PRIVATE SECTOR ENGAGEMENT ANALYSIS IN ELECTRICITY/SOLAR ENERGY, AND YOUTH JOB OPPORTUNITIES STUDY

PRESENTED TO THE DCA/NCA PALESTINE JOINT COUNTRY PROGRAM

NOVEMBER 26, 2018

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Photos on the front page:

1. Right hand side: Bedouin cooperative community solar panels in need of operation and maintenance
2. Left hand side: JDECO training centre- solar system for training

Date of the Research: August to September 2018

Acknowledgment: We the Consultancy Team would like to express our gratitude for all those who contributed to the success of this study; we hereby would like to thank all ***solar power stakeholders, communities and private sector enterprises*** *that have contributed with their time to the interviews, group discussions and to fill the survey.*

WE would also like to thank the DCA-NCA Joint Country Programme (JCP) in ***Palestine*** *for their assistance and support during the mission.*

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Abbreviations

AOC:	Arab Occupational Classification
ARIJ:	The Applied Research Institute in Jerusalem
BTC:	Belgium Technical Cooperation
CCI:	Chambers of Commerce and Industry
CBO:	Community-Based Organisation
CSO:	Civil Society Organisation
CSP:	Concentrated Solar Power
CVT:	Continuous Vocational Education and Training
DCA:	Dan-Church Aid
ECIB:	The Enhancing Capacities for Institution Building Programme
EDC:	Electric Distribution Companies
EJ:	East Jerusalem
GIZ:	German Technical Cooperation
GMR:	Global Monitoring Report
IEC	Israeli Electric Corporation
ILO:	International Labour Organization
IVET:	Initial Vocational Education and Training
JCP:	DCA-NCA Joint Country Programme (JCP) in Palestine
JDECO:	Jerusalem District Electricity Company
KW:	Kilo Watt
KWH:	Kilo Watt Hour
LFPR:	Labour Force Participation Rate
LM:	Labour Market
LMS:	Labour Market Survey
LWF:	Lutheran World Federation
MoEHE:	Ministry of Education & Higher Education
MoLG:	Ministry of Local Government
MW:	Mega Watt
MWH:	Mega Watt Hour
NEDCO:	Northern Electricity Distribution Company
NCA:	Norwegian Church Aid
NGO:	Non-Governmental Organizations
NGO-VET League:	League of Vocational Education and Training Institutes
OCHA:	Office for the Coordination of Humanitarian Affairs in oPt
O&M:	Operation and Maintenance
oPt:	occupied Palestinian territory
PA:	Palestinian Authority
PENRA:	Palestinian Energy and Natural Resources Authority
PERC:	Palestinian Electricity Regulatory Council
PETL:	Palestinian Electricity Transmission
PIPA:	Palestinian Investment promotion agency
PV:	Photo-Voltic

RE:	Renewable Energy
SDG:	Sustainable Development Goals
TEDCO:	Tubas Distribution Electricity company
TNA:	Training Needs Assessment
TVET:	Technical, Vocational Education and Training
UNCTAD:	United Nations Conference on Trade and Development
UNFPA:	United Nations Population Fund
VET:	Vocational Education and Training
VSS:	Vocational Secondary Schools
VTC:	Vocational Training Centre
WB:	West Bank
WBL:	Work-Based Learning
YMCA:	Young Men Christian Association

Executive Summary

Solar energy for generating electricity as part of renewable energy is high on the global agenda, linked with Sustainable Development Goals and international call for protecting the environment and combating climate change. The different national experiences in moving towards this direction has created jobs and skills development opportunities.

The aim of the study is to identify the local and international opportunities for engagement with the private sector that would influence the program interventions. Aiming at providing understanding of the sector, sourcing, collection and storage of energy, job opportunities and overview of the renewable energy sector in Palestine.

The methodology used is qualitative using qualitative and quantitative methods, and using participatory approach. The methodology used two approaches, first; the Labour Market Assessment (LMS) approach of identifying jobs and skills and matching with the TVET supply. Second approach is the sector mapping and assessment, which include assessing the demand and supply, challenges and enabling factors. The consultancy uses pro-poor and inclusive approach. Methods used were labour market survey, semi-structured interviews and group discussions with private sector, other sector stakeholders, communities and youth. 73 people participated in the survey, mapping of private sector enterprises and stakeholders, as well as mapping of communities and projects was done. Results were analysed and matched, and findings presented in the study report.

Findings of the study:

The potential of solar power energy is high in Palestine, yet the political challenges is curtailing related opportunities, mainly the access to Area C of the West Bank and siege on Gaza. Amidst such challenges; the Palestinian Authority (PA) has adopted and renewed a series of laws and regulations for encouraging investment in this sector. Additional reform could further enhance the investment opportunity.

The solar energy sector has a high commercial viability, as vibrant private sector companies and engineering offices are providing the services of design, selling, instalment, and/or operational and maintaince, the number has been growing and the required service, their clients ranged from services to housing and private sector.

Private sector Investors engaged in solar power energy generation have a high financial viability on the long-term, their main challenge is the challenged electricity network and transmission lines infrastructure, one of the projects was able through the Palestinian Electricity Transmission (PETL) support to link with existing Israeli lines. Investors were able to benefit from schools' rooftops initiative through a third-party agreement that enables public schools to benefit as well. Yet investors and private sector support to marginalised communities is limited. Investors are challenged by political challenges, and the outdated and limited transmission lines as well as challenges related to integrating the new technology. In addition; investors don't have special financing agreements or support, except for the Bank of Palestine green loan initiative. Facilitating national and financial support, and engaging financial investors could be an opportunity.

Communities are impacted differently with Solar Power Energy. Although electricity reaches the vast majority of population, there are certain communities as Bedouin and other marginalised communities in Area C of the West Bank, only benefits from off-grid systems that require follow-up and maintenance. Mapping indicated that 658 households in 51 communities Bedouin communities are in need of solar power energy in the centre of the West Bank (Jerusalem, Jericho, and Ramallah) and Bethlehem. There are different systems of operation and maintenance used by these communities, successful ones as third-party maintenance through a fixed fee and cooperatives could be used in other areas.

Tubas community is benefiting from the Palestinian Solar Initiative (PSI) and the electricity company investment, while use of solar energy in other communities in the West Bank is still limited to few housings and economic establishment rooftops. Tubas pilot could be duplicated in other similar communities. East Jerusalem J1, suffer from the limited spaces for Palestinians and the regulations and control, opportunity of using the institutes' rooftops is identified, while opportunities of Area C and East Jerusalem communities were identified.

21 private sector enterprises were surveyed, another 20 were identified, representing a majority of the available private sector enterprises working in the design, selling, installing and /or maintaining. 76% of the companies provide all the services, 90% of the surveyed provide installations.

81% of the surveyed have noted increase in economic feasibility of using solar energy in generating electricity in Palestine, reasons were increase of awareness, increase of companies and consultation, increase of equipment efficiency, reduction of cost and the provided incentive for private sector economic establishments.

85.7% of the surveyed enterprises noted increase in their solar energy work during the past three years. Surveyed enterprises have identified future development that could increase use of solar energy in generating electricity and suggested measures, including further enhancing the

regulations and incentives for new groups, enhance human resources and enhance financial support.

The private sector enterprises are more labour intensive than the national enterprises, as 85.7% of the surveyed enterprises has more than 5 employees, while 88.4% of the national economic establishment had less than 5 employees. Employment within 71.5% of the surveyed enterprises have increased during the past three years.

The study has identified the high labour market demand for employment and self-employment in the sector, as 95% stated the need for employing skilled workers of solar power energy within the coming three years, and 85.7% of the surveyed stated the need for sub-contracting skilled workers of solar power energy within the coming three years. The average requested number of skilled workers for employment is 3.1 per enterprise. The average requested number of skilled workers for sub-contracting is 5.2 per enterprise, these findings are in-line with youth demand for employment and self-employment within the sector.

The study has also highlighted the social demand for male and female youth and echoed some of their voices. Study indicated although sector and the electrician vocation are male-dominated, yet there was a clear demand for female integration within the sector.

Surveyed enterprises have checked the prepared list of the technician skills, list was prepared based on the Arab Occupational Classification (AOC). All skills except 1 got the agreement of 81% and above of the surveyed companies, they have identified technical and technological skills as well as personal and supportive skills, all of these identified skills represent the basis for future training programmes development and related curricula. The average surveyed enterprises' satisfaction of the Level of proficiency of the skilled worker compared to required level by enterprises reached 46%, indicting the need for capacity building of current staff and future preparation of the skilled workers.

