time to develop H&S policies, among other key aspects. For instance, companies might be reluctant to purchase steel-toe shoes because of their higher cost, the need to figure out shoe sizing, the delivery lead time in the country where the company is based – which adds complexity to the procurement process – and the difficulty of passing them along between different staff.

As mentioned in the previous paragraph, workers' limited access to technology and technical knowledge, as highlighted in the interviews, poses a significant occupational risk. This situation is common in developing countries, where the lack of appropriate technology results in work being performed in a suboptimal manner or without optimal conditions[15]. Such limitations in technology significantly contribute to exposing workers to occupational hazards.

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[11] Boissières, I. (Ed.) (2017). The essentials of safety culture. *Institut pour une culture de sécurité industrielle.*

[12] Zaman, R., van Vliet, O., & Posch, A. (2021). Energy access and pandemic-resilient livelihoods: The role of solar energy safety nets. Energy Research & Social Science, 71, 101805. https://doi.org/https://doi.org/10.1016/j.erss.2020.101805

[13] Barbier, E. B. (2020). Is green rural transformation possible in developing countries? *World Development*, *131*, 104955. http://doi.org/10.1016/j.worlddev.2020.104955

[14] Mpufane Glen. (2021). Reunión sobre salud y seguridad laboral en África subsahariana pone el foco en la renuencia a vacunarse contra la COVID-19. *IndustriALL Director for Mining*.

[15] Barbier, E. B. (2020). Is green rural transformation possible in developing countries? *World Development*, *131*, 104955. https://doi.org/https://doi.org/10.1016/j.worlddev.2020.104955

The initiatives identified through the interviews and research are not merely suggestions but rather the seeds of change in health and safety management within the energy access sector. These solutions possess immense potential to generate initial actions, raise awareness among key stakeholders, empower workers and communities, and ultimately cultivate a culture of safety. However, fragmented efforts will yield limited results. A comprehensive strategy is urgently needed – a unified framework that leverages these valuable ideas and structures them into a roadmap for a safer future.

The project is positioned to transform these promising solutions into a powerful force for change. Collaboration with similar organisations within the sector is crucial to bridge the gap between fragmented initiatives and create a comprehensive H&S strategy for the entire energy access sector. This is not merely about incremental improvement -a fundamental shift towards a safer and healthier work environment for everyone involved is envisioned. A first glimpse of the challenges and proposed mitigating actions is analysed in more detail in the following section.

3.2. H&S Challenges, Barriers and Risks in Energy Access

Ensuring a safe and healthy environment is critical for the long-term success of the energy access sector. However, implementing robust health and safety practices presents a range of challenges and barriers. This section explores these challenges, drawing from insights gained through interviews and desk-based research. Potential solutions (along with a first draft of these solutions) are also presented here, which will be further analysed and refined in later project phases. It's important to acknowledge that the level of H&S integration varies significantly across organisations. Factors such as size, resources, and awareness all play a role in determining how effectively H&S practices are implemented. The following discussion delves deeper into these nuances, highlighting the specific barriers and challenges that organisations encounter.

Additionally, based on the interviews and incident reports, this section identifies the biggest risks facing the sector. This initial analysis provides a valuable starting point for exploring further risk mitigation strategies in upcoming project phases.

3.2.1 Implementation of H&S Practices (Barriers and Challenges)

Lack of resources

A significant challenge for organisations implementing health and safety measures is the lack of available resources. This can manifest in various ways, hindering the effectiveness of safety protocols. These resource limitations pose a significant barrier to organisations achieving acceptable H&S standards. They can lead to inadequate training, deficient safety protocols and, ultimately, an increased risk of accidents and injuries within the workplace.

- **Time Constraints:** Competing priorities within organisations often lead to a lack of dedicated time for H&S training, implementation, and monitoring.
- **Financial Constraints:** Insufficient financial resources can limit investments in critical areas such as H&S training for staff, procurement of essential safety equipment (PPE and materials), and hiring qualified personnel to oversee H&S protocols. Additionally, financial constraints can hinder contingency planning and ongoing operation and maintenance. Support is often

provided only during the installation phase, which can often leave organisations struggling to address safety issues that later arise, making it difficult to comply with all H&S practices.

- **Human Resource Constraints:** Limited manpower makes it difficult to dedicate staff solely to H&S tasks, potentially compromising the implementation and enforcement of safety measures.
- **Knowledge and Expertise Constraints:** The absence of readily available tools, specific guidelines, contextualised implementation examples, and experienced personnel can hinder the ability to navigate complex H&S requirements and best practices.
- **Skilled Labor Constraints:** Finding skilled workers with a strong understanding of H&S procedures, particularly in remote project locations, can be challenging and hinder compliance efforts.
- **Safety Equipment Constraints:** The cost and availability of proper safety equipment, including specific safety materials and personal protective equipment, can create hurdles. This can lead to delays in maintenance and operational activities due to safety concerns.

Mitigation Strategies:

There are two levels of support for mitigation strategies to address this challenge, which is one of the most complicated to approach. One is from the funders of projects (donors, lenders, investment organisations) on how to support the project implementors (manufacturers, EPC, developers) and communities, and the other one is from the implementor's perspective.

- Project Funders:

Donors, lenders, and investment organisations play a crucial role in promoting robust H&S practices. They can provide incentives and requirements that encourage project implementors to prioritise H&S throughout the project lifecycle. This could involve mandating H&S budgets, including H&S in the due diligence or tendering process, requiring qualified personnel to be on site, or encouraging the use of technology-enabled solutions for H&S management. Additionally, funders can consider supporting capacity-building initiatives within communities to raise awareness and empower them to participate in safety discussions, as well as to support initiatives on the creation of monitoring tools (mobile apps, templates), protocols, and H&S learning programmes.

- Project Implementers:

Efficient project management practices are essential for overcoming resource constraints in H&S implementation. Standardising H&S procedures across projects streamlines operations, improves overall efficiency, and reduces time wasted on repetitive tasks. Including H&S costs upfront in project budgets ensures adequate resources are allocated for training, equipment, and other safety needs. Implementing regular safety checkpoints during project phases allows for early identification and mitigation of potential risks, preventing accidents and saving time in the long run.

A skilled workforce is fundamental to a strong H&S culture. Investing in comprehensive H&S training programmes equips staff with the knowledge and skills necessary to work safely and

identify potential hazards. Furthermore, electrical safety standards should come from university-level programmes, which are sometimes harder to find where the projects are implemented.

Access to essential safety equipment is crucial for worker safety. Exploring partnerships with reliable safety equipment suppliers can ensure the availability of essential PPE and other safety resources. In addition to access, incorporating training on proper equipment maintenance and care extends the lifespan and functionality of safety equipment, reducing long-term costs.

