Review of Photovoltaic Systems' Technical and Vocational Training Gaps in Palestine: Current Topics, Priorities and Future Outlook

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Abstract – *This study presents a mapping of technical and vocational education and training (TVET) for photovoltaic systems in the West Bank, Palestine. An analysis of photovoltaic system TVET courses and the photovoltaic system market in Palestine is done. This analysis covers the content of photovoltaic TVET courses, the ability of course trainers, training tools and labs, required skills, and the competencies of course graduates. Moreover, experts, photovoltaic system company owners, and large photovoltaic systems owners are interviewed regarding the quality of current delivered courses. The conducted interviews also implied the future outlook of photovoltaic jobs in Palestine. Results show that there is a reluctance to hire technicians from Palestinian PV system companies due to the current economic situation and the size of the photovoltaic market. On the other hand, it is concluded that the number of photovoltaic technicians inside photovoltaic sites is not enough according to the standards and requirements. Finally, it is found that photovoltaic technicians do not have the required practical experience in energy storage sizing and maintenance, solar inverters sizing and maintenance, photovoltaic system operation and evaluation, hybrid photovoltaic systems, and water pumping systems. As for the future look, it is predicted that topics of Energy storage and charge controllers in PV systems", "Solar inverters and optimizers in PV systems", "PV system maintenance and operation management", "PV system project management" and "water pumping PV system installation" will be demanded in the coming future in Palestine.*

Keywords: *Palestine; photovoltaic systems; technical trainings; TVET.*

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I. Introduction

The Palestinian Authority (PA) assumed responsibility for education in 1994. The first Palestinian TVET strategy was developed in 1995. Later, this strategy was revised by the Palestine Ministry of Education and Higher Education and the Palestine Ministry of Labor in 2010 [1]. In addition to governmental TVET structures, church-related organizations (CROs), the UN Relief and Works Agency for Palestine Refugees (UNRWA), non-governmental organizations (NGOs), and many international donors have a long history of providing vocational training and serving youth in Palestine [2]. In 2021 the National TVET Commission of Palestine was established. Its mandate is to harmonize and manage the TVET sector of Palestine, increasing the quality and ensuring a good link with the private sector [3].

In general, there are many studies in the literature that review and evaluate TVET programs including TVET programs in the field of renewable energy. In [4] renewable energy TVET programs content, graduate statistics as well as trainers' qualifications are analyzed for several countries. According to (Lucas et al., 2018) it is found that there is a mismatch between the education system offered courses and industry demand.

In addition, a review of energy education including TVET programs in several countries is presented [5]. The paper reviews the current status of TVET programs, training facilities, and needs. Moreover, it reviews the development method of these programs to fill the gap

between the market needs and curriculum skills. Similarly, mapping and analysis of renewable energy TVET programs are presented in [6]. The authors analyzed the programs considering the same methodology presented in [5]. Furthermore, TVET programs were evaluated by [7] considering content, teaching methods, impact, and market needs. The results showed that the optimal design of a TVET program greatly affects the outcome of the program. Similarly, in [8] TVET programs for photovoltaic systems were proposed considering the needs of the market. The needs were determined by qualitative focus discussion groups with stakeholders. Finally, a review of renewable energy programs including the TVET program was done [9] for a specific country. The review considers the offered program content, trainers, method of training, training facilities as well as market needs and perception.

On the other hand, other researchers used another method to evaluate TVET programs via evaluating the awareness of program members (trainers and trainees). In [10] the ability and awareness of trainers at TVET in renewable energy is evaluated. It is reported in this research that the ability of the trainers affects the level of knowledge delivery. In [11] the author measured the level of awareness of participants in the renewable energy TVET program. It is claimed in this research that the level of awareness of students and teachers is a very important issue to consider when developing, restructuring, or proposing any TVET program. In [12] the authors measured the awareness of students at the university level of renewable energy. Similarly, the awareness of university students in renewable energy is measured by a questionnaire [13]. The main aim of this research is to develop these programs based on students' awareness and opportunities. Finally, [14], it is reported that there is a great association between the learning style of the TVET program and its perception.