95.2% of the surveyed enterprises confirmed their readiness to employ graduates from vocational education and training institutes as the LWF or the YMCA Vocational Training Centres (VTCs). All the surveyed enterprises confirmed their need to train their employees on new techniques of solar energy.

The study has also pointed out to the needs from the remote and Bedouin communities, and the future needs for solar power stations. It has also pointed out to the need for training of practicing electricians.

Overall recommendations have been presented in two parts,

1. First: overall recommendations related to the potential investment opportunities: Recommendations here presented ways of spreading the use of solar power energy in different areas and sectors, supporting investors, providing technical support, continuing with research and piloting and linking with international investment opportunities and financial support.
2. Second: overall recommendations related to skills training and support for jobs and entrepreneurship opportunities and capacity building

Recommendations in this part included introducing training within the current systems, providing outreach courses especially for marginalised communities and provide upgrading training for practitioners and current employees. Recommendations also included engaging electrician union and the JDECO training centre, as well as engaging the private sector through the training provided through Work-Based Learning and other actions.

Finally; the study presents recommended design of the VET training to meet the labour market demand and in line with the identified social demand, with details of the projection of the demand and supply, recommended methods of interaction with the private sector and the design of the recommended trainings as well as required measures to engage women and youth in the sector. The chapter ended by identifying scenarios of support.

The study is divided into five chapters, first is the introduction, second is the methodology while third and fourth are the findings and finally chapter five presents the overall conclusions and recommendations, while the sixth chapter presents the recommended design of the VET training to meet the labour market demand.

1 Chapter 1: Background and Introduction

1.1 Solar energy and green jobs- global trends

Renewable energy is high on the international agenda, as global and national efforts accelerated during the past years in order to reduce the harmful carbon dioxide emissions produced by the traditional fuel fossils used in energy generation. Efforts by different states and regions including the MENA region and other Arab states has increased the use of solar energy in power generation. Its estimated that by the end of 2016, solar power energy reached at least 303 GW, sufficient to supply approximately 1.8 percent of the world's total electricity consumption, as noted by the International Energy Agency (IEA) (2016)

The growing solar power energy markets was able to create jobs in different countries, it was reported by the US Environmental Defence Fund's (EDF) (2017) that solar industry is creating jobs at a rate of 12 times faster than that of the rest of the economy. The ILO (2011) has found that employment in the renewable energy sector has grown rapidly, they pointed out that in 2009 more than 3 million people worldwide were estimated to be working directly in the sector, solar photovoltaic offers the highest employment rate worldwide, with 7 to 11 jobs per megawatt (MW) of average capacity.

1.2 Contextual Background

The area of the Palestinian Territory is 6020 km2; the area of West Bank is 5655 km2, and the area of Gaza is 365 km2. The total population of the Palestinians in the occupied Palestinian territories (oPt) is 4.78 million inhabitants, with the West Bank population reaching 2.88 million and Gaza population 1.899 million. This makes Gaza the most densely populated area in the world, at around 5,200 inhabitants per Km2 (PCBS, 2108b).

The West Bank and Gaza Strip are not geographically connected; they are separated by Israel, with a distance of around 75 km between Gaza and the nearest West Bank city of Hebron. Commuting between the two areas needs the permission of Israel, with only Israeli cars and trucks allowed to commute between the borders of the two areas

According to Palestinian-Israeli agreements, the West Bank was divided into three distinctive areas, A, B, and C, as per the following definition:

- **Area A**: This area is only 18% of the West Bank area, it enjoys a full civil and security control of the Palestinian Authority; this area includes all major Palestinian cities but has no geographical continuity.
- **Area B**: Comprises only 21% of the West Bank area, it has civil Palestinian control and Joint Palestinian-Israeli security control. This means that any Palestinian police

intervention against crime in area B needs the prior approval of the Israeli security forces. It includes most of the Palestinian villages.

- **Area C**: Has a full Israeli control over security, planning and construction, it comprises over 60% of the West Bank in terms of area, but only around 300,000 Palestinian inhabitants live there; a mere 6.2% of the total West Bank population. the United Nations Office of Coordination of Humanitarian Affairs (OCHA) has noted that nearly 30% of Area C is prohibited and only 1% has been planned for Palestinian development by the Israeli Civil administration (2017). Area C, as per OCHA includes all the agricultural land of the Jordan valley, all major roads between Palestinian towns and villages, and most of the water and natural recourses. It also has most of the land needed for solar energy generation stations and transmission lines to the West Bank populated areas. According to the World Bank (world Bank, 2017), 97% of the potential solar electricity generation is located in area C.

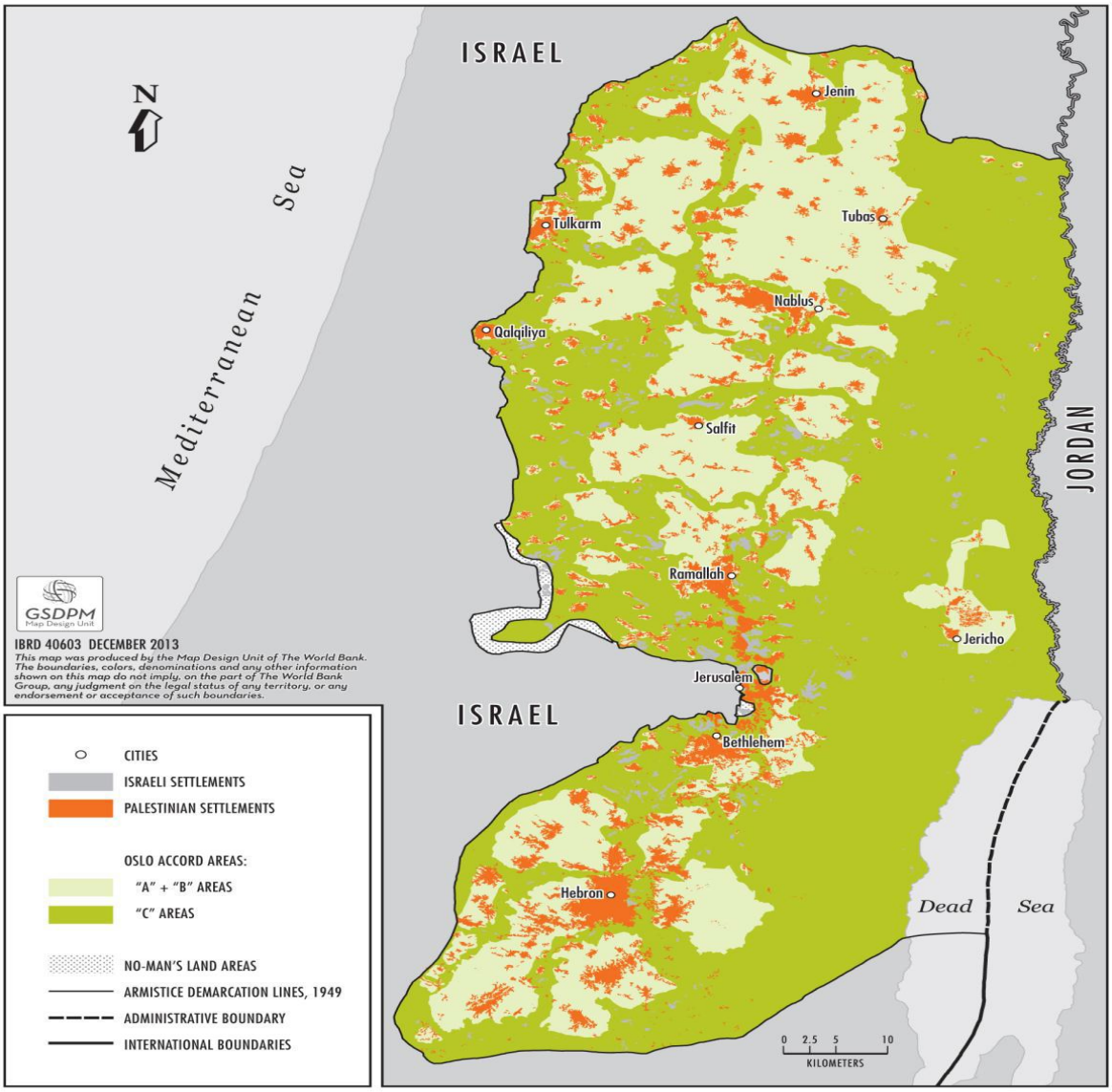
This area is full of Israeli settlements, with around 230 settlements and outposts, housing around 400,000 settlers. The Map below, as published by the IBRD shows the West Bank map illustrating geography of areas A, B and C, where areas A and B are small entities swimming in the ocean of Area C. This area, although containing most of the Palestinian resources including water, mineral and agricultural resources, has a very minimal contribution to the Palestinian economy. This is due to the full Israeli control over this area, and refusal to give the Palestinians permits to work within it. (World Bank, 2013a).