External Influence on H&S System

Organisations may lack external influence and oversight on their H&S systems. This can lead to:

- Negligence and Outdated Practices: Without external pressure to update protocols and procedures, organisations may become complacent and rely on outdated safety measures that no longer reflect best industry practices, which can lead to accidents and injuries in the workplace.
- Difficulty with Compliance: The absence of external controls can make it challenging for organisations to stay up-to-date with evolving safety regulations and implement the necessary changes. This could lead to a loss of trust in the industry as it could seem that H&S is not take seriously
- Time Constraints as a Barrier: Limited time resources can exacerbate the issue. Efforts to update H&S systems and achieve compliance may be deprioritised due to competing demands.

Mitigation Strategies:

- Project Funders:

It is very important to set clear minimum safety standards for project implementation. These standards can be based on industry best practices and the relevant regulations.

Implementing a recognition programme to incentivise organisations that prioritise and demonstrate strong H&S practices should be considered. This could involve public recognition, awards, or access to additional resources for organisations with a proven safety track record.

The establishment of a sector-wide H&S association incorporated in one of the already sector-wide organisations (e.g., AMDA) could be a transformative force in strengthening H&S practices across the industry. The association could serve as a central hub for knowledge and resource sharing, collaboration, and advocacy.

- Project Implementation:

Workers should feel empowered to report and document H&S concerns without fear of retaliation. Implementing a system with clear reporting procedures and protections for whistleblowers is essential. Rewarding workers for identifying and reporting safety issues can further incentivise participation.

Qualified personnel should conduct regular on-site compliance audits to help identify gaps in H&S implementation and ensure adherence to established standards.

Limited Risks Assessment

Firstly, organisations may not conduct thorough or realistic assessments of potential risks associated with projects. This can lead to a misalignment with practical realities, where significant risks are overlooked or underestimated during the planning phase. Consequently, projects can be unprepared for real-world challenges during execution, leading to delays, disruptions, and cost overruns.

Secondly, organisational biases or a reluctance to address sensitive subjects can lead to the underestimation of certain risks. This subjectivity can create a false sense of security and hinder the development of effective mitigation strategies. The underestimation of safety risks, in particular, can increase the likelihood of accidents and injuries within the workplace, ultimately damaging an organisation's reputation and public trust.

Mitigation Strategies:

- Project Funders:
  Mandating an independent review of risk assessments for high-risk projects should be considered. This can help identify potential biases and ensure a more objective evaluation of project risks.

- Project Implementers:
  Implementers should conduct thorough risk assessments that involve a systematic examination of potential project risks. This risk assessment should identify clear, actionable mitigation strategies for each identified risk and assign responsibility for their implementation.

  Health and safety considerations should be considered in project planning as early as possible. Early pre-project evaluations from an H&S perspective allow for the early identification of potential safety hazards.

Safety-Oriented Culture

The absence of a strong safety culture within the workplace, especially during the implementation of energy access projects, can have serious consequences. Cultural factors significantly shape attitudes towards safety, potentially leading to behaviours that undermine safety protocols. In some cultures, productivity or worker comfort may be prioritised over safety, leading workers to take shortcuts or neglect safety protocols. Additionally, a "macho" culture may exist in some workplaces where PPE is seen as a weakness or an inconvenience, causing workers to resist wearing it due to ingrained habits or discomfort.

A weak safety culture can negatively impact workers' and community members' safety and organisational well-being. When safety is not prioritised, workers are more likely to be involved in accidents and sustain injuries. They may also disregard safety rules and procedures if they are not seen as important or enforced.

Mitigation Strategies:

- Project Funders:

Project funders can also play a role in promoting a safety-oriented culture. By prioritising projects that demonstrate a commitment to worker safety, funders can send a strong message. This could involve requiring applicants to outline their plans for promoting safety awareness and compliance within the project. Additionally, allocating resources to support training programmes and capacity-building initiatives can help project implementors to develop a strong safety culture.

By working together, project implementors and funders can create a work environment where safety is valued and prioritised, leading to a safer work environment, improved employee well-being, and increased project success.

- Project Implementors:

It is recommended to adopt a people-centred approach to safety, prioritising worker well-being and creating a work environment where safety is valued. Higher leadership can significantly influence worker attitudes and behaviours by setting a positive safety example through their own actions and consistently following H&S practices.

Effective communication and awareness programmes are essential for reinforcing safety messages. Regular communication should emphasise the importance of safety, highlight the consequences of non-compliance, and celebrate safe work practices.

Investing in comfortable and appropriate PPE for the working environment is crucial. For example, breathable steel-toe shoes, lightweight helmets, and other PPE suitable for hot climates can encourage worker compliance.

National Standards and H&S Regulatory Challenges

The absence of robust national standards in the energy sector can pose significant challenges for organisations implementing projects. In some regions, a lack of specific regulations or a wide variety of available technologies can create a regulatory gap. This forces companies to adopt alternative regulations that may not be well-suited to the local context, potentially compromising safety and hindering project development due to uncertainties surrounding regulatory requirements.

Mitigation Strategies:

- Project Funders:

Organisations that promote, fund, or finance energy access projects can play a crucial role in bridging the gap by providing access to resources such as guidelines, recommendations, materials, tools, and best practices, as the ones being developed for this project. This can assist project implementation by developing and implementing effective safety protocols. Furthermore, supporting regional efforts to establish minimum safety standards can help to minimise

duplication of efforts and ensure a consistent level of safety across different projects within the region.

Similarly, these organisations can support local authorities in adopting and customising safety standards that address the specific challenges and circumstances prevalent in their region. This ensures that safety regulations are relevant and effective in the local context. Additionally supporting the implementation of a system for auditing to identify and address any gaps in safety implementation.

Repairs and Maintenance: Customer Protection & H&S Concerns

A significant challenge in ensuring the safety and longevity of energy access solutions, such as appliances and Solar Home Systems (SHS), arises in remote or hard-to-reach areas. The scarcity of certified technicians in these regions often leads to unqualified individuals attempting repairs, potentially compromising the safety of the equipment for customers and end-users. In some cases, the issue is compounded by the sale of poor-quality equipment with no after-sales support, leaving customers vulnerable to malfunctioning and potentially dangerous products.

The consequences of inadequate repairs and maintenance can be severe. Poorly executed repairs can lead to electrical faults, fires, and other safety hazards, putting users at risk. Furthermore, the lack of accountability from manufacturers or suppliers of substandard equipment exacerbates the problem, leaving customers with little recourse in the event of malfunctions or safety issues.

