CAPABILITIES AND READINESS FOR ENERGY TRANSITION IN TANZANIA

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POLICY PAPER

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In July 2022, The African Union adopted what it called 'the African Common Position on Energy Access and Just Transition.' The position is described as 'a comprehensive approach that charts Africa's short, medium, and long-term energy development pathways to accelerate universal energy access and transition without compromising its development imperatives.' As such, the document would be key to understanding how, overall, African countries perceive energy transition. As indicated, energy transition is seen in Africa as a companion to energy access, and both are seen within a larger picture of 'development imperatives.' (AU, 2022). The importance of energy production for the socio-economic development cannot be overemphasized, while Africa's energy production is estimated to be lowest of all regions of the world to date. In addition, both rapid population growth and economic growth increase energy demand that require immediate solutions.

What is expressed in the summary of the African common position echoes a general expressed position of the economic South, or the majority of low-and-middle income countries. In the meeting of the G77 of developing countries, in Havana, September 2023, the president of Brazil expressed the perspective that is shared by many developing countries, when he said that, "the group should promote sustainable industrialization, investment in renewable energy….without forgetting that we do not have the same historical debt as rich countries for global warming." (Mark and Acosta, 2023). Of course, sustainability and industrial-economic development do not have to be at odds with each other—unless policy discourses and resource allocations make them look that way. The press release by the AU, about the common position, stipulates that 'Africa will continue to deploy all forms of its abundant energy resources including renewable and non-renewable energy to address energy demand'; even clarifies that 'natural gas, green and low carbon hydrogen and nuclear energy will therefore be expected to play a crucial role in expanding modern energy access in the short to medium term.' The press release then pays attention to renewable energy sources in 'long-term' uptake plans for a 'low carbon and climate-resilient trajectory.' In no minced words, the African common position prioritizes energy access, and in the context of the majority of African countries, that puts energy transition (towards low-carbon/renewable sources) in the car, but not the driving seat.

Yet, and because energy is crucial for economic-industrial development, all available sources should be explored. Fortunately, renewable energy sources, in many African countries, are also opportune sources for increasing energy access, in short-, medium- and long-terms. Additionally, and while the prioritization of energy access and economic-industrial development is understood, the global context of today makes climate change a very pressing problem, with severe impacts on African lands and peoples, that should encourage African decisionmakers to treat it with more urgency. Although most African countries contributed the least greenhouse gas (GHG) emissions to global warming, they are nonetheless facing high impacts from climate change, such as the Sudano-Sahelian region in Africa which is experiencing severe droughts, affecting food security and economic development plans (Kummu et al., 2021).

A CLOSER LOOK AT TANZANIA'S ENERGY TRANSITION

Tanzania's overall contribution to the global Carbon Dioxide (CO2) emissions is around 0.03% of the world total, while it still has more work ahead to provide full energy access to its citizens and industries (Dye, 2021). As of 2022, the share of Tanzanians with access to electricity was reported at 45.8%, with stark difference in distribution of access between urban and rural populations-- 74.4% of the urban population have access to electricity compared to 36% of the rural population (World Bank Data 2022). However, the total numbers with regards to energy access have been changing rapidly, over the last decade, and the total installed capacity for energy generation (including for industrial and commercial consumption) has increased from 1.5 Gigawatt (GW) in 2019 to 1.9 in 2023 (IRENA 2024). Yet, between 2021 and 2024 Tanzania moved down from position 80-out-of-115 to 118-out-of-120 (a significant drop in ranking in only 3 years) in terms of readiness to shift to clean energy, as per the Energy Transition Index of the World Economic Forum (2021, 2024). While it ventures on continuous electrification efforts, it is expected to give more emphasis to renewable energy (RE)—particularly 'new' RE, since the country is a historical hydropower producer. Environmental conservation remains crucial to Tanzania: the natural resources and forestry in driving agriculture, nature-based tourism in its globally famous national parks as well as health and human capital development play an important role in national economic growth and development. However, along with the challenge of deforestation through biomass energy production, hydropower systems are also vulnerable to climate change and rainfall fluctuations. Therefore, sustainable, low-carbon energy generation options are important for the big picture. Energy projects will generally have to increase and diversify to meet industrial, commercial, and domestic demands while keeping minimal undesired impacts on the environment.

As for the economic context, Tanzania became a lower-middle-income country in 2019, as its Gross National Income (GNI) per capita reached $1,080 (which passes the threshold by $44). Tanzania's GDP has been increasing about 5-7% annually over the past decade, making it one of the fastest growing economies in Africa (although it has seen some fluctuations in the recent years). However, when adjusted to population growth over the same period, we find that per capita GDP growth has averaged only 2.5–3.5% annually, which is not as outstanding as the initial percentage (Page, 2016). With these indicators of economic development, FDI as a share of GDP fell from 5.7% in 2010 to 2.7% in 2022, indicating decreased attention to investment in Tanzania's economic progress, especially by non-state actors. This is although this FDI share of GDP is not considered low compared to Tanzania's neighbours in East Africa. The main obstacles for investors that were reported include difficulties in hiring expatriate workers, 'opaque' tax policies and a relatively unstable regulatory environment (Kraemer, Sheikheldin and Karimanzira, 2021). Furthermore, the impact of economic growth on poverty reduction is quite insignificant, and understandably so since that growth did not seem to happen in the productive sectors where there are more value-added activities and more skilled employment (Prime Minister's Office, 2015, i).