A World Bank report in 2013, noted that if Palestinians allowed to access and develop Area C without the current restrictions, Palestinian GDP would increase by an estimated 35%. The report estimated the direct benefits of the PA control of Area C in terms of the additional output of agriculture, Dead Sea minerals, stones, construction, tourism and telecommunication to be in the range of US$ 2,276 million per annum. (World Bank, 2013a)

A recent study by United Nations Conference on Trade and Development (UNCTAD, 2018) has highlighted the bleak economic prospects in the oPt due to risky political horizons and unfavourable trends in aid. The report pointed out to the expanding occupation status, settlement expansion and restriction of movement and its effects on creating unfavourable politico-economic conditions for Palestinians.

Such facts have dramatically affected the growth of the Palestinian economy and increased Israeli control.

Map 1-1: West Bank map as per areas division



1.3 The need and potential for Solar Energy in Palestine

The energy sector in Palestine is affected by various challenges the non-availability of natural resources, unstable political conditions, lack of sovereignty and financial crisis of the PA, increased population growth and high standard of living.

The multi-source amount of electricity available in Palestine was 5,812 MW. Hour in 2016 (4,449 in the West Bank and 1,363 in Gaza) (PENRA, 2017). The annual per capita consumption of electricity (after deducting transmission loss) is 950 kilowatt/hour, which is well below the rates in neighbouring countries. (MAS, 2014)

National sources only produce less than 10 percent of the demand, leaving Palestinians almost entirely dependent on the Israeli imports of electricity supplied by the Israel Electric Corporation (IEC). "**The oPt face significant energy security challenges"**, as noted by the World Bank (2017), already sever in Gaza and emerging in the West Bank, the available power supply is below the current demand. The projected annual growth is around 3.5% placing more pressure on the energy power supply that is already reliant on the Israeli side, which add burdens on the PA annual budget and could be affected by the political context.

Hence, developing solar power energy in Palestine through its own resources is a matter of building future state infrastructure and enhancing the resilience of the Palestinians.

The potential of solar power energy is high in Palestine, due to its location and climate, as Palestine location on the Latitude and Longitude gives 5.4 PSH (Peak Sun hours) every day. Palestine is located in a transitional climatic zone between the Mediterranean and arid tropical zones. Climatic conditions of Palestine vary widely. There are three climatic zones in Palestine: coastal areas, hilly areas and Jordan valley. The coastal zone, which is only in Gaza, has mild weather (average of 15 degrees Centigrade) during winters, humid and hot (average of 24 degrees Centigrade) during summer, while hilly areas in WB are cold during winters, and mild in the summer. Jordan valley climate is warm and humid in winters, and hot and dry during summers. Temperatures in Jordan valley are always higher than in coastal areas, while in hilly areas, they are usually low (PCBS, 2014). The best conditions for solar power generation is in the Jordan valley and the surrounding hills, which is mostly located in Area C.

On the macroeconomic level. Electricity consumption to GDP is quite high in Palestine, it was 4.7% in 2016 (calculation Based on PCBS data, 2016). Electricity import to total import was 8% in 2016 (calculation Based on PCBS data, 2016), which is also considered to be high. According the world Bank report (world Bank, 2017), the net estimate of solar electricity produced in 2017 in Palestine was 18 MW only, this is only 0.35% the total Palestinian consumption of electricity. This makes the solar energy contribution to GDP a very small fraction of 0.017%, which is considered to be very low compared to values in neighbouring countries.

If the PA plan of 10% solar energy is to materialise in 2020, then the solar energy contribution to GDP will increase to 0.5%.

The main reason of this low contribution is the Israeli control over area C. According to the World Bank report (World Bank, 2017), the potential of solar electricity production in area C is 3477 MW compared to 103 MW in areas A and B.

Therefore; the importance of solar energy sector stems from the high potential to use green energy and replace the fossil fuel source of energy on the one hand as one of its available resources, its importance exceeds its contribution to the GDP or contribution to employment, the sector development is related to severity and sustainability of the future Palestinian state, and facilitating the resilience of the Palestinians living under military occupation.

1.4 Employment of youth in the oPt

Unemployment rate is high in the oPt and among the highest in the world as recently announced by UNCTAD (2018). The unemployment rate among the population reached 27.7%, highest rates is among youth as unemployment reached 43.8%. Unemployment was highest among graduates of diploma certificates and above reaching 35% (PCBS, 2018a). While recent study of TVET graduates with WBL has found that only 6.9% were unemployed. Female graduates had also much higher participation rate and employment rates than national youth female figures (Hilal, 2018c). These figures resemble the male and female youth participation and employment rates of LWF graduates, according to annual tracking survey (Hilal, 2018a).

Various labour market surveys and studies supported by the Enable and COOPI has identified a high demand for male and female youth skilled labour, whom are TVET graduates in different sectors, either in the services, construction, industrial, tourism, agriculture, crafts and sales related vocations (Hilal, 2011;2013; 2017). The labour market survey carried in 2013 in the West Bank among all sector, indicated that 21% of the private sector were lacking skilled workers, and the demand was for 19% increase above their 2012 employment body annually until the years 2015, this demand was increased for females to reach 28% (Hilal, 2013). Demand varied according to sector and geographic location, but remained high in the field of electric installation in all geographic areas, while demand for females was also apparent although at a lesser extent than males. Request for renewable energy was voiced out by the private sector since 2012.

The need for solar energy was identified in various studies (Hilal, 2011; 2013; 2015). Only recently that some TVET institutes started introducing solar energy training within their curricula including the curricula of the MOEHE vocational schools.

A recent study supported by Enabel for the TVET sector (Hilal et al, 2016) has realised that informal apprenticeship exists in Palestine and it's a root for many marginalised youths and for private sector to fill the skills gaps at the market place.

Different researches including one of the researchers PhD research has identified that although youth TVET graduates have a better opportunity at the market place, working conditions of many are lacking decent work conditions due to various reasons including laws, regulations and implementing of laws, as well as due to the vulnerable private sector within a context of military occupation, the research has also indicated other positive effects of TVET beyond employment, reaching social and economic empowerment, as well as poverty reduction and equality of the marginalised including gender equality. (Hilal, 2018b)

The limitation of decent work conditions was explained by the recent report of the ILO director general on **the situation of workers of the occupied Arab territories** (ILO, 2018),

> From the status of Jerusalem to the situation in Gaza, events at the macro level create tensions and instability on the ground that impact economic activity, employment and livelihoods. The occupation controls and stifles the potential for growth and job creation. In such a constraining context, labour market and employment policies – however well designed –have limited margins of impact. (P. 39)

The recent UNFPA (2017) study Palestine 2030 has demonstrated that Palestinian youth are facing various challenges including occupation, patriarchy, inequality and power. Report noted that unemployed youth are among the marginalized youth, and that the high unemployment rates among youth leads to various social and psychological negative effects and could lead to Gender-Based Violence and other. The study has recommended developing new strategies to foster greater economic opportunities and the creation of jobs for young people, by investing in potential high-value added and growth sectors.

An ILO study (Muhaisen and Ahlbäck, 2012) on green jobs opportunities in Gaza has illustrated that reconstruction works and low-cost housing can be made through green building methods including solar power energy, that could contribute to economic and environment gains. The report called for skills-led strategies for green buildings to enable realization of the shift towards green construction.

1.5 Introduction to the consultancy and the structure of the report

The aim of the consultancy as per the TOR is to identify the local and international opportunities for engagement with the private sector that would influence the program interventions. Aiming at providing understanding of the sector, sourcing, collection and storage of energy, job opportunities and overview of the renewable energy sector in Palestine.

The TOR has requested in-depth analysis of the sector, the labour force needed, and the possible future interaction with private sector.

The consultancy was conducted during Aug and Sept 2018, the team consisted of the TVET and labour market expert Dr Randa Hilal, and the Business development and financial expert Dr Tawfiq Nassar, with OPTIMUM field researchers and support team.

Findings are presented in the study report. The study report is organised as follows:

- Chapter 1 presents background information of the context and the need for the solar energy in the oPt.
- Chapter 2 presents the methodology used, the methods and tools, the conducted field work and people participated in the study.
- Chapter 3 presents the findings of the Solar Energy Sector, presenting an overview of the sector, the legal framework, commercial viability and benefits to the communities,

including mapping of communities and projects. The chapter presents the findings of the field work, desk review and mapping.

