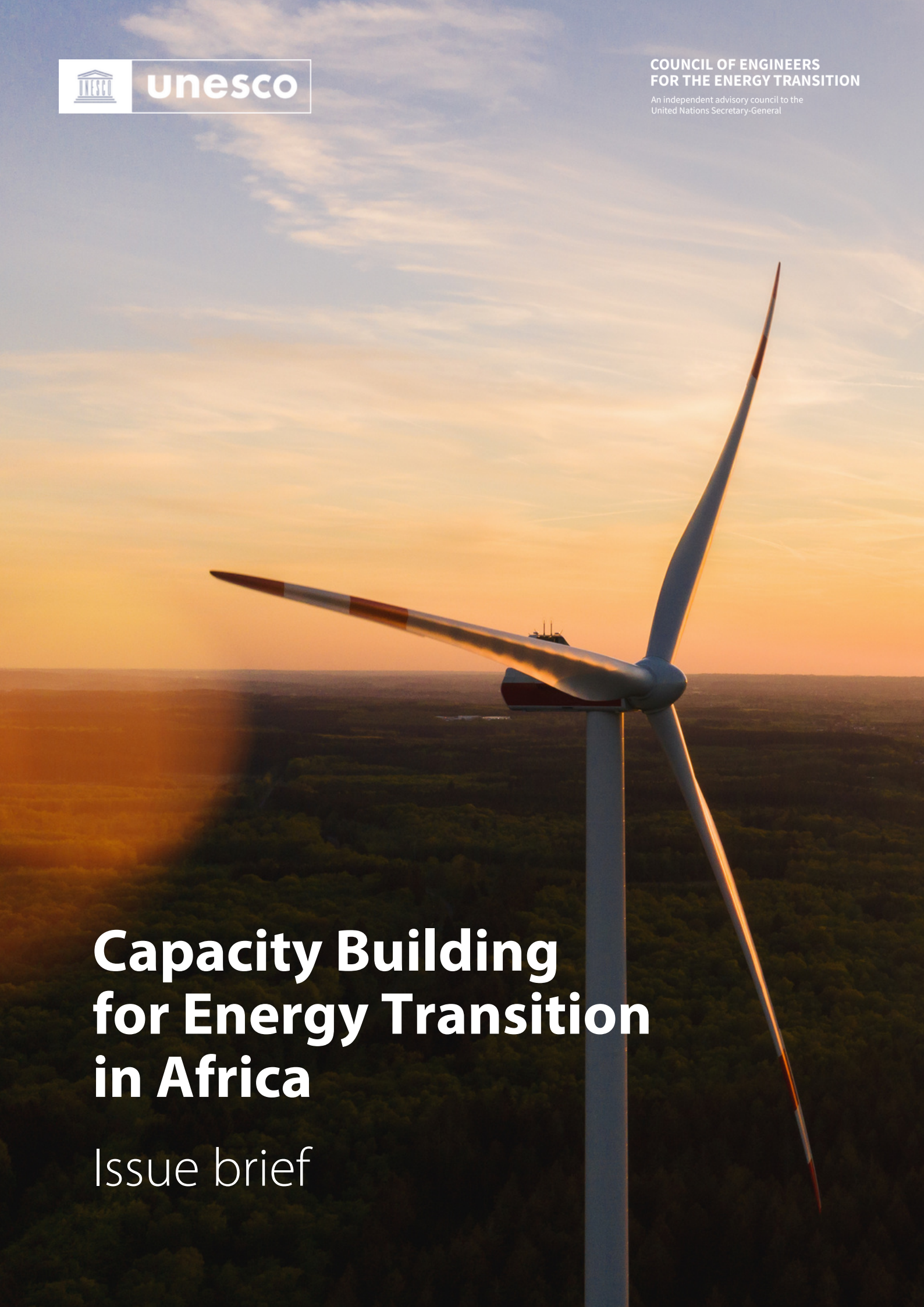




Capacity Building for Energy Transition in Africa

Issue brief

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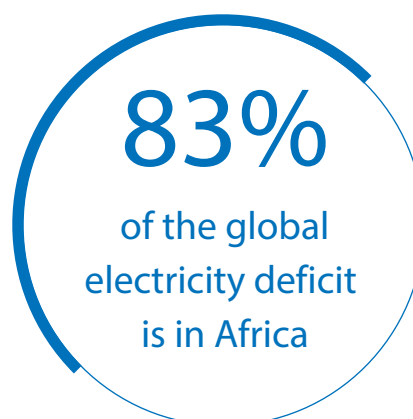
SHORT SUMMARY

Building local expertise to power Africa's energy transition

Africa's clean energy transition depends not only on infrastructure and finance, but on building a skilled local workforce. Despite vast renewable energy potential, the continent faces critical shortages of engineers, technicians, regulators, and project developers across the energy pipeline. Existing capacity-building efforts by governments, universities, and development partners remain fragmented and uneven, and must be better aligned with labor-market needs and continental planning frameworks.

The stakes are high: Africa represented a small share of global renewable energy jobs in 2023, yet could generate millions of green jobs by 2030. Realizing this requires coordinated action across education, vocational training, research, and entrepreneurship. This brief proposes five priority actions: creating a digital platform for sharing best practices; mapping the training ecosystem and critical skills gaps; aligning workforce development with the African Union's Continental Master Plan and the African Single Electricity Market; and ensuring youth and women are fully included.

Strengthening Africa's energy workforce is a strategic necessity - not a secondary concern.



Capacity Building for Energy Transition in Africa

Issue brief

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Editorial note:

UNESCO is the United Nations organization that promotes cooperation in education, science, culture and communication to foster peace worldwide. The Organization provides key services for its Member States, setting global norms and standards, developing tools for international cooperation, producing knowledge for public policies and building global networks of sites and institutions inscribed on its lists.

The Council of Engineers for the Energy Transition (CEET) is a global, high-level body of engineers and energy systems experts, created under the auspices of the United Nations Secretary-General, with the goal of building coalitions and energy pathways for comprehensive decarbonization. The CEET is co-chaired by the Sustainable Development Solutions Network (SDSN) and the United Nations Industrial Development Organization (UNIDO).

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1. Key messages

Accelerating Africa's (especially Sub-Saharan) pursuit of affordable, reliable, and sustainable clean energy requires building strong local expertise. This requires coordinated investment in education, training, and institutional capacity aligned with continental goals.

Five priority actions are proposed in this brief.

1. First, **create a digital platform** to showcase successful capacity-building initiatives, supported by indicators such as people trained, jobs created, and technologies deployed.
2. Second, **map the training ecosystem** to identify gaps and avoid duplication.
3. Third, **map critical skills for the energy transition** to match labor market demand.
4. Fourth, **align skills development with the African Union's Continental Master Plan**. Ensure that workforce development strategies directly support the long-term infrastructure and energy planning goals of the African Union, especially under the CMP and the African Single Electricity Market (AfSEM).
5. Finally, **mainstream youth and women's inclusion**.

Together, these actions aim to strengthen Africa's skilled and inclusive energy workforce.

