Energy Poverty in Togo, Africa

Report prepared by ASSEDEL

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Introduction

The African continent experiences struggles of various nature to this day. The African Development Bank Group has defined the "High 5s", which reflect the five main areas that need further development on the continent. This can in turn fundamentally and strategically transform the lives of the local population. The "High 5s" are as follows: Feed Africa, Light up Africa, Industrialise Africa, Integrate Africa, Improve the quality of life for the people of Africa[1]. These five priority areas can experience significant development with the reduction of energy poverty due to the resultant increase of income and food security, market integration and trade opportunities, infrastructure advancement, and access to "essential services such as health, water and sanitation" [2]. This report aims to define the concept of energy poverty for the African region as well as examine the energy accessibility in Togo as well as the opportunities for such to be increased in a sustainable and socially conscious way.

Defining Energy Poverty

Energy poverty in developing countries is defined by the household's access to electricity at affordable prices. According to the United Nations Development Program, energy poverty is defined as the "absence of sufficient choice in accessing adequate, affordable, reliable, high quality, and environmental and health-friendly energy services to support economic development opportunities for the communities"[3]. There are two types of energy sources: traditional (e.g. firewood) and modern ones (e.g. Liquified petroleum gas and electricity). For efficiency and

[1] *The "High 5s": A Strategic Vision and Results that are transforming Africa*, African Development Bank Group: https://www.afdb.org/en/news-and-events/high-5s-strategic-vision-and-results-are-transforming-africa-35851
[2] *The "High 5s": A Strategic Vision and Results that are transforming Africa*, African Development Bank Group: https://www.afdb.org/en/news-and-events/high-5s-strategic-vision-and-results-are-transforming-africa-35851
[3] *The "High 5s": A Strategic Vision and Results that are transforming Africa*, p.5. African Development Bank Group: https://www.afdb.org/en/news-and-events/high-5s-strategic-vision-and-results-are-transforming-africa-35851

sustainability reasons, modern energy sources are what defines electricity access nowadays. The physical availability of modern sources reduces poverty, while the dependence on the traditional ones of cooking and heating marks a high poverty level[4].

Figure 1 below explains the concept of energy poverty via the demand and supply of energy services[5]:

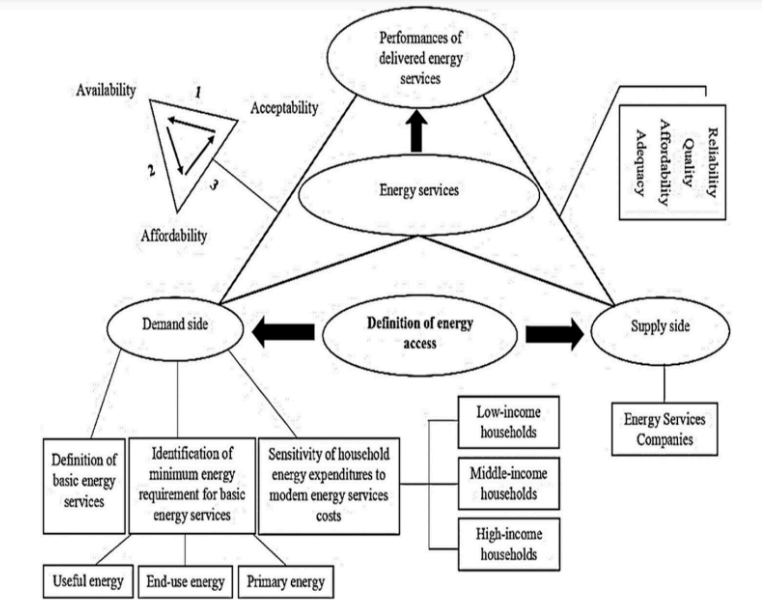

Figure 1: Demand and Supply of Energy Services

The performance of delivered energy services is defined by their demand and supply, which is influenced by the acceptability, affordability, and availability of energy. Therefore, it can be deduced that energy can be inaccessible due to its general non-existence, high price, or

[4] Mokaddem, L., Sy A. S. (2022). *Energy Poverty in Developing Countries: A Review of the Concept and its Measurements,* pp.1-4, ScienceDirect: https://www.sciencedirect.com/science/article/abs/pii/S2214629622000676?fr=RR-7&ref=pdf_download&rr=8ae0607a680d0356

[5] Mokaddem, L., Sy A. S. (2022). *Energy Poverty in Developing Countries: A Review of the Concept and its Measurements*, p.5. ScienceDirect: https://www.sciencedirect.com/science/article/abs/pii/S2214629622000676?fr=RR-7&ref=pdf_download&rr=8ae0607a680d0356

lack of acceptance to the available and affordable energy sources. Understanding the concept of energy poverty is the first step towards energy justice and the reduction of social inequality.