- Chapter 4 presents the findings of mapping of the Solar Energy Enterprises, their needs for Jobs and Skills and available VET Training. The chapter presents the mapping of the private sector enterprises and the findings of the labour market survey and potential training opportunities.
- Chapter 5 presents the overall conclusions and recommendations.
- Chapter 6 presents the recommended design of the training and scenarios for intervention

Attached to the report are the relevant annexes that contains list of people participated in the survey, mapping of private sector enterprises, communities and projects, as well as the data file for the survey.

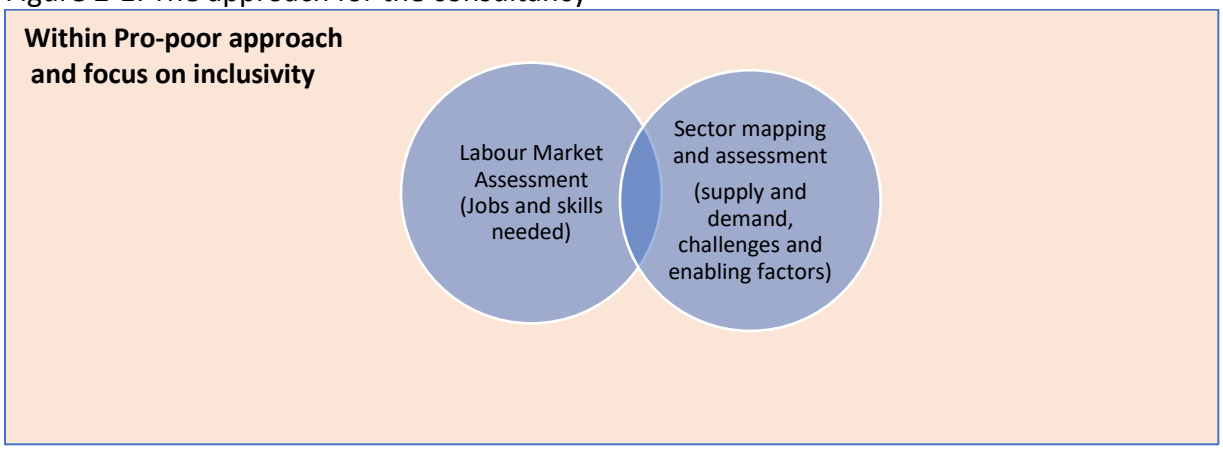
2 Chapter 2: The Methodology and Methods Used

2.1 The methodology and approaches

The methodology is a qualitative methodology using qualitative and quantitative methods, and using participatory approach aiming at mapping and understanding of the renewable energy sector and job opportunities for youth, as well as enabling factors and challenges for demand and supply.

The methodology uses two approaches, as graph indicates.

Figure 2-1: The approach for the consultancy



First; the Labour Market Assessment (LMS) approach of identifying jobs and skills and matching with the TVET supply. Second approach is the sector mapping and assessment, which include assessing the demand and supply, challenges and enabling factors. The consultancy uses pro-poor and inclusive approach.

2.2 Methods used

The methods and activities used to achieve the required output of the study based on the TOR, will be along the following:

- Collecting secondary data through desk review
- Mapping of private sector enterprises
- Mapping of communities and their access to electricity
- Conducting the Labour Market Survey (LMS) through face to face or phone interview for filling the questionnaire.
- Conducting semi-structured interviews with stakeholders, TVET institutes and other training providers
- Conducting group meetings with people from the communities and doing field visits
- Consulted youth enrolled or graduates from electric installation course

Activities used included: gathering secondary data, mapping of private sector, mapping of communities, labour market survey and engaging TVET institutes and stakeholders, the result of these activities were analysed and matched, and then documented through a report that is shared, a final workshop was conducted with the DCA/NCA and partners, feedback was collected and a final report was produced.

2.3 Tools Used and Resources for Information Gathering

3.1.1 Tools used

The tools for each method were as follows:

1. A questionnaire for the LMS that consist of two parts: first part consists of 18 closed and open questions, subdivided into four main sub-parts,
    - **a.** General information,
    - **b.** Solar Power Sector
    - **c.** Employment status and needs
    - **d.** Demanded skills

The second part; consists of a list of technical skills identified from the Arab Occupational Classification (AOC) adopted by the PA, and from international classifications.

2. Semi-structured interviews open questions

A framework was set with information required from each category of people to be interviewed, then two sets of questionnaires for semi-structured interviews with open questions were prepared. One for solar power energy stakeholders, consisting of 10 open questions. The second one with TVET institutes and other training providers in the sector consisting of 7 open questions, with space for additional information and recommendations.

3. Themes for discussion for the group meetings

Three themes were identified for discussion including;

- The community experience in solar power energy, challenges and opportunities
- The available skilled labour and needs, their experience in getting the service and needs for jobs and skills
- Recommendations for developing the services and required skilled labour

4. Frameworks for mapping

Two frameworks were prepared for mapping of private sector and communities, which were filled through desk review, internet search, half of private sector mapping were amended through the private sector enterprises questionnaire.

The first three tools are in annex 2, while the framework for mapping is illustrated in annex 3, results of the mapping.

3.1.2 Resources for information gathering

Resources used were as follows:

- National statistics from PCBS
- Solar power energy studies and reports
- Context related national and international statistics and reports
- The Arab-Occupational Classification
- National and international curricula
- Private sector enterprises web-sites

List of references for studies and reports are at the end of report, while links to websites used in mapping are in the mapping frameworks.

2.4 Conducting the field work

The field work was conducted following the desk review and initial mapping. It was conducted during the period 15th August to 8th September 2018. The field work was preceded by an orientation workshop for the team. The work was done in parallel while discussion among the team took place during the work to enable further understanding of the sector and the needs. The following was done during the field work;

- Conducting the Labour Market Survey (LMS)

The labour market survey was conducted through filling the questionnaire and conducting an interview with the solar power energy enterprises. Questionnaires and interviews were conducted through face to face meeting or through phone interviews depending on the availability of the respondents. 24 enterprises were approached but 21 agreed to fill the questionnaires. 7 out of the 21 questionnaires were filled by phone, and 2 were filled at the site of operation.

- Conducting semi-structured interviews

Semi-structured interviews were conducted with different types of the solar energy sector stakeholders, including policy makers, distributors, private sector and institutes. Interviews included Palestinian Energy and Natural Resources Authority (PANERA), the Palestinian Investment Promotion (PPI) Agency, Jerusalem District Electricity Co. (JDECO), Northern and Tubas electric companies. Interviews included NGOs working in the sector as Palestinian Energy and Environment Research Centre (PEC). Al-Najah University and Applied Research Institute-Jerusalem (ARIJ). Interviews also included investors and other private sector enterprises.

Interviews and filed visits were also conducted with TVET institutes و namely the LWF and the YMCA, and other training providers, as JDECO- training centre and the electrician union.

- Conducting group meetings and field visits

Group meetings were conducted in the communities (Arab-Rashaydeh and Tubas) with field visits to these communities and to the installed solar energy system. Group meetings was also conducted with students of electric installations and solar energy at the YMCA-VTC. In one case interview was conducted with the rep. of Rawayn community, accompanied with a field visit to the community and the solar energy structure.

2.5 Participants in the study:

73 people participated in the study. They represent various arrays of solar power energy stakeholders, being policy makers of different entities, private sector enterprises providing services in the sector, investors in the sector, institutes and NGOs in the sector, people from the communities using solar power energy, TVET institutes and training providers. The table below summarises the type and number of people participated in the study and method of participation used.

Table 2-1: Type and number of people participated in the study and method of participation used

	People participated in the study	Number of participants	Methods of participation
1.	Policy makers- Palestinian Energy and Natural Resources Authority (PENERA) and PPI	3	Semi-structured Interviews
2.	Policy makers- electric distributors- Electric companies, JDECO, North and Tubas	4	
3.	Institutes and NGOs working with solar energy (ARIJ, PEC, council and PEA)	4	
4.	Investors	2	
5.	Private sector companies	21	Labour Market Survey
6.	Tubas Community	2	Field visit and group discussion
7.	Arab Arshaydeh Community	5	
8.	Arab Arshaydeh Official and youth in the village	2	Field visit and interview

	People participated in the study	Number of participants	Methods of participation
9.	Rawayn Community	1	
10.	Students at YMCA-VTC electrical installation	18	Group discussion
11.	TVET institutes	5	Field visit, Interviews and group discussion
12.	Training institutes	4	Semi-structured Interviews
13.	The DCA/NCA	2	Discussion
TOTAL		**73 Participants**	

2.6 Private Sector and communities' Mapping

Private sector enterprises providing services for Solar Power Sector were mapped initially, then 21 of whom were surveyed. Information collection for the remaining 20 private sector enterprises was done. The 41 private sector enterprises contact information and their geographical distribution was done and listed in annex 3.2. Detailed information about the private sector enterprises can be found in the survey data attached in annex 4.

