The Youth and the Energy Transition

*The **Global Forum on Sustainable Energy (GFSE)** is a neutral multi-stakeholder platform, which is facilitating international dialogue on energy for sustainable development by taking into accounts the special interests and challenges of developing countries. GFSE aims at the establishment of a sustainable world energy system from a social, economic and environmental perspective.*

GFSE contributes to both international discourse and information dissemination on sustainable energy. The multi-stakeholder platform plays a crucial role in facilitating sustainable energy projects by bringing together donors, investors and project developers. Their interaction creates new opportunities and enhances existing initiatives in the field of sustainable energy.

1. Introduction

Sustainable energy has an essential role in government strategies to build back better in the current economic crisis. Energy efficiency and renewable energy, for example, can deliver a significant number of jobs and provide multiple benefits, among other related to climate change mitigation.[1]

The young generation has lots of potential to contribute to the energy transition in many ways, for instance through engagement in decision-making processes at local and international level and as skilled workforce supporting the development of renewable energy, energy efficiency and clean mobility value chains. Youth are emerging as an important source of talent for achieving energy access, renewable energy, energy efficiency targets, and already account for a substantial fraction of jobs in the renewables sector. At the same time, youth is increasingly engaging in climate change and energy transition issues.

One of the most pressing challenges for emerging economies is a shortage of jobs among the youth. Enhanced skills development and decent work opportunities for youth can be created in the sustainable energy and clean mobility sectors. Initiatives to develop business and technical skills and create jobs targeting the youth should be pursued more vigorously, with increased collaboration between the private sector and educational institutions to improve the quality and accessibility of training.

[1] International Energy Agency and International Monetary Fund (2020). Sustainable Recovery. A World Energy Outlook Special Report in collaboration with the International Monetary Fund. World Energy Outlook 2020. Paris, France.

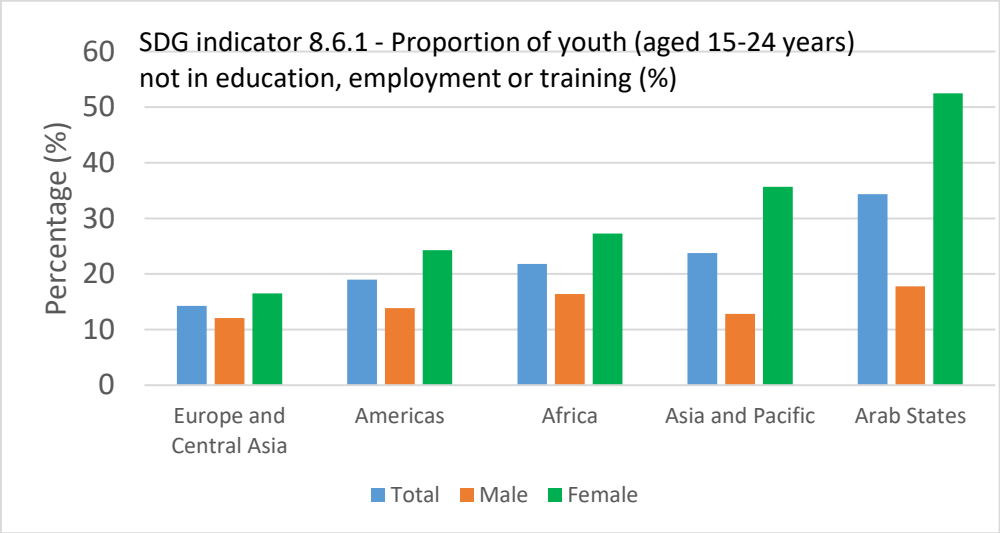

Figure 1: SDG indicator 8.6.1 - Proportion of youth (aged 15-24 years) not in education, employment or training (%) in 2018. Source: ILO statistics. https://ilostat.ilo.org/data/

At the same time, we need to build foundations for better governance in the energy sector and encourage multi-level energy and climate dialogue between stakeholders to overcome political resistance and shape the political incentives that are necessary for the transformation. Engaging the youth in decision-making will support shared ownership of transition strategies and help gaining political buy-in in their implementation.

In the remainder of this paper, some key elements of youth engagement and training are discussed and some examples highlighted.

2. Green skills for the youth in the energy sector

The energy transition can only be achieved with a skilled workforce commensurate with the challenge at hand. Renewable energy and energy efficiency can deliver a substantial amount of jobs, an inmmediate need in many countries in the current economic crisis. [2],[3] However, the lack of a skilled workforce is currently a major bottleneck for the sustainable energy transition and vigorous efforts will be necessary to overcome this substantial barrier. A greater integration of climate and energy polices with measures to support employment, and technical vocational education and training (TVET) policies that encourage the development of skills and job creation is necessary.[4]

[2] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J. & Zenghelis, D., 2020: Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? *Oxf. Rev. Econ. Policy* https://doi.org/10.1093/oxrep/graa015 (2020).

[3] Hanna, R., Xu, Y., and Victor, D. (2020). After COVID-19, green investment must deliver jobs to get political traction. Nature. 582. 178-180.
[https://www.nature.com/articles/d41586-020-01682-1]

[4] OECD and cedefop, 2013: Greener skills and jobs. Highlights. OECD green growth studies

To exploit its full potential, the renewable energy and energy efficiency industry needs to make use of the entire talent pool available. That is, tapping into the talents of women, youth, and minorities to fill its growing demand for skills.[5] Challenges include availability of a skilled work force, quality of training, lack of adequate recruitment channels, lack of training institutions and certification/accreditation schemes. A coordinated effort to develop the necessary human capital pipeline to meet the needs of the rapidly growing renewable energy sector is necessary.

For example, in the solar value chain, the number of jobs at the global level has substantially grown over the past years (see Figure 2 below). Looking ahead, a large number of skilled workers will be needed in the coming years to achieve renewable energy targets in many countries. IRENA expects the annual deployment of solar PV to grow from 94 GW/year to 270 GW/year in 2030, as the trend towards electrification and decarbonisation of the global economy continues (see Figure 3).[6]

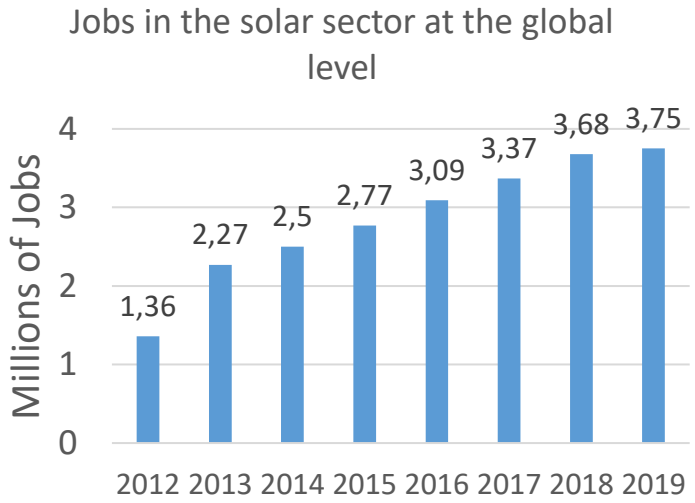

Figure 2; Number of jobs in the solar sector at the global level 2012-2019 (Source: IRENA, 2020: Renewable Energy and Jobs. Annual Review 2020).