From these researches, there is a dire need for evaluating and mapping TVET programs in photovoltaic systems considering courses' content, trainers' ability, market's needs, training facilities, and training tools. Thus, the main objective of this research is to map and evaluate TVET programs in the field of photovoltaic systems in the West Bank, Palestine. The contribution of this research is that it maps the needs for PV system skills in Palestine and designs courses that reduce the gap between the currently offered TVET courses and market needs.

II. Study Methodology

To review and analyze the current TVET activities in the field of photovoltaic (PV) systems in Palestine, a specific methodology is followed in this research. The methodology starts with a comprehensive review of skills that are required in PV system sites, as well as PV system courses that are being taught at different levels. The aim of surveying all courses including TVET courses and higher (B.Sc, M.Sc., and Ph.D) courses is to analyze the ability of TVET trainers as well. This assumes that most of the TVET trainers are getting their skills from Palestinian universities. After listing the courses on PV systems, the content of these courses is analyzed to gather information regarding the ability of the trainers or professors who teach these courses. Finally, information on the training tools and labs that are available at these institutes is collected. This methodology was followed in many researches such as in [15] – [16].

In this Research, about 20+ companies, 8+ academia, 10+ stakeholders, and 13+ beneficiaries were surveyed and asked specific questions to highlight the skills that are required for PV systems in Palestine as well as the ability of TVET graduates to fulfil these skills.

The response of 20 PV system companies working in Palestine is reported as a response to questions that cover, the size of solar energy projects implemented by the company, the nature of projects implemented (domestic, industrial, commercial), the number of hired technicians, and engineers, the academic qualifications of the employees, the experiences required for site engineers, technicians, and labors, feedback on fresh university graduates, TVET graduates as well as labors, salary range for engineers, technicians and labors, most demanded jobs currently and in the future in the field of PV system.

Meanwhile, eight experts were surveyed to learn about the required skills of PV technicians. The opinion of the expert was surveyed based on the "Expected vs Perceived form" with a scale of (Five). On the side of the Expected scale value (One) means least important, while (Five) means very important. On the other hand, the scale value of (One) on the side of perceived means briefly covered, while (Five) means fully covered. The skills required for installing PV systems are listed in association with these experts, and then the evaluation of the perception of these levels is done. Finally, sixteen beneficiaries of PV systems were asked about their perception of PV system service after installation.

III. Required Skills for PV Systems in Palestine and Current TVET courses

To construct a comprehensive educational system for any topic, the required skills for this topic should be summarized and listed. Then, an educational system, including theoretical and vocational systems, can be constructed by matching these skills with the developed curriculum activities. Here, the output of these systems should be examined by the level of matching between required market skills and graduates' abilities.

For photovoltaic systems, there are many required skills ranging from advanced skills to basic labor skills. Here these skills may vary depending on the type of the system. There are three types of PV systems which are photovoltaic grid-connected systems, standalone photovoltaic systems, and hybrid photovoltaic systems. For these systems, there are some mutual skills needed for construction, management, and maintenance. These skills are discussed in detail with a focus on technical and vocational training (TVET) opportunities.

A. Required skills in photovoltaic systems site

In general, for grid-connected PV systems, there are many required skills including planning skills, construction skills, managing skills as well as maintenance skills. These skills are listed below as below.