It is recommended that activities be carried in partnership with relevant leading organizations, such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Programme (UNDP), African Union Commission, International Atomic Energy Agency (IAEA),

International Renewable Energy Agency (IRENA), World Bank, and others. Section 5.iii provides the complete list of suggested potential partners for each action area.

2. Background and Context

A successful energy transition may be defined as a timely shift towards an inclusive, affordable and secure energy system that sustainably addresses global challenges while creating value for business and society¹.

One of the major constraints to the African clean energy transition pathway is a shortage of an experienced local workforce and a supporting institutional ecosystem. Despite existing engineering capacity, these gaps are evident across the entire clean energy project pipeline. Engineering, business, and hands-on technical skills are required for every aspect of a clean energy project pipeline, including:

- Enhancing innovation on energy technologies (renewables and conventional).
- Informing and iterating on a robust clean energy regulatory framework.
- Running energy marketplaces and auctions.
- Attracting finance and designing alternative business models.
- Planning and building energy projects pipelines and value chains.
- Operating and maintaining energy facilities (including renewables).
- Building a robust and dynamic electricity sector (on-grid, smart mini-grids, and off-grid).

This brief aims to consolidate insights from

https://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Transition_2021.pdf

¹ World Economic Forum, *Fostering Effective Energy Transition 2021* (Geneva: 2021),

stakeholder interviews, review UNESCO's integrated approach to science, education, and capacity building, and examine existing initiatives across Africa and globally to draw out their shared experiences and trends, including:

- a. Skills gap assessment at regional, sub-regional, and national levels;
- b. Best practices for enhancing capacity building and skills development; and
- c. Institutional and ecosystem strengthening that aligns higher

education and Technical and Vocational Education and Training (TVET) programs with labor market needs.

We hope these reflections could be used to develop a framework and cooperation strategy that encourages cross-border learning and knowledge exchange, as well as to identify key research gaps.

Research Thesis

A key constraint on scaling renewables in Africa is the cost and complexity of project delivery, which is amplified by gaps in local technical and institutional capacity. Higher project capital costs and reliance on external expertise can reduce bankability and slow deployment. Addressing these gaps requires coordinated investment in workforce development across the project lifecycle, alongside measures that strengthen the enabling environment for implementation.^{2,3,4}

3. Introduction

According to Mission 300, 83% of the global electricity deficit is in Africa. To address this, the 2025 Mission 300 Africa Energy Summit brought together African Heads of State, private sector leaders, development partners, and civil society to broaden support for building electricity access across the continent. Led by

the World Bank and the African Development Bank, Mission 300 brings together governments from across Africa to define actionable steps for transforming the region's energy sector with the goal of providing energy access to 300 million Africans between 2025 and 2030⁵.

Africa currently makes up very few of the global renewable energy jobs, about 324,000 in 2023, compared to 16.2 million jobs worldwide⁶.

² International Energy Agency, *Financing Clean Energy in Africa* (Paris: International Energy Agency, 2023), <https://www.iea.org/reports/financing-clean-energy-in-africa/executive-summary>

³ International Energy Agency, "Doubling Energy Investment in Africa Requires Urgent Action to Bring Down Financing Costs and Boost Access to Capital," news release, September 6, 2023, <https://www.iea.org/news/doubling-energy-investment-in-africa-requires-urgent-action-to-bring-down-financing-costs-and-boost-access-to-capital>

⁴ Attia, Benjamin, "Top 10 Barriers to Utility-Scale Solar in Sub-Saharan Markets," *Energy for Growth Hub*, December 14, 2018, <https://energyforgrowth.org/article/top-10-barriers-to-utility-scale-solar-in-sub-saharan-markets/>

⁵ Mission 300 Africa Energy Summit, *Mission 300: Africa Energy Summit* (Dar es Salaam, Jan. 27–28, 2025), <https://mission300africa.org/energysummit/>

⁶ International Renewable Energy Agency (IRENA), "Highest Annual Growth of Renewables Jobs in 2023, Reaching 16.2 Million," press release, October 1, 2024,

Projections show that by 2030, Africa can create 3.3 million green jobs, including an estimated 1.7 million in the solar sector⁷, with 30% requiring vocational training and 10% requiring university education⁸. Notably, women hold 38% of solar energy jobs in Africa, surpassing traditional industries. However, realizing this job creation potential depends on the design and effectiveness of training programs that can equip the workforce with the necessary competencies.

While many organizations and institutions are engaged in energy-sector capacity building, current efforts are often fragmented and insufficient to meet the scale of the transition.

4. Insights from interviews with stakeholders

The purpose of this analysis, led by engineers from the Council of Engineers for the Transition (CEET), was to undertake a qualitative survey among training providers and clean energy implementers in Africa to propose ways to link top-down initiatives with bottom-up activities for accelerating clean energy pathways in the continent.

Over a period of nine months, a series of virtual interviews were conducted to assess the nature of existing training programs and identify related skills gaps. The insights gathered from these discussions with various stakeholders informed the development of the scoping

Most regional-level programs focus on modelling and energy planning, while national-level programs tend to concentrate on technical skills. Yet the demand for skills required across the entire clean energy value chain far exceeds what these programs currently deliver. Africa's challenges in executing programs with significant impact largely arise from systemic weaknesses at national, regional, and continental levels, as well as within institutions and among individuals.

An ecosystem for technical training solutions providing a wide range of programs designed to address the skills required in the rapidly developing technical environment is needed.

document.

Below is a summary of **key takeaways** from these interviews:

- a. The solar industry's capacity-building efforts, particularly when installing at small scale, are nearing saturation, limiting job creation. However, expanding the focus to include complementary systems, including battery storage production, installation, and management, presents significant opportunities. A broader value chain approach is necessary to maximize benefits, including the integration of critical materials. Similarly, scaling up wind energy and other renewable forms in Africa requires technical skills,

<https://www.irena.org/News/pressreleases/2024/Oct/Highest-Annual-Growth-of-Renewables-Jobs-in-2023-Reaching-16-point-2-Million>

⁷ FSD Africa, "New Research Suggests Africa's Green Economy Could Create More Than 3 Million Direct Jobs by 2030," press release, July 24, 2024, <https://fsdafrica.org/press-release/new-research-suggests-africas-green-economy-could-create->

[more-than-3-million-direct-jobs-by-2030/](https://www.reuters.com/sustainability/climate-energy/how-bridging-skills-gap-can-boost-africas-green-energy-transition-2024-11-19/)

⁸ Ben Payton, "How Bridging the Skills Gap Can Boost Africa's Green Energy Transition," *Reuters*, November 19, 2024, <https://www.reuters.com/sustainability/climate-energy/how-bridging-skills-gap-can-boost-africas-green-energy-transition-2024-11-19/>

education, policy support, community engagement, and financing. Key areas for development include wind resource assessment, energy planning, energy financing, regulatory frameworks, project management, grid integration, and energy storage.