Other stakeholders in the sector as the electric distribution companies, as well as institutes and NGOs working in the sector is also listed in annex 3.2 to provide the bigger picture of the sector.

Communities and projects that were provided with electricity through donor or public investment were mapped and listed with details in annex 3.1.1. Bedouin communities in the centre of the West Bank region that need electricity and those that were provided with electricity through initiative are listed in annex 3.1.2.

The table below summarises the number of mapped enterprises, institutes and communities.

Table 2-2: number of mapped enterprises, institutes and communities

Type	Mapped	Number
Private sector enterprises	Private sector enterprises providing services that were surveyed	21
	Private sector enterprises providing services that were not surveyed	20
Solar power energy stakeholders	Electric Distribution companies	5
	Public institutes and NGOs working in the sector	10
Communities	Communities and institutes benefited from projects	18
	Bedouin Communities in the central region lacking electricity	51
	Bedouin Communities in the central region that have electricity (off-grid or generators)	32

Such mapping enabled the study to provide a clear picture of the sector.

2.7 Documentation and Analysis:

The qualitative semi-structured interviews and group meetings were documented, and analysed. The team have discussed and analysed the findings for an overall picture of the solar energy sector through several meetings.

Validation and checking of the filled questionnaires were done, data entry of the filled surveys was done on the designed EXCEL Sheet, cleaning of data and further validation was achieved. Statistical analysis of the questionnaires using Excel was conducted. Findings were extracted and matched, graphs were constructed and qualitative analysis of open parts of the survey was also carried by the Team leader. The two main consultants documented the findings in the study report.

2.8 Challenges faced and ways of mitigation

Following are challenges faced and measures taken in dealing with those challenges:

1. The scarcity of the data and information available for mapping and identifying of private sector enterprises. Measure: Snowball method was used in identifying the private sector enterprises, were each one was able to identify others.
2. The private sector enterprises were very busy and several appointments were made with many of them to be able to interview and fill the questionnaire. Measures taken was in following up the change in the appointments, having to do phone survey for some, and meeting at the site of work for others.
3. The fear of the market in Jerusalem from filling the survey due to various reasons including fear of tax authority. Measures taken were in filling the questionnaires through people they know and without contact details.
4. Focus group discussion were planned with the communities, due to time limitation and number of participants, Measures were conducting group meetings and discussion instead of focus group discussion.
5. Eid el-Adha coincided with the field work, which delayed the field work, parallel work was done by the team to enable finalising within the allocated time.

2.9 Limitation to the study

- **Geographic:** the study was conducted for the West Bank including East Jerusalem, Gaza is not included.
- **Time**: the surveys were conducted during the period August-September 2018
- **Skills level**: the surveys were addressed to the basic three levels relevant to the VET institutes' graduates.

3 Chapter 3: Findings: Solar Energy Sector overview, legal status, commercial viability and benefits to the communities

3.1 The Solar Energy Sector Overview

Available Electricity in Palestine in 2016 reached 5812 MWh. Energy sources are almost fossil fuels, with only 18 MWh renewable energy, according to World Bank (2017). Available electricity for consumption has increased by 30% during the years 2010-2016, and is expected to increase by at least 25% in 2020.

Total energy consumption in Palestine is considered the lowest in the region, while its costs are relatively high compared to its neighbours. The majority of this consumption goes to the residential sector. Almost 100% of the fossil fuels and 89% of the electricity supply come from Israel, resulting in a demand increase for both countries, with less than 1% coming from Egypt, 2% coming from Jordan and around 8% produced locally by the power generation station in Gaza. (World Bank, 2017)

Solar energy is the most important source of renewable energy. Palestine receives about 3,000 hours of sunshine per year and has an average solar radiation of 5.4 kWh/m2 daily (World Bank, 2017). The average solar radiation varies by season: it reaches as low as 2.63 kWh/m2 per day in December and as high as 8.4 kWh/m2 per day in June. These levels of solar radiation are encouraging to harness solar energy for various applications. According to the Palestine Central Bureau of Statistics (PCBS, 2015), approximately 57% of Palestinian homes use solar water heaters. More than 90% of these solar water heaters are manufactured locally and cost between $250 and $350.

The Jordan valley in Palestine receives high solar radiation levels of 5.4-6.0 kWh/m2 per day annually. These are excellent conditions for harnessing solar energy for both large-scale and stand-alone applications. The Palestinian Territories have substantial potential for solar electricity in the West Bank, particularly in Area C (which is under full Israeli control). Solar energy is the only significant renewable resource in the Palestinian Territories. The technical potential in the West Bank is estimated to be around 530 MW of rooftop solar PV, and at least 100 MW of utility scale solar in Areas A and B (Fully or partially under Palestinian control). Area C still has the largest potential of 3,000 MW, which would be suitable for both PV and CSP technologies. Nevertheless, the significant political challenges associated with securing Israeli approval for construction in Area C cast some doubt over the possibility of developing this resource. By contrast, extreme land constraints in Gaza and Area A limit the available solar potential of rooftop solar, as table below illustrates (World Bank, 2017).

Table 3-1 Overview of solar energy potential in West Bank and Gaza

Potential Available RE capacity (MW)				
Utility Scale PV and CSP				
	Area A and B		**Area C**	**Total**
West Bank	103		3,374	3,477
Gaza				0
PT				3,477
Roof Top Solar				
	Residential	**Public**	**Commercial**	**Total**
West Bank	490	13	31	534
Gaza	136	8	19	163
PT	626	21	50	697

Source: World Bank, 2017, P. 70

The Palestinian cabinet adopted a renewable energy strategy in 2012, which set a target of 130MW for domestic renewable energy generation by 2020, half of which are from solar power energy. Only 18MW is available as of 2012 (PA, 2012).

The Palestinian electricity sector went through a number of institutional reforms, which still require further consolidation. In 1995, the sector was reorganized to cluster most of the former municipal service providers into six local distribution utilities including the Jerusalem District Electricity Company (JDECO), the Northern Electricity Distribution Company (NEDCO), the Tubas Electricity Distribution Company (TEDCO) and two in the South of the West Bank and one in Gaza.

The Electricity Law of 2009 created the Palestinian Electricity Regulatory Council (PERC), the sector regulator, with responsibility for tariff-setting, as well as the Palestinian Electricity Transmission (PETL), a new transmission operator and wholesale power trade. While there is no Palestinian transmission infrastructure at present, PETL will take charge of four high voltage sub-stations, of which three have recently been built, to consolidate the physical flows of electricity from Israel into the West Bank as opposed to the default mechanism by which, electricity is imported through hundreds of low and medium voltage connection points. (World Bank, 2017)

The current sources of solar power energy come from the 1000 rooftops Palestinian Solar Initiative (PSI), generating 5MW, the available power generation at Tubas Power station (TEDCO) and few investment projects. 6 solar power stations of 19.5MW were licenced and 3 are in the pipeline with 15.6MW capacity, according to the Palestinian Investment Promotion Agency (PIPA, n.d.). Several other projects were set to increase investment in the sector as section 3.3 and annex 3.1.1 illustrates.

In presenting the options for energy security in the oPt, the World Bank (2017) has pointed out the importance of generated renewable energy;

> Domestic renewables represent the only source of truly independent power as neither the power, nor the fuel, needs to be imported. The maximum share that can be reached for domestic renewables, even under the most optimistic scenario, is 19 percent if production is limited to Areas A and B or 30 percent if sites in Area C can be developed. (p. 15)

The national energy strategy has called for reforms in policies and strategy to develop the capacity to manufacture, install and operate the renewable energy systems. (PA, 2012)

3.2 The Solar Energy Regulatory framework

The renewable energy law (PA, 2015), which laid the rules and regulations for entering the Palestinian renewable energy market, were released only in mid-2015, sets of regulations were followed. In terms of utility scale solar PV, many private sector entities have shown great interest and several licenses have been granted.

The law and regulations defined brackets and prices for the solar generated power as follow:

- **Palestine solar initiative:**

Introduced in 2012 targeting Palestinians rooftop households, the incentive scheme allowed the first 100 households to sell generated electricity for the distribution companies at 1.07 NIS per KWH, this was 3 times the price distribution companies' buys from Israel, the next 300 households would sell for 0.8 NIS and the next 600 will sell for 0.54 NIS. This reduction in price made the initiative less attractive.