The energy metrics are viewed from engineering and economic perspectives. Firstly, the engineering approach makes an estimate of the "minimum energy requirement for basic energy services demanded by the household"[6].

This energy requirement threshold is calculated by taking into consideration the efficiency and type of available energy source as well as how useful it is for the household size. Secondly, the economic approach identifies the "energy poverty line based on household income and expenditure"[7]. It measures how the energy expenditure share of the household's financial resources impacts their overall monetary quantity and how this is reflected in comparison to the conventional poverty line.

The energy development of Togo, which is located in Western Africa, is of intriguing nature due to its multilayered complexity and various factors of influence. Its coastline to the Gulf of Guinea extends to about 51km and is bordered by Benin to the east, Ghana to the west, and Burkina Faso to the north. Due to the elongated shape of the country, there are different relief and climatic conditions along its area, with the general climate being defined as tropic. Additionally, according to statistics from 2022, 57.1% of the population lives in rural areas, while 42.9% occupies the urban ones. The settlements are scattered in the rural areas in small villages[8].

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[6] Mokaddem, L., Sy A. S. (2022). *Energy Poverty in Developing Countries: A Review of the Concept and its Measurements,* p.6, ScienceDirect: https://www.sciencedirect.com/science/article/abs/pii/S2214629622000676?fr=RR-7&ref=pdf_download&rr=8ae0607a680d0356

[7] Mokaddem, L., Sy A. S. (2022). *Energy Poverty in Developing Countries: A Review of the Concept and its Measurements,* p.6-7, ScienceDirect: https://www.sciencedirect.com/science/article/abs/pii/S2214629622000676?fr=RR-7&ref=pdf_download&rr=8ae0607a680d0356

[8] Pedanou, M. K. , Deschamps, . H. J. (2024). *Togo*. Encyclopedia Britannica: https://www.britannica.com/place/Togo

The population of Togo is predicted to witness significant growth in the period 2019-2043 with about 5.7 million people. A contributing factor of great significance for this is that the highest percentage of the population is aged below 15 years old. Additionally, there is an expected increase in the urbanization rate and a tendency for more people to move to urban areas rather than stay in the rural ones[9]. With this population growth, energy optimization is becoming even more necessary.

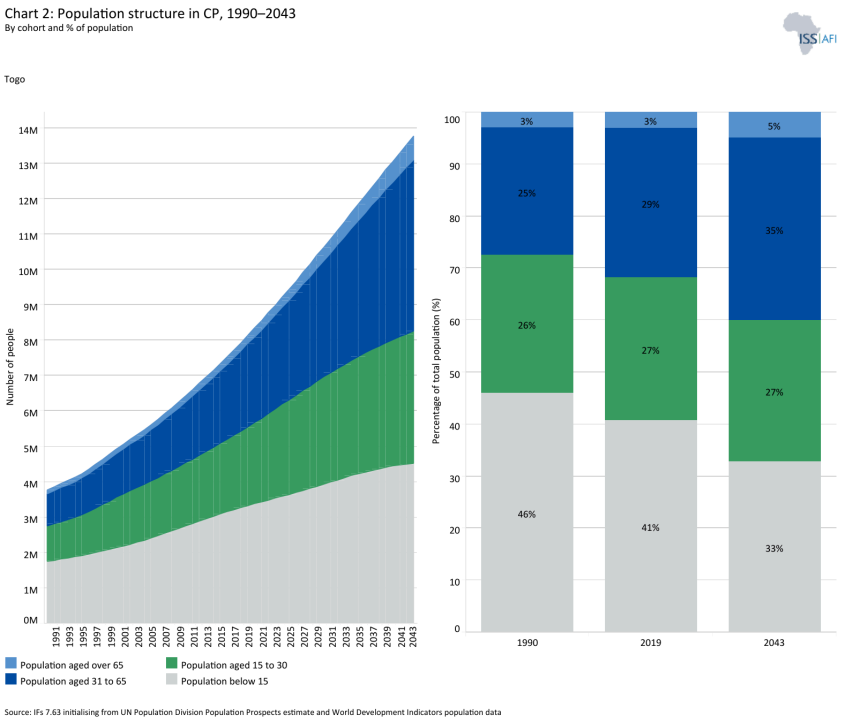

Figure 2: Population Structure (Togo): 1990-2043

Togo is located in Sub-Saharan Africa whose power generation capacity stands out as extremely low from a global perspective. Additionally, the capacity growth has experienced stagnation in terms of further development. Main characteristics of the region include inefficient household electricity connections to the grid, unreliable electricity supply and high prices due to