- b. Local governments and municipalities, particularly in Africa, face significant challenges in supporting energy transition due to a lack of technical expertise, financial resources, and suitable policies. Many municipal policies are not fit for purpose, and without proper funding and support, the transition process becomes even more difficult. Additionally, workers' skepticism and resistance highlight the need for extensive education and awareness programs. To effectively engage in the transition, municipalities must develop capacity in technical expertise, financing, procurement, private-sector partnerships, and adopt a system-wide approach.
- c. Most policies are not currently fit for purpose. There is a need to identify and develop just transitions for municipalities in Africa. Government's overstructure makes it difficult for different departments to work with each other.
- d. Implementing community ownership models, wherein locals actively participate in the management and maintenance of these systems, might

enhance long-term sustainability. Building local expertise is essential for the enduring success of renewable energy installations. This entails training local technicians in the operation and maintenance of renewable energy systems while fostering partnerships with local enterprises and non-governmental organizations.

- e. It is challenging for training institutions to follow up with alumni. However, they do track particular people who do well in the industry.
- f. Training directly related to renewable energy includes solar photovoltaic (PV) training and energy efficiency audit technicians. In energy efficiency, most of the focus is on skills for renewable energy, with just about 12% on energy efficiency skills development. However, an energy-efficiency system could help accelerate access to electricity.
- g. Expanding and strengthening the role of universities and other relevant educational institutions in the training ecosystem is essential. Furthermore, specialized hubs can help to drive capacity development and are strengthened when integrated with certain industries. Examples from Brazil and Silicon Valley demonstrate how the Triple Helix Method of linking government, academia, and the private sector can bridge capacity gaps and drive technology development.

5. Insights from UNESCO's integrated approach to science, education and capacity building

Box 5.1: UNESCO's integrated approach to science, education and capacity building

Building on its longstanding emphasis on human capital, UNESCO's experience across 54 African Member States demonstrates that effective capacity building must integrate formal and non-formal education systems to create pathways from basic education through technical training to professional development. Locally led clean energy transitions depend on supportive investment climates, efficient regulation, and strong professional ecosystems. Sustainable capacity building must therefore align with clear regulatory and fiscal policies that attract private investment in renewables.

The education-energy nexus represents a critical but often overlooked dimension of this challenge. UNESCO finds that 32% of African school-aged children lack access to clean electricity, directly impacting educational quality and digital literacy development⁹. Higher education access is limited, with a gross enrollment rate of 9%, compared to a 43% global average. This creates a fundamental challenge for developing the skilled workforce needed for energy transitions, as quality education systems are essential for producing the engineers, technicians, and managers required for clean energy implementation. UNESCO addressed challenges relevant to capacity building for energy transition, as summarized in Table 1.

Table 1: Summary of UNESCO's initiatives contributing to capacity building for energy transition

Focus Area	Initiative	Description	Impact
Scientific and technical competencies	International Basic Sciences Programme	The programme demonstrates how capacity building must integrate theoretical knowledge with practical application, combining remote access to advanced research equipment with hands-on training opportunities ¹⁰ .	Builds deep technical expertise in physics, chemistry, and engineering essential for clean energy technologies.
	Global Renewable Energy Education and Training (GREET)	The Programme has historically addressed these challenges through comprehensive training	Provides valuable lessons for creating

⁹ Magda Moner-Girona, Fernando Fahl, Georgia Kakoulaki, Do-Hyung Kim, Iyke Maduako, Sándor Szabó, Godwell Nhamo, Benjamin K. Sovacool, and Daniel J. Weiss, "Empowering Quality Education through Sustainable and Equitable Electricity Access in African Schools," *Joule* 9, no. 2 (2025): Article 101804, [https://www.cell.com/joule/fulltext/S2542-4351\(24\)00540-3](https://www.cell.com/joule/fulltext/S2542-4351(24)00540-3)

¹⁰ United Nations Educational, Scientific and Cultural Organization (UNESCO), "UNESCO's Remote Access to Lab Equipment (UNESRALE) Initiative," <https://www.unesco.org/en/basic-sciences-engineering/remote-access>

		across four distinct axes: researchers, decision makers, engineers, and administrators ¹¹ .	coordinated capacity building frameworks that address the full spectrum of skills needed for energy transitions.
System-wide education strengthening	Operational Strategy for Priority Africa (2022–2029); Campus Africa Flagship Initiative	This initiative identifies renewable energy as a key focus, enhancing research, doctoral training, and technical higher education through regional offices, UNESCO Chairs, and partnerships.	Aligns education systems with labor market needs, offering joint research, doctoral mobility.
Green and inclusive education	Greening Education Partnership	provides a roadmap to help countries integrate climate change and sustainability across all levels of education.	Promotes climate literacy and prepares graduates for green jobs in emerging sectors.
	Green Skills in Higher Technical Education Initiative (CFIT Phase III with UNESCO-UNEVOC)	Promotes the integration of green and transversal skills into higher technical education programmes across Africa.	
Innovation and entrepreneurship	Innovative science and engineering-entrepreneurship bootcamps (e.g., HEXTECH)	These programs foster entrepreneurial thinking among young scientists and engineers, resulting in breakthrough innovations such as HEXTECH; a smart energy solution developed by bootcamp participants to address Africa's specific power challenges ¹² .	Uses capacity building to create innovation ecosystems that generate scalable, locally relevant energy solutions.
Technical and Vocational Education and Training (TVET)	UNESCO TVET Strategy 2022–2029; "Going Clean: TVET and the Green Energy Transition"	focuses on 'Transforming TVET for successful and just transitions,' directly addresses these capacity challenges by emphasizing skills development for empowerment and employability in emerging	Provides equitable and employable skills for green economy sectors, including women and youth.

¹¹ Oussama Benchikh, "UNESCO's Global Renewable Energy Education and Training Programme (GREET Programme)," *Science Forum*, 2004, https://www.fvee.de/wp-content/uploads/2022/03/sf2004_03_02.pdf

¹² United Nations Educational, Scientific and Cultural Organization (UNESCO), "Smart Energy for a Smarter Future: HEXTECH Tackling Africa's Power Challenges," *UNESCO*, May 15, 2025, <https://www.unesco.org/en/articles/smart-energy-smarter-future-hextech-tackling-africas-power-challenges>

		green economy sectors. Beyond technical skills, these include social equity, gender inclusion, and community empowerment, in addition to employability through curriculum reform, quality assurance, and partnerships.	
Higher education and research, development, and innovation (RDI) systems	Campus Africa	Capacity building here is about upskilling learners and improving the employability of graduates; however, the initiative implements this work at a higher-education institutional and systems level. It links higher education, research, and employment; promotes data collection, quality assurance, and academia–industry collaboration.	Improves employability and strengthens Africa’s local research and innovation capacity.
Knowledge sharing and collaboration	UNESCO Recommendation on Open Science	This approach is particularly relevant for energy transitions, where rapid dissemination of research findings, best practices, and technical innovations can significantly accelerate learning curves and reduce development costs ¹³ .	Accelerates learning, reduces development costs, and enhances Africa’s participation in global knowledge systems.

6. Insights from other capacity-building initiatives for energy transition

In addition to what UNESCO’s work illustrated in Box 3.1, there are many initiatives developed at local, national, regional, or continental level that have been trying to address skill gaps by connecting large research centers, young

professionals, industry stakeholders, and government entities to foster a robust program and pathway to a clean energy career.

