Needs Assessment Report

Deliverable 2.2

Authors: Félix Mateus (ISPS)
Leonel João Muthemba (UniRovuma)

https://www. slsim.eap.gr

Co-funded by
the European Union

Document Information

Grant Agreement Number	101128788
Project Title	Capacity Building for Sustainable Lighting Solutions in Mozambique
Project Acronym	SLSIM
Project Start Date	01/11/2023
Number of Pages	34 (20+14)
Report Title	D2.2 Needs assessment report
Related Work Package	WP2: Preparation
Submission Date	29.3.2024

Document History

Version	Date	Author	Comment/Change
1	15.2.2024	Félix Mateus (ISPS) Leonel João Muthemba (UniRovuma) Nabote António Magaia (ISPS)	Initial draft
2	29.3.2024	Felix Mateus (ISPS)	Final

Table of Contents

Acronyms and Abbreviations

CBHE	Capacity Building in Higher Education
SLSIM	Capacity Building for Sustainable Lighting Solutions in Mozambique
WP	Work Package
SADC	Southern African Development Community
NEG	National Electricity Grid
SDG	Sustainable Development Goal
NES	National Electrification Strategy
CFL	Compact fluorescents lamp
LED	Light-emitting diode
ISPS	Instituto Superior Politécnico de Songo
UniRovuma	Universidade Rovuma
AALTO	Aalto University
HOU	Hellenic Open University

Executive Summary

Needs Assessment Report Mozambique is the result of a survey carried out as part of the implementation of the "Capacity Building for Sustainable Lighting Solutions in Mozambique (SLSIM)" project, funded by the European Union's Erasmus+ program, which aims to empower higher education institutions in their (research) role of contributing technological innovations to society. Therefore, the aim of this report was to gather feedback from students, alumni of engineering programs that teach lighting courses in the country, employers, managers and engineers who deal with lighting, so that the consortium formed by (ISPS, UniRovuma, AALTO, HOU) can understand the level of literacy of Mozambicans in matters related to sustainable lighting. And, based on the results of the survey, design courses that include content focused on artificial lighting engineering and that look at the "sustainability" aspect as the key word.

1. Introduction

1.1 Background

Mozambique is a developing country and investing in basic infrastructure is still a challenge for the Mozambican government. In this context, for the development of industrial and socio-economic activities in the communities, various actions have been developed domestically and coordinated in the Southern African Development Community (SADC) region, with a view to responding to the shortage of electricity. Thus, Mozambique is looking for more economical alternatives to continue expanding the National Electricity grid (NEG) and, consequently, to respond to demand in the region. Nevertheless, the efficient consumption of electricity could contribute to the rapid expansion of the NEG.

In line with global challenges, the Mozambican government has committed itself to achieving the goal of universal access to energy by 2030, as set out in the 7th Sustainable Development Goal (SDG) and, to this end, energy must be affordable and sustainable.

Currently, Mozambique has an electrification rate of 49%, which shows that more than half of Mozambicans still don't have access to electricity in the country. However, through the Energy for All (ProEnergia) project, launched in 2018, the Mozambican government is stepping up access to electricity for more families and companies nationwide, as a contribution to the

universal electrification of Mozambique by 2030, defined in the National Electrification Strategy (NES).

It should be noted that ProEnergia is in its second phase of implementation. In the first phase, it received funding of 152 million dollars, which enabled it to achieve an electrification rate of 35% in 2019 (Diario Economico, 2023) and aims to increase access to energy from 49% to 64% by 2024.

It is well known that in the field of lighting, the quality of light is decisive both in terms of the performance of activities and the influence it has on the emotional state and well-being of human beings. Therefore, knowing the light, the alternatives available and knowing how to control quantity and quality are precious tools for the success of any electrical installation.

Mozambican electrical installation systems are generally not up to the appropriate technical standards, with the most common types: excessive lighting; lack of use of artificial lighting; use of equipment with low luminous efficiency; lack of controls (switches) for the luminaires; lack of maintenance, depreciating the system and inadequate usage habits.

1.2 Energy efficient lighting scenario in Mozambique

In view of the huge demand for electricity and the current deficit, the Mozambican government is implementing policies in the energy sector to ensure efficient energy consumption, including the replacement of incandescent light lamps with low-cost ones.

A detailed study carried out by Electricidade de Moçambique in 2014 shows that replacing three million incandescent light lamps with low-cost lamps would save 107 MW, in other words, a virtual 107 MW power plant.

The company Electricidade de Moçambique, E.P (EDM, E.P), responsible for generating, transporting, distributing and marketing electricity, in pursuit of the Mozambican government's objectives, launched a pilot project in 2014 to replace 150,000 incandescent light lamps with low-consumption ones (compact fluorescents lamps-CFL) in Maputo city and Nampula province.

Considering that most of the electricity used in homes is consumed by lighting, the above actions, combined with educating communities about the use of energy-efficient light lamps

(CFL, LED lamps) will help raise awareness among consumers to opt for sustainable practices, as the cost of energy is high (7.64 MT/kWh for domestic tariffs, for prepaid consumers) (EDM, 2024).

Although Mozambique is a major exporter of electricity in the SADC region, there are still challenges in expanding NEG, because by the end of 2022 (EDM Annual Report, 2022), 318 Administrative Posts out of 416 were connected to NEG, which represents 76%. However, for the same period (2022), the Central and Northern regions of Mozambique, where the samples for this project were taken, had an average electrification of around 34% and projects such as ProEnergia aim to make universal access to energy operational by 2030, through solutions inside and outside NEG.

However, the lack of specific policies and legislation on the marketing and use of energy-efficient equipment is a major obstacle for consumers.

In this way, the consortium made up of four (4) Higher Education Institutions, two of which are Mozambican, the Instituto Superior Politécnico de Songo (ISPS) and the Universidade Rovuma (UniRovuma), one from Finland, Aalto University (Aalto), and one from Greece, Hellenic Open University (HOU), through the "Capacity Building for Sustainable Lighting Solutions in Mozambique - SLSIM", aims to contribute technical solutions to the training and dissemination of good practices in communities for the efficient consumption of electricity.

1.3 Training in Mozambique

In Mozambique, ISPS, UniRovuma, Universidade Eduardo Mondlane (UEM), Universidade Católica de Moçambique and Universidade Apolitécnica all teach lighting and electrification projects in their curricula. But none of these Higher Education Institutions offer specific subjects that teach students about the design of efficient installations, economic analysis and environmental sustainability in lighting and other technologies that minimize consumer costs. Therefore, there is a need to train technicians who can teach students these subjects, as well as to acquire laboratory equipment for the effective transfer of knowledge on efficient and intelligent lighting systems.

2. Data Collection Method

The questionnaire were prepared by the consortium and the survey was carried out in central and northern Mozambique by ISPS and UniRovuma. It was attended by students, alumni, teachers, employers, researchers, engineers, managers and government entities working in the field of lighting and illumination. The survey participants are characterized into three groups as follows.

- **Group I:** Engineers, teachers, managers and researchers;
- **Group II:** Students and Alumni;
- **Group III:** Employers.

The questionnaire to survey the groups had the same content, and was carried out online using a Google form. The survey data was collected and analysed by ISPS and UniRovuma using Microsoft Excel.