Mitigation Strategies:

- Project Implementors:

By prioritising partnerships with manufacturers and suppliers who offer robust after-sales support and training programmes for local technicians, they can ensure that quality products are accompanied by the necessary expertise for maintenance and repairs. Additionally, investing in comprehensive training and certification programmes for local technicians will equip them with the skills, knowledge, and tools needed to perform safe and effective repairs, ultimately enhancing the safety and longevity of energy access solutions in these communities.

- Project Funders:

Incentivising project implementors to prioritise after-sales support and training local technicians, with a focus on adhering to established principles such as GOGLA's Consumer Protection Principles[16]. Furthermore, funders can actively support the development and implementation of certification programmes for technicians in remote areas, ensuring a pool of qualified individuals capable of providing safe and effective repairs. Encouraging the use of technology and innovative solutions, such as remote monitoring and maintenance capabilities, can also play a vital role in

[16] GOGLA's Consumer Protection Principles & Indicators, retrieved on August 2024 from : https://www.gogla.org/what-we-do/business-services-and-standards/consumer-protection-code/consumer-protection-principles-indicators/

overcoming the challenges of distance and accessibility. Finally, by requiring certification of appliances or equipment under a reputable body like VeraSol[17], project funders can help ensure that only safe and reliable products reach the market, further protecting consumers and promoting sustainable energy access.

Accountability with Daily Workers and Subcontracted Companies

A prevalent challenge in maintaining consistent H&S standards lies in the management of daily workers and subcontracted companies. These workers, often engaged in temporary or project-based roles, may not be held to the same safety standards as permanent employees. This disparity can lead to a situation where they are assigned more hazardous tasks or are not provided with adequate safety training and equipment.

The consequences of this lack of accountability can be severe. Daily workers and subcontractors face a heightened risk of accidents and injuries due to their exposure to more dangerous tasks and potentially inadequate safety provisions. This not only compromises their well-being but also creates a liability for the companies employing them. Furthermore, it can foster a culture of complacency towards safety, undermining overall workplace safety standards.

Mitigation Strategies:

- Project Implementors:

  Clear and consistent health and safety standards for all workers should be established, including those engaged on a daily or subcontracting basis. While these standards might not be as stringent as those for direct employees, they should represent a meaningful first step towards accountability and improved safety practices. It's also essential to ensure that daily workers and subcontractors receive adequate safety training and have access to the necessary personal protective equipment. To ensure compliance across all workforce categories, implement robust oversight and monitoring mechanisms.

- Project Funders:

  Project funders can play a crucial role by including provisions in funding agreements that require adherence to rigorous health and safety standards for everyone involved in the project. They can also support initiatives promoting fair and safe working conditions for daily workers and subcontractors. Additionally, encouraging the adoption of transparent and accountable labour practices throughout the project supply chain is vital.

End-of-Life Waste Management

The increasing adoption of electrical appliances, particularly those containing batteries, presents a looming challenge in the energy access sector: the proper management of end-of-life waste. Improper

[17] VeraSol certifies pico-solar products and solar home system kits to internationally-recognised standards for product quality, durability, and truth-in-advertising. Retrieved on August 2024, from: https://verasol.org/solutions/certification/

disposal or mishandling of these products can lead to severe health and safety risks for both workers and the surrounding communities, now and in the future.

Battery leakage, fires, and the release of hazardous materials into the environment are just some of the potential consequences. Additionally, the lack of established infrastructure and regulations for repairing, recycling or repurposing these products can exacerbate the problem.

The potential impact of this issue is significant. Without proper end-of-life management, communities could face increased health risks, environmental pollution, and even economic burdens associated with cleanup and remediation efforts. Moreover, the potential for future hazards from improperly disposed batteries and electronic waste further underscores the urgency of addressing this challenge.

Mitigation Strategies:

- Project Implementors:

  Project implementors should proactively integrate comprehensive end-of-life management plans into their project designs. These plans should clearly outline strategies for the collection, transportation, and safe disposal or recycling of electrical waste. Establishing effective partnerships with local communities and recycling organisations is crucial to setting up collection points and promoting awareness regarding proper disposal practices. Additionally, exploring innovative opportunities for repurposing or finding "second-life" applications for batteries and other components can significantly extend their useful life and minimise waste.

- Project funders

  Project funders can play a pivotal role by mandating the inclusion of end-of-life management plans in project proposals, ensuring that waste management is considered from the outset. Furthermore, actively supporting the development of recycling and repurposing infrastructure in project regions will provide accessible and viable options for responsible waste handling. Encouraging research and innovation into safer, more sustainable battery technologies and end-of-life solutions can drive long-term improvements in the sector. Finally, advocating for the development and enforcement of robust regulations governing the disposal and recycling of electrical waste will establish a supportive framework for responsible practices across the industry.

3.2.2 Identified H&S Risks in Energy Access

Assessing occupational risks involves a careful and systematic approach that focuses on two fundamental variables: probability and consequence. This process is essential for identifying, understanding, and addressing hazards present in work environments and while using certain technologies.

Probability refers to the likelihood of a specific risk occurring. Evaluating this variable involves considering various factors, such as the frequency of hazardous events, working conditions, and the effectiveness of existing controls. Daily activities are examined to determine the likelihood of a risk materialising. This assessment helps prioritise risks based on their likelihood of occurrence, enabling a more effective allocation of resources and prevention efforts.

On the other hand, consequence relates to the impact of a risk materialising. Potential implications for injuries, property damage, loss of productivity, or any other adverse consequences are analysed. This evaluation is crucial to comprehending the severity of a risk and determining its priority level based on its potential consequences.

The combination of probability and consequence allows for the classification of risks into different levels ranging from those with high probability and severe consequences to those with low probability and minor consequences. This assessment aids in identifying critical risks that require immediate action and those that can be managed with existing controls or mitigated through preventive strategies.

Occupational risk assessment aims to identify potential hazards and implement measures to reduce the likelihood of their occurrence or minimise their consequences. This proactive and systematic approach protects workers' health and safety and contributes to a safer and more productive work environment.

		Consequences →				
		A	B	C	D	E
Likelihood →	V	Medium 5	High 10	High 15	Extreme 20	Extreme 25
	IV	Medium 4	Medium 8	High 12	High 16	Extreme 20
	III	Low 3	Medium 6	Medium 9	High 12	Extreme 15
	II	Low 2	Low 4	Medium 6	High 8	Extreme 10
	I	Negligible 1	Low 2	Medium 3	High 4	Extreme 5
Consequence scale 1		Description 1	Description 2	Description 3	Description 4	Description 5

Figure 3 Example of a risk assessment of Likelihood vs Consequence

Electrification projects in the energy access sector pose numerous occupational risks, particularly in Low- and Medium-Voltage environments, and in energy storage through batteries. These risks demand careful management and preventive measures to ensure worker safety.