[5] Kwauk, C., 2021: The road to a net-zero economy requires building girls' green skills for green jobs. Education plus development. Brookings Institution. https://www.brookings.edu/blog/education-plus-development/2021/03/01/the-road-to-a-net-zero-economy-requires-building-girls-green-skills-for-green-jobs/

[6] IRENA (2019): FUTURE OF SOLAR PHOTOVOLTAIC Deployment, investment, technology, grid integration and socio-economic aspects.

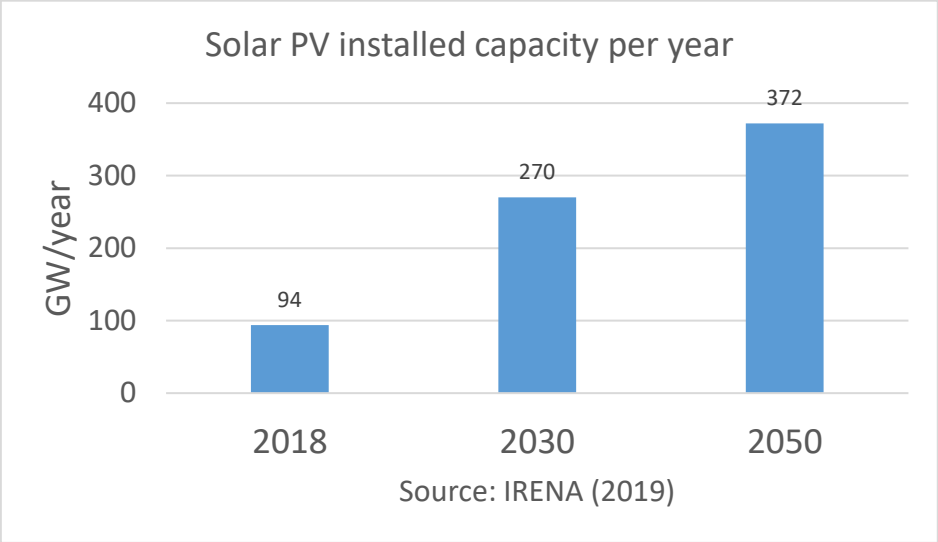

Figure 3: Solar PV installed capacity per year until 2050 according to IRENA REMAP Scenario. Source: IRENA (2019): FUTURE OF SOLAR PHOTOVOLTAIC Deployment, investment, technology, grid integration and socio-economic aspects.

The solar branch provides jobs in areas ranging from technology acquisition and manufacturing, to sales and distribution of products, to technical installation, through to customer support and after sales services. The number of jobs in each area strongly depends on the business model. For example, in the off-grid sector, the number of jobs in the pay-as-you-go business model[7] tends to concentrate in the areas of installation, manufacturing and acquisition as well as customer support, according to GOGLA (Global Off-Grid Lighting Association).[8]

Solar companies require a broad range of skills encompassing many areas such as:

- solar technology and grid connection issues,
- construction skills,
- financial skills,
- software skills,
- economics of solar technologies,
- understanding of the permitting and commissioning processes and
- managerial skills, sales and marketing.[9]

[7] Mobile phone enabled pay-as-you-go (PAYG) models offer not only flexible payment terms (on a daily, weekly or monthly basis) for customers, but they also establish credit history. PAYG addresses larger markets and helps build consumer trust by offering payment methods that require minimal upfront costs.

[8] GOGLA, 2018: Employment opportunities in an evolving market Off-grid solar: creating high-value employment in key markets. Global Off-Grid Lighting Association.

[9] NISE, 2020: SKILL DEVELOPMENT PROGRAMME ON PROSPECTS FOR START-UPS IN SOLAR ENERGY TECHNOLOGIES. National institute of Solar Energy. India.

Delivering all these skills with good quality level is a considerable task that requires well-trained trainers in sufficient numbers and good training facilities on a sufficient scale. It also requires close cooperation between companies, educational institutions and governments.

When it comes to the installation of solar systems, certification schemes that ensure the quality of the workforce are required. For example, solar PV installers require certification to make sure that only professionals with the skills and knowledge to install solar PV systems that meet the performance and reliability needs of their customers are allowed. For example, certification schemes for installers in Austria need to cover the following aspects:[10]

- Legislation, subsidies and standards
- Costs/Benefit analysis (eg. payback period)
- Design
- Installation (actual installation process)
- Commissioning of system for optimal performance
- Monitoring (operational or performance monitoring)
- Maintenance (understanding of maintenance and warranty based issues)

Efforts to certify solar PV installers are under way in several world regions but must be intensified. If possible, they should be harmonised at the international level. Regional cooperation can facilitate the harmonization of qualification and certification schemes across countries. For example, in West Africa. the ECOWAS center for Renewable Energy and Energy Efficiency (ECREEE) in cooperation with the West African Economic and Monetary Union (UEMOA), IRENA, GIZ and the EUEI PDF, established the **ECOWAS Certification for Sustainable Energy Skills (ECSES)**, a scheme for certifying the skills of solar PV installers, introducing a quality seal for sustainable energy skills that is recognized by professionals and end users across ECOWAS member states. The scheme was launched in 2018. ECREEE serves as the regional certification body in line with the requirements of ISO/IEC standards. The scheme initially focused on installers of simple off-grid PV systems, but will gradually also cover installers of more complex off-grid and on-grid PV systems as well as other RE and EE professionals.The regional certification body partners with training institutions, which prepare installers for the exams.[11] This is an example of how regional cooperation through regional centers for renewable energy and energy efficiency can help building up harmonized training and certification systems that facilitate mutual recognition of installers´ qualifications.

Electromobility is another area that creates promising future-oriented options in education and training, as well as job profiles, and create jobs and new employment opportunities,

[10] https://reseu.eu/schemes/austria
[11] http://www.ecreee.org/certification

especially for young people. Scaling up e-mobility should be backed up by robust skill development in the sector. Targeted and flexible education, training, and qualification systems for electromobility need to be established, to enable the build-up of innovation and technology competence in developing countries, to generate jobs, and to establish new skills.