The numbers of participants in the survey are listed in Table 2.1. A total of 105 participants answered the questionnaire, of which around 50% were from group I, 45% from group II and 2% from group III.

Tabela 2.1. The number of participants in the survey in Mozambique

Group ID	Number of participants (n)	Percentage of participants (%)
Engineer, Teacher, Manager and Researcher	54	51,43
Student and Alumni	48	45,71
Employer	3	2,86
Total	**105**	**100,00**

The average age of the participants in each group is shown in Figure 2.1. Group II (average age 25) shows that they are old enough to give responsible answers. The same applies to all participants.

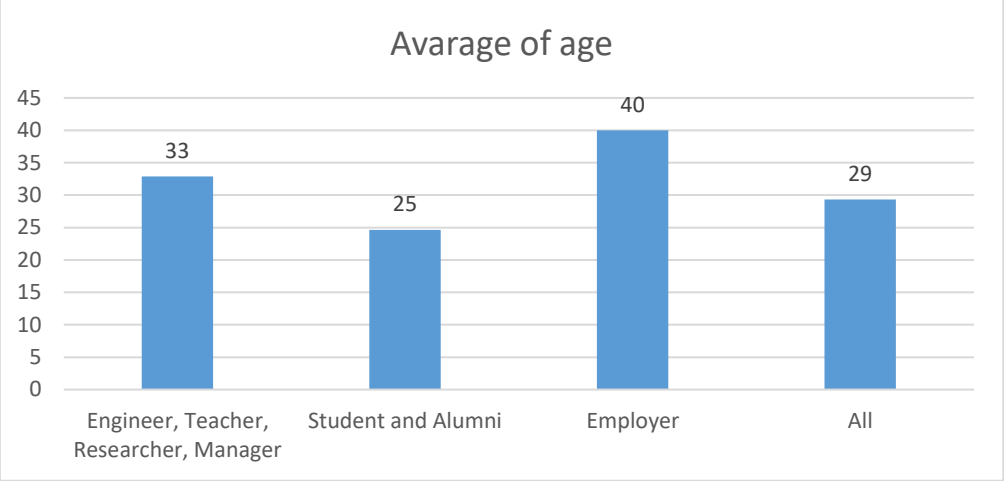

Figure 2.1. The average age of the participants in each group

The percentage of participants by gender in each group is shown in Figure 2.2. Unfortunately, gender equity falls short of expectations, accounting for only 11%.

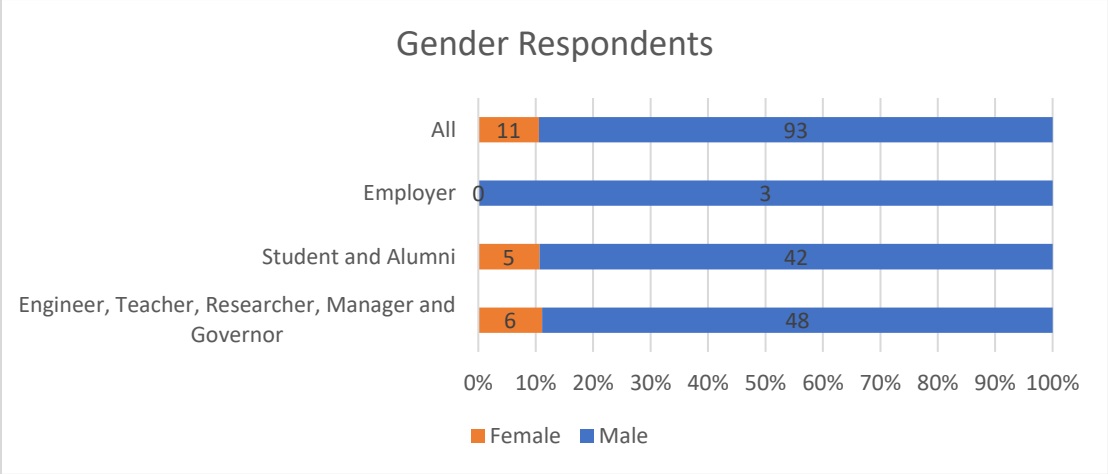

Figura 2.2. The percentage of participants in each group by gender

3. Assessment of Awareness of Energy Efficiency in Lighting

The assessment of awareness of energy efficiency in lighting was carried out on the three target groups (see Table 2.1), based on the completion of an individual questionnaire.

In Figure 3.1, when analysing the responses from Group I, it can be seen that there is controversy, as there is a balance in the perception that the adoption of energy efficiency technologies in lighting has a very high initial cost of energy efficiency products and a lack of knowledge and awareness (22%). And it can be considered that there is no shortage of qualified human resources (7%). Therefore, from the total number of respondents to this

question it is clear that there may not be a clear understanding of the real situation of the initial costs of products that contribute to energy efficiency in Mozambique, as this fact prevails as one of the biggest challenges for the adoption of efficient lighting technologies in the country.

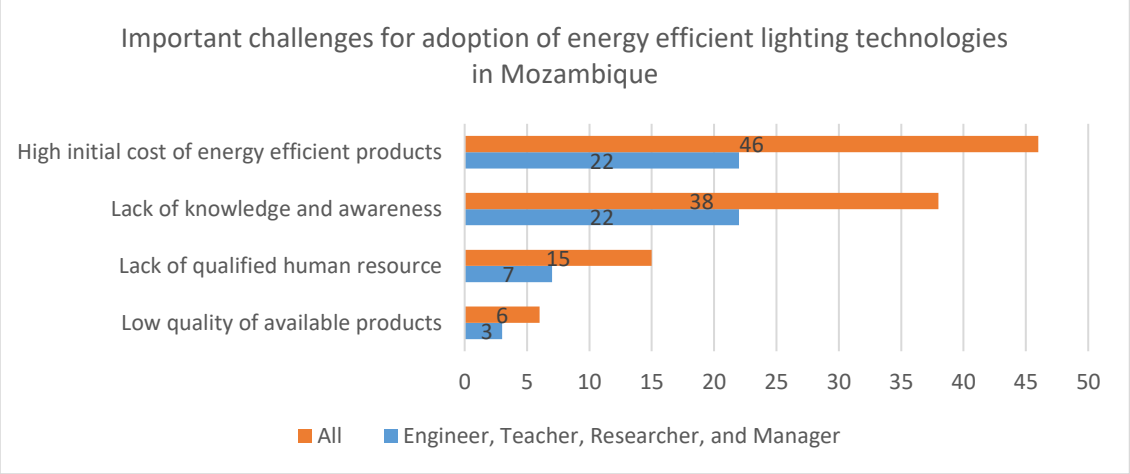

Figura 3.1. Important challenges for adoption of energy efficient lighting technologies in Mozambique

4. Assessment of the need for lighting Experts

The questionnaire was sent to stakeholders in order to get a sense of what kind of human resources they need. Below are the details of the analyses made using the samples collected.

4.1 Requirements and availability of technical experts

Figure 4.1 shows that there are many companies in Mozambique that provide lighting installation services. And these companies have hired electrical engineers with basic knowledge of lighting (25%) to design and install efficient lighting systems. Of which 16% hire technicians with basic knowledge of lighting systems. And expert technicians capable of assembling and installing electrical equipment are generally hired on a smaller scale (7%).