[9] ISS African Features. (2024). *Togo*: https://futures.issafrica.org/geographic/countries/togo/

the overall electrical scarcity. The situation in the region has been worsened by droughts, high international oil prices, and geopolitical tension[10].

Electricity Access and Consumption

According to estimates from 2022, about 57.2% of the population have access to electricity[11]. With such estimated access, Togo into the category of energy poor[12].

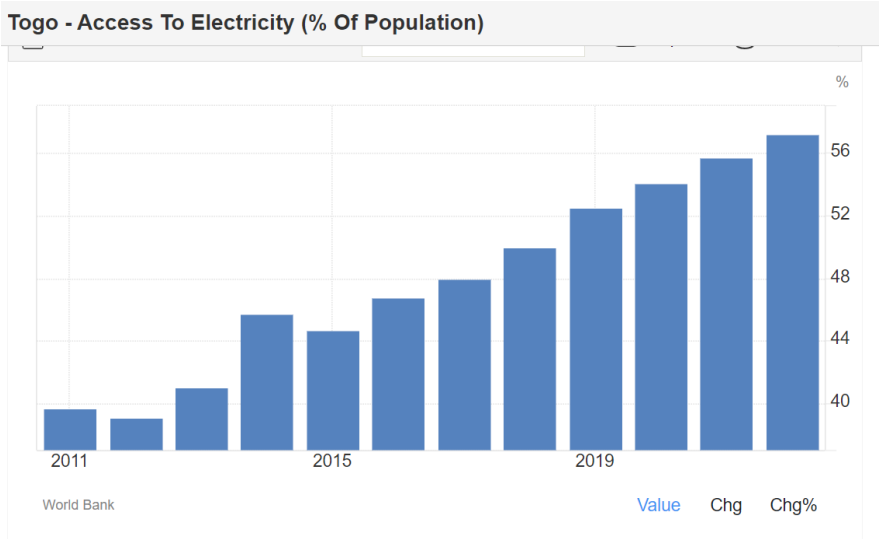

Figure 3: Togo's Access to Electricity (in %)

As depicted in Figure 3 above, the overall access to electricity has been rising since 2016. However, the pace is rather slow and there has been marked stagnation in the percentage growth rate.

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[10] Eberhard, A., Rosnes, O., Shkaratan, M., Vennemo, H. (2011). *Africa's Power Infrastructure,* pp. 1-12. The World Bank: https://www.google.fr/books/edition/Africa_s_Power_Infrastructure/bPasSxcQ858C?hl=en&gbpv=1

[11] World Bank. (2024). *Togo - Access To Electricity (% of Population).* Trading Economics: https://tradingeconomics.com/togo/access-to-electricity-percent-of-population-wb-data.html#:~:text=Access%20to%20electricity%20(%25%20of%20population)%20in%20Togo%20was%20reported,compiled%20from%20officially%20recognized%20sources.

[12] *Energy System of Togo,* IEA 50: https://www.iea.org/countries/togo

According to estimates from 2021, Togo's electricity consumption comes primarily from fossil fuels, followed by a significantly lower share by hydropower and other clean energy sources. This can be observed in the graph "Electricity Consumption in Togo - in %" below:

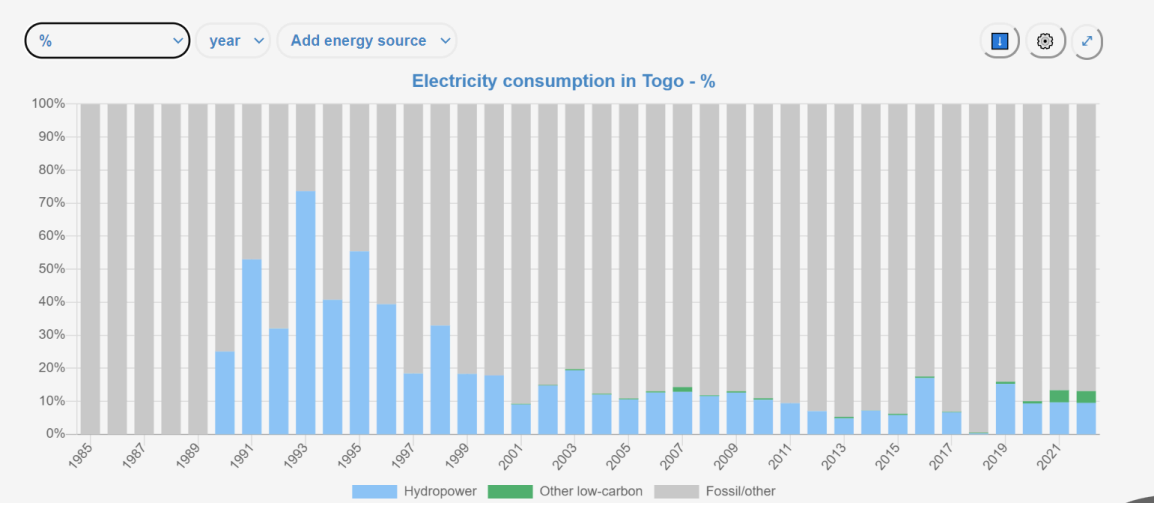


Figure 4: Electricity Consumption in Togo (in %)

Most of the energy demand is met by imports from countries in the sub-region. Petroleum products enter Togo due to established energy trade relations with Ghana, Nigeria, etc.

This is why the balance of trade in Togo is negative (*refer to Figure 5*).

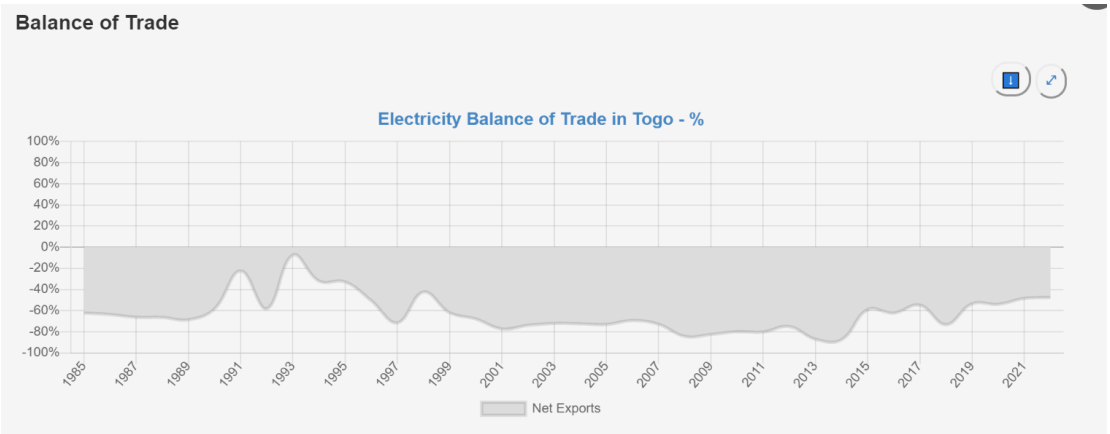


Figure 5: Togo's Electricity Balance of Trade (in %)

The population's access to clean cooking was reported to be 11.9% in 2022, which is remarkably low for the 21st century[13].