- *Senior Electrical Engineer* with experience in system design, engineering diagrams, high voltage power stations, high voltage cables, grid impact studies, earthing systems, batteries, AC and DC installation, renewable energy policies, and engineering project management.
- *Senior Civil Engineer* with experience in solar PV systems, mounting steel structures, solar PV site preparation and leveling, and steel welding.
- *Solar PV Engineer* with experience in solar PV system design and simulation, earthing systems, batteries, AC and DC installation, and solar inverters.
- *Civil Engineer* with experience in solar PV system steel structure construction and mounting, piles sizing and construction, solar PV site preparation and leveling, steel welding, and road construction.
- *Electrical Power Engineer* with experience in high voltage power stations and grid impact studies, protecting relay commissioning and testing, high voltage cables sizing, testing and construction
- *Environmental Engineer* with experience in environmental impact assessment and monitoring
- *Solar PV Electrician* with experience in engineering diagrams including systems layout, DC cables diagrams, AC cables diagram, earthing system diagram, solar inverter diagram, DC and AC distribution boards including fuses and circuit breakers installation as well as system commissioning and operation. The candidate should hold a diploma degree in electrical engineering or equivalent. Such a technician might also be without a diploma degree but should have graduated from a vocational secondary school with a specialty in electrical engineering or equivalent. Such technicians are considered the most important human resource in the site, as 50% of the whole field work is done by them. The daily rate of electrical technicians in PV systems in Palestine is about 65 USD.
- *Electrical Power Electrician* with experience in implementing power substation diagrams, switch gear diagrams, high voltage metering unit diagrams, and power substation earthing diagrams, testing power transformers, high voltage cables, fuses, circuit breakers, cables insulation, and relays testing. Electrical technicians are required to handle the connection of the system –in some cases- to the medium or high-voltage network. This job implies high risks and should be only implemented under the supervision of highly skilled engineers. Here, due to the nature of work, only electricians with a diploma degree in electrical power networks and special licenses are allowed to work. The daily rate of a technician who works in a high-voltage network with licenses is around 155 USD.
- *Civil Engineering Technician* with experience in the implementation of mounting piles construction and steel structure construction and welding. A diploma degree in civil engineering or equivalent is required. The daily rate of civil technicians is around 50 USD.
- *Surveyor* with experience in solar PV site surveying and should hold a surveying license based on a degree in this field (mainly a diploma) with special requirements in site surveying for PV systems. The daily rate of a surveyor with licenses is around 35 USD.
- *Labor* with experience in electrical installation and civil construction. This labor helps the technician and work under his/her supervision. The qualifications of this position are within the scope of the basics of electrical installation and safety. The daily rate of any la-borer who works in electrical installation is around 40 USD. As for labor with civil engineering skills, the basic skills of steel structures and foundation construction are inquired. The daily rate of laborers who work in civil construction is around 50 USD.
- *Welder* with experience in steel welding. This skill is really important and should be done by someone who can implement the welding according to specific requirements and protocols. No specific degrees here

are required, as it is all about personal abilities. The daily rate of professional welders in Palestine is about 130 USD.

As for standalone PV systems and hybrid PV systems, the required skills are mainly the same for grid-connected PV systems in addition to electrical technicians who are experienced in storage batteries installation and operation. It is also worth mentioning that the setting and commissioning method of inverters in standalone PV systems is different from the setting and commissioning of inverters in grid-connected PV systems. As for wind power systems skills, it is not that preferred in Palestine due to their relatively low potential. Fig. 1 shows a bar chart that illustrates the daily rate of the aforementioned skills in Palestine

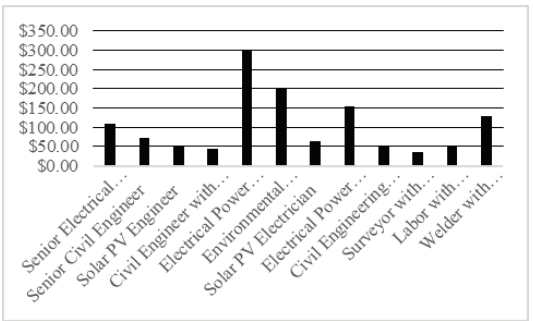

Fig. 1 daily rate of PV system skills in Palestine

B. Review of PV system courses offered by governmental vocational secondary schools and other training centers

In the West Bank, Palestine there are twenty governmental and vocational schools as well as sixty-six governmental vocational units that work in the technical and vocational training field. These schools aim at accepting students who pass the 10th grade of school. The graduates of these schools are being admitted by technical colleges to pursue their diploma degrees.
Recently, these schools were funded to establish PV system vocational streams. The training facilities in these schools are the best in the country; however, they still need some capacity building in terms of trainers' ability and practical implementation as well as curriculum development.