Energy is at the centre of this economic context, since access to adequate and sustainable energy is one of the reported challenges for the manufacturing sector in Tanzania (Newman et al., 2016). Besides power shortages in urban areas where most manufacturing industries are, low rural electrification makes it generally prohibitive to initiate non-farm industrial activities (agro-processing and others). Nonetheless, an appreciable number of agro-processing and light industries use electricity in rural areas, with grain grinding/milling being the most common, followed by carpentry workshops (REA, 2017).

In Tanzania, estimates say that the solar power potential is one of the largest RE resources in Africa, reaching up to 38 TWh/year (for photovoltaics - or PV - and a little less for concentrated solar power - or solar thermal), while the potential for wind energy is considered limited – not exceeding about 18 TWh/year – but still valuable (Hermann, Miketa and Fichaux, 2014, 36).

Historically, with the political independence of Tanganyika, in 1961, energy production and supply moved to become state-owned, and it remains mainly so. The state acquired the two colonial electricity supply companies in the country at the time: Dar es Salaam and District Electric Supply Company (DARESCO) and the Tanganyika Electric Supply Company, and the two were merged into the Tanzania Electric Supply Company (TANESCO) (Eberhard et al. 2016). Reports show that during 1960s and 1970s electricity supply was adequate (within the limits of the established national power grid), but since the 1980s it deteriorated (Ibid). The liberalization process of the 2008 Electricity Act removed control of electricity production and distribution from TANESCO, but it remains to date the main energy generator and supplier.

Levels of local capabilities in technical knowledge and operations management are important to consider when we look at long-term goals of energy access and transition. These capabilities are necessary for sustainable expansion of projects and services of technological nature (Lall, 1992; Nasir et al., 2011). These local capabilities are also related to the size of local skilled labour force as well as the local capacities to operate and maintain machinery, whether the machinery is wholly or partially produced locally or imported. In the long run and with considerable size expansion of RE technologies in any country, there need to be localized capabilities: technological, industrial, logistical, and managerial (Sheikheldin and Devlin, 2019; Davy, Hansen and Nygaard, 2022). This means that understanding current capabilities, and capacities to increase them, should be of high concern to policymakers.

This section will summarize the levels and aspects of capabilities that are currently in Tanzania, as found by the 'Energy Struggles' project.

PUBLIC SECTOR CAPABILITIES

Several national plans and documents that address RE already exist, such the Power System Master Plan (2020), Rural Electrification Master Plan (2022), Regulatory Performance Reports by EWURA, the National Energy Policy (by the Ministry of Energy), and the Electricity Act 2008. The country's Power System Master Plan 2020 (Ministry of Energy) indicates that more attention will be given to renewable energy sources. However, national plans for increasing energy generation are still prioritizing hydro, natural gas, and coal – including plants under development. As of 2021, Natural Gas contributed ~60% of energy supply to the electricity sub-sector, while hydro contributed ~39% to the electricity supply, with 0.99% of supply coming from small power producers, such as mini-grids (EWURA, 2021). Plans to reach generation capacity of 20.2 GW by 2044 also prioritize hydro (28.15%), natural gas (33.18%) and coal (26.24%), with the remaining percentage (12.4%) divided between wind, solar and geothermal sources of energy (Ministry of Energy, 2020). (See Figure 1).

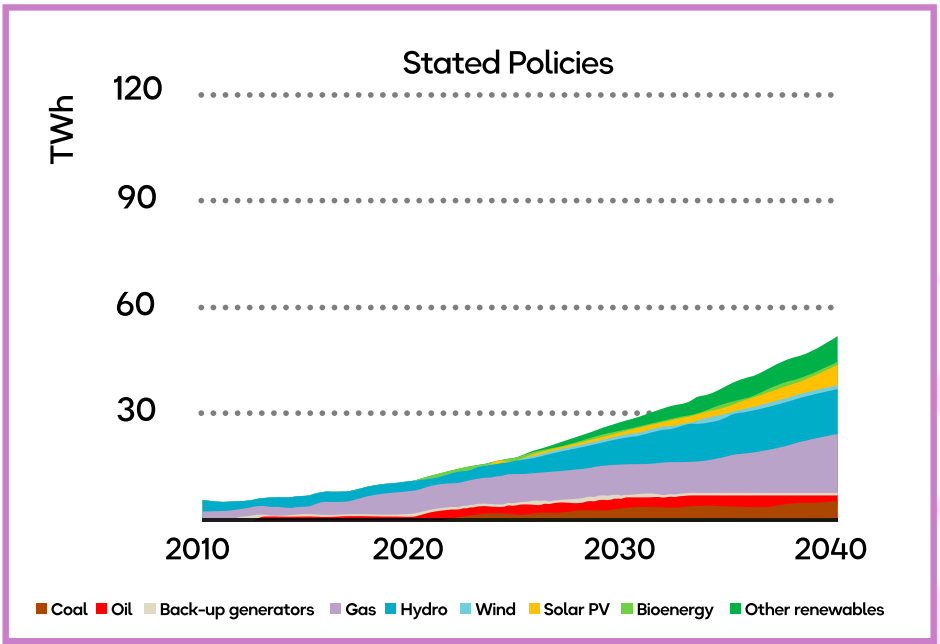

Figure 1: Tanzania electricity generation (past, current and planned) by technology. Source: International Energy Agency 2019.