The initial interviews and research have identified several critical risks within the energy access sector, which are presented below. These are some of the risks that will be further evaluated in the next

phase of the project through a comprehensive H&S Heatmap and the solutions will be explored during the final phase of the project.

Low and Medium-voltage – Electrocution

Working with low and medium-voltage electricity, particularly in the context of mini-grids and weak grid zones often found in remote areas, poses a significant risk of electrocution. Direct or indirect contact with live wires can lead to fatal shocks or severe injuries. Electrical faults can also trigger fires and explosions, further endangering workers and the surrounding environment. Even handling tools and equipment carries the risk of mechanical injuries.

These risks are compounded in remote areas where installations may be carried out by uncertified workers, potentially leading to faulty wiring and unsafe connections. Additionally, attempts by residents to repair or modify parts of the grid or their installations can expose them and others to serious electrical hazards.

Energy Storage (Lithium-Ion Batteries) – Fire Hazards

On the other hand, energy storage through lithium-ion batteries (LIB) has emerged as a significant trend but also presents specific risks. LIBs overheating poses a latent threat that can lead to fires or explosions, emphasising the critical importance of precise and constant temperature control in storage environments. Improper handling or inadequate maintenance of batteries can result in chemical leaks or electrical discharges, endangering personal safety, the workplace, and environmental integrity.

The use of LIBs in mini-grids as battery energy storage systems has brought additional challenges to the forefront. There have been instances of fires occurring without a clear root cause analysis, and warranties being voided due to the inability to properly investigate or comply with the requirements, particularly in remote project locations. Furthermore, the logistical requirements for transporting, installing, and maintaining LIBs in these remote areas can be complex and costly, potentially hindering effective oversight and safety compliance.

While the probability of fire is generally low when LIBs are used, charged, and stored correctly, any physical damage or improper use can significantly increase the risk. Factors such as battery design and quality, charge status, ambient temperature, and any previous damage can influence this risk. Though statistics indicate that lithium battery fires are u uncommon, it's crucial to recognise that they can occur under specific circumstances, underscoring the need for robust safety protocols and user education.

Construction and Material Handling – Injuries

The risk of injuries increases during the construction phase of projects due to the use of tools and material handling. Proper training and the use of adequate PPE are crucial in this phase.

Battery Room (Lead-Acid Batteries) – Intoxication

Inadequate ventilation in lead-acid battery (LAB) rooms can lead to the buildup of hazardous fumes, potentially causing lead intoxication in personnel performing maintenance task. To mitigate this risk, proper ventilation is essential, adhering to the relevant safety standards and guidelines. Additionally, personnel must wear appropriate PPE and regular air quality monitoring and health check-ups are also crucial to ensure the well-being of workers.

Furthermore, when LABs are used in mini-grids, the ergonomic design of the battery packs can often make maintenance difficult and even dangerous for operators. This, coupled with a lack of proper follow-up and control mechanisms, can further increase the risk of accidents and injuries.

LPG – Explosion

Liquefied petroleum gas (LPG) is highly flammable and explosive, making handling it a risk to. Accidents involving LPG, although quite rare, can cause sudden fires and explosions, leading to severe injuries, significant property damage, and even death.

The occurrence of accidents involving LPG depends on multiple factors, including compliance with safety regulations, proper equipment maintenance, and personnel training. Leaks of LPG can happen in industrial, residential, or transportation settings, and can all be potentially dangerous.

Compiling accurate global data on the exact frequency of LPG accidents is challenging due to variations in incident reporting across different regions. Nevertheless, reports indicate that LPG-related accidents can occur in various scenarios, from leaks in storage tanks to improper connections in household supply systems, which can have severe consequences.

Special Case of Electric Vehicles (E-mobility)

Electric vehicles offer several advantages in terms of environmental sustainability and energy efficiency. However, they also come with unique safety risks that need to be taken into consideration when compared to conventional internal combustion engine vehicles.

- **Accidents:** One immediate risk with electric cars and motorcycles is the handling of high-voltage batteries in the event of an accident. Electric vehicles are equipped with large lithium-ion batteries that can pose fire risks and even electrical hazards if damaged in a collision. Although uncommon, post-collision fires could be more challenging to extinguish due to the batteries' chemical nature and the risk of re-ignition.
  Furthermore, safely disconnecting electrical power in a crashed vehicle presents a challenge for rescue teams. Safety systems integrated into electric cars, such as battery isolation to prevent electrical discharge, require specific protocols for emergency personnel.
- **Battery Waste & Environmental Concerns:** The rapid adoption of electric motorcycles could lead to a significant increase in battery waste in a few years. Improper disposal or recycling of these batteries can pose health and safety risks due to the release of hazardous materials. While safety measures have been implemented to minimise this possibility, severe accidents

could expose toxic or corrosive substances, raising additional public and environmental safety concerns.

- **Lack of Standardisation:** The primary concern lies in the lack of standardised battery and charger specifications. This can lead to a scenario where some components meet adequate safety standards while others fall short. The competitive market environment can hinder collaboration and the development of unified safety standards, potentially compromising user safety.
- **Battery Damage:** Batteries can become jammed or obstructed, leading to accidental damage by technicians or drivers during attempts to remove them. One company in Kenya reported an incident where a user tried to force a battery out of its casing that was stuck due to excessive dirt, causing damage that resulted in a battery fire. This underscores the need for clear procedures, user education, and training to prevent such incidents.
- **Domestic Charging Accidents**: Improper handling or setup during home charging can result in accidents. Additionally, the electrical installations in many homes might not be equipped to handle the high-power demand of electric vehicles charging, potentially leading to electrical faults or fires.

The prevalence of these challenges in rapidly emerging electric vehicle markets (especially of motorcycles), particularly in some regions where infrastructure and regulations may be less developed, underscores the critical need for proactive measures to ensure the safe and sustainable integration of e-mobility.

3.3. Roles of Stakeholders in the Implementation of H&S Practices

The energy access sectors in sub-Saharan Africa, South Asia, and the Indo-Pacific region require tailored solutions due to their specific challenges. While leveraging various international standards, weak enforcement and inspection, and sometimes the absence of local regulations, make it difficult to implement H&S practices. Furthermore, organisations operating in these contexts must address resource constraints, organisational structures, and regulatory gaps. Overcoming these challenges requires a collaborative effort.

Achieving a safer and healthier work environment requires a collaborative effort, prioritising worker well-being in daily operations. Stakeholders at all levels, including customers, developers, manufacturers, providers, project funders, and donors, have unique perspectives and capabilities that can contribute to addressing H&S challenges. Working together and using a targeted approach can achieve compelling outcomes that foster a safer and healthier workplace.