This document does not claim to provide a comprehensive inventory of initiatives, as they are too numerous to be covered here. We have chosen to cite a few examples that illustrate the diversity of approaches and the range of stakeholders involved. See **Appendix: Examples of capacity-building and skills development**

¹³ United Nations Educational, Scientific and Cultural Organization (UNESCO), *UNESCO Recommendation on Open Science*, 41 C/Res 25 (2021), <https://www.unesco.org/en/open-science>

programs in energy for further details.

i. Programs from International Agencies: IAEA, IRENA, World Bank

The International Atomic Energy Agency (IAEA) contributes to capacity-building in Africa, through:

- a) System analysis and planning, helping countries develop national energy provision of tools, methodologies, and training programs for energy strategies;
- b) Support for countries considering nuclear energy, such as the “SMR School” to inform about small modular reactors (SMR) and the development of safe and secure nuclear infrastructure.
- c) Collaboration with regional bodies like the African Commission on Nuclear Energy and the Forum of Nuclear Regulatory Bodies in Africa to harmonize regulatory frameworks and strengthen oversight capacities.
- d) Regional projects in cooperation with AFRA (African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology) focused on energy analysis and planning capacity development; and
- e) Participation as a modeling partner, alongside IRENA, in support of the African Union’s Continental Master Plan for power systems. The work was done by the AUDA-NEPAD experts, who received capacity building.

The International Renewable Energy Agency (IRENA) supports capacity-building in Africa, particularly through:

- a) Programs for energy planning and modeling to improve national

institutional capacities;

- b) Regional initiatives like the Africa Clean Energy Corridor (ACEC) and the West Africa Clean Energy Corridor (WACEC), with integrated capacity-building for planning, operation, and grid maintenance; and
- c) Support for the Accelerated Partnership for Renewables in Africa (APRA), to mobilize funding, provide technical assistance, and build capacity.

The World Bank supports capacity-building in Africa through its Scaling Solar program, which helps governments develop large-scale solar projects by:

- a) Providing technical assistance for project preparation, including site assessment, regulatory support, and standardized documentation to strengthen institutional capacity;
- b) Implementing transparent and streamlined competitive procurement processes that build government expertise in tendering, project structuring, and contract management;
- c) Offering integrated financing and risk-mitigation instruments that help local institutions understand and adopt best practices for mobilizing private investment; and
- d) Creating replicable frameworks that enable countries to scale future solar projects more efficiently, contributing to long-term energy planning and capacity development.

ii. University Program: example of Strathmore University

Strathmore University is actively contributing to

capacity building for the energy transition through a range of targeted training programs, including Solar PV training at levels T1/T2 (focused on systems below 250Wp, primarily for solar home systems), grid-tied and hybrid solar PV systems, solar water heating, and energy management. The university is also developing new programs such as a clean cooking course and an improved cookstove training program, with the latter's curriculum in its final stages. Additionally, Strathmore offers customized renewable energy training tailored to specific audiences. An example of this is a basic renewable energy course designed for county energy champions in Kenya.

In addition, Strathmore University has strengthened its role in renewable energy capacity building through strategic partnerships. It has signed an agreement with the National Industrial Training Authority (NITA) in Kenya to offer certified training in renewable energy. Furthermore, the university has entered into memoranda of understanding with the Energy and Petroleum Regulatory Authority (EPRA) and the Africa Minigrid Developers Association (AMDA), fostering collaboration in advancing training, policy support, and practical implementation within the energy transition space.

iii. Just Energy Transition Partnerships

In South Africa, Senegal, and Indonesia, these international partnerships mobilize funding and technical assistance to ensure a fair energy transition, with a strong focus on skills development for workers in affected sectors and the creation of opportunities in clean energy value chains.

iv. Regional initiatives

"Desert to Power" Initiative (G5 Sahel) led by the African Development Bank, aims to make the

Sahel a solar power hub, with capacity-building as a cross-cutting objective for the design, installation, and maintenance of solar systems, including mini-grids.

v. Entrepreneurship Support Programs

Initiatives such as Meet Africa, Energy Generation, and RAISE Africa target entrepreneurs, including those from the diaspora, by offering training, mentoring, and financing to launch and grow businesses in the renewable energy sector.

vi. Key takeaways from existing initiatives

These programs demonstrate **a diverse range of approaches** tailored to the specific contexts and goals of each initiative. Notable insights include:

- **Multi-stakeholder approach:** They often involve bringing together governments, private sector, academic institutions, and international organizations to address the skills gap.
- **Demand-led skilling:** Models, such as South Africa's JET SEP, ensure that training programs are aligned with the actual needs of the job market which enhances the employability of participants.
- **Inclusion of underrepresented populations:** Targeted programs focusing on specific demographic groups, such as women and youth, promote inclusivity and ensure that the benefits of the energy transition are shared broadly.
- **Scalable national programs:** Large initiatives, such as Indonesia's Prakerja, demonstrate the potential to reach a wide segment of the population and equip them with skills relevant to the

green economy.

- **Varied program duration:** Program length can vary from short-term workshops and certification courses to longer-term vocational training and academic programs.
- **Need for better data and evaluation metrics:** More data collection and long-term impact studies are needed to fully understand the effectiveness of these initiatives in driving employment and skills development in the renewable energy sector.

7. Conclusion: recommendations and a call to action

i. Recommendations

To effectively advance Africa's transition to a low-carbon energy future, the following recommendations identify priority areas for action, spanning workforce development, institutional reform, business-model innovation, and regional collaboration.

Address systemic skills gaps and align stakeholders:

Africa faces a variety of challenges in transitioning to a low-carbon energy system, including the skill gap. The Mission 300 initiative, through the Africa Energy Summit, was established to address the issue of energy access by bringing together governments to define actionable steps to accelerate electricity access -- which is both a major challenge and an opportunity to transform the region's energy sector. Although several efforts have been implemented to build capacity, they might not yet be achieving this goal at the scale required for a successful transition. Therefore, **there is a need to map out the exact skill gap that is required for the transition.** The interconnected roles of academia, the private sector, and the

government in cultivating a robust clean energy workforce are critical. To meet Sustainable Development Goal 7 (Affordable and Clean Energy), Africa must address these gaps and explore ways to accelerate sustainable clean energy pathways. Furthermore, the definition of "skills" should include sustainable construction, circular economy, agroecology, e-mobility, water resource management, green entrepreneurship, digital skills needed for achieving SDG7.

Strengthen enabling business environments alongside capacity building:

It is imperative to recognize that **capacity building alone might not be the only bottleneck** in Africa's energy transition. Supplemental international and business efforts are needed to address other factors that could accelerate progress. African expertise can increase significantly when projects are properly developed and executed. However, regardless of the investment in training and capacity building, these efforts will not result in tangible changes and impact if the business environment surrounding these projects remains stagnant. Once there is a dynamic and supportive environment, then the local expertise may develop naturally. In such an environment, private companies will be more likely to invest or sponsor capacity-building programs because they rely on skilled, local personnel to develop their business. Experience shows that theoretical learning is not enough; there is a need for hands-on experience for people to truly build capacity. At the same time, effective business models must be adapted and designed specifically for African markets, where many utilities, as the main offtakers, operate in a weakened financial state. To ensure project viability and enable both infrastructure development and local skill growth, financial flows must support risk-mitigation instruments (such as Partial Risk Guarantees (PRGs) and Project Credit Obligation Agreements (PCOAs))

and the preparation of essential infrastructure, including transmission lines. When these efforts, coupled with capacity building trainings, are implemented, it will enable and allow for both infrastructure development and the growth of local expertise.