There are also policies, in place, that aim to promote increased use of RE through economic incentives, which are part of a country's available set of capabilities. According to the Tanzania Renewable Energy Association (TAREA), main solar PV components are zero rated (not charged any type of tax), such as solar panels, solar chargers, invertors. Solar batteries were zero rated, but by July 2022 they are charged excise duty—5% if the product is locally manufactured and 10% if the product is imported (as per the country's Finance Act 2022, for 'electric accumulators'). However, there is, to date, a need for a national RE strategy (which is said to have already been developed and is expected to be released soon). The significance of a national strategy is that it is expected to operationalize the national plans and policies already in place by identifying tools, milestones, actors responsible, and allocated budgets. We were informed that a national RE strategy is in the works, by the Government of Tanzania, but dates of publication are still unknown to date.

One of the most recent energy related documents published by the Government of Tanzania (GoT) is the Rural Electrification Master Plan (REMP), published in August 2022 by the Rural Energy Agency (REA). The REMP sets the goal of 100% access to energy in rural Tanzania by 2030, with 75% connectivity. Within that connectivity goal, the plan indicates a total of 312 locations proposed for mini-grids, with all of them, save one, proposed for solar mini-grids, leaving room for non-state actors to participate in the electrifiation process. Such regulatory shifts over the last years illustrate concerted efforts by GoT to electrify the country with the help of multiple actors.

Increasing local capabilities in terms of human resources are also in progress, with public sector support, and with noticeable milestones. Arusha Technical College (ATC), for example, established a bachelor's degree program in RE in 2018, while it also graduates around 200 technologists and artisans in RE annually. The Kikuletwa Renewable Energy Training and Research Centre, that operates under ATC, has undergone expansions and renovations – with international funding and state support – to increase capacity and become a centre of excellence for RE training and research in Tanzania and East Africa, spanning the technologies of Solar, Hydro, Wind, and Biomass energies. GoT also supports other programs spread across multiple universities and colleges in Tanzania, such as the University of Dar es Salaam, the Dar es Salaam Institute of Technology, Arusha Technical College, and the Nelson Mandela Institute for Science and Technology.

INDUSTRY CAPABILITIES

In the context of the capabilities of the public sector (i.e. the state apparatus), above, it is important to understand how the capabilities of non-state actors are faring accordingly within the country. Non-state actors include firms/enterprises as well NGOs, social enterprises, civil society associations, etc. that are involved and invested in RE sub-sector.

Based on our research, a few findings are relevant enough to highlight here, because the size and involvement of non-state actors in the energy sector at large are minimal (similar to many countries around the world).

While only a few enterprises in Tanzania are engaged in design and manufacturing of RE, and while most of them are having those design and manufacturing activities outside Tanzania, there are very few local cases that may signal an evolution in its infancy. For example, Nextec, a small new firm established by ambitious Tanzanian engineers and incubated by a veteran local social enterprise, Kakute, has two products in its profile so far: a fishing micro-grid charging station (for charging batteries for lighting purposes instead of diesel) and the N-switch, an offline remote monitoring device for irrigation and agricultural activities. Both products are designed by Nextec engineers, also the founders, while the manufacturing is currently outsourced. Additionally, a few local firms are involved in big installation jobs, such as designing and installing mini-grids. Photons Energy, a local EPC firm (engineering, procurement, and construction) co-founded by a group of young Tanzanian engineering and business graduates, designed and oversaw the construction of an 80.1 Kwp solar PV mini-grid system, with a 15 Kwh battery bank, in Kokota islet, Pemba, Zanzibar, in a project supported by the Government of Zanzibar. Additionally, various medium-sized local enterprises provided technical services similar to those provided by bigger and international enterprises.

Additionally, while the majority of big RE enterprises are not locally owned, about 60% of all enterprises work with local producers (of complimentary products, such as installation and wiring parts, transportation equipment, etc.), and about 60% of all enterprises contract local installers (although mostly individually, i.e., without full-time employment in the firm or contracting a local firm to take care of installations). There are also cases of local enterprises that establish further local connections (through incubation, training, and partnerships) such as the case of Kakute, a veteran social enterprise that has incubated both international and local enterprises and has been a main champion for RE in policy circles (with TAREA) and with local communities and organizations.

When we look at the workforce in foreign RE firms in Tanzania, we see tangible evidence of knowledge transfer to locals. The majority of RE firms in Tanzania have local employees in decision-making positions. Most of the international RE firms have those high-ranking local employees (although many of them are decision makers at the national Tanzania level, not internationally, and sometimes at the regional East African level for enterprises that have branches all over East Africa). About half of RE enterprises have local employees in design positions (most local firms, some international), and about 95% have locals in repair-maintenance positions. There are also numerous cases of local, highly skilled employees experiencing upward mobility within their firms, including the bigger international firms, as well as within the RE sub-sector at large.

We should understand, however, that the RE industry in Tanzania is relatively small overall. About 60% of enterprises/firms have less than 20 staff, and firms that have larger numbers are mostly multinationals (from outside Tanzania, with some having smaller Tanzanian partners). Table 1 summarizes some of the main and relevant findings with regard to capabilities of non-state actors in solar RE in Tanzania.