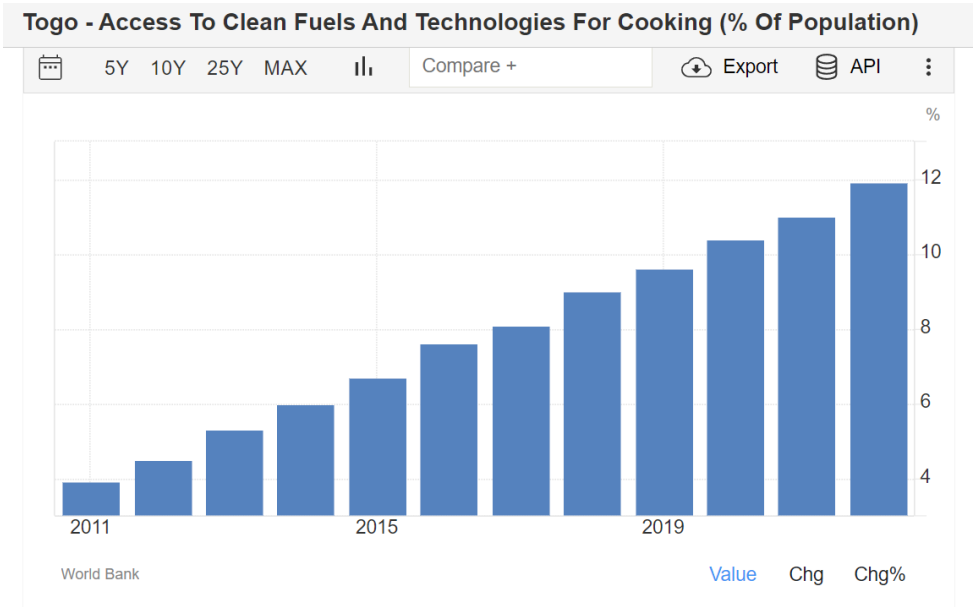


Figure 6: Access to Clean Fuels and Technologies for Cooking (% of Population)

[13] World Bank. (2024). *Togo - Access to Clean Fuels and Technologies for Cooking (% Of Population)*. Trading Economics: https://tradingeconomics.com/togo/access-to-clean-fuels-and-technologies-for-cooking-percent-of-population-wb-data.html

This percentage is very concerning, since cooking without clean stoves releases toxic pollutants. Consequently, households are exposed to severe risk of diseases, especially the most vulnerable groups - women and children. Additionally, the toxic gasses emitted contribute to climate change and harm the environment. Collecting wood is usually a task of the female members of the households and proves to be economically inefficient, since it takes too much time of their day as well as effort to carry it to their homes - this time could rather be dedicated to attending school or earning an income to increase the family's budget. Moreover, such a need for wood contributes to deforestation. Therefore, there is an urgent need for Togo to increase its population's access to clean cooking, since this will help the environment and improve society's health and living conditions[14].

Renewable Energy in Togo

Especially due to the negative trade balance of the country, it is a priority for it to reduce its dependence on fossil fuels and increase its domestic energy production via sustainable energy sources. To add, switching to renewable energy sources is beneficial for Togo's environment and will help combat climate change. Africa suffers disproportionately from a global perspective, since it is experiencing the environmental harm caused by more developed economies such as China and the USA; however, it is also unable to financially support a proper recovery of the local population after a natural disaster such as a flood occurs.

[14] Clean Cooking Alliance. (2024). *The Value of Clean Cooking:* https://cleancooking.org/the-value-of-clean-cooking/

Biomass

Energy's availability concerns have been shifting more and more the focus towards renewable energy alternatives. Currently, traditional biomass is an important source of energy used for heating and cooking purposes. The sources are domestic, including firewood and plant waste. The amount of wood used is determined by the household's type of cooking stove and its efficiency.

Hydropower

Togo has very favorable conditions for the development of renewable energy capacity. However, to this day it remains underdeveloped, including, although less prominently, the hydroelectric potential of its territory. Currently, it is estimated that only 11% of its hydropower potential is optimized, which is not favorable for the energy needs of the population.

Togo's territory can be subdivided according to climate type and consequently into various rainfall patterns. Southern Togo (Transitional equatorial climate) has two rainfall peaks - in June and September, and northern Togo (Transitional tropical climate) has rainfall peaks in August[15].

[15] ECOWAS Centre for Renewable Energy and Energy Efficiency. (2017). Togo - Country Report: Hydropower Resource Mapping and Climate Change Scenarios: http://www.ecowrex.org/sites/default/files/country_report_14_togo.pdf.