Frame capacity building within the triple transition (green, digital, and social): Capacity building programs should be framed within the triple transition—green, digital, and social—to ensure inclusivity, relevance, and future-proof skills development.

Develop targeted actions for priority groups: There should be dedicated actions to identify and tailor training approaches for target segments including youth, women, transitioning workers, educators, policymakers, entrepreneurs, and community leaders.

Promote effective teaching methodologies: Effective teaching methodologies should be developed such as project-based learning, blended/mobile learning, peer mentorship, micro-certifications, and community-based training suited to African contexts.

Strengthen Education System Integration for Energy Transitions: Develop comprehensive frameworks for integrating clean energy education across all levels of formal education systems, from primary school science curricula through university engineering programs. This includes establishing clean energy education standards, developing age-appropriate learning materials, and training educators to deliver quality clean energy education.

Modernize TVET Systems with Industry 4.0 Capabilities: Implement systematic approaches to modernizing TVET systems for clean energy transitions, including competency-based curriculum development, industry-education

partnerships, quality assurance mechanisms, and regional coordination frameworks. This requires investment in TVET infrastructure, instructor training, and equipment procurement to ensure training programs meet international standards while addressing local energy sector needs.

Promote open science and Remote Access to Advanced Infrastructure: Leverage UNESCO's Recommendation on Open Science and innovative programs like [UNESRALE](#) to facilitate knowledge sharing, collaborative research, and remote access to expensive laboratory equipment. This approach enables developing countries to access cutting-edge research facilities and participate in global scientific collaborations without requiring massive infrastructure investments.

Establish Regional Centers of Excellence: Create specialized regional centers following UNESCO's Category 2 Centre model and UNITWIN Networks to provide localized capacity building, technology transfer, and research coordination. These centers should focus on specific energy technologies relevant to regional resources and needs while maintaining connections to global knowledge networks.

Promote upskilling and reskilling: As seen in previous transitions, sustaining a skilled workforce is essential for economic resilience and technological progress. Emerging clean energy industries will require a higher share of skilled employees, making targeted upskilling and reskilling for existing workers vital, in conjunction with new education and training programmes. With other energy and industrial sectors facing major shifts, it is important to retain capacity while redeploying sector-specific expertise into clean energy, enabling diversification and safeguarding livelihoods.

ii. Call to action: develop a strong local expertise for energy in Africa

As discussed above, building strong local expertise is central to Africa's energy transition. This requires coordinated investment in education, training, and institutional capacity aligned with continental goals. Five priority actions are proposed in Figure 1 below.

CALL TO ACTION :

Develop a strong local expertise for energy in Africa

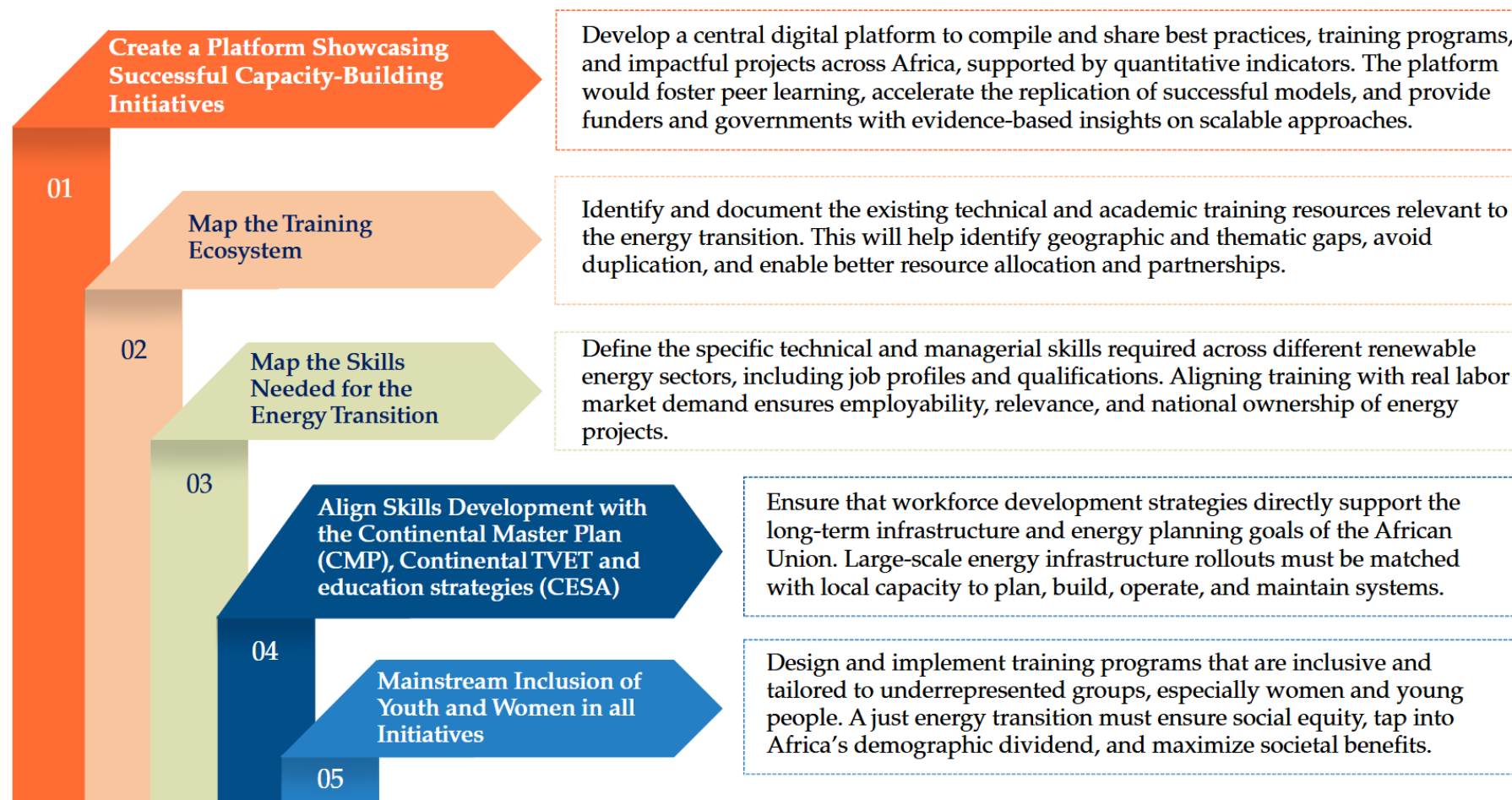


Figure 1: Proposed five priority actions for strengthen local capacities for energy transition in Africa