- **Net metering:**

This initiative targeted both households and commercial and industrial institutes, in which, the investor will transmit the surplus generated electricity to the distribution company. At the end of each month the distribution company will settle the account of purchased and sold electricity. If there is a surplus, this will be accounted for in the next month after the deduction of 25%, a charge for using the distribution company grid. In June 2018, the ministry of education signed agreements with investors to generate solar power on the rooftops of more than 500 schools, based on net metering schemes.

- **Solar Stations (1-5 MW):**

Solar station (parks) are treated as a power generation station, where the investment to be licensed by the Palestinian Energy Authority, and sell the generated power to the Palestinian Electricity Transmission (PETL), at a maximum price of 0.34 NIS, 10% less than the Israeli purchased price.

- **Solar Stations (competitive bidding):**

In this case, the investors will again negotiate with PETL, the establishment of a power generation station, and agree a location, capacity and price.

However, projects over 1MW can only sell to the single buyer, PETL, which is According to the (World Bank, 2017), it is not currently creditworthy and lacks any kind of payment record. This high risk of non-payment, together with the possibility of significant construction delays is discouraging project developers and financiers alike. Further obstacles, are lack of access to prime land in Area C, as well as the lack of transmission infrastructure to evacuate the power.

Incentives:
The investment promotion law of 1998 was reviewed in 2004, 2011, 2014 and 2016, the reviewed law has introduced an income tax incentive package, in order to encourage private sector institutes to invest in solar energy, the following is a summary of this incentive package:

1. **Utility Scale project, more than 1 MW per hour power generation**
    - Stage 1: 0% income tax for seven years starts from operations.
    - Stage 2: 5% income tax following stage 1 for 5 years.
    - Stage 3: 10% income tax following stage 2 for 3 years.

2. **Net metering projects with less than 1 MW per hour power generation:**

Current Projects, that enjoys incentives receives additional extension if they generate power as follow:

- 20 KWH, extension of the exemption of income tax for 1 year.
- 40 KWH, extension for 2 years.
- 60 KWH, extension for 3 years.

Projects never received incentives or their incentives period expired and generates 40 KWH subject to 5% income tax for 2 years.

Solar Power energy in the West Bank and Gaza follows (PENRA) laws and regulations, and would work with the different Electric Distribution Company (EDC) according to their area. Institutes and housing in East Jerusalem would follow JDECO company regulations but would request licensing from the Israeli controlled municipality.

3.3 The Solar Energy commercial viability

The solar power energy private sector companies provide the services of installation, operation and/or maintenance. Their main clients are either individuals, donors, public and private sector entities. Donors clients support the marginalised and Bedouin communities, as well as the CSO institutes for rooftops solar power energy to increase the sustainability of these institutes, which are mainly health or educational facilities. Donors' clients pay for solar power systems that are part of their support to development effort as the support to Jericho Industrial Park by JICA or lighting of rehabilitated streets. Individual clients are mainly for housing projects, they could be of the PSI initiative, who were supported by the public sector, or are mainly well-off people who can afford installing the system and paying the cost immediately. Some solar private sector companies are linking individual clients with banks that provides green loans to enable higher number of the population to install the rooftops solar panels. Private sector clients are owners of industrial, trading or tourism businesses.

Some important self-supporting model is the Royal Industrial Trading Company in Hebron, who has a large plastics factory and other investments. The company started its solar power energy investment and was able to install off-grid units and systems to cut down the cost of electricity from production, during the daylight, knowing that the industrial electricity tariff is higher than the housing one. Other factories and industrial businesses are making use of the newly reviewed investment promotion law and are investing in solar power energy, and some are also making use of the net-metering regulations to have on-grid system. One out of three of the surveyed companies had installed systems for factories.

Investors engaged in solar power energy generation have a high financial viability on the long-term, their main challenge is the challenged electricity network and transmission lines infrastructure. One model is the Jenin Solar power station that had to link to the Israeli network to enable the station functionality.

Investors were able to benefit from schools' rooftops through a third-party agreement that enables public schools to benefit as well. Within such agreement; investors will install and provide O&M of the system, while schools get the electricity. MOEHE has announced the availability of 500 schools for such model.

Investors were also engaged in manufacturing certain element of the system, as NAPCO the Aluminium company has constructed the fixtures for some projects, hence, cutting the cost. Other investor is currently preparing for manufacturing the solar panels, costly part of the system.

Yet the marginalised and remote communities from the electric distribution networks, whom would require off-grid systems are unable to benefit from such investments. Investors are hesitant to invest in solar power energy systems and support individuals for housings' PV rooftops, or supporting a Bedouin community through a payback financial system. Building the financial model and developing human resources could enhance investment opportunity.

3.4 The Solar Energy Growth Challenges

In order to meet the national vision and plan of increasing the use of solar energy and to maintain and enhance commercial viability of the sector, infrastructural and regulatory challenges should be addressed.

According to experts interviewed, the distribution grids in the West Bank and Gaza, can sustain the pumping of 20% of its capacity from the solar power generators. This means that it is possible to generate and pump to the grids, at least 360MW, compared to 20 MW generated now and further 20 MW under establishment. This shows that there is huge space for further investment in the field.

But according to officials and technical people interviewed in JDECO, NEDCO and TEDCO, there are improvements to the grids that must be completed, as well as improvements in the laws and regulations, the following are the most important:

- The available land in area A and B, and the perfect sun condition is available in Jericho and Tubas areas. These 2 areas are the least populated and lowest in terms of electricity consumption. Tubas consumption is 20 MW, and the solar power generated is 5 MW. This means that the Tubas area have reached its 20% generation of solar power, any further production needs a detailed study on the effect of solar power on the grid. It also needs a connection with other distribution companies to transfer the surplus to other areas. Jericho grid, which falls under JDECO authority, can withstand a maximum load of 11.5 MW, with some 4 MW of solar power generated, and 20 MW solar power stations under construction. JDECO will not be able to transmit the access power to other areas, except of small quantity to Jerusalem, through a small transmission line Another issue would be; if the infrastructure of the electrical grid is ready to handle this amount of energy and what effect will cause on the PF (power factor).

Accordingly, some investment must be in the local grids as well as construction new high voltage transmission lines between the different areas, in order to transmit surplus electricity.

Another solution is to negotiate a deal with Israel to allow Palestinian electricity distribution companies to use the Israeli grid in transmitting surplus electricity to different areas. An agreement was signed through PETL in July 2017 for the new power station in Jenin to use the Israeli grid for transmission.

- Solar power in its present shape is causing voltage drop to the local grids, with sudden increase and decrease in the electricity generated due to weather conditions. Further studies are required to examine the long-term effect of sudden voltage drop on the local grids.

- With the distribution companies being unhappy of the price structure of the solar power the purchase, further studies must be conducted, and a change of law must be implemented based on the results of the study.

- Future maintenance of the solar power stations would be required, and hence, trained human resources.

- **Another identified challenge is the access to finance:** Beside one specialized program at the Bank of Palestine, it is confident to say that there is no preferable treatment given to investors in the solar energy. This finding was confirmed by a recent study (Nassar, 2017) investigating the Palestinian financing sector role in the financing of eco-innovative businesses in Palestine. Increasing national financial systems and engaging of international investors could be an opportunity.

3.5 Rights, benefits and viability of solar energy within communities

Communities are impacted differently with Solar Power Energy. Although electricity reaches the vast majority of population, there are certain communities as Bedouin and other marginalised communities in Area C of the West Bank, only benefits from off-grid systems that require follow-

up and maintenance, annex 3.1.2 presents Bedouin communities in need of solar power energy in the centre of the West Bank (Jerusalem, Jericho, and Ramallah) and Bethlehem, results indicate that 658 households in 51 communities.

Tubas in the West Bank is benefiting from the solar power system in reducing their electricity bills and generating income, as the roof-tops initiative by the PSI, they present a model for other communities.

East Jerusalem, has also a different situation, especially inside the walls part called J1, where there are limited spaces and requirements are complicated.

Each of these cases is documented below as cases. Mapping of other communities is attached in annex 3.1.1.

3.5.1 Arab Rashaydeh Case- Area C Bedouin Communities

Bedouin communities in the oPt have benefited from the off-grid solar energy system in their resilience and carrying out their daily lives amidst context and various transferable plans by the Israeli occupation. There are 26,000 Bedouins living in 115 communities, According to UNOCHA over 7000 residences in 46 localities living in area C are at high risk of forcible transfer, 18 out of which were able to obtain solar power through donor support (2014). The case of Arab Rashayda village and surrounding communities illustrates the importance of the off-grid system for these communities.