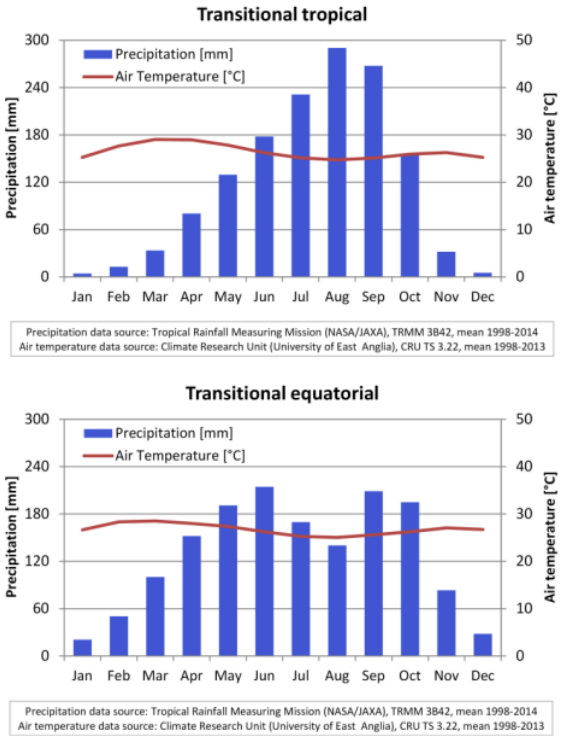


Figure 7: Togo's Weather Patterns and Precipitation Peaks

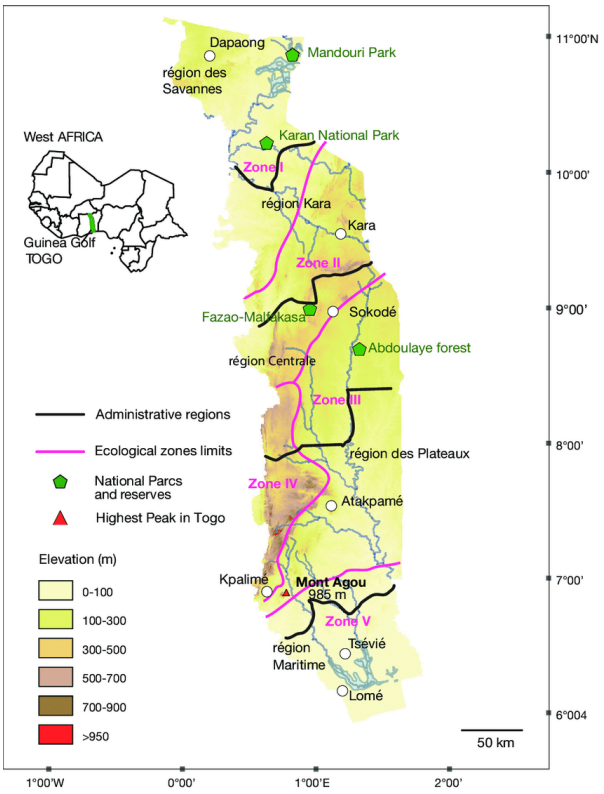
The precipitation level determines the overall distribution of water and affects the water levels of Togo's biggest river, Mono. The highest percentage of theoretical hydropower potential is designated to small hydropower plants. By looking at Figure 7 above it can be deduced that there is a concentration of rainfall in the so called wet seasons with very little precipitation during the rest of the year. Moreover, the aridness of the climate causes high evaporation. Due to the mainly flat topography of the region, hydropower reservoir sites are rarely found.

Therefore, utilization of hydroelectric power plants which are limited by an uneven streamflow pattern, especially small ones, could be efficient if the generated power serves as replacement for high cost sources. This is possible when the energy generation of the HPP is at

its peak[16]. Environmental and public health hazards should always be taken into consideration such as creation of barriers to fish migration and increasing the risk of mosquito-borne diseases.

Solar power

Togo is a country of high PV power potential as shown on the right map below, with red regions carrying the highest potential and those marked in blue and green marking the lowest one[17]:



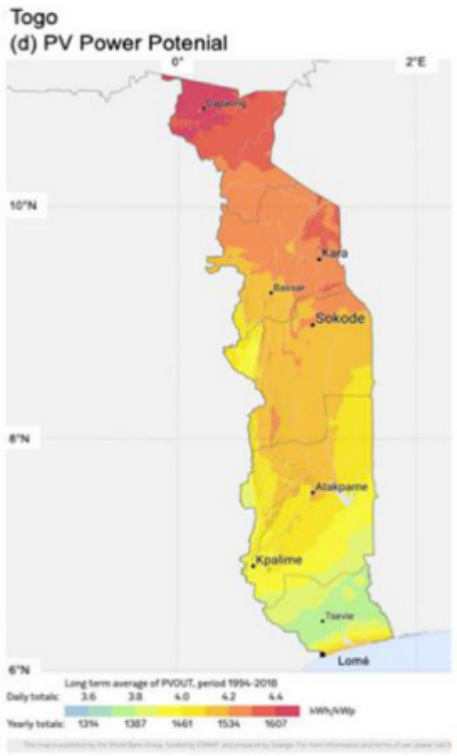


Figure 8: Elevation Map of Togo

Figure 9: PV Power Potential Map

[16] NRECA Small Decentralised Hydropower Program. Togo: an Assessment of Decentralised Hydropower Potential: https://pdf.usaid.gov/pdf_docs/PNAAS975.pdf