Table 1: Summary findings about Industry capabilities in solar RE in Tanzania

Indicator	Summary findings	Notes
Size of Organization	- 30% less than 5 staff. - 30% between 6-20 staff - 40% above 50 staff members - Larger enterprises are older ones with various market activities and/or international enterprises.	
Activities in Value Chain of RE	10% are engaged in design & manufacturing, mostly outside Tanzania, with few local cases. Almost all are engaged in sales and installation. Few local enterprises involved in big installations (such as mini-grids). Tech-services are often provided by big and medium-sized enterprises, with a few small ones. Promotion + lobbying performed by few.	Most rely on TAREA for promotion and lobbying for friendlier policies.
Ownership	- 50% locally owned. - 40% Foreign (Europe, USA, Kenya). - 10% hybrid or mixed partnership (local and foreign).	Kenyan-owned enterprises are older in Tanzania.
Local Linkages	- 60% work with local producers (of complimentary products). - 60% contract local installers (mostly individually). - Cases of local enterprises that establish further local connections (through incubation, training, and partnerships)	Complimentary products include installation and wiring parts, transportation equipment, etc.
Human Resources	- 80% with local employees in decision-making positions. - 50% with local employees in design positions (most local enterprises, some international enterprises). - 95% with locals in repair-maintenance positions. - Local, highly skilled employees grow in responsibilities and influence and are mobile in the industry/sub-sector.	Decision-making staff in international enterprises often manage local operations.

LINKAGES IN THE SOLAR PV INDUSTRY

The assessment of the production linkages between MNCs and local companies that particularly focused on backward linkages reveled that there are different extent of linkages depending on the level of value chain and also on the type of the solar system provided. We observed limited local linkages in the manufacturing chain of solar components in Tanzania (Malima et al. 2024). Solar home systems and mini-grid components, including PV modules, inverters, batteries, and controllers, are almost exclusively manufactured abroad, predominantly in China and other international markets. Local actors have minimal roles in production, with only tasks like packaging and basic repairs conducted within Tanzania. Companies in the solar industry often design products in-house in Western countries, outsource manufacturing to Chinese companies, and import finished products. For instance, Off-grid electric, D-Light, Greenlight planet, and Engie Mysol reported designing systems in the U.S. or Europe and manufacturing in China, leaving Tanzanian companies largely excluded from core production processes.

In contrast, the deployment chain demonstrates somewhat more substantial local linkages, especially in distribution and installation (Malima et al. 2024). Companies that import solar home systems handle distribution internally, but they partner with local mobile phone companies for payment monitoring using the "pay-as-you-go" model. Mini-grid developers, such as JUMEME Rural Power Supply, exhibited more extensive local engagement, procuring components like pipes, connectors, and cables locally. Some companies even set up open tender systems to encourage local suppliers to participate in mini-grid projects. Companies like PowerCorner and JUMEME reported sourcing 25-40% of construction materials, such as cables, wires, poles and cement, locally, fostering some degree of local procurement (Ibid.).

At the installation and construction stages, mini-grid companies display greater integration with Tanzanian suppliers, whereas solar home system providers remain mostly vertically integrated and handle these activities in-house. Mini-grid developers purchase auxiliary materials, such as galvanized metals, transformers, and energy meters, from local suppliers like AFRICAB and Multicables Ltd (Ibid.). Some companies outsource logistical and civil engineering services to local firms, boosting local business opportunities. For example, JUMEME has used local contractors for transportation and installations, while Sagemcom company that constructed PowerCorner minigrids engaged local firms for mini-grid construction in rural areas, supporting a mix of imported and locally sourced materials.

In terms of operation and maintenance, linkages remain limited, as solar home-system providers handle most of these tasks in-house, while mini-grid companies involve local contractors for some services. JUMEME stands out by empowering village committees in mini-grid management, combining company-led oversight with community involvement. The complexity of locally sourced components remains low, with Tanzania primarily providing less complex items like switches, sockets, and mounting structures. The Product Complexity Index (PCI) reveals that Tanzanian industry is yet to attain the capabilities required for producing advanced solar components, underscoring a structural gap in local manufacturing capacity.

Generally, we found that depth and breadth of these linkages remain low and shallow, and their extent of formation varies greatly between the manufacturing chain and the deployment chain. The manufacturing chain shows almost no local involvement in the production core components or components with high complexity, thus restricting knowledge transfer and skill-building opportunities for local actors (Figure 2). Conversely, the deployment chain includes some linkages, particularly in installation and construction, but these are mainly in auxiliary, lower-complexity components. This pattern highlights the need for policy interventions aimed at enhancing local capacities and fostering industrial growth in renewable energy manufacturing. Local procurement requirements, training programs, and strategic partnerships could support deeper integration, allowing Tanzanian firms to move from peripheral roles to more central positions in the solar energy value chain.