As Figure 4.2 illustrates, 22% of respondents argue that technicians are available and easily found and 14% argue that they are rarely available and difficult to find. However, 13% believe that they are available but very expensive.

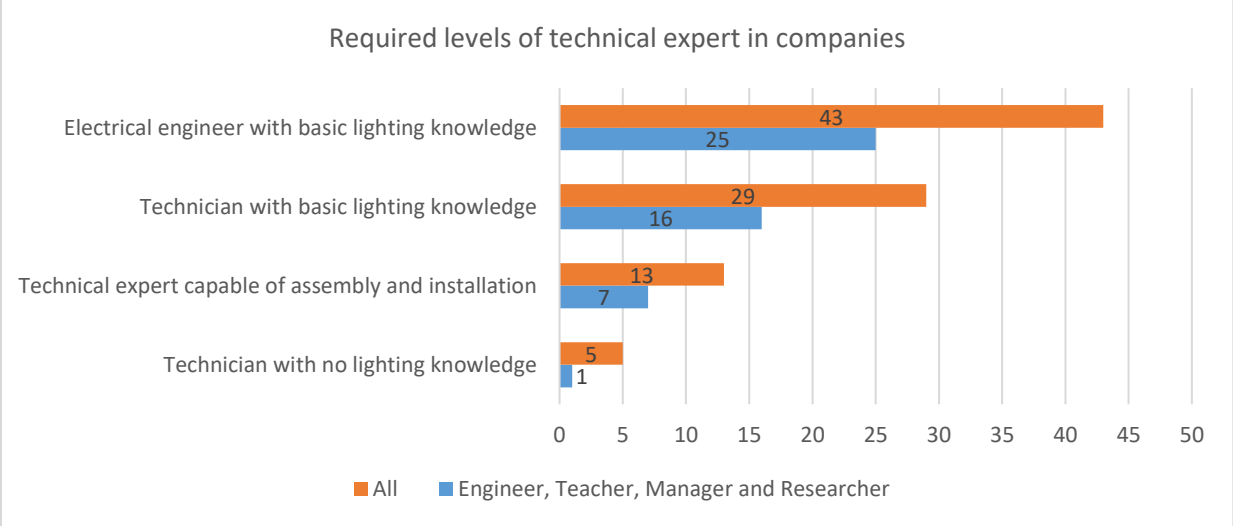

Figura 4.1. Required levels of technical expert in companies

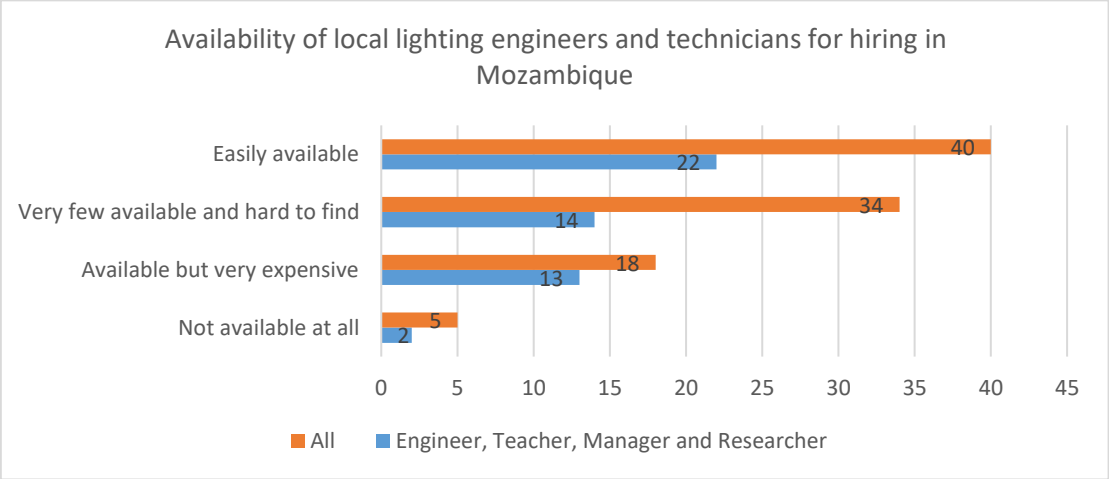

Figura 4.2. Availability of local lighting engineers and technicians for hiring in Mozambique

5. Evaluation of the Subjects Required in Academic Institutions

Lighting design is a vast field that combines various artificial lighting techniques to provide human comfort and well-being in interiors, and this task requires specific and specialized training. And ISPS and UniRovuma, as well as no other university in Mozambique has a subject in its curriculum that deals with the design of energy-efficient lighting projects.

5.1 Subjects related to lighting in Mozambican universities

During the preparation of this report, the curricula of the Mozambican universities that teach Electrical Engineering courses were consulted and it was found that subjects such as: Lighting Techniques, Residential and Industrial Electrical Installations are taught, where the content does not cover energy efficiency in lighting.

5.2 Requirements for new courses in energy efficiency in lighting

Figure 5.1 shows that 52% of respondents think that lighting technologies should be taught in the electrical engineering degree course, 50% think it should also be taught in the renewable energy engineering degree course and 30% think it should be taught in the electronics and telecommunications engineering degree course.

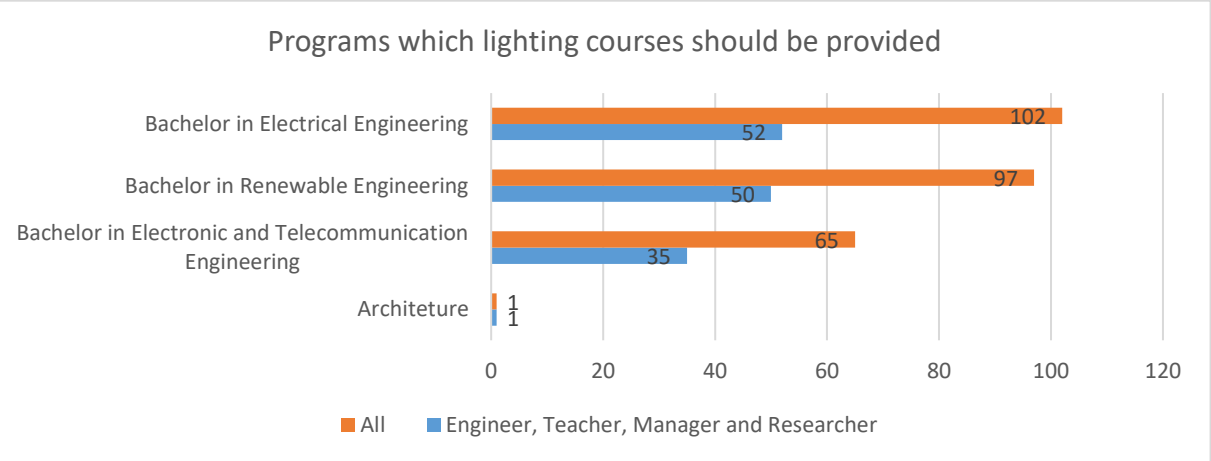

Figura 5.1. Programs which lighting courses should be provided.