On the other hand, some other TVET governmental centers aim at school dropouts to qualify them as professional laborers. Meanwhile, in partnership with chambers of commerce in West Bank and with the support of different international funding agencies, there were some courses on smart homes, electrical installation, and PV systems. On the other hand, electrician syndicates have implemented some PV courses with the support of international funding agencies. These courses were very basic on the regulations and rules of electricity distribution companies and the electrical installation of PV systems.
A review of 350+ PV system courses offered by many private and public entities is done in this research. The content of these courses is used to create the word cloud of PV system training topics in Palestine. Table I shows a summary of offered courses by vocational and industrial schools in the West Bank. This data is gathered by this research after reviewing all required documents from the adapted TVET schools.

IV. Results and Discussion

After reviewing, the PV system courses, it was found that there are only two specialized diploma courses in renewable energy in Palestine. These programs offer theoretical courses on PV systems and solar energy as well as courses on electrical installation and circuits. They also offer a renewable energy lab without having a facility for that (outsourced). Meanwhile, two photovoltaic system workshops are also given to the students. However, there is no full-time expert in this regard in the colleges, and thus, a part-time lecturer from PV companies is hired to deliver this course. Here also there is no equipped PV workshop in the colleges but it is done by site-seeing visits without real interference in the installation of the PV system.

As for the trainers, there are no trainers specialized in PV systems in the two colleges. Meanwhile, Ph.D holders in the field of electrical power systems and power electronics are delivering the theoretical courses. Other practical courses are being delivered by part-time lecturers.

On the other hand, Palestinian university offers B.Sc courses on PV systems in a good way, whereas most of the fundamentals are covered. However, there is a very clear lack of practical courses and research activities in this field. Moreover, novel design and testing tools as well as computer applications are not given that attention. Meanwhile, most of the MSc. programs are not well established with specialized staff, except few programs. It is found that the content of all of these programs is not that advanced and it is equal to B.Sc level. It is also found that most of the students who attend these programs are working in the local market, either in the government or private sector with outdated knowledge regarding photovoltaic systems. As for the only Ph.D program in Palestine, it offers a thesis on PV systems but there is a lack of professors in this field including PV systems, renewable power systems, storage, smart grid, and energy informatics. Moreover, there is a lack of advanced research labs.

As a result, all of the aforementioned degrees do not cover all aspects of PV systems whereas "grid-connected and standalone Inverters programming and commissioning", "storage in PV systems", "PV water pumping systems", "PV system maintenance and operation management", "PV system site evaluation", "grid impact studies" and "AI application for PV systems" topics are missing.

A. Photovoltaic systems TVET topics in Palestine

Fig. 2 shows the word cloud that highlights the most frequent topics of PV systems TVET. It is very clear that most of these topics are for general electricians with some information on PV systems. This is to ensure a wider working field for the graduate as the scope of technicians for PV systems is still not clear in Palestine. On the other hand, some of these topics are advanced for TVET training such as grid impact study and environmental impact assessment although such topics are delivered within TVET programs.

As a result, the target groups of such training are engineers with degrees that are higher than diplomas. Thus, such courses cannot be classified as TVET courses, although some of them are being delivered by TVET centers.

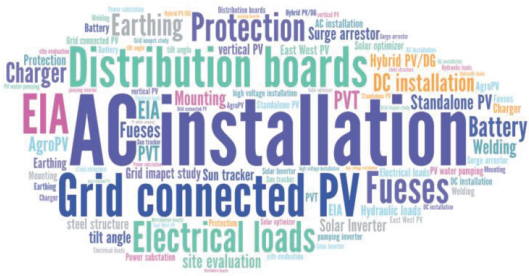

Fig. 2 Keyword cloud for PV system training topics in Palestine

The reason behind this issue is the TVET funding schemes, where engineers and master's degree holders attend TVET courses to compensate for the missing topics from their degrees. Although this practice enhances their knowledge the mixing between continuous learning and TVET is not a good education practice. Such a practice may affect the opportunities of students with lower degrees negatively.