Arab- Rashaydeh communities are located in Area C. Arab- Rashaydeh village is a central Bedouin community that has been announced by the PA as a village within Bethlehem governorate for urbanization and linking it to services including electricity, water, schools...etc. There are 85 Bedouin households located around the town for their livelihood system that depends on herding, the communities are spread over surrounding mountains that reach to Jericho Bedouin communities. Each community consists of 5 to 30 households spread from each other, the land is announced as Natural Preserved Land.

Photo 3-1: One of the Arab-Rashaydeh sub-communities

According to PCBS census (2007), only 1.9% of Arab Rashaydeh are connected to the electricity network. The surrounding communities are not linked to the electricity network. Part of these

communities had donor support in 2010, others in 2012 and in 2014. The introduction of solar energy had an impact on the Bedouin lives and economy. It has saved time and energy spent in manual work, such as the work done to produce the dairy products, which was reduced from 5-6 hours to less than one-hour work, preparation and cleaning the electric utility. Their work is seasonal, during other seasons people work in other jobs to support their families. The introduction of electricity enabled other economic products, such as raising poultry or taking part in tourism activity.

The experience of communities has varied, whereas Al-Rashaydeh communities have solar panels per household, the nearby Rawaeen community has collective solar panels for 12 households in a cooperative manner.

Photo 3-2: Solar Panel for Bedouin household (surrounded by red marker)	Photo 3-3: Solar Panel for Bedouin cooperative community
	

The issues raised by the communities as conveyed by members of the communities were as follows:

- There are differences in projects due to different specification used, a donor-company direct relation without any technical supervision produced such differences.
- The storage battery lifetime is four years and some of the structures' batteries are obsolete, these communities are operating their power during sunny daytime only.
- The communities have experienced the need for maintenance they were able to pay for it then, but are unable to purchase new batteries.
- The communities have grown since they first installed the solar power system, new household existed, the new households are unable to use the current system, hence, they lack electricity. In short, communities are unable to install a new system or expand the current system. Although some companies are offering payment by installments of systems, its linked with banks and would require collaterals and salary slips for regular employees.
- Some of these communities have people that were trained from previous projects, but others lack the technical knowledge of the system.

- Whenever maintenance is required, they would wait for the engineer who has installed the system.
- There is a community with commit-me services (which link the customers through a monthly payment system to a company that could do maintenance) that could be also done by other companies from Bethlehem or another region.
- There are communities that have a cooperative and collect monthly fees, which could be used as another option for providing maintenance services.
- Communities depend on donors for installing new solar panels and changing batteries, there is a request for 110 units in the remote communities in the governorate according to the head of solar energy at the MOLG.
- The communities have the following training needs:
    - Solar power energy skilled workers in the area. The available unemployed youth or previously trained technical youth could participate in the outreach courses.
    - Each community need to have basic training in the solar power systems
    - Each community need to send people for technician training
    - The communities are in high need of various outreach training in other fields as water networking, plumbing, and sanitation.
    - The village lacks services that require other fields of vocational training with integrated entrepreneurial skills, such as carpentry, auto mechanics, metal work.

It's expected that the availability of the human resources will enhance the operation and maintenance of the solar energy system and hence, the financial viability of the relevant system. Its only for the O&M that would need investment from the community in systems as commit me or a cooperative model, which are within the reach of the community and are implemented in certain communities. Installing new units or changing batteries, or for new communities is outside their reach and would require a certain investment model if not donor or public sector support.

3.5.2 Tubas Case

Due to the heavy financial burden of energy and as a pilot, the PA has supported the Palestinian solar Initiative (PSI) through 1000 solar power units, distributed to 1,000 homes. These units are owned by citizens so that these solar units contribute to their energy and are a contributing source of income. Generated electricity is priced at 1.07 NIS per KWH.

The Tubas Electricity company is one of the leading companies in the field of electricity generation through solar energy, since the beginning of 2013 the number of applications submitted by citizens to the Tubas Governorate electricity company to set up solar power generation units are 130 applications, 50 of which have implemented to produce what an average of 250 KWH of electricity.

Tubas electricity company was able to cover its 25% of electricity from solar energy (maximum possible), the people who benefited from the initiative has noted their content with the system.

The surveyed community was part of the first 100 houses benefiting from the high tariff, as the previous section of the report clarified. They are engineers hence, were able to operate and maintain their systems, and until the meeting was conducted, they did not face any technical challenges or maintenance issue. Maintenance is foreseen to be done with the same company installed their systems. The full cooperation with electricity company with the beneficiaries and the initial 1.07NIS paid per KW has played a positive role in the initiative.

Tubas presents the perfect environment for Solar energy generation, Maslamani (Investor) solar power station is in the region, and other investors could operate. Its foreseen that linking Tubas electricity network with other networks in the north of the West Bank could maximise the use of generated solar power energy.

The pilot of Tubas could be used as a model for other similar locality in the West Bank, taking into consideration the different set-up in each community.

3.5.3 East Jerusalem Case

Solar power energy is provided through Jerusalem District Electricity Company Ltd. (JDECO), yet a permission is requested from the municipality of Jerusalem to install any solar power unit for houses or institutes. East Jerusalem is suffering limited land available, as according to UNOCHA (2017) report;

> 35% of the land in East Jerusalem has been confiscated for Israeli settlement use; only 13% of East Jerusalem is zoned for Palestinian construction, much of which is already built up. (p.14)

Although the Israeli Electricity Corporation (IEC) has announced series of incentives for solar power energy, people in East Jerusalem can make use of, but requesting a permit from the municipality is also difficult for the Palestinians residing in East Jerusalem. People are afraid to apply for any permit for changing in the home structure, as according to OCHA (2017);

> At least a third of all Palestinian homes in East Jerusalem lack Israeli-issued building permits, which are difficult to obtain, potentially placing over 100,000 residents at risk of displacement. (p.14)

The head of research at JDECO, engineer Ali Hamoudeh has noted that there are minimum rooftops and that they have constructed a power generation company outside Jerusalem to generate electricity for the old city in Jerusalem.

The LWF -VTC in Jerusalem are considering installing a solar energy system, and have approached JDECO and some of the surveyed companies. Some of the private sector companies are able to work with the municipality for the permits of institutes. East Jerusalem CSOs could benefit from such transition to solar energy in increasing their sustainability.

The LWF-VTP is planning to provide training in the field as stated by the director Yousef Shalian. VTP has the experience of conducting short courses in various fields. Short courses for practicing electricians will enable the possibility of spreading the system in East Jerusalem (J1 and J2) and the surrounding. The donor support for institutes sustainability in Jerusalem could include the use of rooftops for these institutes to generate solar energy.

4 Chapter 4 Findings: Solar Energy Enterprises, their needs for Jobs and Skills and available VET Training

4.1 Mapping of Solar Power Energy Private Sector Enterprises:

There are 46 companies in the West Bank working in electricity, gas, steam and air conditioning supply, as noted by PCBS (2018a). Yet there are around one hundred electrical, mechanical and electro-mechanical engineering offices, all are working solar water heat systems, but some of them (20-30%) are working in solar power energy, as the study have identified. There are other electrical and electro-mechanical companies introduced the solar power energy product and service.

Mapping of private sector enterprises working in solar power energy has indicted the growing sector in the field and the change within the sector. 21 private sector enterprises were surveyed, and another 20 enterprises were identified, all listed in annex 3.2. Enterprises are situated in different areas of the West Bank, and many are working inside and outside their areas.

Solar power energy projects vary in size and type, working modality of some of the huge projects are through sub-contracting other companies. The detailed characteristics of the enterprises, their needs and demands for jobs are detailed in the following section of this chapter.

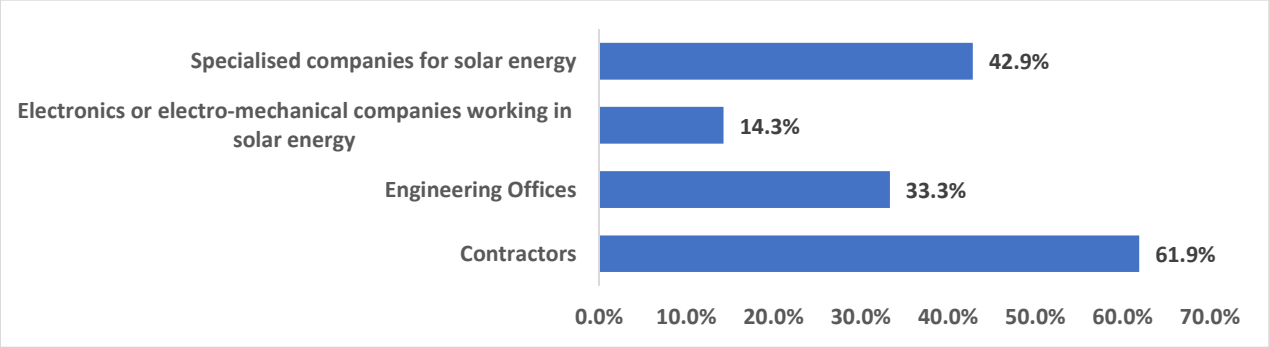
Some private sector companies and investors are investing in power generation plants, were 6 plants were licensed with 19.5MW capacity and 3 in the pipeline with 15.6MW capacity according to PIPA.