Among others, engineering curricula must be adapted to cover subjects such as battery design, charging station development, battery management systems, drivetrain and propulsion system, vehicle-to-grid integration, electric motor, energy storage and management.[12] Training programmes should also be set up to for staff in sales and marketing, assembly, operation and maintenance of e-vehicles (e-cars but also e-scooters, e-cargo bikes, e-boots) in order to make young trainees familiar with the requirements of electromobility and accompanying digitalisation.[13] Skill development must be accompanied by pilot projects demonstrating technology and awareness raising jointly conducted by industry and government as well as financinal and fiscal incentves for start-ups in this area.

Children and young people should be introduced, during their education and training, to the potential of e-mobility, to awaken their interest in technical, marketing and managerial job profiles in this area. Training modules on e-mobility should be introduced in the apprenticeships on automobile technology and vocational schools. For example, qualified electricians that safely deal with high voltage systems in electric cars and charging infrastructure.

Incubation programs to support e-mobility start-ups in testing and applying their technologies and business models are useful in developing a local industry and business. For example, Siemens Stiftung and its not-for-profit enterprise, WE!Hub Victoria Ltd (WeTu), have established an incubation program for e-mobility solutions in rural Western Kenya.[14] The incubator programme supports young entrepreneurs with the conception of a business plan, testing their technologies and developing marketing, technical and managerial skills. WeTu also owns and operates seven solar powered hubs to charge electric vehicles and provide other energy services to young entrepreneurs and other actors in the region.

Green skills initiatives to empower the youth to realise their full potential in the renewable energy and energy efficiency sectors are urgent. They require governments and industry to prioritise skill building for youth aimed at increasing employment opportunities, raising productivity and boosting individual earnings. Coordination with stakeholders in various sectors and accurate forecasting of training and re-training needs are important to develop and deploy education, training and qualification systems that serve the needs of the market.

[12] Mandal, S., 2020: Can India's Current Engineering, Tech Courses Cope With EV Skills Demand?. Inc42. India.
[13] BMLFUW, BMVIT, BMwFJ, 2012: Electromobility in and from Austria: the common path.
[14] Siemens Stiftung, 2018: E-Mobility Solutions for Rural Sub-Saharan Africa: Leveraging Economic, Social and Environmental Change.

Figure 4: Three key elements of green skills programmes

In order to achieve renewable energy and clean mobility targets, we need to strengthen youth capacities to engage in local renewable energy and energy efficiency value chains. This implies on the one hand, empowering and qualifying youth as entrepreneurs and salespeople but also training them to produce, operate, maintain and repair renewable energy and energy efficiency systems. This requires **cooperation between companies, educational institutions and governments to ensure that the youth develop marketable skills and have access to on-the-job training and internships, making the match between demand and supply in the labour market easier**.

It also calls for the implementation of certification systems for the workforce and accreditation systems for training institutions to enable companies hire good quality workers, who can quickly address real-world challenges. In doing so, training and certification should meet local needs but be aligned, whenever possible, to international standards.

In a nutshell, the partnership between businesses and the education sector should be deepened with a view to the development of well-tailored curricula and the anticipation of future needs. Training should lead to employment and synergies between practical activity, workplace learning and classroom work make young people more employable.

For foreign companies introducing renewable energy and energy efficiency products to local markets in the developing world, the link to local universities and other education institutions is important to adapt products and services to the local context. This link also helps them to create programmes to qualify a local work force that responds to the specific needs of the companies. A case in point are Austrian manufacturers that open local plants in Eastern Europe (e.g. Serbia) and Latin America. These companies suffer from the lack of qualified personnel and are sometimes obliged to train apprentices on their own. Partnerships with local training and educational institutions to implement dual training help companies overcome this lack of skilled workers. Dual vocational training combines apprenticeships in a

company and vocational education at a vocational school in one course, allowing apprentices to gain hands-on work experience and receive theoretical foundations at the same time.

For example, the Austrian plastics producer ALPLA, one of the world market leaders for packaging solutions, has a production facility in Mexico. Because qualified workers are scarce there, ALPLA trains apprentices itself in close cooperation with the state vocational training institution CONALEP and the ALTRATEC Foundation, a specialist in dual education. The project has introduced new curricula and co-financed training facilities for apprentices, which will also be open to other companies. This training project has been made possible by an Austrian business partnership from the Austrian Development Agency (ADA). [15] Similar approaches can be implemented in the energy sector.

Dual training, allowing apprentices to receive hands-on training in companies while at the same time attending lectures in vocational schools, are very effective in addressing real-market needs and driving employability

Combined efforts between the government, companies and educational institutitions to create local capacity to train young adults in the renewable energy sector are fundamental to achieve renewable energy goals. For example, a youth-focussed, job creation programme, with on-the-job training, specialist support for those who need it and a focus on developing future-focussed skills (e.g. in renewable energy, building retrofits, energy efficient construction). In addition, in order to foster the creation of youth-led small enterprises, credit and financing instruments, and other services to develop and market their business plans are necessary.[16]

Moreover**, listening to the youth´s voice is essential for a good training design**. Youth are struggling to identify new employment opportunities and their interests and needs should be reflected in the design of education and training programmes in the sustainable energy sector. Engaging youth perspectives is an important factor to ensure that programmes are aligned with the needs and expectations of young people. This includes in particular nurturing and integrating their digital, communication, and networking skills into training programmes to fully tap into their innovation potential and interests. It also means providing youth with tools to address pressing environmental and social challenges in real life. Many youngsters feel passionate about these challenges and are eager to address them but lack the necessary skills.

[15] Austrian Development Bank, 2014: RELEVANT. #1a, 2014. https://www.oe-eb.at/entwicklungsschwerpunkte/jobs-schaffen.html

[16] Education Development Center, Inc., 2018: Global Promotion of Youth-Led Enterprises in Off-Grid Renewable Energy with Applications in Costa Rica. Project document for the Global Environmental Facility (GEF).

One particular aspect concerns offering training and educational programmes that cater to the needs of Small and Medium Enterprises (SMEs), the backbone of economies in many countries, and help them generate jobs and income opportunities. Generally, SMEs have a reduced capability to train people on green energy skills and predict their own future skill needs. Developing green skills can also impose burdens and costs on SMEs. The critical role of policy frameworks – whether access to finance or skill development - is to help them create a competitive advantage through green skills and reduce the burdens.[17] Thus, SMEs require government support to develop green skills among their staff and better position themselves in the market. A case in point is industrial energy efficiency. SMEs require significant skill improvements to be able to understand and implement energy efficiency measures and accrue the corresponding money savings, which in their turn can help them innovate their products and business models.

3. Digital skills

Together with decentralisation and decarbonisation, digitalisation is driving a transformation in the energy sector. Digitalisation has become essential for renewables´ penetration and the integration of renewables into electricity grids. It enables smart grids and virtual power plants that aggregate output from distributed power plants. It also enables better forecasting (e.g., wind speeds), intelligent predictive maintenance of assets and outage prevention, and plant optimization, among other things. Digital technologies are reshaping the energy system by enabling behind-the-meter generation, as well as unlocking flexibility from different sources, such as battery storage, heat pumps, and appliances in the form of demand response [18].