TABLE I
OFFERED TVET COURSES IN PALESTINE

	Couse	Trainer qualification	Training equipment	job opportunity
Ten vocational and industrial schools. (10-15) student per year	• PV system (60%) [Off-grid PV system (55%), On-grid PV system (48%)] • AC & DC Electrical installation (100%)	MSc in EE (20%), BSc in EE (50%), Diploma in EE (30%)	PV system component (40%), Off-grid PV system kit (30%), grid PV system kit (35%), Electrical installation workshop (100%)	Electrical technicians (87%), PV technicians (13%)
Nine electrical syndicate (13-20) student per year	• PV system (67%) [Off-grid PV system (0.0%), On-grid PV system (100%)] • AC & DC Electrical installation (100%)	MSc in EE (40%), BSc in EE (60%), Diploma in EE (0.0%)	PV system component (0.0%), Off-grid PV system kit (0.0%). On-grid PV system kit (0.0%), Electrical installation workshop (100%)	Electrical technicians (98%), PV technicians (2%)
Fourteen vocational training center (15-30) student per year	• PV system (50%) [Off-grid PV system (0.0%), On-grid PV system (100%)] • AC & DC Electrical installation (100%)	MSc EE (0.0%), BSc in EE (30%), Diploma in EE (70%)	PV system component (50%), grid PV system kit (0.0%), grid PV system kit (0.0%), Electrical installation workshop (100%)	Electrical technicians (72%), PV technicians (28%)
23+ internationally funded training programs (10-15) student per year	• PV system (100%) [Off-grid PV system (30%), On-grid PV system (70%)] • AC & DC Electrical installation (10%)	MSc EE (0.0%), BSc in EE (30%), Diploma in EE (70%)	PV system component (0.0%), Off-grid PV system kit (10%), On-grid PV system kit (10%), Electrical installation (5%) workshop, Site visits (75%)	Electrical technicians (5%), PV technicians (5%), Electrical engineers (90%)

B. Stakeholder perception of photovoltaic system graduates

Based on the response on the ability of PV system technicians versus the expectation from them based on feedback from the surveyed PV systems companies In Palestine, the following remarks can be concluded as below,

a) PV system companies do not hire technicians as full-time employees but they use their services based on day-to-day contracts subject to the availability of projects. This practice is being applied by PV companies to avoid continuous salary payments when there are no projects to implement. This also shows an unstable workflow for some PV companies. Anyway, this practice is challenging for developing PV technician skills as there is no job security in this field. Thus, most PV technicians provide general services in the field of electrical installations for houses and industries as freelancers.
b) The average salary of a PV technician is considered low as it is around 650 USD. This low salary pushes most of the PV technicians to work outside the West Bank (in Israel), where the salaries are much higher (about 2000 USD) per month with much better working conditions. Otherwise, these PV technicians rely on freelancing in the field of electrical installations.
c) The number of PV technicians inside a PV site is not enough according to the standards and requirements.
d) Most companies tend to hire a solar PV engineer as a full-timer while they resort to a day-to-day contract for PV technicians when needed. This is because the salary of the solar PV engineer is not significantly higher than the salary of the solar technicians.
e) According to the PV companies, PV technicians do not have the required practical experience, while most of them master traditional experience (AC and DC installations including earthing systems). Meanwhile, skills for solar inverter installation and commissioning, distribution boards for PV systems, energy storage for PV systems, PV system optimizers, earthing, PV systems testing devices, and PV system maintenance are missing.
f) According to PV companies, there is a dire need for professional welders inside PV system sites. The companies showed the ability to hire such professionals for a salary of 2000 USD per month
g) According to PV companies, solar PV engineers also suffer from weak experience in designing procedures, PV software, required studies for PV systems, and PV system project management including tendering and procurement.