Figure 5.2 shows the subjects that need to be taught. According to the survey, 46% of respondents think it is important that the subject of Energy Efficiency and Intelligent Lighting, 42% think that the design and application of lighting and finally 29% advocate that Lighting Engineering should be taught.

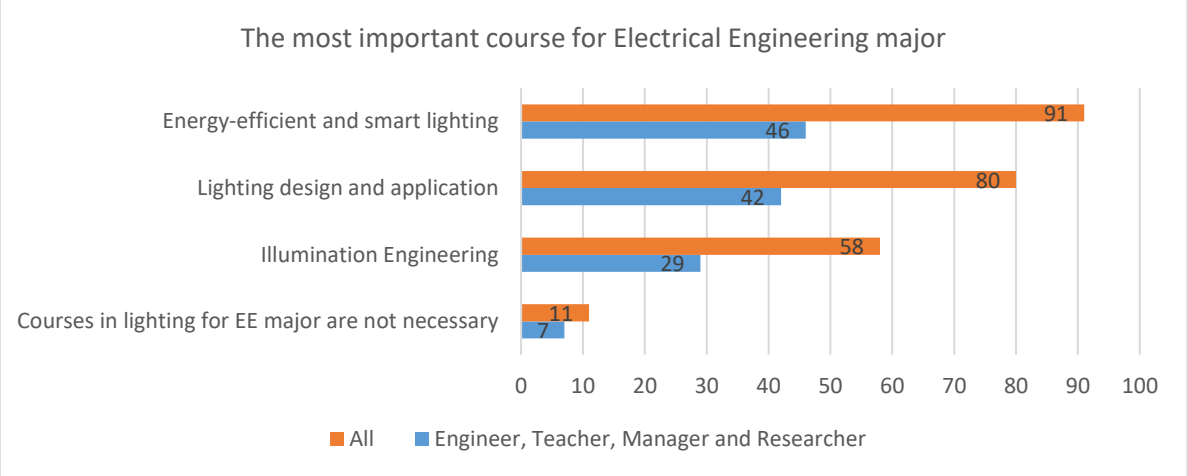

Figura 5.2. The most important course for Electrical Engineering major.

Figure 5.3 shows the devices suggested by the respondents in relation to the laboratory equipment that should be part of the lighting laboratory for electrical engineering.

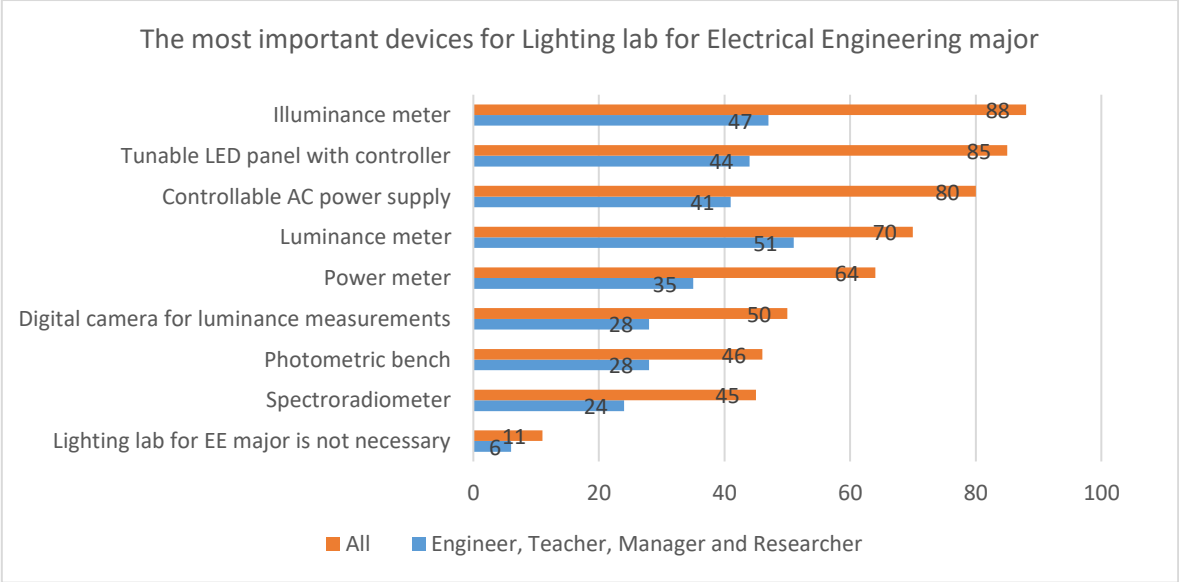

Figura 5.3. The most important devices for lighting lab for Electrical Engineering major.

Below (Figure 5.4), the expected learning outcomes in the subject of Lighting Engineering are listed. In ascending order of priority.

1. Design lighting
2. Perform measurement of quality of lighting
3. Perform measurement of light sources and luminaires characteristics
4. Use basic terms in illumination engineering
5. Compute energy performance of lighting

7. Incorporate daylight in lighting design
8. Describe the light color characteristics
9. Use different lighting controls
10. Perform life cycle cost calculation

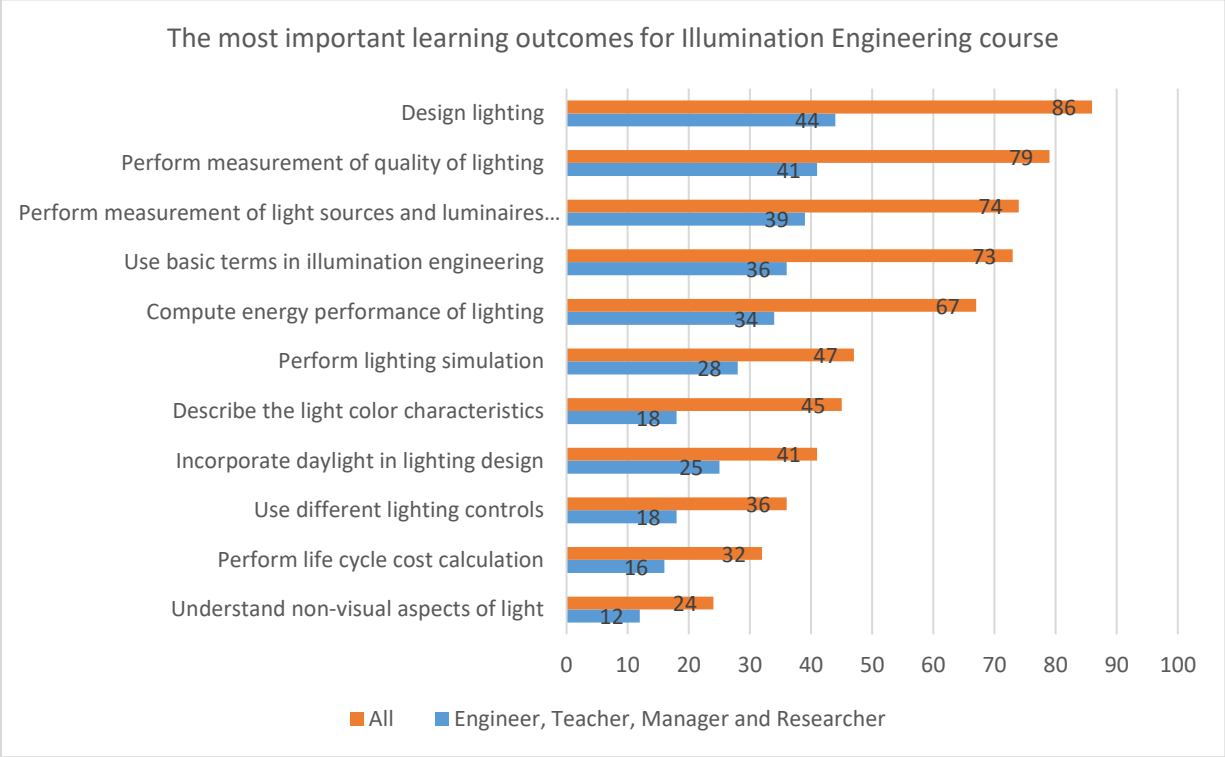

Figura 5.4. The most important learning outcomes for Illumination Engineering course.