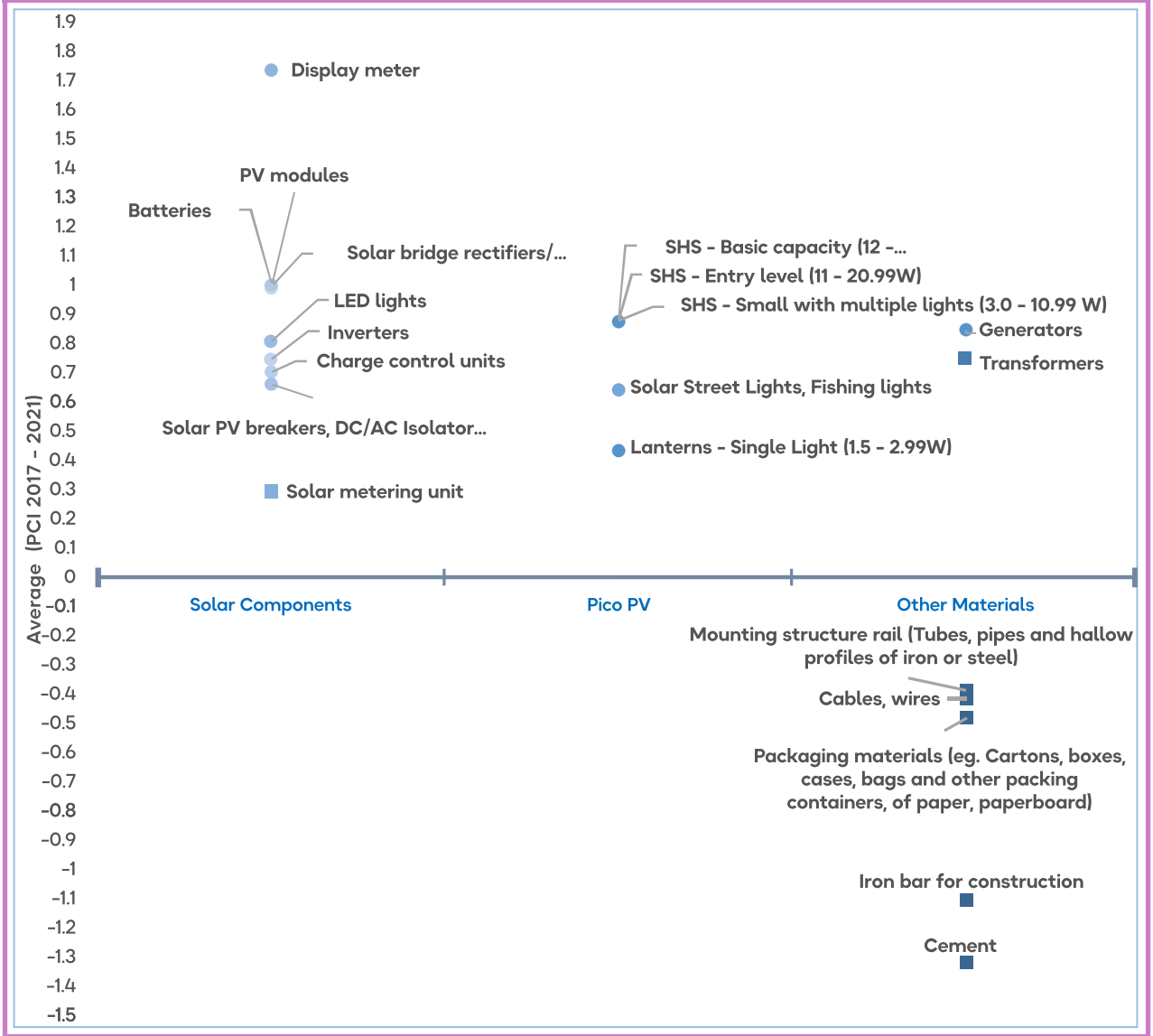

Figure 2: Solar components and products in the Tanzania market (with Product Complexity Index scores) Source: Malima et al. 2024

Can Tanzania achieve its plans for energy access while adhering to energy transition principles? Is Tanzania ready for energy transition? In our exploration of obstacles to increased capabilities of RE in Tanzania, a few areas appeared to be quite influential.

TECHNOSOCIAL PERSPECTIVES

According to the literature, RE enterprises that sell and promote Solar Home Systems (SHS) are more dominant in the Tanzanian market because the regulatory environment makes SHS easier (Jaglin and Guillou, 2020) and because large-scale solar PV projects have more financial risks (Aly et al., 2019; Creti et al., 2021). Our findings confirm what the literature says, in general. However, we see that SHS are predominant in 'new' RE (solar, wind, biomass, etc.) because of relative 'newness', because large-scale RE is dominated by traditional RE (particularly hydro) for historical reasons. Hydropower, being considered a traditional/old RE, enjoys the things that new RE is said to lack. (Notwithstanding the legitimate argument that large hydropower project may not meet the definition of 'renewable energy' due to negative long-term environmental impacts in reservoir areas and river downstream). The difference of history may explain this and may also point out that new RE may not always remain marginalized; they just need more time to build local capabilities. One of the reasons that solar SHS and solar mini-grids face current challenges in diffusion could be because they are presented as an electrification option for environmental and off-grid options, but not as a strong part of the national development narrative and agenda.

Additionally, extant scholarly literature offers very little mentioning of a relation between industrialization and RE in Tanzania. In that literature, the main discourse is RE as an alternative for electrification (particularly an alternative to the national grid) and RE as a wave that needs to be pushed for environmental reasons. When treated as such, it is difficult to argue, from the perspectives of policymakers and of users, why RE should be given more accommodation in policy and in finance, since it does not appear to contribute visibly to economic growth through productive sectors. If one argues that more investment should be channelled into extending the national grid and keeping electricity subsidies affordable, there is little legitimate counterargument for that in the name of RE. As for the perspective of private energy producers and distributors, it is a different story. This observation, we argue, deserves more attention.

Extant literature also says, in general, that there are low levels of technological capabilities in Tanzania, particularly in human resources, when it comes to RE (Aly et al., 2019). Our findings can tell a different story: as shown in the preview section, local capabilities in RE show these capabilities are limited but building up in a manner we would expect from newly-arriving technologies to the country.

Using a technosocial perspective, we come to identify two shared sources of the challenges to RE diffusion in Tanzania: 1) Symptoms of separating RE from national or regional narratives of sustainable development (rendering RE solutions as second options and as obligations); and 2) Resistance to change as a systemic symptom in cases of technological development, that can be remedied by technosocial interventions (such as technology localization activities).