- **Employers:** Organisations are accountable for safeguarding employees through risk assessments and maintaining a secure environment throughout all stages of a project. They must establish a hazard-free workplace in compliance with the relevant standards and regulations and regularly evaluate workplace conditions for compliance. They must maintain safe equipment and tools and communicate potential hazards to their employees. This requires the establishment and regular updating of internal policies and procedures, while providing safety training in a language

understandable to employees.[18] Some organisations seek third-party expertise for comprehensive management, continuous improvement, and effective implementation and monitoring, while others prefer to have a committee, or specific workers dedicated to H&S.

Health and safety varies noticeably across regions, business sectors, technologies, and organisational priorities. However, one universal measure that is crucial is allowing employees sufficient time to perform their tasks and prevent overtime. This necessity became more apparent through an employer's insight, who underscored the potential risks of rushing employees, emphasising that such practices increase the risk of accidents and pose a potential threat to the workforce's well-being.

Organisations prioritise time allocation as a safety measure, especially when rushed work can adversely affect an employees health. To ensure the health and well-being of the workforce, some organisations have implemented strict safety measures, including prohibiting weekend work. This strategic decision aligns with minimising the likelihood of fatigue-induced accidents and stress-related health issues.

- **Manufacturers and Suppliers:** Establishing effective hazard control and prevention strategies is imperative for maintaining a secure work environment, particularly in the manufacturing stage. This involves implementing safety measures, equipping employees with the necessary gear, delivering comprehensive training programmes, and designing safer products. The role of manufacturers goes beyond the factory floor; they can play a proactive role in ensuring safety throughout the product lifecycle. This includes developing guidelines and training material for end-users and installers, and extending their commitment to safety from the production line to the product's distribution and setup phases. This holistic approach aligns with a commitment to meeting and exceeding regulatory standards and fostering a culture of safety and responsibility.

- **Funders (Donors or Sponsors):** Funders play a multifaceted role in enhancing H&S within both organisations and projects. They can contribute significantly through strategic planning, providing technical assistance, and producing diagnostic documents for identifying and mitigating risks. These efforts encourage a proactive approach to embracing H&S practices and prompt employees to develop procedures that seamlessly embed an H&S policy into organisational frameworks.

The shortage of experienced professionals heightens the risk of accidents in the specific context of energy access project implementation. Addressing this challenge requires a practical approach, necessitating strategic investments in educational programmes. This will help mitigate the shortage and empower organisations to identify and address risks effectively, benefiting all stakeholders involved in these initiatives.

Recognising the costs associated with maintaining appropriate H&S standards in off-grid energy projects is essential. Donors are encouraged to integrate these costs into their toolkits and

[18] Employer responsibilities, by the Occupational Safety and Health Administration. (n.d.). Retrieved in November 2023, from: https://www.osha.gov/workers/employer-responsibilities

recommendations to ensure safety considerations are not overlooked or compromised. Donors can actively participate by providing the necessary resources, such as PPE, and addressing challenges related to their availability and use. This comprehensive approach shows the commitment of stakeholders to promoting a safe and sustainable environment within the scope of off-grid energy projects. In addition, donors and sponsors can emphasise the importance of H&S in tendering or grant processes by setting strict requirements or providing incentives for more robust health and safety strategies.

- **Employees**: Employees are crucial to maintaining their well-being and a safe organisational culture. By incorporating safety measures into their daily routines, such as using PPE when necessary and following safety protocols, they help to reduce potential risks and hazards. With continuous awareness, training, and commitment to safety practices, employees become valuable partners in fostering a work environment that prioritises the health and welfare of everyone involved.

- **Customers and End Users:**

Customers, community members, or end-users living in remote rural areas with limited or unreliable electricity grids are critical stakeholders in maintaining safety within the energy access ecosystem. Their active participation is vital for ensuring the safe and effective utilisation of energy access solutions. These users are expected to understand and adhere to safety instructions provided with the products, promptly report any safety concerns or malfunctions, use products responsibly, and actively participate in community awareness programmes and training sessions.

However, several challenges can hinder their ability to fulfil these responsibilities. Many end-users may have a limited understanding of electrical equipment, safety protocols, and proper maintenance, especially in contexts with little prior exposure to such technologies. Additionally, complacency or a lack of awareness can lead to neglecting safety recommendations and care requirements, potentially resulting in accidents or equipment damage.

To mitigate these challenges, it's important to consider providing accessible and ongoing after-sales support, including training on correct usage, maintenance, and troubleshooting. This empowers end users to operate products safely and confidently. Leveraging existing community structures for information dissemination and training can also enhance the reach and effectiveness of safety initiatives.

3.3.1 International Standards and Recommendations

Ensuring health and safety in the energy access sector requires a strong foundation in international standards and regulations. Building on the sector classification presented in Section 2.4, this section explores how international standards and regulations can be used to improve H&S practices. While there may be a lack of national guidelines and best practices specifically tailored to the local context, many companies in these regions are taking a proactive approach by adapting international and regional standards. Notably, the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC) standards are widely used.

Some of the key international standards that can be applied to improve H&S practices across these technologies are presented below. It is important to note that the list provided is not exhaustive; a broader array of standards may be applicable depending on the specific technology and local context.

Clean Cooking

The International Organisation for Standardisation (ISO) has developed standards for clean cookstoves and clean cooking solutions. Specifically, ISO 19867-1 and ISO 19867-2 provide guidelines for evaluating cookstove performance. Additionally, the Global Alliance for Clean Cookstoves is a worldwide organisation that promotes clean and efficient cooking solutions and provides guidance on standards and best practices in the African region. [19]

Energy Storage & Batteries

- IEC 62933-2-1 concentrates on unit parameters and testing methods, particularly for domestic lithium-ion battery storage systems, emphasising the assessment of cell failure propagation.
- IEC TS 62933-4-1 addresses broader environmental issues related to EES systems, offering guidelines for mitigating environmental impacts and chronic exposure effects on humans.
- IEC 62485-1 specifies foundational requirements for secondary batteries and their installations.

The report, Domestic Battery Energy Storage Systems, produced by Intertek[20] for the Office for Product Safety and Standards (OPSS), provides a comprehensive overview of the state of the existing standards regarding batteries that can be used at different lifecycles of the batteries, from testing to installation. Furthermore, the Australian Best Practice Guide outlines electrical safety requirements for battery storage equipment. In Germany, the Safety Guideline focuses on Li-ion home storage systems adapted in those regions.

Within the realm of energy storage research, the Faraday Institution emerges as a leading research centre dedicated to advancing the field. The institution aims to address challenges and expedite the development of next-generation energy storage systems through strategic collaborations with researchers, industry experts, and policymakers. A recent focal point of their research is highlighted in the paper "Improving the Safety of Lithium-ion Battery Cells"[21], which examines and addresses critical safety concerns associated with lithium-ion battery technology.