And here's a list of the contents that should be taught in lighting engineering in order of increasing priority

1. Energy efficiency for lighting
2. Basic of light
3. Lighting control (smart lighting)
4. Luminaires
5. Lighting design through simulation
6. Measurement of light
7. Indoor workspace lighting
8. Light sources
9. Lighting economics

10. Outdoor lighting (parking lots, parks)

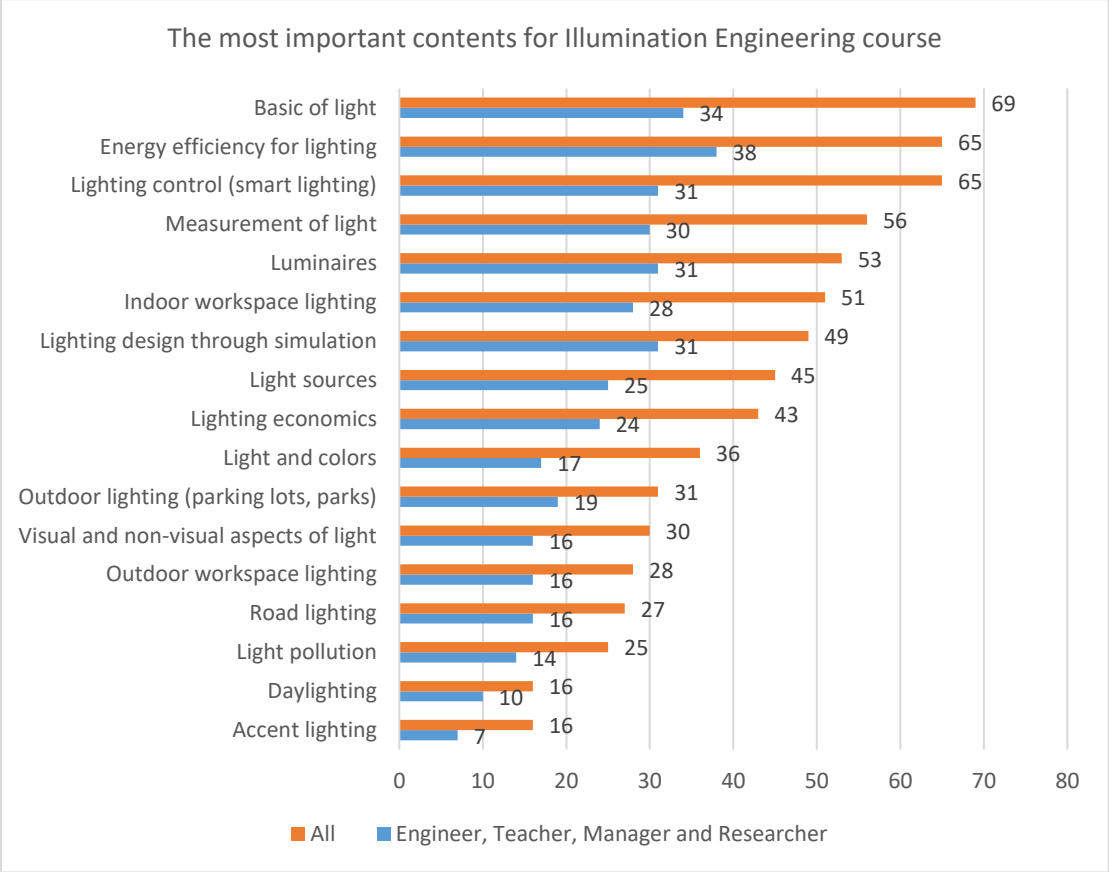

Figura 5.5. The most important contents for Illumination Engineering course.

The respondents suggest that the software in Figure 5.6 be used to simulate learning outcomes in lighting engineering.

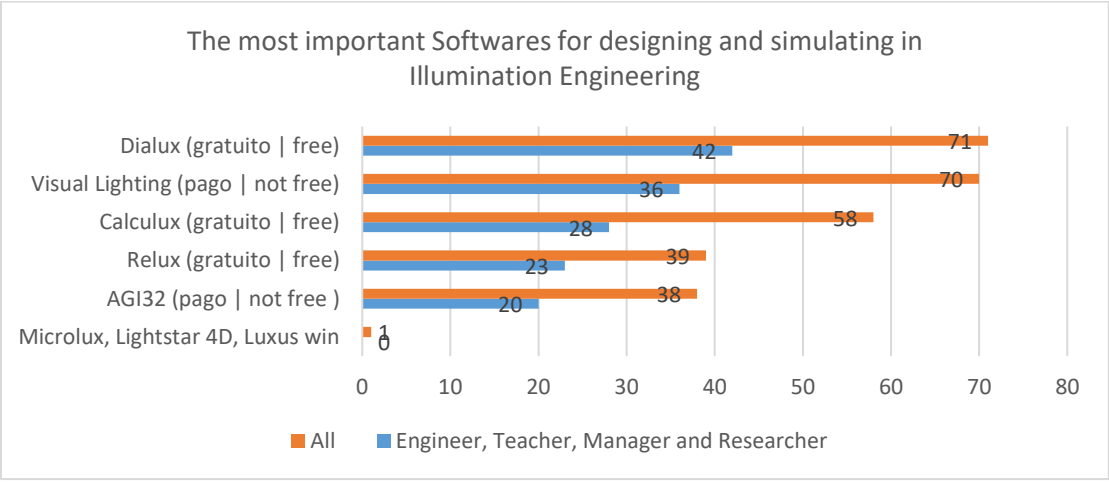

Figura 5.6. The most important Softwares for designing and simulating in Illumination Engineering.

Figures 5.7 and 5.8 illustrate the respondents' thoughts on the price of light lamps and the type they use in their homes. And 11% consider light lamps to be very expensive, 12% consider them to be expensive and 20% consider them to be normal market prices. Fortunately, the majority (33%) use light lamps that contribute in some way to energy efficiency.