With regards to the first shared source: we can connect many of the challenges to the reality that 'new' RE projects are seen in Tanzania as temporary replacement for the national grid, and therefore they are a more expensive second option for electrification when the national grid is absent. This perception, which is widespread among Tanzanian communities and policymakers alike, induces a dichotomy that puts RE at odds with the national grid, and when so it is also put at odds with national narratives and agenda of economic development and industrial development. Non-state actors, including the private sector (local and foreign) and international/funding agencies, do not seem to be helping to resolve this dichotomy, because from their end they are largely promoting agenda that barely touch on a triple-bottom-line (social, environmental and economic) of RE diffusion, and instead herald RE as a necessary response to climate change and environmental degradation, which are, in turn, not prioritized within Tanzania's own national development agenda, as explained earlier in this paper. Several incidents of main grid encroachment into mini-grid operational areas have been reported, highlighting this issue. These occurrences reinforce the perception that RE projects are treated as temporary solutions, leaving mini-grid developers frustrated as their investments are not adequately safeguarded by regulatory bodies, despite previous assurances.

With regards to the second shared source: the phenomenon described as 'resistance to change', in technosocial processes, has been studied in the literature of diffusion of innovations (Rogers, 2003) and the adjacent literature from development studies and technological change (Eisler, 2002; Jones, 2009). One of its manifestations is the difficulty for local institutions to embrace new technologies that replace older ones with which everyone is familiar. Even when the new technologies may offer particular advantages that current technologies do not have, the fact that new technologies will require institutional transformations to take place, in a long process, to embrace them as the new norm, makes resistance an expected response—at least until we have more effort in making the new technologies locally functional and locally embedded, i.e., localized. Sheikheldin and Devlin (2019) propose that cases of resistance to technological change can be mitigated with technology localization which comprises three main activities: diffusion, institutional support, and technical adaptation.

POLITICAL ECONOMY OF BUILDING CAPABILITIES

The larger context of the two technosocial problems, discussed above, is a context relevant to political economy and to development studies. Other studies have pointed out that Tanzania is currently in a state of limbo between aspiring economic liberalization and strong remnants of the command-economy era that led Tanzania through the foundational decades of nation-building and establishing enduring national institutions (Sheikheldin, 2021; Baker et al. 2022). Currently, Tanzania could be seeking a mixed-economy approach, with a developmental state model, but is still struggling with defining that path well after it left the command-economy era in a shy, unmethodical way. Currently, some policies issued by consecutive Tanzanian governments claim to have adopted liberalization (of the economy) but many national institutions are not re-designed or trained to implement them or carryout the practices of a liberalized economy. On the other hand, dominant Tanzanian political arguments and governance paradigm still see a big role for the state to play in economic and industrial development.

Dominant sentiments and arguments in the country agree that the state should not abandon its role as a development driver and assume the market forces will take the steering wheel, but the state also needs to evolve and adapt to new realities. These sentiments and arguments identify with the model of the developmental state, which still has strong proponents not only in Africa but around the world in the circles of development studies.

Understanding the role of the state is critical for understanding the 'limbo' situation under which the Tanzanian political economy currently operates, and understanding that limbo situation helps to contextualize the main technosocial challenges discussed earlier. In their comprehensive treatise titled 'African Economic Development: evidence, theory, policy', Cramer et al. (2020, p. 88) note that:

> *"If the state is the central economic actor in the drama of late development, even more so than in advanced economies, one important role it must play is in stimulating and coordinating investment. Aside from the issue of using state-owned enterprises to achieve these ends, this includes managing monetary policy, fiscal policy, and development finance: that is, organizing macroeconomic policies and a financial system around the goals of sustained long-run economic growth and structural change."*

The role of the state is huge and is irreplaceable by non-state actors (market forces, international investors, civil society organizations, and others), particularly in countries where market forces are generally smaller, less organized, and characterized by a huge informal sector. Another important aspect of the developmental state in Africa is promoting industry, especially the manufacturing sector:

> *"The manufacturing sector in particular has been the engine of economic development for the majority of developed countries, and very few countries have developed their economies without a strong manufacturing base, so much so that the terms "industrialized" and "developed" are often used interchangeably when referring to a country. In developing such strategies, policies must ensure concomitant investments in infrastructure, human capital and energy, all of which are critical for expanding the manufacturing sector…. For many African countries, the manufacturing sector will be essential for yielding employment, diversifying technological capabilities that promote and expand the skills base and deepening individual countries' industrial structures."*
> *(United Nations Economic Commission for Africa 2016, pp. 2-3)*

Under such context, the RE sub-sector, cannot expect to receive fair and deserved attention if it is not well connected to national development narratives and agenda. And for that connection to take place, the way RE expansion plans are strategized should be integrated into industrial development plans, with reasonable criteria to fulfill, such as:

> *"First, does an activity or sector generate foreign exchange earnings (i.e., will it help relax the balance of payments constraint on growth)? Second, is it characterized by scope for rising labour productivity vis-ŕ-vis other sectors and activities?.... Third, will it create employment (directly and indirectly), especially for women? In particular, will it generate an increase in higher-productivity job opportunities relative to other projects that might benefit from state support? Fourth, will it help address the need for a non-inflationary supply of basic wage goods?"*
> *(Cramer et al. 2020, p. 108)*

The state's efforts in promoting RE, as mentioned above, should be acknowledged, to be built upon. Nonetheless, considerable rooms for improvement should also be highlighted. Currently, coordination between state and non-state actors, in RE, is left almost entirely to one body (TAREA). This can be interpreted as good unification of efforts, if TAREA was sufficiently supported and funded by an interconnected network of RE non-state actors to push the RE agenda, but we only found indicators of faint enthusiasm among TAREA membership, manifested in paying membership fees and attending some of TAREA events. We also found less indicators of visible interest among RE enterprises to coordinate and collaborate with each other. Much work awaits to bridge this coordination gap. One of the ways this situation could be understood, for policy discussions, is that non-state actors have not yet developed a strong public narrative for RE to persuade both the public and policymakers that RE is not simply a second option for electrification but one of the gateways to sustainable development (economic, technological, and ecological).