Digital skills in areas ranging from RES grid integration to marketing and payment systems are key for the youth to thrive in the future job market in the renewable energy and energy efficiency sectors.

Digitalisation is also enhancing energy management systems in buildings and industry. Buildings are at the center of a decarbonized energy system. Smart buildings can play a leading role in transforming the energy landscape into a more decentralized, renewable-based, interconnected system that maximizes efficiency and ensures the optimal use of resources. A smart-ready built environment can enable energy-system-responsive buildings, which at the same time provide a better indoor environmental quality and comfort for the occupants. AI algorithms in Building Management Systems, for instance, can optimize commercial building energy use and allow buildings to participate in demand response markets, decreasing the

[17] Koirala, S., 2018: SMEs: Key drivers of green and inclusive growth. Environment Directorate. OECD.
[18] IRENA (2019). Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables. International Renewable Energy Agency, Abu Dhabi. Accessed 25 November 2020

demand for electricity when there is insufficient renewable electricity supply or increasing it when there is a surplus of variable renewable electricity from solar PV and wind power.[19]

Digitalisation also facilitates innovative business models and new payment systems (e.g. Pay-as-you-go). Given the importance of digitalisation in the energy sector, **digital skills are indispensable to integrate the youth in renewable energy and energy efficiency value chains**. Lack of digital skill is stalling progress towards net zero energy systems.[20] Equipping young people with job-ready digital skills will contribute to achieving SDG 7 and SDG 8 (achieving decent work for all and inclusive and sustainable economic growth). This requires cooperation between a wide range of stakeholders (e.g., the private sector, government, development banks, NGOs, and UN agencies).[21]

Digital technologies are also starting to play an important role in boosting education and training of the workforce. Going forward, such technologies can provide flexibility on time, place and costs of the delivery of education. For example, focused online and blended learning programs (combining face-to-face interaction in the classroom and online learning) as well as learning platforms can facilitate market growth and contribute to reduce the deficit of skilled workers in the renewable energy, energy efficiency and e-mobility sectors. In this context, Artificial Intelligence (AI) is making inroads into e-Learning. AI allows tailoring learning materials to the needs and performance of a particular individual, thus facilitating personalized learning and has a promising future as a learning aid.

4. Examples of green skills development for the youth

Some examples of initiatives to provide green energy skills to the youth are briefly presented below:

Dual training in Serbia supported by Austria

Serbia has a significant problem with youth unemployment (29.5% unemployment rate in 2019) and with the availability of qualified blue-collar workers. Moreover, the quality of training requires substantial improvements. The Austrian Chamber of Commerce (WKÖ) in cooperation with the Serbian Chamber of Commerce, the Institute for Educational Research of the Economy (ibw), the educational institute ZAVOD (part of the Serbian Ministry of Education) and the German International Cooperation (GIZ) successfully carried out a project

[19] Global Forum on Sustainable Energy (2020). Digital Solutions and Knowledge Transfer for Energy, Water and Agriculture. Vienna, Austria. GFSE Policy Brief. August, 2020. [https://www.gfse.at/fileadmin/files/Services___Policy_Briefs/GFSE_Policy_Brief__10_Digital_Solutions_and_Knowledge_Transfer_for_Energy__Water_and_Agriculture.pdf]

[20] DNV, 2020: Digitalization and the future of energy: Beyond the hype – How to create value by combining digital technology, people and business strategy.

[21] Decent jobs for youth, Digital Skills Campaign. https://www.decentjobsforyouth.org/commitment/58

to support the implementation of dual training in Serbia, with support from the Austrian Development Agency (ADA) and the Austrian Ministry for Digitalisation and Economy.

The project contributes to alleviate the shortage of skilled workers, specifically for Austrian companies operating in Serbia, and reduce the high youth unemployment rate. The project supports the Serbian Chamber of Commerce with the implementation of the Dual Education Act, which entered into force in 2019.

The dual training in Serbia is part of the secondary vocational training, whereby pupils acquire knowledge in school as well as practical knowledge in a real work environment in a company. The development of dual training has resulted in the educational system being adapted to the needs of the companies and in a reduction in the costs of recruiting employees.[22]

Project activities were focused in the following areas:[23]

- Creation of the legal framework:
  - Anchoring of companies as educational partners in the Serbian school system
  - Making business a co-decision maker in vocational training
- Processes for the administration of dual training (accreditation of training companies, licensing of trainers, etc.)
- Training of trainers
- Development of 10 new apprenticeship occupations
- Capacity building of the institutions involved (establishment of 16 apprenticeship offices)
- Redesign of the "enrollment policy of students "
- Design of in-company training (training guidelines, examinations, etc.)
- Development of a new training program for apprentices.

As part of the project, ten new apprenticeships were introduced, such as retail sales representative, specialised construction worker, information and telecommunications technician, electrician and buildings technician in hotels etc.

The SOLTRAIN programme in Southern Africa

SOLTRAIN is a regional initiative on capacity building and demonstration of solar thermal systems in the Southern African Development Community (SADC) carried out by AEE INTEC together with regional partners and supported by the Austrian Development Agency (ADA) and the OPEC Fund for International Development (OFID). SOLTRAIN supports the target countries with the development of value chains for solar thermal technologies. In particular,

[22] https://www.wko.at/service/aussenwirtschaft/lehrlingsausbildung-in-serbien.html
[23] WKO, 2020: Mit Lehrlingausbildung zum Firmenerfolg. Duale Ausbildung als Erfolgsfaktor für Ihr Unternehmen in Serbien (towards succesful business with training and eductaion of apprentices: Dual Training as key success factor for your company in Serbia, only available in German). Austrian Economic Chamber of Commerce. https://www.wko.at/service/aussenwirtschaft/webinar-lehrlingsausbildung-praesentation.pdf

SOLTRAIN promotes the use of solar thermal systems while ensuring selection of quality products and workmanship in order to guarantee optimal performance. In addition, SOLTRAIN supports the Southern African Development Community (SADC) policies on Energy for Sustainable Development and the national energy policies of the SOLTRAIN partner countries by creating new jobs in small and medium-sized enterprises, setting up demonstration systems, and strengthening the mechanisms for local support for solar thermal systems.[24]