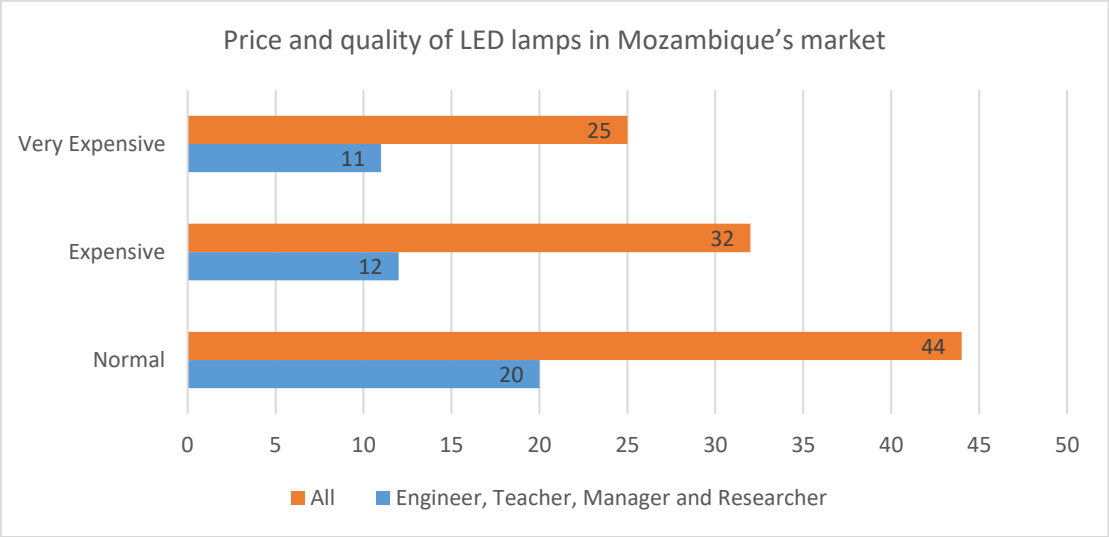

Figura 5.7. What is your opinion about the price and quality of LED lamps in Mozambique's market?

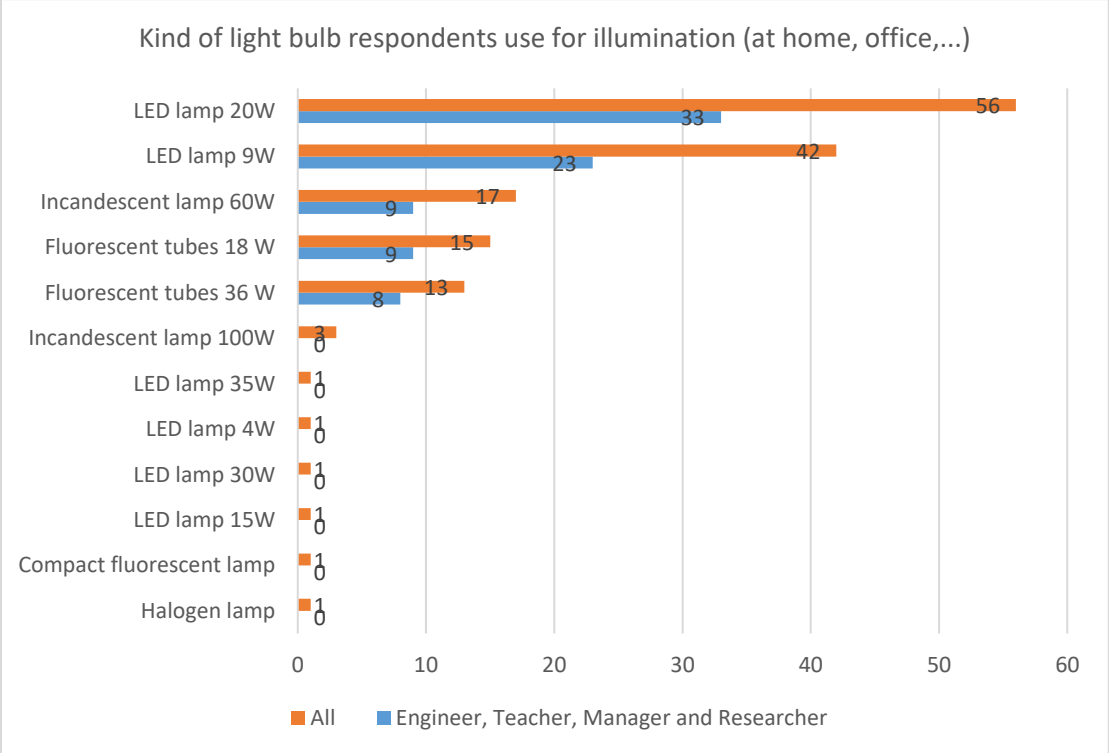

Figura 5.8. Kind of light bulb respondents use for illumination (at home, office,...)

6. Findings of the Assessment

The survey focused on three previously defined groups, Group I: Teacher, Engineer, Researcher, Manager; Group II: Student and Alumni Group III: Employer. With the data collected, it was possible to identify actions that should help in the design of energy efficiency courses, needs in terms of technical experts and the most important laboratory equipment.

6.1 General Awareness

From the survey, some knowledge of energy efficiency technologies in lighting is summarized.

- The national electricity grid is expanding and Mozambique's 49% electrification rate corresponds mainly to urban areas.
- The survey was carried out in central and northern Mozambique because, firstly, they are the regions where ISPS and UniRovuma are based, respectively, and secondly because the electrification rate is very low (34%).
- The majority of respondents are aware of energy efficiency management in lighting.
- In urban areas, Mozambicans are aware of efficient lighting and there is a preference for using LED and compact fluorescent lamps. However, in rural areas the use of incandescent lamps is high due to the availability and purchasing power of the communities.
- It can be seen that there is a controversy because there is a balance in the perception that the adoption of energy efficiency technologies in lighting has a very high initial cost of energy efficiency products and a lack of knowledge and awareness of around 22%. This shows that the participants are more aware.

6.2 Need for expert technicians

- 25% of respondents hire electrical engineers with basic knowledge, 16% hire technicians with basic knowledge of lighting systems. And, in general, specialist technicians capable of assembling and installing electrical equipment are hired on a smaller scale (7%).

- 22% of respondents argue that technicians are available and easily found and 14% argued that they are few in number and difficult to find. However, 13% think that they are available but very expensive.
- 52% of respondents think that lighting technologies should be taught in the electrical engineering degree course, 50% think that it should also be taught in the renewable energy engineering degree course and 30% think that it should be taught in the electronics and telecommunications engineering degree course.

7. Conclusion and Recommendation

7.1 Conclusion

Once the representative sample had been collected, an important stage of data processing followed, which will help define the new subjects and content to be taught in the field of lighting engineering, taking into account energy efficiency issues.

The survey responses show what the local challenges are, ranging from raising awareness among the direct beneficiaries of the results of this study to training technicians and teachers/trainers for the subsequent replication of content that will focus on lighting economy.

The equipping of the ISPS and UniRovuma lighting laboratories will make the teaching of the content effective, and there is a need to ensure that the necessary and appropriate equipment is acquired for the success and sustainability of the project.

7.2 Recommendation

Bearing in mind that Mozambique has many particularities in the energy sector, ranging from the lack of a robust consumer grid, and according to the survey carried out on the data collected, no Mozambican university teaches the content proposed to teach. Therefore, the design of the subjects needs to be well discussed so that it reflects the reality of the country. There are two scenarios to take into account: (1) the urban environment has minimal awareness of energy efficiency, (2) and rural areas where the dissemination of information on intelligent lighting is poor. It is therefore, hoped that the experience of the consortium members will be useful in designing practical courses with achievable results.