Energy Network & System

- ISO 50001 proposes practical ways of reducing energy consumption by implementing an energy management system (EMS).
- IEC 61850 ensures interoperability and communication standards in substations, enhancing energy network reliability.
- AS/NZS 3000 sets out requirements for the design, construction, and verification of electrical installations, including the selection and installation of electrical equipment.

[19] Clean Cooking Alliance. (2021, October 7). "Standards & Testing", Clean Cooking Alliance. Retrieved in November 2023, from: https://cleancooking.org/research-evidence-learning/standards-testing/#

[20] Office for Product Safety & Standards in the Department for Business, Energy &Industrial Strategy (2020) "Domestic Battery Energy Storage Systems", Report by Intertek

[21] Christensen, Mrozik, and Weaving, (2023, July) "Improving the Safety of Lithium-Ion Battery Cells", Faraday Insights - Issue 17 by The Faraday Institution,.

Productive Uses

- IEC 60034 Rotating Electrical Machines: Relevant for motors used in various industrial applications for productive purposes.
- IEC 60947 states the general rules and standard safety requirements for low-voltage switchgear and control gear.

Appliances

- IEC 60904 Photovoltaic Devices: Covers the performance testing of photovoltaic devices, by providing instructions for measuring the current-voltage characteristics (I-V curves) of photovoltaic (PV) devices under natural sunlight conditions or simulated sunlight.
- IEC 60335 Safety of Household and Similar Electrical Appliances: This standard specifies safety requirements for a wide range of household and similar electrical appliances.

Mini Grids

- The IEC Technical Specification 62257 (formerly IEC TS 62257) series offers guidelines for the design, operation, and maintenance of rural electrification systems, specifically addressing mini-grids.

Dedicated to rural electrification through community energy systems and microgrids, the ISO/IEC standard addresses crucial elements, including design, operation, and maintenance. Simultaneously, the National Electrical Code (NEC) acts as a comprehensive reference, compiling essential requirements for the secure installation of electrical systems. The National Electrical Safety Code® (NESC®), exclusively published by IEEE and regularly updated, lays down fundamental rules and guidelines by safeguarding utility workers and the public during the installation, operation, and maintenance of electric supply, communication lines, and associated equipment.

E-Mobility

The field of E-Mobility is rapidly evolving compared to more established technologies. The International Electrotechnical Commission (IEC) and the United Nations Economic Commission for Europe (UNECE) are witnessing concerted efforts to establish comprehensive standards and regulations.

IEC has made notable strides in E-Mobility standards. IEC 63110, for instance, lays out the management protocol for EV charging and discharging infrastructure. Complementing this, IEC 63119 defines high-level communication protocols for information exchange between Charging Service Providers (CSPs) and Charging Station Operators (CSOs). Moreover, IEC 61980 sets forth the general requirements for electric vehicle wireless power transfer (WPT) systems.

In parallel, UNECE, through entities like the Working Party on Pollution and Energy and the World Forum for Harmonisation of Vehicle Regulations (WP.29), has been involved in shaping policies and best practices to facilitate the deployment of electric vehicles and charging infrastructure. Notably, WP.29 is actively engaged in crafting regulations addressing safety, performance, and environmental impact.

Regional Standards

Aside from international standards, several regional standards and initiatives are notable in these regions. One such example is the IEC Africa Regional Centre (IEC-AFRC)[22], which serves as the focal point for the International Electrotechnical Commission (IEC) in Africa. The Centre's objectives include raising awareness of the IEC in the African region, promoting the adoption of IEC International Standards and Conformity Assessment Systems by governments and local industries, and encouraging active participation and contributions to IEC initiatives, irrespective of commitment level.

The African Electrotechnical Standardisation Commission's (AFSEC) key function is the promotion, development, and application of harmonised standards throughout the continent to improve access to electricity. AFSEC has produced Technical Guidelines for Low Voltage Electrical Installations, serving as a practical and immediate-use reference tool for electrical technicians and engineers. Furthermore, AFSEC contributes to rural electrification in Africa by offering a guide for applying standards tailored to such projects' unique challenges and requirements. Additionally, AFSEC provides recommendation of standards[23] applicable to the energy sector in Africa.

The Bureau of Indian Standards (BIS) stands as the national standards body of India and its representative in ISO, ensures the quality and reliability of products and services in the country. Established to develop, maintain, and promote standards, BIS acts as a guiding force, fostering innovation and safeguarding the interests of consumers and industries alike through stringent quality norms and certifications. For instance, BIS has formulated the National Electrical Code of India (NEC), a comprehensive code governing electrical installations. This code serves as a set of guidelines to regulate electrical installation practices throughout the nation.

Various organisations actively contribute valuable insights to H&S guidelines. Notably, the Private Infrastructure Development Group (PIDG) has crafted a booklet outlining 12 transformative life-changing rules,[24] underscoring the pivotal role of implementing Health, Safety, Environmental, and Social practices. This resource specifically addresses activities with a heightened fatality risk and emphasises individual control over life-saving actions. Additionally, the CDC group collaborates with partners to provide good practices such as "Electrical Power Transmission and Distribution: Health, Safety, and Security."[25] This publication delivers a comprehensive overview of guidelines, protocols, and measures for ensuring the well-being and security of those engaged in electrical power transmission and distribution.

3.4. Case Studies and Recommendations

From the different case studies shared with the team, either in writing or during the different interviews held with the stakeholders, three successful trends emerged. These trends will be

[22] IEC Africa Regional Centre. (n.d.). Retrieved in November 2023, in: https://www.iec.ch/offices/iec-africa-regional-centre

[23] AFSEC. (n.d.). Retrieved in November 2023, from: https://afsec-africa.org/RecommendedStandard.aspx

[24] PIDG (2020), HSES Life-Saving Rules: Changing Lives Saving Lives.

[25] CDC Group, PIDG, Gridworks and actis (July 2021), «Electric Power Transmission and Distribution: Health, Safety and Security.»

described below and further analysed in the next steps of the project as part of the implementation strategy.

Harnessing Local Solutions to Address Resource Shortages

When addressing resource limitations in H&S practices, it is essential to remember that safety measures are not merely an adherence to regulations, but to actively reducing the likelihood of incidents and mitigating their impact should they occur. With this goal in mind, implementing local adaptation measures can help develop a stronger H&S culture.

During an interview, one of the examples was about using locally available materials like bamboo trees and large rocks to construct fences or mark roads where access needs to be restricted. This approach utilises readily available resources and leverages the understanding of local workers and the community's knowledge and expertise about the significance of these barriers. This shared understanding fosters a sense of ownership and responsibility for safety, thereby promoting a proactive approach to H&S practices.