1. Create a Platform Showcasing Successful Capacity-Building Initiatives

- **Objective:** Develop a central digital platform that compiles and shares best practices, training programs, and impactful projects across Africa, with quantitative results (e.g. number of people trained, jobs created, technologies deployed).
- **Why:** This will promote peer learning, accelerate replication of successful models, and inform funders and governments of scalable approaches.
- **Potential Partners** (examples but open to others):
 - UNESCO –Experience on building such Platform (ex : Open and Inclusive Science Hub)
 - IAEA- Sectoral expertise, tools and data
 - IRENA – Sectoral expertise and data on energy skills
 - UNDP – Support for innovation diffusion and visibility
 - AUDA-NEPAD – Alignment with African priorities and initiatives

2. Map the Training Ecosystem

- **Objective:** Identify and document the existing technical and academic training resources (centers, universities, online platforms, centers of excellence, etc.) relevant to the energy transition.
- **Why:** This will help identify geographic and thematic gaps, avoid duplication, and enable better resource allocation and partnerships.
- **Potential Partners** (examples but open to others):
 - UNESCO – Sharing knowledge and coordination
 - IAEA -Sharing knowledge and

coordination

- World Bank – Methodology and data analysis experience
- African Union / AUDA-NEPAD – Strategic coordination

3. Map the Skills Needed for the Energy Transition

- **Objective:** Define the specific technical and managerial skills required across different renewable energy sectors (solar, wind, grids, hydrogen, etc.), including job profiles and qualifications.
- **Why:** Aligning training with real labor market demand ensures employability, relevance, and national ownership of energy projects. **It is recommended that an exact map be made out of** these skills required to match the scale of efforts needed for the energy transition. This will provide the basis for institutions in Africa on what skills should be prioritized to be able to transition in a just and equitable way within the continent.
- **Potential Partners** (examples but open to others):
 - World Bank / IFC – Proven expertise in green jobs diagnostics
 - ILO – Frameworks for green jobs and labor standards
 - IRENA – Workforce planning based on energy scenarios

4. Align Skills Development with the Continental Master Plan (CMP), Continental TVET and education strategies (CESA)

- **Objective:** Ensure that workforce development strategies directly support the long-term infrastructure and energy planning goals of the African Union, especially under the CMP and the African Single Electricity Market (AfSEM).

- **Why:** Large-scale energy infrastructure rollouts must be matched with local capacity to plan, build, operate, and maintain systems.
- **Potential Partners** (*examples but open to others*):
 - African Union Commission – Leadership on CMP implementation
 - AfDB – Project finance and technical support
 - IRENA and IAEA – Strategic planning and modeling support

5. Mainstream Inclusion of Youth and Women in all Initiatives

- **Objective:** Design and implement training

programs that are inclusive and tailored to underrepresented groups, especially women and young people.

- **Why:** A just energy transition must ensure social equity, tap into Africa's demographic dividend, and maximize societal benefits.
- **Potential Partners** (*examples but open to others*):
 - ILO – Gender- and youth-inclusive labor frameworks
 - UN Women – Equity-driven policy design
 - Meet Africa / RAISE Africa / Energy Generation – Inclusive entrepreneurship and technical support

Appendix: Examples of capacity-building and skills development programs in energy

Just Energy Transition Partnership (South Africa, Senegal, Indonesia)

Just Energy Transition Partnerships (JETPs) are international agreements designed to support climate action in emerging and developing economies that are heavily reliant on fossil fuels. These partnerships involve a coalition of countries committing to mobilize significant financial and technical resources to help partner countries accelerate their transition to clean energy while ensuring that the social and economic consequences of this shift are addressed in a just and equitable manner. Skills development is a critical component of these partnerships, as it is essential for creating new economic opportunities in green sectors and supporting workers and communities affected by the phase-out of fossil fuel industries.

South Africa: Building a Skilled Workforce for a Just Transition from Coal

South Africa's Just Energy Transition Partnership (JETP), launched at COP26 in 2021, marks a significant step in the country's efforts to decarbonize its economy, particularly its electricity system, which is heavily reliant on coal. The JETP aims to support South Africa in achieving its emissions reduction targets while fostering economic diversification, industrial growth, and job creation in new green sectors. Recognizing that a skilled workforce is paramount to achieving these goals, the JETP framework includes a strong emphasis on skills development and training initiatives to ensure a just transition for workers and communities impacted by the shift away from coal.

Several key skills development programs are underway in South Africa to support this

transition.

Just Energy Transition Skilling for Employment (JET SEP)

The JET Skilling for Employment Program is a coordinated private sector effort in South Africa aimed at proactively preparing the workforce for the significant energy transition anticipated over the next three decades, as outlined in the Integrated Resource Plan (IRP) 2023. This plan projects a substantial increase in renewable energy capacity, necessitating a workforce equipped with the skills to support this growth. JET SEP recognizes that many of the emerging job opportunities in the clean energy sector and related green value chains will require skills that are currently lacking in South Africa. Launched in April 2024, the program coordinates private sector initiatives to accelerate workforce preparation in alignment with the government's JET Skilling Implementation Plan. Its primary objective is to contribute to equipping the South African workforce by aligning the private sector's approach with the demand for skills in emerging jobs related to the Just Energy Transition. JET SEP targets the broader South African workforce, including vulnerable workers and communities that may be disproportionately affected by the transition from coal. The program focuses on demand-led skilling for emerging jobs in key green economy sectors such as Electric Vehicles, Green Hydrogen, and Renewable Energy & Transmission. By focusing on skills that are in demand, JET SEP aims to create pathways to employment in the green economy, thereby mitigating potential job losses in the coal sector. The program operates in three phases, with the initial phase focused on mobilizing private sector support, providing recommendations on the skills ecosystem, developing a skills and jobs gap fact-base, and establishing a pipeline of interventions.

AWEaP Just Energy Transition Skills Development Programme

The African Women in Energy and Power (AWEaP) has designed a Just Energy Transition (JET) Skills Development Program specifically targeting women in the power and energy sector. The program aims to empower women leaders, managers, and operators with the knowledge and skills necessary to create, drive, and execute local just energy transition strategies and initiatives. By doing so, it intends to stimulate micro-economies and provide market access for companies owned and led by women, youth, and persons with disabilities. The first phase of the program specifically targets municipal officials and electricity utility officials in South Africa, with an initial focus on the Mpumalanga province, a region heavily reliant on coal. The academic component of the program is delivered by the Wits Business School African Energy Leadership Centre (AELC). The curriculum is designed to equip delegates with the knowledge required to design and implement inclusive JET strategies and initiatives at the local level. USAID Power Africa provides full tuition funding for 40 delegates in the first phase, prioritizing municipal women leaders, managers, and operators, with a significant number coming from Mpumalanga. This program directly addresses the gender imbalance in the energy sector and aims to ensure that women play a central role in shaping and leading the energy transition in their communities and organizations. By focusing on women in municipal utilities, the program targets a critical area for implementing local energy transition strategies and promoting inclusive economic development.