It is suggested that content related to Energy Efficiency and Intelligent Lighting should not be missing from the design of the courses.

It is also recommended that the consortium partners share their experience in training and teaching these subjects, as they will be completely new to the ISPS and UniRovuma curricula.

8. Acknowledgements

We would like to express our gratitude to the European Union's Erasmus+ Program for funding the development of the SLSIM project. Our thanks also go to all our consortium partners at Aalto University from Finland, Hellenic Open University from Greece and Universidade Rovuma from Mozambique for their valuable contributions to this report. We would also like to give special thanks to Project Coordinator Dr. Pramod Bhusal from Aalto University for sharing relevant information that enabled us to develop the questionnaire and carry out the survey successfully.

9. References

[1] EDM. Electricity Tariffs: Social Tariff, Household, Agriculture and General (Low Voltage). Available at: https://www.edm.co.mz/en/website/page/electricity-tariffs. Accessed on: 15/03/2024 18h GMT+2

[2] EDM. Annual Report, 2022.

[3] https://www.pressreader.com/mozambique/o-pais/20140820/281676843075971. Accessed on 14/03/2024 19h GMT +2

[4] 2030 Agenda for Sustainable Development.

[5] https://www.diarioeconomico.co.mz/2023/06/20/oilgas/energia/mocambique-pretende-elevar-o-acesso-a-energia-de-49-para-64-ate-2024/. Accessed on 16/03/2024

10. Appendix

Appendix – Survey Questionnaire for Academic Purposes

The survey was conducted online using Google Forms, as showing in the following pages.

Questionário sobre Iluminação Sustentável

O Consorcio formado pela Aalto University da Finlândia, a Hellenic Open University da Grécia, e pelas Moçambicanas Universidade Rovuma e Instituto Superior Politécnico de Songo a estão a desenvolver o projeto **Capacitação em Soluções de Iluminação sustentável em Moçambique** financiado pela União Europeia. O Objectivo do Projecto é melhorar a acessibilidade e a qualidade de educação no campo da eficiência energética e sistemas de iluminação sustentáveis em Universidades em Moçambicanas, a fim de promover o consumo de energia e minimizar os impactos ambientais relacionados ao aumento do seu uso.

Este questionário destina-se a obter um feedback das partes interessadas para auxiliar no processo de concepção de programas/módulos de cursos apropriados a serem ministrados a estudantes/estagiários em universidades ou centros de formação.

Os dados coletados serão mantidos em sigilo. Os detalhes de contato são apenas para fins de registo.

Para qualquer esclarecimento/dúvida
contacte felmateus@ispsongo.ac.mz ou leonel.muthemba@gmail.com

Por favor ignore as questões nas quais não tenha certeza.

==========

*The Consortium formed by Aalto University of Finland, the Hellenic Open University of Greece, and the Mozambican University Rovuma and Instituto Superior Politécnico de Songo are developing the **Capacity Building for Sustainable Lighting Solutions in Mozambique** project financed by the European Union. The Project Objective is to improve the accessibility and quality of education in the field of energy efficiency and sustainable lighting systems at universities in Mozambique in order to promote energy consumption and minimize environmental impacts related to increased energy use .*

The questionnaires are intended to get the best feedback from stakeholders to aid the process of designing appropriate syllabus/course modules to be delivered to students/trainees at universities or training centers.

The collected data will be maintained confidential. Contact details are for record purpose only.

For any clarification/queries please contact felmateus@ispsongo.ac.mz or leonel.muthemba@gmail.com.

Please skip questions in which you feel not sure.

Informação Pessoal

Personal Information

1. Sexo

   Gender

   Marcar apenas uma oval.

   - ◯ Masculino | Male
   - ◯ Feminino | Female

2. Idade

   Age

   Marcar apenas uma oval.

   - ◯ 18-23 anos | 18-23 years
   - ◯ 24-28 anos | 24-28 years
   - ◯ 29-33 anos | 29-33 years
   - ◯ 34-38 anos | 34-38 years
   - ◯ 39-43 anos | 39-43 years
   - ◯ mais de 43 anos | more than 43 years

3. Qual das seguintes categorias melhor te representa?

Which of the following categories best represents you?

Marcar apenas uma oval.

- ◯ Estudante | student
- ◯ Docente | teacher
- ◯ Empregador | employer
- ◯ Pesquisador | researcher
- ◯ Engenheiro | engineer
- ◯ Vendedor | salesperson
- ◯ Gestor | manager
- ◯ Governante | governors
- ◯ Outra: _____

4. Diga ha quanto tempo lida com iluminação?
How long have you been dealing with lighting?

Marcar apenas uma oval.

- ◯ 0-5 anos | 0-5 years
- ◯ 6-10 anos | 6-10 years
- ◯ mais de 10 anos | more than 10 years

Eficiência Energética
Energy Eficiency

5. 1. Tem algum conhecimento sobre eficiência energética?

1. Do you have any knowledge about Energy Eficiency?

Marcar apenas uma oval.

- ◯ Não | No
- ◯ Sim | Yes

6. 2. Tem algum conhecimento sobre iluminação sustentável?

   2. Do you have any knowledge about Sustainable lighting?

   Marcar apenas uma oval.

   - ◯ Não | No
   - ◯ Sim | Yes

7. 3. Qual é o nível técnico dos especialistas em iluminação exigidos em sua instituição/empresa?

   3. What is the technical level of lighting specialists required in your institution/company?

   Marcar apenas uma oval.

   - ◯ Técnicos sem nenhum conhecimento de iluminação | Technician with no lighting knowledge
   - ◯ Técnicos com conhecimentos básicos de iluminação | Technician with basic lighting knowledge
   - ◯ Engenheiros Eléctricos com conhecimentos básicos sobre iluminação | Electrical engineer with basic lighting knowledge
   - ◯ Especialista técnico capaz de montar e instalar | Technical expert capable of assembly and installation
   - ◯ Engenherio Expert em Iluminação | Lighting expert/engineer
   - ◯ Outra: _____

8. 4. Qual é a disponibilidade de engenheiros e técnicos de iluminação locais para contratação em Moçambique?

   4.How are local lighting engineers and technicians available for hiring in Mozambique?

   Marcar apenas uma oval.

   - ◯ Facilmente disponíveis | Easily available
   - ◯ Disponível, mas muito caros | Available but very expensive
   - ◯ Muito poucos disponíveis e difíceis de encontrar | Very few available and hard to find
   - ◯ Indisponíveis | Not available at all
   - ◯ Outra: _____

9. 5. Qual é o maior desafio para a adopção de tecnologias de iluminação energeticamente eficientes em Moçambique?

   5. What is the most important challenge for the adoption of energy-efficient lighting technologies in Mozambique?

   Marcar apenas uma oval.

   - ◯ Falta de conhecimento e conscientização | Lack of knowledge and awareness
   - ◯ Falta de recursos humanos qualificados | Lack of qualified human resource
   - ◯ Alto custo inicial de produtos energeticamente eficientes | High initial cost of energy efficient products
   - ◯ Baixa qualidade de produtos disponíveis | Low quality of available products

10. 6. Por favor seleccione todos cursos abaixo nos quais acha que as disciplinas de iluminação sustentável poderiam ser leccionadas.