Implementers can take advantage of local solutions that go beyond physical barriers. In many regions, traditional knowledge and practices hold valuable insights into effective H&S measures. Incorporating these traditional practices into formal H&S guidelines can enhance their effectiveness, their use, and relevance to the local context.

Adopting a community-centred approach to developing and implementing H&S solutions can instil a sense of ownership and responsibility among community members. It is advisable to involve them in identifying potential hazards, assessing risks, and designing appropriate control measures whenever it is feasible to so. This approach can result in culturally appropriate and more effective solutions catering to the community's needs.

Establishing Comprehensive Health and Safety Guidelines for all Workers

Leading by example is a crucial element of a sustainable H&S culture. This implies that all employees, irrespective of their position or seniority, must adhere to H&S guidelines and policies rather than just making suggestions or applying them selectively. Setting a positive precedent from the top down can profoundly impact and shape the H&S mindset among all workers.

One of the interviewees shared a stark illustration of this principle. On a construction site, the management personnel often failed to follow PPE procedures during supervisory visits. They did not wear safety shoes or helmets, even while enforcing these rules on workers. This conflicting message undermined the importance of H&S compliance.

Conversely, when visitors to the site, including funders or high-ranking management, demonstrated visible compliance by wearing PPE and following H&S standards, it conveyed a powerful message of unity and commitment to safety. This top-down approach instilled a sense of respect for H&S regulations and encouraged workers to emulate these practices, fostering a stronger H&S culture.

In essence, H&S measures should permeate every level of an organisation, from the highest management level to frontline workers. Leading by example is about enforcing rules and

demonstrating a genuine commitment to safety through personal actions. When leaders walk the talk and prioritise H&S, it sets the stage for a culture where safety is not just a policy but a shared value and a way of life.

Utilising Health and Safety Notes and trainings to Educate Customers, Visitors, customers, and the General Population

Using graphical checklists is an efficient way to present H&S guidelines in a simple and understandable manner. These checklists can be used in various contexts, such as describing a process, outlining safety measures in specific areas, or providing emergency response procedures. Regularly incorporating these checklists into training sessions ensures that all employees remain informed and updated on H&S protocols.

To promote inclusivity and cater to a diverse workforce, it is crucial to translate these checklists and safety notes into local languages, even if they are not officially recognised, use a variety of ethnicities in the images, and include different gender identities in the trainers. This demonstrates a commitment to ensuring that all workers have equal access to essential H&S information, regardless of their linguistic, cultural, or gender identity.

Health and safety notes should not be limited to employee training. They should also be readily available and utilised when welcoming visitors to a site, onboarding new employees, or conducting training for specific tasks. This ensures that everyone entering the workplace or engaging with the organisation knows and adheres to the established H&S guidelines.

Customer education is vital to promoting safe product use and preventing accidents. When selling or providing appliances or equipment, training sessions that highlight proper usage, potential hazards, and emergency response procedures can significantly enhance customer understanding and compliance. These training sessions can also serve as an opportunity to promote the product by emphasising its safety features and benefits.

Health and safety notes and trainings are more effective when tailored to the specific needs and understanding of the target audience. Simple language, clear visuals, and relatable examples can make the information more accessible and engaging, particularly for those with limited literacy or language proficiency.

A Holistic Approach to Safety in Energy Access

A provider of solar home systems and appliances has demonstrated a commendable commitment to safety by integrating it into every stage of their product lifecycle. From the initial design phase, safety is prioritised, with features like tamper-proof access to the battery and other critical components incorporated to minimise the risk of accidental damage or misuse. Additionally, a strategically located network of repair and service centres ensures convenient access to after-sales services.

The company also understands the importance of user education and support. During installation, technicians provide comprehensive training to customers on the safe use and maintenance of the equipment. Furthermore, a remote monitoring system allows for the proactive identification of

potential issues and timely interventions despite the challenges of implementing such technology in remote areas.

End-of-life responsibility is also a key focus. The company operates a take-back programme for end-of-life devices, ensuring responsible disposal or recycling and preventing environmental pollution and potential safety hazards. This holistic approach to safety has presumably resulted in high levels of customer satisfaction and a low incidence of safety-related issues.

This case study showcases how a comprehensive approach to safety, encompassing design, training, support, and end-of-life management, can significantly enhance the user experience and contribute to the sustainable growth of the energy access sector. It serves as a valuable example for other organisations seeking to prioritise safety and build trust with their customers. While the complex approach may be challenging to replicate without significant investment, its holistic approach to safety throughout the product lifecycle provides a valuable model for other organisations in the energy access sector to learn from.

People-centred Culture

When embedding H&S practices, the value of one's life and physical integrity is of utmost importance. This must supersede any economic, time, or other aspect of a project. This mentality helps prioritise H&S and aids workers at different levels in being conscious of the reasoning behind H&S's actions.

4. Beyond the State of the Sector

During the next phases of the project, an in-depth look at the broader TEA portfolio was performed. As a result of this analysis, two key deliverables were produced to expand on the foundation set out in this report:

- **H&S Framework and Heatmap:** This deliverable equips stakeholders with a structured and robust methodology to address the identified barriers and challenges to H&S implementation. The risk management heatmap, which assesses the primary risks associated with each category within the Energy Access Sector (Section 3.2.2), will guide the prioritisation of efforts in the final project phase, focusing on support mechanisms and long-term strategies.
- **H&S Recommendations and Adoption Strategy**: This deliverable presents concrete proposals to accelerate the implementation and further development of mitigation strategies for the identified barriers and challenges outlined in this document. It serves as an actionable roadmap to enhance H&S practices across the entire sector, paving the way for a safer and more sustainable energy access future.

The initial identification and analysis of the barriers and challenges presented in this report lay the groundwork for developing a practical and effective H&S Framework. The framework, coupled with the risk management heatmap, will enable stakeholders to identify gaps in their H&S management and allocate resources strategically. Furthermore, the H&S recommendations and adoption strategy will provide a clear roadmap for integrating health and safety considerations into the different facets of the energy access sector.

Together, these three deliverables form a comprehensive and interconnected approach to improving health and safety practices, ultimately contributing to a more robust and resilient energy access sector.

5. Annexes

5.1. Methodology

The main objective of this report is to describe the sector's current state using a baseline of the different technologies that the TEA portfolio supports. To achieve this objective, an extensive data collection effort has been initiated to comprehend and identify key issues, weaknesses, opportunities, available resources, and occupational H&S within the energy access sector. This undertaking comprises two primary components: desk-based research and stakeholder interviews to gather insights from those working on the ground to implement projects.