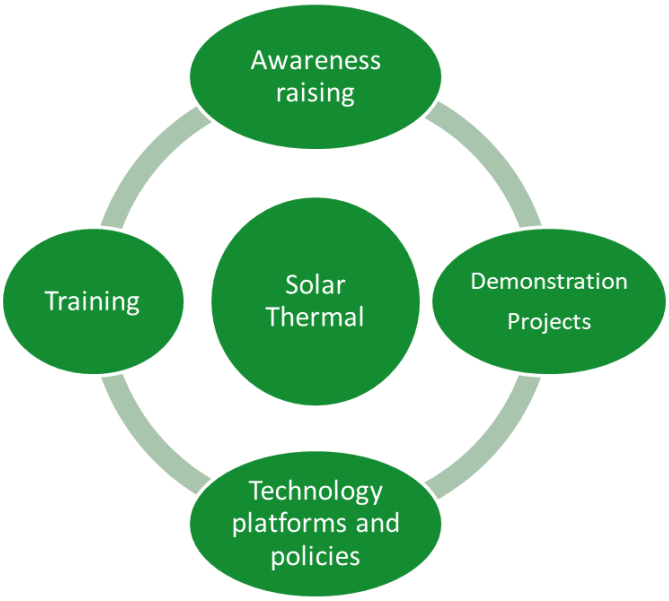

Figure 5: Main elements of the SOLTRAIN programme

The SOLTRAIN programme focuses on the following main elements:[25]

- Supporting political stakeholders with the implementation of Solar Thermal Roadmaps
- Increasing technical skills by carrying out training courses
- Raising awareness on the potential of solar thermal technologies
- Strengthening institutional structures, which can offer expert advice, training and technical support to the local industry and politicians
- Demonstration of solar thermal technology by supporting the design, installation, and quality check of demonstration systems.

As part of the demonstration programme, SOLTRAIN has made emphasis on demonstrations systems on institutions that support women and marginalized groups.

[24] Ministry of Mines and Energy, 2019: Solar Thermal Technology Roadmap and Implementation Plan for Namibia. Government oft he Republic of Namibia. February, 2019. https://soltrain.s3.eu-west-2.amazonaws.com/media/public/documents/Solar-Thermal-Technology-Roadmap-and-Implementation-Plan-Namibia.pdf

[25] https://soltrain.org/about/focus/

SOLTRAIN also runs a Student Project Support Scheme for postgraduate studies. This programme provides supervision and peer-review to students working on various topics related to solar thermal technologies such as for example:

- solar thermal systems in the health sector
- Analysis of measurement data from selected systems from the SOLTRAIN project
- Use of solar thermal technologies for heating/drying/cooling in industrial applications.
- Documentation and analysis of mass housing programmes with mandatory installation of solar water heaters

The project support scheme allows students to become familiar with concrete cases of solar thermal projects and enhance their skills and knowledge, accompanied by SOLTRAIN partners.

Solar Energy Training Network (SETNET) in India

The National Institute of Solar Energy in India (NISE) has established the Solar Energy Training Network (SETNET) to build skills and capacities to ensure the availability of qualified solar energy professionals. SETNET contributes to ensure availability of skilled manpower to meet the solar deployment target of India for 2022 (100 GW), which represents a significant challenge. Through a competitive process, SETNET partners across the country were identified to provide the skill development courses. The SETNET network seeks to harmonise training concepts and approaches to make solar training programs compatible with each other and make sure they cover a minimum amount of key materials to ensure their quality.[26] Through SETNET, young people have been trained and found jobs in the Indian solar industry.

Youth energy squad in the U.S.

The Youth Energy Squad is a program of EcoWorks[27], a Detroit-based non-profit organisation that creates just, equitable, and inclusive solutions to climate change and other community sustainability challenges. The Youth Energy Squad engages youth from diverse backgrounds in hands-on service learning projects that make their homes, schools and communities more sustainable and teaches them hands-on leadership skills. It offers activities in and beyond the school to engage students with sustainability and leadership. For example, during summer, the YES Summer Program provides employment opportunities for high school students. Students selected for the program become members of Americorps, a voluntary civil society program supported by the U.S. federal government, foundations, corporations, and other donors that engages adults in public service work with a goal of meeting critical needs in the community.[28] They also receive a stipend, a scholarship and mentorship from AmeriCorps.[29]

[26] NRDC and CCEW, 2016: FILLING THE SKILL GAP IN INDIA'S CLEAN ENERGY MARKET: SOLAR ENERGY FOCUS. National Reosurces Defence Council and Council on Energy, Environment and Water.
[27] https://www.ecoworksdetroit.org/
[28] https://americorps.gov/serve
[29] https://www.youthenergysquad.org/instruments

Training in energy efficiency and renewable energy for youths in Nigeria

The United Nations Human Settlements Programme (UN-Habitat), in partnership with the Federal Government of Nigeria, conducted training in energy efficiency and renewable energy technologies, green entrepreneurship and enterprise development for young people.[30]

The training focused on empowering young entrepreneurs to start micro enterprises in the renewable energy sector, which sell products to replace kerosene stoves and lanterns, act as multipliers in their communities to raise awareness for renewable energy and stimulate behavioral change in their communities.

The training allowed participants to build solar lanterns, build, assemble and install Solar Home Systems and improved cook stoves as well as set up briquette production to substitute charcoal and firewood.

E4VAfrica- African electromobility and green energy accelerator

EV4Africa is a technology accelerator that helps African mobility and green energy innovators to spread their innovations across Africa. It accompanies business through several stages from the conception to market. It also offers re-skilling and up-skilling for young women and men in e-mobility and accompanying digital business models. EV4Africa provides support for the development and testing of innovative e-mobility concepts and gives young entrepreneurs access to a network of companies and financing possibilities.[31]

Learning and Knowledge Development Facility (LKDF)

The Learning and Knowledge Development Facility (LKDF) is a platform of UNIDO that promotes industrial skills development among young people in emerging economies.[32] LKDF works with the private sector through Public Private Development Partnerships to support the establishment and upgrading of local industrial training academies to help meet increasing demand for skilled employees. LKDF also supports market transformation programmes through a systemic approach tha reduces proverty, addresses causes of market failure and improves the long-term impacts of development projects. The LKDF also provides a dialogue platform for companies to discuss with peers how to implement training and educational programmes together with national governments, NGOs and other LKDF partners. The facility leverages the experience in the private sector to make training programmes more effective and market responsive.

In Liberia, for example, the LKDF is conducting the project “Youth Rising” with support from the EU to strengthen the Liberian Technical Vocational Education and Training (TVET) sector. The project contributes to improve the quality of training and modernize training facilities

[30] UN Habitat: Youths in Nigeria trained in renewable energy technologies and green entrepreneurship. https://www.un.org/africarenewal/news/youths-nigeria-trained-renewable-energy-technologies-and-green-entrepreneurship

[31] https://www.ev4africa.com/what-we-do/

[32] https://lkdfacility.org/about/about-lkdf/

while increasing private sector involvement in the Liberian TVET system, including in curriculum development and delivery of training courses. It has also implemented measures to increase enrolment of young women and vulnerable youth including people with disabilities.[33]

5. Social innovations and the role of the youth

The energy transition has given rise to various forms of social innovation, defined as new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaborations.[34] Examples of social innovations are energy cooperatives, energy "prosumers" consuming and producing energy simultaneously, and new participative forms of decision making such as youth climate councils.[35] They are linked to new business models and governance arrangements and can contribute to making energy more sustainable and affordable.