On the other hand, Inadequate coordination among public sector agencies presents a significant obstacle to the development of renewable energy (RE) projects in Tanzania. Misaligned mandates, unclear roles, and inconsistent standards among entities such as TANESCO, REA, EWURA, and NEMC lead to delays in project implementation, inefficiencies, and missed opportunities for synergies. For example, there is a discrepancy between the codes and standards accepted by REA for mini-grid enterprises and standards accepted by TANESCO. Additionally, permit and approval processes, including those for environmental and energy licenses, are frequently prolonged due to what non-state actors describe as bureaucratic inefficiencies. Further complicating matters is the fragmentation and inaccessibility of energy-related data, which prevents informed decision-making and strategic investments. Energy data, critical for planning and deployment, is currently scattered across multiple agencies, leading to inconsistencies and duplication of efforts. Often, such efficiencies as signs of fragmented institutional frameworks.

With evidence of weak coordination among non-state actors and among public agencies, there is no surprise that there is insufficient communication between public agencies and the private sector, as mentioned earlier. Overall, these cumulated inefficiencies weaken collaboration and limit opportunities for scaling up RE initiatives.

SURVIVAL OF RE LOCAL SECTORS UNDER THE GLOBAL CONTEXT

A brief look at the bigger pictures – at a global level – should serve in further understanding policy limitations regarding local RE plans and capabilities. Access to affordable, reliable, sustainable and modern energy is the focus of Goal 7 of the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development adopted by the United Nations in 2015. Achieving this goal demands coordinated strategies between developing and developed countries in terms of capacity building to ensure that all benefits are realized by all nations. The implementation of this goal has followed the Global Value Chains (GVCs) approach, which aims to coordinate manufacturing activities across enterprises from around the world as part of a worldwide network (Lall 2003). The idea is that global producers of renewable energy products will collaborate with local enterprises in developing nations to produce renewable energy products by investing in local manufacturing, design, branding, or after-sales services, resulting in RE growth.

However, under GVCs, the reality is different. This is because, while a large number of renewable energy firms have established themselves in developing countries, including Tanzania, with the majority coming from industrialized countries, these firms rarely manufacture locally. Instead, they seek international markets for their manufactured products. The larger picture has industrialized countries positioned as manufacturers of RE products whereas developing countries are positioned as purchasers/recipients of those products, thus creating imbalanced power dynamics that do not favour advancing local capabilities in developing countries. This problem is not unique to Tanzania, and has been highlighted in recent research that describes it as 'anti-productivist bias' in the green transition economy (Behuria 2025). For instance, in many donor-funded agricultural initiatives focused on climate-smart agriculture in Tanzania, the advanced solar pumps, solar dryers, and other equipment are predominantly not manufactured in Tanzania. Instead, they are largely imported from industrialized countries. It is noteworthy that financing for such projects also often originates from the same countries, and comes with a strong preference for procuring the required goods from their home-based corporations. Consequently, foreign companies are not motivated to explore opportunities for investing in and establishing local manufacturing capabilities for cost-effective, RE solutions.

"First, does an activity or sector generate foreign exchange earnings (i.e., will it help relax the balance of payments constraint on growth)? Second, is it characterized by scope for rising labour productivity vis-ŕ-vis other sectors and activities?.... Third, will it create employment (directly and indirectly), especially for women? In particular, will it generate an increase in higher-productivity job opportunities relative to other projects that might benefit from state support? Fourth, will it help address the need for a non-inflationary supply of basic wage goods?"
(Cramer et al. 2020, p. 108)

The situation, described above, makes the likelihood of RE sectors in developing countries flourishing within the framework of GVCs low. This poses challenges to growth and expansion for local RE actors. Many local firms/enterprises act as representatives for foreign companies, focusing on the sale of renewable energy products and engaging in activities such as after-sale services, as shown in the previous sections.

This bigger picture does not mean that there is nothing to be done. It means, however, that local efforts to advance emerging sectors, such as RE, would have to push for alternatives to global economic trends—i.e. not very far from what is needed for other sectors related to industrial development aspirations in low-and-middle income countries.

RE actors in Tanzania – both state and non-state – need to align their efforts with proper strategies, incentives, and indicators, to edge the RE sub-sector forward. This paper highlights may need to be addressed towards achieving that alignment. The policy relevance of this paper may also extend to other countries in Africa with comparable circumstances to Tanzania. The RE sector in all those countries would benefit from clarifying sectoral, national, and regional strategies for promoting RE and enhancing local capabilities.

One of the main things that can be concluded, from research on the topic, is that there is a myriad of overlapping factors at play regarding RE as an emerging sub-sector in a country where the policy environment is painted by pressuring demands for extending energy accessibility by all available means and for rapid economic growth (and industrial development). This multipolicy of interacting factors makes it a complex-system problem and makes RE itself part of a bigger picture of local and regional challenges that cannot be addressed in isolation from each other. Policy packages that concern the improvement of RE contribution to meeting the sustainable development goals may need to address multiple levels of policy frameworks, such the sectoral (meso) level and the national (macro) level, while singular RE actors (agencies, enterprises, etc.) may also need to work on their organizational (micro) level. (see Figure 3).