6. Please choose all programs below you think in which lighting courses should be provided.

Marcar tudo o que for aplicável.

- [ ] Licenciatura em Engenharia Eléctrica | Bachelor in Electrical Engineering
- [ ] Licenciatura em Engenharia de Energias Renováveis | Bachelor in Renewable Engineering
- [ ] Licenciatura em Engenharia Electrónica e de Telecomunicações | Bachelor in Electronic and Telecommunication Engineering
- [ ] Outra: _____

11. 7. Selecione os conteúdos mais importantes para o curso de Engenharia Elétrica (EE).

7. Please select the most important one among the courses below for Electrical Engineering (EE) major.

Marcar tudo o que for aplicável.

- [ ] Engenharia de iluminação | Illumination engineering
- [ ] Projeto e aplicação de iluminação | Lighting design and application
- [ ] Iluminação inteligente e energeticamente eficiente | Energy-efficient and smart lighting
- [ ] Conteúdos de iluminação não são necessários no curso de EE | Courses in lighting for EE major are not necessary

12. 8. Selecione os 5 dispositivos mais importantes para laboratório de iluminação para engenharia elétrica

8. Please select 5 most important devices for Lighting lab for Electrical Engineering major

Marcar tudo o que for aplicável.

- [ ] Espectrorradiômetro | Spectroradiometer
- [ ] Wattímetro | Power meter
- [ ] Fonte de alimentação AC | Controllable AC power supply
- [ ] Painel LED ajustável com controlador | Tunable LED panel with controller
- [ ] Medidor de iluminância | Illuminance meter
- [ ] Medidor de luminância | Luminance meter
- [ ] Banco fotométrico | Photometric bench
- [ ] Câmera digital para medições de luminância | Digital camera for luminance measurements
- [ ] Laboratório de Iluminação não é necessário o curso de EE | Lighting lab for EE major is not necessary
- [ ] Outra: _____

13. 9. Escolha os 5 resultados de aprendizagem mais importantes para o curso de Engenharia de Iluminação. Depois de concluir com êxito o curso, os alunos serão capazes de:

9. Please choose 5 most important learning outcomes for Illumination Engineering course. After successfully completing the course, the students will be able to:

Marcar tudo o que for aplicável.

- [ ] Utilizar termos básicos em engenharia de iluminação; | Use basic terms in illumination engineering;
- [ ] Realizar medição de fontes de luz e características de luminárias; | Perform measurement of light sources and luminaires characteristics;
- [ ] Realizar medição de qualidade de iluminação; | Perform measurement of quality of lighting;
- [ ] Descrever as características da luz; | Describe the light color characteristics;
- [ ] Conceber projectos de Iluminação | Design lighting;
- [ ] Realizar simulação de iluminação; | Perform lighting simulation;
- [ ] Calcular o desempenho energético da iluminação; | Compute energy performance of lighting;
- [ ] Realizar cálculo de custo do ciclo de vida; | Perform life cycle cost calculation;
- [ ] Utilize diferentes controles de iluminação; | Use different lighting controls;
- [ ] Compreender os aspectos não visuais da luz | Understand non-visual aspects of light;
- [ ] Incorporar a luz natural no projeto de iluminação; |Incorporate daylight in lighting design;
- [ ] Outra: _____

14. 10. Selecione 5 conteúdos mais importantes para o curso de Engenharia de Iluminação.

10. Please select 5 most important contents for Illumination Engineering course.

Marcar tudo o que for aplicável.

- [ ] Generalidades sobre iluminação | Basic of light
- [ ] Medição da luz | Measurement of light
- [ ] Aspectos visuais e nao visuais da luz | Visual and non-visual aspects of light
- [ ] Luz e cores | Light and colors
- [ ] Fontes de luz | Light sources
- [ ] Luminárias | Luminaires
- [ ] Controle de iluminação (iluminação inteligente, ...) | Lighting control (smart lighting, ...)
- [ ] Iluminação do espaço de trabalho interno | Indoor workspace lighting
- [ ] Iluminação do espaço de trabalho externo | Outdoor workspace lighting
- [ ] Iluminação exterior (estacionamentos, parques, ...) | Outdoor lighting (parking lots, parks, ...)
- [ ] Iluminação de destaque | Accent lighting
- [ ] Iluminação Rodoviária | Road lighting
- [ ] Iluminação natural | Daylighting
- [ ] Projeto de iluminação usando simulação | Lighting design through simulation
- [ ] Efciencia energética na iluminação | Energy efficiency for lighting
- [ ] Economia de iluminação | Lighting economics
- [ ] poluição luminosa | Light pollution
- [ ] Outra: _____

15. 11. Selecione os 3 softwares mais importantes para projetar e simular em Engenharia de Iluminação.

11. Please select 3 most important Softwares for designing and simulating in Illumination Engineering.

Marcar tudo o que for aplicável.

- [ ] Visual Lighting (pago | not free)
- [ ] Dialux (gratuito | free)
- [ ] Relux (gratuito | free)
- [ ] Calculux (gratuito | free)
- [ ] AGI32 (pago | not free)
- [ ] Outra: _____

16. 12. Por favor, sugira disciplinas/conteúdos que um engenheiro que trabalha na área de iluminação deva frequentar (após se formar em Engenharia Elétrica).

12. Please suggest any courses that an engineer working in lighting area should take (after graduating from Electrical Engineering major).

_____

_____

_____

_____

_____

17. 13. Por favor liste 4 estratégias para o acesso global de iluminação em Moçambique até 2030, especialmente para as áreas rurais.

13. Please list 4 strategies for global lighting access in Mozambique by 2030, especially for rural areas.

_____

_____

_____

_____

_____

18. 14. Conhece algum projecto de electrificação em zona rural? Se sim, liste bons pontos a serem seguidos e maus a serem evitados.

14. Do you know any electrification Projects in rural area? If yes list good points to be followed and bad to be rejected.

19. 15. Qual é a sua opinião sobre o preço e a qualidade das lâmpadas LED no mercado Moçambicano?

15. What is your opinion about the price and quality of LED lamps in Mozambique's market?

Marcar apenas uma oval.

- Muito caro | Very Expensive
- Caro | Expensive
- Acessível | Normal
- Barato | Cheap

20. 16. Que tipo de lâmpada você usa para iluminação? (em sua casa, escritório,...)

16. What kind of light bulb you use for illumination? (at home, office,...)

Marcar tudo o que for aplicável.

- [ ] Lampada LED 9 W | LED lamp 9W
- [ ] Lampada LED 20W | LED lamp 20W
- [ ] Lampada Incadescente 60 W | Incandescent lamp 60W
- [ ] Lampada Incadescente 100 W | Incandescent lamp 100 W
- [ ] Lampada Halogena | Halogen lamp
- [ ] lampada fluorescente 18 W | Fluorescent tubes 18 W
- [ ] lampada fluorescente 36 W | Fluorescent tubes 36 W
- [ ] Outra: _____

Informação Adicional *Additional information*

Se desejar, pode fornecer a seguinte informação adicional.
If willing, you can provide your personal information below.

21. Nome
Name

_____

22. email

_____

23. Celular

Cellphone

_____

24. Nome da sua organização

Name of the organization

25. Sua posição ou cargo

Position at organization