The youth have a key role to play in creating and disseminating social innovations that enable decentralised, digitalized and decarbonized energy systems

We need to create enabling conditions that facilitate the emergence of social innovations that lead to the development of new business models and facilitate greater acceptance of the transition towards net zero, climate resilient energy systems. The youth have a key role to play in creating and disseminating social innovations that enable decentralised, digitalized and decarbonized energy systems. Youth-led social innovations have a significant transformative potential to solve both local and global problems, using their creativity and capacity to quickly adapt and learn. To implement them, the youth must develop job-specific technical skills but also build a broader set of capacities including sustainability competencies and empowerment skills.

For example, the youth is well suited to make lifestyle changes that favor more resource-efficient and low-carbon consumption patterns. Sustainable consumption initiatives require awareness raising and capacity building for individual consumers and communities that lead them to, for instance, demand and buy more energy efficient and longer lasting appliances. Communities and civil society play a central role by supporting sustainable consumption initiatives, engaging in policy dialogues towards sustainable consumption and production, supporting behavioural change processes and facilitating awareness raising. The youth are

[33] LKDF, 2018: Youth Rising, Liberia. https://lkdfacility.org/youth-rising/

[34] European Commission, 2013: Guide to Social Innovation. Regional and Urban Policy. February, 2013. https://ec.europa.eu/eip/ageing/library/guide-social-innovation_en

[35] Wittmayer, J., de Geus, T., *et al.* 2020: Beyond instrumentalism: Broadening the understanding of social innovation in socio-technical energy systems, Energy Research & Social Science, ISSN: 2214-6296, Vol: 70, Page: 101689

well positioned to lead and implement such a global sustainable consumption movement, showing the advantages of new consumption patterns to older generations.[36]

Local communities in many countries are being particularly affected by the COVID-19 pandemic and the climate crisis. Many communities also lack access to modern energy services, which are fundamental. The youth can develop homegrown, creative solutions building on local strengths to overcome the crisis, improve their livelihoods, address long-term inequity and injustice and tackle climate change. For example, the youth could lead the establishment of local renewable energy communities that invest in renewable energy and energy efficiency projects, providing benefits and profits to the members of the local community. However, a lack of adequate national policy and regulatory frameworks, workforce skills and funding often make it difficult, for citizens and municipalities to become involved in the energy sector.[37] Changes to market rules, support schemes and capacity building are necessary to empower communities to get involved in energy supply and collective self-consumption. [38]

Social innovations are facilitated by digital technologies. Thus, it is also important to create equitable opportunities for youth, who may be left behind due to the digital divide. Inequalities in digital access are very large. For example, in schools there are massive inequalities in internet access. Facilitating digital inclusion for the youth is important to increase their skills and employability, enable a more meaningful participation in economic activities, and facilitate engagement in their communities. Digitalisation can also facilitate social inclusion for the least favoured populations. Through digital tools, they can become more involved in social and political activities, voice their concerns and ideas, and organize themselves better. Digital inclusion requires collaboration across the public, private and civil society sectors, awareness raising and subsidies to access digital tools.

6. Youth engagement

The transition to a sustainable energy system is a social and technical challenge that requires the meaningful participation of wider society and in particular of citizens, including youth and

[36] Zakeri, B. , Paulavets, K., Barreto-Gomez, L., Gomez Echeverri, L., Pachauri, S. , Rogelj, J. , Creutzig, F., Urge-Vorsatz, D., et al. (2021). Transformations within reach: Pathways to a sustainable and resilient world - Rethinking energy solutions. IIASA Report. IIASA-ISC

[37] Ambole, A.; Koranteng, K.; Njoroge, P.; Luhangala, D.L. A Review of Energy Communities in Sub-Saharan Africa as a Transition Pathway to Energy Democracy. Sustainability 2021, 13, 2128. https://doi.org/10.3390/su13042128

[38] Federal Ministry for Economic Cooperation and Development, 2017. Green people´s energy for Africa. BMZ POSITION PAPER 06. German Federal Ministry for Economic Cooperation and Development. https://www.bmz.de/en/publications/topics/energy/Strategiepapier395_06_2017.pdf

women. Societal engagement has become central for energy transitions that are more democratic, sustainable, just, and responsive to public values and human needs.[39]

A fair and equitable energy transition is necessary. The energy transition must ensure justice towards both fellow humans and the environment. Not considering justice can erode the political support for the transition. To achieve justice, reducing energy poverty and securing universal access to sustainable and affordable energy carriers is essential.[40]

The youth has a key role to play in shaping the legal and policy frameworks as well as building the political foundations for an inclusive, just and effective energy transition.

The youth can play a fundamental role in this transformation. By including them in the energy transition, we make sure that the future energy systems are fit for a sustainable society.[41] Youth engagement can help governments achieve improved results on public service delivery, public financial management, governance, social inclusion and empowerment. Youth leaders can engage with policymakers and other relevant stakeholders in civil society and the private sector to advance the energy transition. Their active involvement in implementing SDG7 and related SDGs that represent the interests of young people such as SDG1 on fighting poverty, SDG4 on providing quality education and SDG8 on decent work and economic growth is essential. Young people should have a say on the substantive matters and be involved in the decision-making process. They should also receive training on how to self-organize and turn their ideas into actionable proposals. **Developing the 21st century´s youth leadership and technical skills to tackle the challenges at hand in the energy sector is one of our most important tasks to secure a sustainable future**.

One example of youth engagement at the international level is the SDG7 Youth Constituency, an engagement mechanism for young people in UN and UN-related processes focused on energy topics. SDG7 Youth Constituency works on policy advocacy in inter-governmental and multi-stakeholder processes of UN and allied institutions, including engagement with member states but also on building regional networks of youth involved in renewable energy sector, among others.[42]

Young people can also engage in their communities to create better services for the broader community. Local communities in many countries are being particularly affected by the

[39] Chilvers, J., Pallett, H., Hargreaves, T., 2018: Ecologies of participation in socio-technical change: The case of energy system transitions. Energy Research & Social Science Volume 42, August 2018, Pages 199-210. https://doi.org/10.1016/j.erss.2018.03.020

[40] High-level Dialogue on Energy 2021. Technical Working Group III.Enabling SDGs through inclusive, just energy transitions. CONCEPT NOTE.