[17] Salifoua, T., Nabilioua, A. , Alloulaa, M., Vasi, J. , Malbranchec, P. , Ossenbrink, H., Verlindene P., Nowakf S. , Kurtz, S. , Lawrence L. Kazmerski. (2023). *Creating a Solar Roadmap for the Republic of Togo,* p.2. ScienceDirect: https://www.sciencedirect.com/science/article/pii/S2772940023000115

The process of developing Togo's solar roadmap is separated into four main phases: 1.) planning and preparation, 2.) visioning, 3.) roadmap development, 4.) roadmap implementation and revision.

These four main stages are based on a careful evaluation of the current situation in Togo and then IEA's procedure of evaluation[18]:

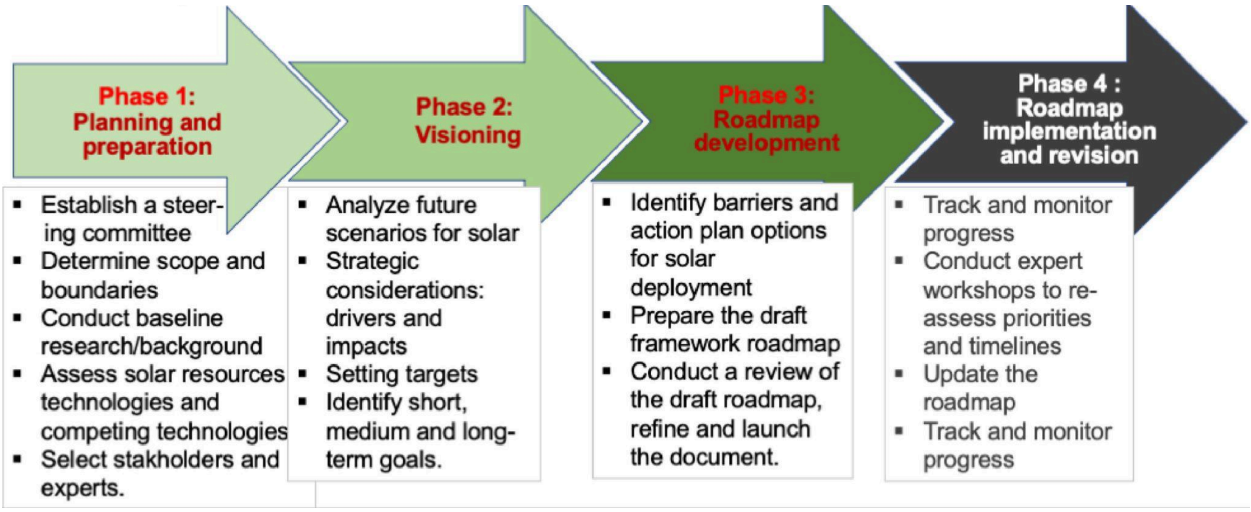


Figure 10: Togo's PV Sector - 4 Stages of Evaluation

The first phase is connected to availability of solar technologies and documentation and analysis of Togo's PV potential. Additionally, governments and education institutions should take the responsibility of educating the local population on the advantages of solar energy as well as their individual opportunities to contribute to the growth of the energy sector.

[18] Salifoua, T., Nabilioua, A. , Alloulaa, M., Vasi, J. , Malbranchec, P. , Ossenbrink, H., Verlindene P., Nowakf S. , Kurtz, S. , Lawrence L. Kazmerski. (2023). *Creating a Solar Roadmap for the Republic of Togo,* p.2. ScienceDirect: https://www.sciencedirect.com/science/article/pii/S2772940023000115

The second phase, visioning, has to do with the setting of short-term and long-term targets in a clear and realistic manner. It is based on discussion with local stakeholders and the national energy plan.

The third phase, roadmap development, identifies potential barriers to solar deployment specifically for the country Togo. This activates the permitting process, policy implementation and import restrictions.