Meanwhile, according to PV system beneficiaries and large PV system owners, there is a dire need for qualified technicians in the field of system maintenance and system operation management. Meanwhile, there is a need for experts in designing these systems and providing feasibility studies. However, the second need is considered an engineering skill. Therefore, system maintenance and system operation management are considered the most important requirements of these beneficiaries.

On the other hand, Table II shows the response of the expert on PV systems on the importance of PV systems topic in Palestine. This data is based on the reviews conducted with experts, PV system company owners, and large PV system owners based on their experience with TVET course graduates. In this Table I indicates the lowest, while 5 indicates the higher. The difference between these scores indicates the gap.

TABLE II:
REQUIRED PV SYSTEM SKILLS BASED ON EXPERTS' OPINION IN PALESTINE

Expert Ref.	Responses average	
Skill Ref.	Expected	Perceived
AC installation	5	5
AC distribution board	5	3
DC installation	5	3
DC distribution boards	5	3
Battery	4	3
Chargers	5	2
PV optimizers	4	1
PV panel installation	5	5
Inverter installation	5	1
Inverter commissioning	5	1
Earthing system and survey arrestors	5	3
PV System basic design	5	5
PV System simulation	4	1
PV System management	3	1
PV System Maintenance	5	1
PV System tendering and procurement	3	1
Grid connection and impact	1	1
Hybrid PV system	4	1
Water pumping PV system	3	1
Site pre-evaluation	5	2
Steel structure construction	5	4
Steel structure welding	5	2

C. Estimation of the number of required technicians per system

To understand the required number of technicians per PV system, Table III illustrates the number of skilled technicians and labor. This estimation is done based on the experience of the investigators of this research, the surveyed experts as well as the conducted survey for the stakeholders (companies and experts). Moreover, these numbers were supported by [17] – [20]. S1 to S6 skills

shortcuts are given to electrical technician (low voltage), electrical technician (high voltage), civil technician, steel welder, labor (electrical), and labor (civil), respectively.

TABLE III:
REQUIRED PV TECHNICIAN AT THE PV SITE

System	S_1	S_2	S_3	S_4	S_5	S_6
	(up to 50 kWp) systems, rooftop, connected to low voltage network					
Grid-connected PV system	1	0	1	0	1	1
Standalone PV system	1	0	1	0	1	1
Hybrid PV system	1	0	1	0	1	1
	(50- 200 kWp) systems, ground-mounted, connected to low voltage network					
Grid-connected PV system	2	0	1	1	2	2
Standalone PV system	2	0	1	1	2	2
Hybrid PV system	2	0	1	1	2	2
	(0.2 to 1 MWp) systems, ground-mounted, connected to medium voltage network					
Grid-connected PV system	4	2	2	2	2	3
Standalone PV system	5	0	2	2	2	3
Hybrid PV system	5	0	2	2	2	3
	(>1 MWp) the system, ground-mounted, connected to a medium voltage network					
Grid-connected PV system	7	3	4	4	12	15
Standalone PV system	9	0	4	4	16	15
Hybrid PV system	10	0	4	4	14	15

D.Required PV system TVET topics

According to the previous analysis of TVET providers, the best stakeholders for delivering TVET courses are Governmental Technical and Vocational Schools, Technical colleges, and Electrician Syndicates. This is because previous PV system TVET courses were delivered through electrician syndicates and were found to be successful. However, these courses need to be updated as in Table IV.

E. Current vs. future jobs of PV system in Palestine

The conducted market analysis as well as the consultation of PV system stakeholders in Palestine shows a specific level of occupancy of PV system jobs in Palestine. However, it is also expected that these levels will be changed shortly (ten years) following the current development status in Palestine.