[41] https://www.unido.org/stories/austria-wants-more-women-and-youth-engage-energy-transition

[42] SDG7 Youth Constituency, 2020: Overview and Introduction to the UN Major Group for Children and Youth (UN MGCY). https://static1.squarespace.com/static/5b2586e41aef1d89f00c60a9/t/5f44d8e26804fe2415e3afb0/1598347497454/SDG7+YC+Introduction+Deck.pdf

COVID-19 pandemic and the climate crisis. Many communities also lack access to modern energy services. At the same time, communities are developing homegrown, creative solutions building on local strengths that can help them overcome the crisis, improve their livelihoods, address long-term inequity and injustice and tackle climate change.

Decentralised energy systems enable the participation of local actors such as communities, SMEs and micro-enterprises in the provision of energy services and have spurred the development of new business models and social innovations. The youth can apply their substantial innovative capacity to drive these developments further. Decentralisation empowers communities to make their own decisions regarding the choice of energy systems that are able to provide the energy services they need and accrue the most benefits to them through open, democratic participation and governance structures. Young people can help implementing people-centered energy solutions responding to the needs of the people and communities they serve, such as energy cooperatives and prosumerism**.** At the same time, the youth can engage in supporting broad social mobilisation towards climate and environmental action.

In the context of an inclusive, just transition, measures for countries and communities that currently depend on fossil fuels are urgent to help them achieve the transformation towards sustainable economic activities and reduce the economic losses. Energy transitions affect local communities substantially, and may result in job losses, for instance after closure of large fossil fuel plants and coal mines. The social and economic effects of the transition must be addressed to ensure that no one is left behind. Just transition mechanisms focusing on people, regions and sectors most affected by the energy transition can help create new jobs and new economic activities through a combination of worker education and retraining, social support, local economic development tools for communities and support to the creation of new businesses, among others. Supporting the youth in their efforts to achieve a just energy transition is essential.

Climate education also plays a fundamental role in shaping the minds of the new generations. Education provides clarity as to the magnitude of the challenge ahead to curb climate change and helps them devise means to solve this challenge. This requires educating their teachers as well such that they are able to convey the subject to their pupils in a good manner.[43] Good climate education is fundamental to remove system inequalities and achieving a net zero energy system. Quality climate education should be accessible to everyone.

7. Examples of youth engagement

The youth are taking an innovative approach in solving the multiple challenges of sustainable energy. Below some examples are briefly described.

[43] The Climate Reality Project, 2020: What does climate justice look like around the world.

Youth involvement in the Austrian Spatial Development Concept (ÖREK 2030)

Young experts from all provinces of Austria were asked to co-design the guidelines of the new Austrian Spatial Development Concept (ÖREK 2030). A representative group of 18 young experts was selected through an open application process. Although only 18 experts were selected, all applicants (120) were given an opportunity to engage with the process and provide inputs through a pre-conference. The young people selected to participate provided input on social and technological challenges, as well as on climate-friendly spatial development. The elaboration of the ÖREK is a participative process, involving actors from national, provincial and local levels. Involving youth helped ensuring a future-proof concept. Thematic workshops for the young experts and co-creation sessions with senior experts have been organised. The young experts also participated in workshops with stakeholders, the conference on spatial development and a young experts conference.[44]

Youth Climate Leaders (YCL)

The Youth Climate Leaders initiative was created in 2018 by four Brazilian women and offers solutions to help young people tackle the climate crisis and structural unemployment. Young people have access to a global network and opportunities in organizations and projects engaged in climate action. The organization provides on-line training courses and mentoring programmes and propagates professional opportunities for young people bridging gaps with organizations that are already established in this sector. YCL local and regional hubs have been created in Latin America, Africa, and Europe. The hubs act as platforms to coordinate climate solutions and activities locally. They convene key actors in the fields of climate change and sustainability including local experts and organizations to promote YCL programmes and connect YCL fellows to job opportunities in their region.[45]

Youth climate council in Frederikshavn, Denmark

Frederikshavn, asmall town in the coast of Denmark, has approved a Masterplan for Renewable Energy 2030, which sets a target of 100% renewable energy supply by 2030. The masterplan is an essential tool for energy managers in the city, facilitating overseeing and coordination of the transition process. Annual evaluations of the plan are reviewed and approved by the city council.

The city has implemented a number of measures including setting up a municipal Youth Climate Council to unlock the creative potential of young people in the region. The group focuses on educational activities and is looking for ways to implement the 17 United Nations Sustainable Development Goals within the context of Frederikshavn, translating them into concrete initiatives in everyday life, informing and engaging their peers and the citizens. The

[44] European Commission, 2021: Good Practices of Youth Engagement. Annex. Youth for a Just Transition. https://ec.europa.eu/regional_policy/sources/docgener/guides/youth_just_transition__annex_en.pdf

[45] https://www.youthclimateleaders.org/

youth climate council also participates in national and European-wide activities voicing their ideas in the climate and energy debate.

The city council has created a steering committee on sustainable development and green growth, headed by the mayor. The group consists of representatives of the Citizens' Forum, the Youth Climate Council, industry representatives, educational institutions and local politicians.

Participation of the youth in the Dutch Climate Agreement

The Dutch National Climate Agreement, which was concluded in June 2019, contains agreements with different sectors on what they will do to help achieve the climate goals. The participating sectors are electricity, industry, built environment, transport, and agriculture. Two organisations representing young people were invited to participate in the process. One of them is the young climate movement (JKB). The second is KEK, a Dutch think-tank formed by young professionals in the climate and energy sectors. The young people organised a bottom-up selection process to choose their representatives in the negotiations, with a democratic approach based on competence.

The young climate movement (JKB) has been involved in setting the Youth Climate Agenda and discussing topics of the Dutch Climate Agreement with its members a well as setting up capacity building programmes with the Ministry of Foreign Affairs to help youth in developing countries build their own climate agenda.

The two organisations were involved in several joint activities, including:

- A joint initiative to professionalise youth participation in local climate and energy policy
- Building a Youth Climate Platform to monitor the achievement of the Dutch Climate Agreement Targets together with the ministry of economic and climate affairs.

Lal Sabuj Society in Bangladesh

Lal Sabuj Society in Bangladesh is working across the country on climate change, the protection of children and women, mental health, self-defence for girls, soft skills development, debate practice, and other areas. Thanks to their efforts, opportunities are being created for marginal societal groups, especially children at risk from the impacts of climate change in coastal areas.