Finally, the fourth phase, the implementation, monitoring, and revision, is subject to continuous modification and improvement. Energy needs can change according to the overall development of the country and can be affected by political shifts, technological innovations, or unforeseen barriers.

If all stages of the solar roadmap are carried out successfully, there are numerous socioeconomic benefits, including sustainable energy production from non-greenhouse gas production sources, net job creation in the domestic solar energy supply chain, and percentage increase of the population having access to electricity.

Wind Power

There is room for exploitation in terms of Togo's wind energy potential. There has been recorded a sufficient level of wind speed for wind energy production in Togo's coastal regions. Nevertheless, its utility on the grand scale of the renewable energy sector in Togo is relatively small.

Important Prerequisites for Togo's Energy Sector Growth

The first stage of development of Togo's energy sector requires sufficient information availability, which is also of high quality in order for the evaluation of the situation to be possible. In order for this goal of information collection to be achieved, it is necessary to take action at a national and international level. Firstly, domestic measures can be taken so that the information which has been gathered already is preserved and built upon by local experts. A national platform for data exchange can be maintained. Secondly, international initiatives can enable the detailed documentation of solar data as well as the identification of prospects for solar energy growth in the region. Moreover, training and educational opportunities should be given to business developers, installers, and engineers. This enables continuous update of energy projects as well as their increase in number and impact. The requirements for the whole set of skills needed should be met.

It is also important that energy infrastructure barriers should be overcome. Such obstacles can be insufficient grid capacity, lack of proper connection of new projects to the grid or incorrect commissioning. This enforces the necessity for grid expansion, which can encompass mini grids and solar home systems. Regulation of system operators as well as proper land distribution and the corresponding building access for installation are main predispositions for successful grid expansion.

In terms of Togo's energy market expansion, the availability of financing is key - the government should offer support for the development of domestic or regional bond markets in low- carbon goods. This could help with the establishment of long-term revenue certainty, which eliminates the feeling of risk and uncertainty in investors. To add, government intervention can

reduce cost of loans through "grant funding, credit guarantees, tax incentives"[19]. It is of utmost priority that any installation of new energy systems occurs sustainably and does not cause any environmental damages. Finally, local opposition to renewables specifically should be prevented via the education of Togo's population in terms of the economic importance of energy as well as the long-term environmentally friendly energy solution in the face of renewables.

Benefits of Developing Togo's Energy Sector

There are numerous benefits for Togo if the country manages to develop its energy sector. From an economic perspective, if the population has a reliable access to electricity at an accessible price, it will be significantly more productive with its education and professional activities. This would result in increased economic growth rate and consequently social development. Income growth could reduce Togo's overall poverty rate and give more chances to people in terms of personal development. Additionally, an increased access to education and healthcare will result in overall long-term improvement of the locals' life.

[19] Salifoua, T., Nabilioua, A. , Alloulaa, M., Vasi, J. , Malbranchec, P. , Ossenbrink, H., Verlindene P., Nowakf S. , Kurtz, S. , Lawrence L. Kazmerski. (2023). *Creating a Solar Roadmap for the Republic of Togo,* p.5. ScienceDirect: https://www.sciencedirect.com/science/article/pii/S2772940023000115

Conclusion

Insufficiency in investment in generation capacity and network connection, high costs and prices influencing the maintenance and system expansion result in a power crisis in the region of Sub-Saharan Africa[20]. Moreover, Togo faces the challenges of limited experience with independent power producers, technical and commercial losses as a result of nonpayments and aging infrastructure, and lack of an integrated electrification strategy that aligns on- and off-grid connections goals[21]. These unfavorable conditions affect the everyday life of the local population very negatively and need to be subject to improvement. A solution for Togo would be development of its renewable energy potential. This increased capacity would meet the population's needs and reduce its negative trade balance characterized by exceeding imports. Therefore, Togo suffers under the burden of energy poverty and it is a global responsibility to help the country to reduce it and balance the trilemma of energy security, economic development and environmental protection.

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[20] Eberhard, A., Rosnes, O., Shkaratan, M., Vennemo, H. (2011). *Africa's Power Infrastructure,* p. 16. The World Bank: https://www.google.fr/books/edition/Africa_s_Power_Infrastructure/bPasSxcQ858C?hl=en&gbpv=1

[21] USAID. (2021). *Togo - Power Africa Fact Sheet:* https://2017-2020.usaid.gov/powerafrica/togo