GIZ Career Path Development for Employment (CPD4E)

The GIZ Career Path Development for Employment (CPD4E) project is a collaborative initiative designed to address the interconnected challenges of high youth unemployment and the transition to a low-carbon economy in South Africa. The project is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and co-financed by the Swiss State Secretariat for Economic Affairs (SECO). It adopts an integrated approach to employment promotion, focusing on both the supply and demand sides of the labor market, active labor market policies, and conducive framework conditions. CPD4E targets young South Africans, particularly unemployed individuals and new entrants to the labor market, as well as Small, Medium and Micro-sized Enterprises (SMMEs) operating or with the potential to operate in low-carbon economic sectors. The project offers needs-oriented vocational training and supports the professional development of lecturers in sectors relevant to the Just Energy Transition. It also provides support to start-up entrepreneurs and existing SMMEs to enable them to create jobs in green sectors. Furthermore, CPD4E includes gender-sensitive approaches to support young women in accessing the job market and securing livelihoods. In collaboration with the International Labor Organization (ILO), the project develops and implements skills programs for population groups adversely affected by the structural changes in the energy sector. It also partners with the United Nations Development Program (UNDP) to upskill unemployed young female electricians in the coal-rich Mpumalanga region in renewable energy technologies and entrepreneurship.

Eskom Just Energy Transition Project (EJETP)

The Eskom Just Energy Transition Project (EJETP) is a \$497 million initiative approved by the World Bank Group in November 2022 to

support South Africa's public energy utility, Eskom, in its transition away from coal. A key component of this project includes skills training for workers at a coal-fired power plant, which will be decommissioned and repurposed with renewable energy and battery storage. The project will provide coal workers with a combination of measures, including transfers to other Eskom projects, reskilling and upskilling for deployment to the new renewable energy plants, and voluntary separation packages for those choosing to leave the coal sector. Additionally, a significant portion of the project financing, \$47.5 million, is dedicated to the socio-economic component, which includes skills training for local communities and workers in areas such as agriculture, local manufacturing, and digital technology. The EJETP also aims to build in-house technical capacity within Eskom for future repurposing projects and the renewable energy component. These activities are expected to benefit approximately 15,000 people, including the Komati workers receiving transition support. The implementation of these skills training programs will be coordinated with local government, civil society organizations, and the private sector to maximize benefits and ensure a transformative impact on the region.

Senegal: Investing in Renewable Energy Expertise for Universal Access

Senegal's Just Energy Transition Partnership (JETP), launched in June 2023, focuses on expanding the country's renewable energy capacity and achieving universal access to electricity while promoting green economic growth. Unlike South Africa and Indonesia, Senegal's energy mix is not heavily reliant on coal; instead, the JETP aims to accelerate the deployment of renewable energy.

Senegal's JETP explicitly emphasizes the

importance of innovation and technology integration to drive its energy transition. With support from the International Partners Group (IPG), the partnership aims to foster the development of training programs and research and development initiatives in renewable energy technologies. This includes efforts to build local capacity in equipment manufacturing, strengthen and modernize the electricity grid, enhance electricity storage capacities, improve energy efficiency, and develop capabilities for the production of green hydrogen. The JETP also aims to support Senegal's ambition to become a regional hub for renewable energy innovation through these training and research efforts. This focus on building local expertise in advanced renewable energy technologies and grid infrastructure is essential for Senegal to achieve its ambitious renewable energy targets and ensure a sustainable energy future.

Renewable energy research program at the Polytechnic School of Dakar in partnership with IDRC Canada and Meridiam

Since February 2019, the Polytechnic School of Dakar has been implementing a major renewable energy research program in West Africa in collaboration with IDRC (International Development Research Centre) Canada and Meridiam, a French investment firm. This program delivers short-term qualification certificates to students, engineers, and technicians in the energy sector who wish to specialize in renewable energy. The initial phase of the program focused on setting up a Solar Systems Testing Centre and included the training of technicians and senior staff in renewable energy technologies. By 2021, the program had trained 100 technicians and 100 officers.

Senelec training programs in partnership with

various organizations

Senelec, Senegal's national electricity company, has actively engaged in various training programs in partnership with international organizations to enhance its capacity in renewable energy integration and grid management. In 2023, Senelec partnered with IRENA (International Renewable Energy Agency) and GIZ to implement a training program focused on building capacity in long-term energy planning among public institutions in Senegal's energy sector. USEA (United States Energy Association) and USAID have also collaborated with Senelec to provide training on power system modeling and network analysis. Additionally, Tata Power Delhi Distribution Ltd conducted a training program for Senelec officials on best practices in smart metering. The French Development Agency (AFD) has also supported Senelec in implementing a training program focused on renewable energy integration into the power grid.

Indonesia: Equipping the Workforce for a Low-Carbon Energy Future

Indonesia's Just Energy Transition Partnership (JETP), announced in November 2022, aims to accelerate the country's energy transition by peaking power sector emissions by 2030 and achieving net-zero emissions in the power sector by 2050. As the largest economy in Southeast Asia with a significant reliance on coal for electricity generation, Indonesia's energy transition has substantial global implications. Skills development is a key priority within the JETP to ensure a just transition for workers and communities affected by the phase-down of coal and to build the workforce needed for the expansion of renewable energy and other green sectors.

Energy Transition Acceleration Program (ETAP)

In partnership between KfW and PT PLN, the

Energy Transition Acceleration Program (ETAP) is a collaborative effort between KfW Development Bank and PT PLN, Indonesia's state-owned energy provider. Launched in January 2024 and spanning until December 2028, ETAP aims to support PLN in successfully shaping and accelerating the just energy transition in Indonesia. The program focuses on strengthening the personnel and technical capacities of PT PLN in two key areas: mainstreaming environmental and social management in line with international standards and expanding technical and personnel capacities regarding the implementation of geothermal energy projects. The target beneficiaries are PLN employees working in these priority areas, and their capacities will be enhanced through a combination of training courses, on-the-job training, and other measures, in close cooperation with PLN's own university (PLN Pusdiklat). This program directly addresses the capacity-building needs of Indonesia's primary energy provider, equipping its workforce with the necessary skills to navigate the environmental, social, and technical aspects of the energy transition, particularly in the development of geothermal energy, a significant renewable resource for the country.

Renewable Energy for Electrification Programme Phase II (REEP2)

The 1,000 Islands – Renewable Energy for Electrification Programme Phase II (REEP2) is a project implemented by GIZ. Running from January 2021 to December 2024, REEP2 focuses on improving the institutional, regulatory, and technical conditions for achieving Indonesia's policy target of 23% renewable energy by 2025 at the national and regional levels. A key aspect of REEP2 is its support for PLN (Indonesia's state-owned electricity provider) in power system planning and operation with high shares of variable renewables. This support includes

providing technical training to PLN in assessing the local grid's capacities to incorporate higher shares of variable renewable energy in PLN's in-house institutes. The ultimate goal of this training is to help PLN replace fossil fuel options with renewable energy sources. These training programs are integrated into PLN's in-house training institute to distribute skills and knowledge across the PLN corporation. REEP2 adopts a comprehensive approach by combining policy advisory work for renewable energy regulation with the demonstration of innovative renewable energy solutions in selected regions, focusing on Sulawesi, East Nusa Tenggara (NTT), and Bangka Belitung.