Currently 400 children across Bangladesh are working with the Society to clean up public places like canals and tourist spots and separate the recyclable plastics, which they sell at recycling centers. They reinvest the money on planting trees. They also working on developing

a mobile app that presents various information about climate change by creating content, quizzes and challenges.[46]

Youth Challenge International (YCI) in Canada

The organization brings together young people in Canada to take action on environment and drive youth-led climate solutions.[47] It conducts activities in the following main domains:

- **Peer-to-Peer Education:** Through the Global Youth Partnerships Solution, YCI works together with local development partners to design and implement youth innovation programs through Canadian volunteers and peer-to-peer learning with a sector focus on health, private sector development and democratic governance.
- **Volunteer Activities for capacity building:** Together with local partners, YCI identifies capacity building needs in the local context. Thereafter, volunteers from Canada and other countries with the required skills are identified and work alongside youth in partner communities to co-facilitate and co-implement programs with local champions. Capacity activities have been taking place with 11 organizational partners in Ghana and Tanzania.[48]

UN SDSN Youth

The UN Sustainable Development Solutions Network launched the SDSN Youth in 2015, to empower youth globally and create sustainable development solutions. The SDSN Youth initiatives covers several areas, from social entrepreneurship (Youth Solutions Program), education for sustainable development (Global Schools Program), sustainable cities and communities (Local Pathways Program), sustainable campuses (SDG Students Program), and collaboration between youth leaders (Vatican Youth Symposium).

One key programme is the Global Schools Program, which supports UNESCO's Global Action Program on Education for Sustainable Development (ESD). The Global Schools Programme aims to transform learning environments globally and make schools the hubs of education and leadership on the SDGs. [49] Together with the SDG Academy, the Global Schools Programme founded Mission 4.7 in partnership with the Ban Ki-moon Centre for Global Citizens, UNESCO, and the Center for Sustainable Development at Columbia University, which focuses on the implementation of Education for Sustainable Development.

[46] https://www.voicesofyouth.org/blog/what-are-impacts-climate-change-and-environmental-damage-bangladesh
[47] https://www.yci.org/InnovateMYFuture/home
[48] https://www.yci.org/
[49] https://sdsnyouth.org/about

8. Outlook

The transition towards a sustainable energy system opens up substantial opportunities for a skilled workforce. It also brings with it additional requirements to scale up the number of qualified workers and professionals and to improve the quality of education and training. Today, the lack of green skills represents a significant barrier to achieve a sustainable and affordable energy system. Thus, job creation and green skills development should become a priority area in the energy sector.

Training and education programmes yield the most beneficial results if they are designed as long-term initiatives that are integrated into national education systems and respond to the needs of companies. To make sure that demand-driven skills are developed, a close collaboration with companies in technical and vocational education and training (TVET) should be pursued. Thereby, emphasizing equality and inclusiveness to ensure that a larger fraction of the population has access to training opportunities throughout their working life is paramount.[50] In addition, training should be used as a complementary tool in policy programs to improve the incomes of the poor and socially disadvantaged.

Certification schemes are useful to ensure quality of training and recognition of qualified installers and other professional by companies and clients. If possible, they should be harmonised at the international level. Regional cooperation can facilitate the harmonization of qualification and certification schemes across countries. A case in point is the ECOWAS Certification for Sustainable Energy Skills (ECSES), which provides certification for solar PV installers and, in the future, for other RE and EE professionals. Regional centers for renewable energy and energy efficiency (e.g. ECREEE, CCREEE, SACREEE etc.) can facilitate the harmonization of certification and mutual recognition of installers and other professionals in renewable energy and energy efficiency across countries.

New technologies (e.g. Artificial Intelligence, web-based training) are changing the TVET landscape and TVET must respond to these developments to become more effective. Mainstreaming successful innovations in new training programmes, learning platforms and resources as well as advancing the digital agenda would help making TVET available to a broader audience and may lower the costs of training. It will also facilitate international knowledge and experience exchange.

Societal engagement has become central to make energy transitions more democratic, sustainable, just, and people-centered. The youth has a role to play in shaping the legal and policy frameworks as well as building the political foundations for a just and effective energy transition. Youth engagement can help governments achieve improved results on

[50] ILO, 2021: Skills development in the time of COVID-19: Taking stock of the initial responses in technical and vocational education and training - Key findings. International Labour Office – Geneva: ILO, 2021. SBN 978-92-2-034414-9 (print); ISBN 978-92-2-034415-6 (web PDF).

transparency, public service delivery, public financial management, governance, social inclusion and empowerment. Youth leaders can engage with policymakers and other relevant stakeholders in civil society and the private sector to advance the energy transition. Young people can also engage in their communities to create better services, including energy, and foster economic activities. Youth engagement can also help mitigating negative social and economic effects of the energy transition to ensure that no one is left behind.

9. Key messages

	Green skills
1	Developing and emerging economies must strengthen their capacities to develop green skills in the clean energy and climate mitigation and adaptation areas.
2	Suitable policies prompting cooperation between companies, government and educational institutions are necessary to ensure that training programmes respond to real market needs
3	Educational models such as dual training, allowing apprentices to receive hands-on training in companies while at the same time attending lectures in vocational schools, are very effective in addressing real-market needs.
4	Development cooperation programmes combining training, demonstration projects, technology platforms, policy development and awareness raising have proven to be effective.
5	Certification schemes are useful to ensure quality of training and recognition of qualified installers and other professional by companies and clients. Regional cooperation, for instance through the regional centers for renewable energy and energy efficiency can facilitate the harmonization across countries.
6	Digital skills have become highly relevant to implement new business models in the clean energy and mobility sectors (e.g. PAYGO, shared mobility, renewable energy communities, cybersecurity). A strong focus should be put in providing digital skills to children and youth.
7	Young entrepreneurs are well positioned to explore innovative business models for energy services and should receive the training they need to launch start-ups in the renewable energy and e-mobility sectors and bring them to success.

	Youth engagement
1	Youth engagement is fundamental to shape the policy agenda in the sustainable energy field and achieve energy and environmental justice.
2	Youth engagement can help governments achieve improved results on transparency, public service delivery, public financial management, governance, social inclusion and empowerment.

	Youth engagement
3	Young people can help implementing people-centered energy solutions based on the needs of the people and communities. At the same time, the youth can engage in supporting broad social mobilisation towards climate and environmental action.
4	Young people can apply their innovation power to advance new technological solutions and business models to facilitate the uptake of renewables, energy efficiency and clean mobility solutions.
5	Just transition mechanisms focusing on people most affected by the energy and climate transitions can help create new jobs and economic activities through worker education/retraining, social support, local economic development tools and support to the creation of new businesses.
6	Climate education also plays a fundamental role in shaping the minds of the new generations as to the magnitude of the challenge ahead to curb climate change and how can they solve this challenge.

*The **Global Forum on Sustainable Energy (GFSE)** is a neutral multi-stakeholder platform, which is facilitating international dialogue on energy for sustainable development by taking into accounts the special interests and challenges of developing countries. GFSE aims at the establishment of a sustainable world energy system from a social, economic and environmental perspective.*

GFSE contributes to both international discourse and information dissemination on sustainable energy. The multi-stakeholder platform plays a crucial role in facilitating sustainable energy projects by bringing

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