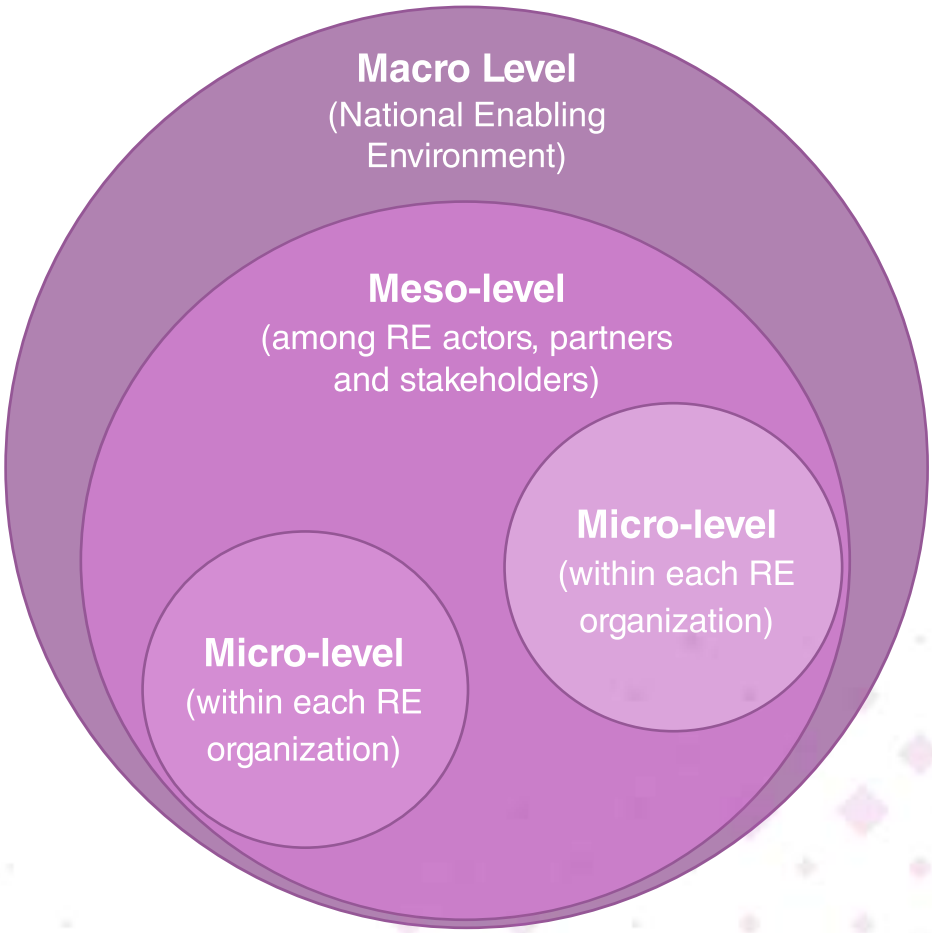

Figure 3: Multi-level Policy Map Adapted (with modificaitons) from: Sheikheldin 2021

Some of the areas that we recommend for policy considerations (at various levels):

Macro-level Policies

1) There should be well-articulated and operational policies that promote local content increase in RE technologies and incentivise partnerships between international and local firms. Such partnerships should involve sizable knowledge and skill transfer, to accelerate the growth of RE local enterprises. For example, implementing a public procurement policy that enhances domestic production of goods and services; introducing incentive schemes for local manufacturers; facilitating foreign direct investments in manufacturing of renewable energy products locally; and implementing customs and duties on imported goods that increase the competitiveness of local products in the domestic market; etc.

2) Non-state actors (firms, associations, NGOs, etc.) may find good space to contribute to RE transition, but only with the conducive enabling environment, fostered mainly by the public sector, and resulting from serious discussions between state and non-state actors to allocate roles and have a common understanding.

3) There should be clearer frameworks and programs that regulate how energy produced at household (off-grid), factory, and mini-grid levels can coexist with the national grid supply, and even integrate with it when circumstances demand so, to secure a sustainable future for RE as national grids expand and as further economic development happens.

4) Embedding the African Common Position on Energy Access and Just Transition, by the African Union, would help in synchronizing policies and implementations at the regional level, with African neighbouring countries, around energy issues in general and around sustainable transition to renewable energy options in particular.

Meso-level policies

5) In order to enhance the depth of backward linkages, we recommend building up the capacity of local solar companies to provide auxiliary components and services in the deployment value chains. This involves engaging local companies in downstream activities such as distributing solar components and offering balance-of-system services in large-scale solar-energy systems, including mini-grid constructions. Simultaneously, efforts should be made to build capacity for core solar-energy services and manufacturing.

6) It is essential to establish a comprehensive framework for inter-agency coordination, including unified standards and guidelines for RE projects. Centralizing energy data collection and management under a standardized system can ensure the availability of consistent and up-to-date information for decision-making.

7) Strengthening communication channels between public agencies and the private sector will foster greater trust and enable collaborative approaches to renewable energy development.

To achieve all the above, in good coordination, a clear national RE strategy, to get all RE actors on the same page, is needed as a prudent step, from the national authorities, and it would be a historical milestone towards mainstreaming RE in Tanzania. The strategy itself does not have to be final and rigid, but it should guide coordinated practice and evolve with it. Fortunately, we hear news that a national strategy will be released soon.

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