Indonesia Prakerja program, a large-scale skill development program including green skills training

Launched in April 2020, is a large-scale skill development initiative by the Indonesian government aimed at enhancing the competencies, productivity, and competitiveness of the workforce, as well as encouraging entrepreneurship through skilling, reskilling, and upskilling. With over 17.5 million beneficiaries trained, the program plays a critical role in preparing the Indonesian workforce for the future, including the transition to a green economy. Prakerja offers a wide range of online and offline training courses across various sectors, including a growing number of "green skills" training modules. These green skills courses cover areas such as sustainability reporting, carbon accounting, renewable energy technologies, environmentally friendly fertilizers, and waste management. The program partners with numerous training institutions and utilizes digital platforms to provide flexible and accessible learning opportunities. The program's emphasis on adapting to labor market trends and fostering partnerships with multi-stakeholders ensures its relevance to the evolving skills needs of the green economy.

Desert to Power Initiative (G5 Sahel): Training for Sahel electrification

The Desert to Power Initiative, led by the African Development Bank, aims to transform the Sahel region into a solar energy powerhouse, providing clean electricity to 250 million people across eleven countries, including the G5 Sahel nations: Burkina Faso, Chad, Mali, Mauritania, and Niger. Recognizing that a skilled workforce is essential for achieving this ambitious goal, the initiative incorporates various training programs focused on supporting Sahel electrification and the broader adoption of renewable energy. Capacity building is a cross-cutting objective integrated across all five priority areas of intervention, which include expanding grid-connected solar power generation, strengthening national and regional grids, deploying decentralized energy solutions, improving the financial and operational capacity of power utilities, and strengthening the enabling environment for private sector investments.

Mini-grid Training for Energy Professionals in the G5 Sahel countries

In collaboration with the African Development Bank, the RES4Africa Foundation launched a specialized mini-grid training program specifically for energy professionals in the G5 Sahel countries (Burkina Faso, Chad, Mali, Mauritania, and Niger). This online training program focuses on decentralized renewable energy systems, covering key aspects such as site selection, engineering design, and practical implementation. The program includes theoretical lessons, collaborative working groups, and opportunities to learn from practical experiences in local power plants.

West Africa Regional Energy Program (WAREP) Phase 1

Implemented by the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) with funding from the AfDB, WAREP Phase 1 includes a dedicated Capacity Building and Certification Program. This program targets technicians, craftsmen, and other stakeholders within the Economic Community of West African States (ECOWAS) region and focuses on developing the skills necessary for the design, installation, and inspection of clean mini-grids. Key activities include the development of training modules on mini-grid technologies, regional training programs for trainers, and national training sessions for developers, designers, and promoters of clean mini-grids.

MEET Africa Program

The MEET Africa program supports diaspora entrepreneurship between Europe and Africa, aiming to encourage the creation of sustainable businesses and jobs in Africa by mobilizing the talents and resources of African diasporas. The program operates in five partner countries: Cameroon, Ivory Coast, Morocco, Senegal, and Tunisia, and includes training and mentoring components for entrepreneurs in the renewable energy sector. It provides support to diaspora entrepreneurs, including technical assistance, financing, coaching, workshops, and training on various aspects of business development, such as developing a business model, drafting a business plan, navigating legal structures, and fundraising. The program also facilitates networking opportunities through B-to-B events and connections with support players in both Europe and Africa. Furthermore, MEET Africa offers seed funding to entrepreneurs with mature projects to help accelerate their development and mobilize additional financing.

Energy Generation Solar Entrepreneurship Training Program

Energy Generation, a pan-African organization,

offers a ten-month Solar Entrepreneurship Training Program aimed at training and supporting young Africans in becoming solar entrepreneurs. This program combines technical courses on the installation and maintenance of photovoltaic solar panels with entrepreneurship courses focused on business setup and management. The technical course includes different levels of training, from basic installation to more advanced system design, and provides participants with individual safety tools and a technical certificate. The entrepreneurship course covers topics such as introduction to entrepreneurship, business planning, and financial management, culminating in an entrepreneurial certificate. The program also offers the possibility of an internship and seed funding for promising entrepreneurs.

RAISEAfrica - Renewables Accelerators for Innovative Startups and Entrepreneurs in Africa

The RES4Africa Foundation has launched RAISEAfrica, a program designed to support and scale up renewable energy-focused projects within the African startup ecosystem. This initiative includes both pre-acceleration and acceleration programs targeting young African entrepreneurs (aged 18-35) with innovative ideas in the renewable energy sector. The program provides a range of support services, including mentoring and coaching from experienced professionals, networking opportunities with industry players and investors, increased visibility for their startups, and support in fundraising. RAISEAfrica aims to empower young talents and innovators by providing them with the opportunities and platform to develop and scale their renewable energy businesses, ultimately contributing to the acceleration of the energy transition in Africa.

Scaling Solar - Zambia

Scaling Solar is a World Bank Group initiative

designed to make it faster, easier, and cheaper for developing countries to procure utility-sized private solar power. Zambia was one of the first countries to participate in this program, which has resulted in the development of several large-scale solar projects. While the primary focus of Scaling Solar is on project procurement and financing, some initiatives within the program in Zambia have also emphasized local capacity building and skills development in the solar energy sector.

GET FiT (Global Energy Transfer Feed-in Tariff) - Zambia

The GET FiT Zambia program, which facilitated the procurement of 120MW of solar energy in the country, includes specific requirements for winning projects to implement local capacity building and training components. These requirements mandate that developers establish trainee programs, hiring and training local university graduates in renewable energy project development through active involvement throughout the project lifecycle. Furthermore, the program encourages partnerships between the developers and local educational institutions, such as the University of Zambia (UNZA) Solar Centre of Excellency, to host workshops and equip students with the knowledge and skills needed to develop and execute renewable energy projects. This focus on local capacity building aims to ensure that

Zambia develops a skilled workforce capable of supporting the long-term growth and sustainability of its solar energy sector.

GBE Project - Zambia

The GBE project in Zambia focuses on promoting technical and vocational education and training in the water and solar energy sectors. In the solar energy sector, the project supports vocational training institutions in Southern and Lusaka Provinces to deliver courses on solar energy applications, with a focus on the productive use of energy. This includes conducting training needs assessments, developing curricula and training materials in partnership with the Technical Education, Vocational and Entrepreneurship Training Authority and vocational training institutions, and implementing a "training of trainers" program at the University of Zambia and FGCATS's Solar Academy. The project also facilitated the installation of solar demonstration systems in partner vocational schools to provide hands-on learning opportunities and supported internships for trained professionals at Zambian solar companies. By enhancing the capacity of TVET institutions and providing practical training and industry experience, the GBE project contributes to building a skilled workforce to meet the growing demand for solar energy expertise in Zambia.

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Capacity Building for Energy Transition in Africa

Issue brief

Africa's energy transition requires more than new infrastructure and finance. It requires strong local expertise, resilient institutions, and training systems capable of preparing the engineers, technicians, educators, entrepreneurs, and policymakers needed to drive implementation at scale.

This issue brief argues that capacity building must be treated as a strategic foundation for delivering affordable, reliable, and sustainable clean energy across the continent. It highlights current skills gaps, reviews lessons from existing initiatives, and proposes priority actions to strengthen education, technical training, institutional coordination, and workforce inclusion.

By aligning skills development with continental energy ambitions, Africa can expand opportunity, reduce dependency on external expertise, and build a more just, inclusive, and locally anchored clean energy future.



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