To conduct the literature review, the team began with a brainstorming process to pinpoint the main areas of interest, facilitating an in-depth understanding of the subject. Key terms, including the energy off-grid sector, health and safety practices, regulations and standards, and vulnerable and neglected groups, were systematically identified, forming the foundational basis of this research. The search for literature was directed towards relevant documents, reports, and case studies, selected according to the identified key terms. To enhance the quality research review, the investigation spans diverse platforms, including websites (government, non-governmental organisations, international organisations, etc), academic journals, and industrial reports.

Simultaneously, stakeholder interviews were leveraged to gather first-hand information. Stakeholder selection was strategic, spanning different sectors such as energy production, clean cooking, appliances, and productive uses, while also encompassing the various technologies presented in Section 2.4 (as shown in the two tables below). The interviews were structured around specific questions designed to delve into integrating health and safety measures into day-to-day activities in an office setting, production area, construction site, or energy production facility (as seen in Annex 5.2). It is noteworthy that the formulation of the interview questions and the context in which they were conducted, took into account the specific challenges and circumstances prevalent in the underprivileged communities where the majority of the projects have been implemented and, thus, consider both vulnerable and neglected groups.

Region	Number of interviews
Indo-Pacific	2
Africa	13
Latin America and Caribbean	2
Total	**17**

Table 1 Number of interviews disaggregated by region

Sector	Number of interviews
Clean Cooking	5
Energy Storage and Batteries	5
Mini Grids	8
Productive Uses	7
E-mobility	3
Appliances	7
Energy Network and Systems	6

Table 2 Number of interviews disaggregated by EA sector

The deliberate mixed-method approach of this report, which combines in-depth desk-based research and targeted interviews, helps to provide a balanced perspective. Consequently, the data collection effort enables a thorough exploration of the importance and necessity of H&S in the Energy Access sector, the current situation and prevailing challenges, pathways for collaboration, the role of different stakeholder levels, resource considerations and sustainability factors, as well as the examination of case studies and incident reports. The present report discusses in depth the results of this data collection.

Although this methodology offers a comprehensive approach to understanding the integration of H&S in energy access, some limitations deserve consideration. The investigation adopted a focused approach centred on the Energy Access sector in sub-Saharan Africa, South Asia, and Indo-Pacific regions, refraining from presenting an all-encompassing analysis of global H&S practices. Nevertheless, the findings can be extrapolated to other regions where similar contexts are found (e.g., rural areas of Latin America and the Caribbean and non-energised areas of the Middle East), and the general recommendations could also be applicable.

During the stakeholder interview phase, participants might be biased, with certain viewpoints or sectors over- or under-represented due to availability. To mitigate these limitations, the team transparently set out criteria for selecting sources in the literature search and including stakeholders in the interviews. By acknowledging these constraints, the team aims to provide an understanding of the scope of the study and potential contextual limitations.

Several months after the initial drafting of this report, the research team conducted a 10-day field visit to Kenya, focusing on the greater Nairobi area and Turkana County. This visit aimed to gain a deeper understanding of the Health and Safety challenges faced by various sectors within the Energy Access industry. The insights gathered were instrumental in refining the proposed solutions that will form the foundation of the project's final deliverable.

During the visit, the team interviewed representatives from a diverse range of companies involved in clean cooking, productive uses of energy, mini-grids, -e-mobility, energy storage, and other key areas of the energy access sector. The findings from these interviews were integrated into various sections of this report

5.2. Interview Questionnaire

Basic information

- Name of Organisation:
- Type of organisation
- Business sector
- Type of projects
- Type of technologies

Importance and Need for Health and Safety Practices

What importance do you attach to H&S practices in the implementation, execution, and operation of your project and why do you think is important?

How do you incorporate health and safety practices into the design, procurement, construction, and phases of off-grid energy projects, and what impact does this have on project execution, including worker safety, end-user health and general population?

Current State and Challenges in Health and Safety Practices

1. Does an internal H&S policy exist within your organisation?

2. How often is it updated / reviewed?

3. Is there a dedicated service / worker for H&S procedures?

4. Do you provide internal training within your organisation for your workers? Do the workers get special H&S training at the company onboarding?
When started working on a new site?
□ Yes □ No
For the onboarding:
□ Yes □ No
When started working on a new site:
□ Yes □ No

5. Do you use third party consulting companies for H&S related topic for your organisation's common activities?
□ Yes □ No
If yes, with what purpose?

6. From 1 to 10 how would you characterise the current state of health and safety practices within the off-grid energy access sector? (0 really bad and 10 excellent)

7. What key challenges or gaps have you identified in implementing the best health and safety practices in your field? (day to day)

8. Have you encountered any barriers that hinder the implementation of health and safety best practices in the off-grid sector, and how do they affect both safety and health aspects? (strategy)

9. Are there any third-party stakeholders specialised in Health and Safety practices that are involved in your projects?
If yes, at what stage do they intervene? Which?

Collaboration and Roles of Stakeholders

10. How do you think donors can contribute to the implementation of H&S in this field?

11. How do you implement H&S standards in your projects based on what the different stakeholders require?

12. What specific safety measures and protocols do you follow for the different stages of a project, and how do they contribute to safe and reliable operation? (Specific methodology? National standards?)

Impact of H&S Practices & Specific Case Studies & Examples

13. Could you share the five most common health and safety issues or accidents that frequently occur in your field?

14. Do you have an accident log to track health and safety incidents throughout the project?

If yes, could you share an extract of the accident log with us? How does this impact your H&S management?

If not, can you share your thoughts on the conditions or arrangements that might make it feasible to establish a dedicated accident register for tracking health and safety-related incidents?

15. Can you give examples (success stories) of how meeting H&S standards has improved project efficiency, reduced risk, or improved the quality of work in your experience?

16. Can you give examples of how non-compliance or non-use of health and safety standards has impacted the quality of work, the success of a Project, and worker safety in your experience?

17. Are there potential financial, reputational, legal, and regulatory implications for neglecting security best practices in your industry?

If so, what are they?

Resources and Sustainability

18. What recommendations or suggestions do you have for developing a methodology to implement best practices for H&S standards in your sector?

19. Are there any specific resources, partnerships, or collaborations that you believe would be valuable for advancing H&S goals in your sector?

20. As a stakeholder in this Project, how do you plan to contribute to the implementation of the H&S in projects related to your sector?

21. Is there any vulnerable or neglected population or group more prone to H&S incidents in your sector or project (either from the general population or from the implementation of the project itself)? Any idea on how to address it specifically?

22. Can you explain how you ensure that the workers on the site are well-informed about their rights and duties regarding health and safety?

23. Would you mind sharing case studies, reports, recommendations, or any other relevant documents related to H&S in your sector?

24. Do you have any specific information and recommendations that will be useful for the outcome of this Project that you would like to share with us?