TABLE IV:
REQUIRED PV SYSTEM TVET COURSES IN PALESTINE

Topic (needed)	Considered TVET?	Being delivered?
AC installation	Yes	Yes
Grid-connected PV	Yes	Yes
Distribution boards	Yes	Yes
Electrical loads	Yes	Yes
Protection	Yes	Yes
Fuses	Yes	Yes
DC installation	Yes	Yes
Earthing	Yes	Yes
Standalone PV	Yes	Yes
Surge arrestor	Yes	Yes
Hybrid PV/DG	Yes	No
Grid Impact Study	No	No
Site evaluation	Yes	No
Solar Inverter	Yes	No
Battery Chargers	Yes	No
Battery for PV system	Yes	No
Hydraulic loads	Yes	No
EIA	No	No
Steel structure design	No	No
Mounting	No	No
Welding	Yes	No
Solar optimizer	Yes	No
PV water pumping	Yes	No
high voltage installation	No	No
Tilt angle setting	No	No
AgroPV	Yes	No
East West PV	No	No
Sun tracker	No	No
Power substation	No	No
pumping inverter	Yes	Yes
vertical PV	No	No
PVT	No	No

Table V shows the current occupancy (C.O.) versus future occupancy (F.O.) of PV systems jobs in the Palestinian market.

TABLE V:
CURRENT VS FUTURE PV SYSTEM JOBS OCCUPANCY IN PALESTINE

Job title	C.O	F.O	Required skills
PV system engineer	30%	19%	PV system fundamentals, power electronic fundamentals, machine fundamentals
Renewable power system engineer	25%	12%	PV & wind systems fundamentals, Power system fundamentals, grid impact studies
RE funding projects coordinator	11%	14%	Management, tendering procurement, finance
Energy management and efficiency engineer	10%	14%	Thermos dynamic, HVAC, insulation, ventilation, energy auditing, energy economics, boilers and steam systems, waste management
Environmental and social officer for RE systems	7%	12%	Environmental and social impact assessment, resettlement plans, stakeholder engagement plans, labor management plans
Energy policy and data analyst	5%	10%	Policies, data analysis, machine learning, smart grid
Solar thermal systems engineer	4%	4%	SWHs, CSP, desalination
Biomas and biogas engineer	3%	5%	Gas turbines, digesters, grid connection, collection, storage, feasibility
Renewable water pumping systems engineer	3%	7%	wind and solar power for water pumping, mechanical load, static & dynamic head, water distribution networks, water storage, civil loads
SCADA for renewable energy engineer	2%	3%	Control, energy informatics, sensors, programming

V. Conclusion

In this research mapping of TVET courses in PV systems in Palestine was conducted. The mapping was

done based on analyzing all PV system courses including Diploma, B.Sc, M.Sc, and Ph.D courses. Trainings that are given at lower levels by TVET governmental schools were also considered. In addition, an analysis of PV system companies' perceptions by PV system graduates was done. The opinion of PV system experts as well as large PV system owners was also provided. After that analysis of the PV system TVET requirement was provided. According to the results, The most required topics but not adequately delivered by current TVET programs in Palestine are "Energy storage and charge controllers in PV systems", "Solar inverters and optimizers in PV systems", "PV system maintenance and operation management", "PV system project management", "Hybrid PV/Diesel Generator System Installation", and "Water pumping PV system installation". Results also show that the current PV system jobs are appropriate and in demand in Palestine. However, the occupation level of these jobs will change in the next ten years, it is predicted in this research that jobs related to PV systems in electrical power systems, PV system environmental issues, PV system management and evaluation, PV system data analysis, PV system-based water pumping will be in high demand in the coming ten years.

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Conflict of Interest

The authors declare no conflict of interest in the publication process of the research article.

Author Contributions

A. Alothman: Conceptualization, methodology, validation, writing, review, and editing. E. Sawi: Conceptualization, methodology, validation, writing, review, and editing; H. Maltzahn: Conceptualization, methodology, validation, writing, review, and editing; T. Khatib: Conceptualization, methodology, validation, formal analysis, writing original draft preparation, writing, review, and editing.

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