There are private sector electricity distribution companies as the JDECO, in addition to public sector institutes and LGUs. List of the 6 electricity distribution companies and institutes are in annex 3.

4.2 Surveyed private sector enterprises

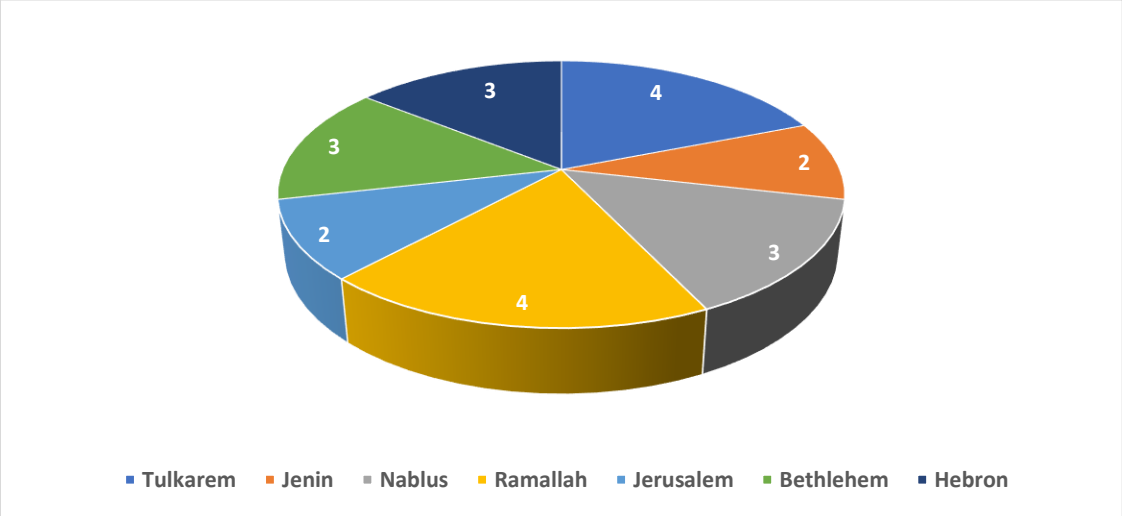
21 private sector enterprises were surveyed. All of which were working in solar energy, some were engineering offices carrying out design or supervision, while others were contractors installing the work, some were specialised companies for solar energy and others were electro-mechanical companies working in solar energy or others as the graph below illustrates. Results indicated that most were either engineering or contracting offices and working with Solar energy or with electro-mechanical including solar energy.

Figure 4-1: Type of surveyed companies



The surveyed enterprises were geographically distributed over the West Bank, but most work outside their areas, as graph below indicates.

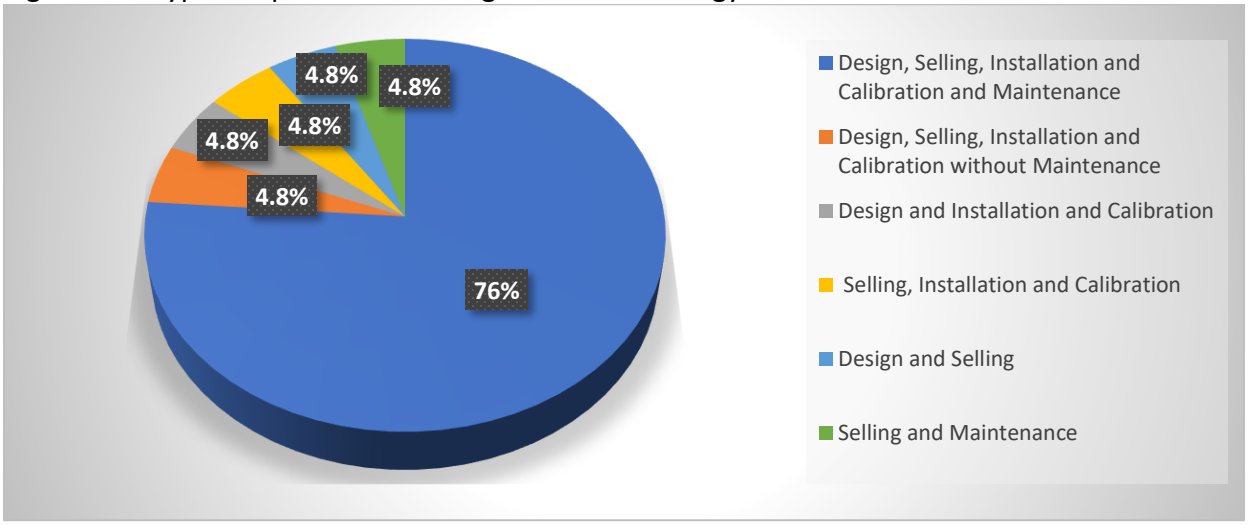
Figure 4-2: Geographic distribution of surveyed solar power energy enterprises



It was very hard to identify companies working in Jerusalem. Two companies were found working in Jerusalem as sub-contractors of Israeli or other Palestinian companies due to complications in registrations. Other companies registered in the West Bank and working from Ramallah work in Jerusalem as well. A company that has double registration in Israel and Palestine and has an office in Ramallah works in Jerusalem, they did not participate in the survey.

Most of the enterprises (76%) were providing design, selling, providing installation and maintenance. 81% of the companies are providing maintenance with other service or services, while 95% are selling with other service/s, and 90% providing design or installation with another service/s. Maintenance is mainly upon request, or for their installed design, one of the companies noted adding the service of maintaince to sell his products, other providing operation and maintenance through software and field visits.

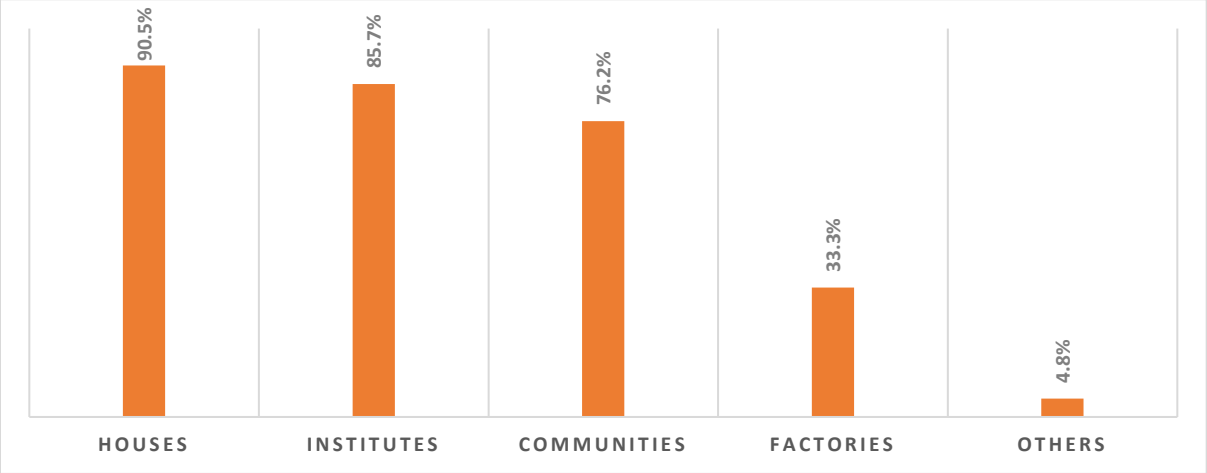
Figure 4-3: Type of operation with regard to solar energy



All surveyed enterprises are working in generating electricity through solar energy, 19% of them are also working in other fields as heating water through solar energy, other energy conversation or producing energy related products.

Surveyed enterprises have noted that they have a mixture of clients including communities, institutes, factories, houses and others, as over 90% have provided their services to houses, over 85% to institutes and 76% to communities. One third of the surveyed companies provided their services to factories mainly following the incentive provided for private sector and investors to install solar energy systems for generation of electricity, graph below summarises the findings.

Figure 4-4: Clients of the surveyed enterprises



In detailing the type of communities, they worked in, some has noted working in Bedouin communities, or marginalised communities, while others have worked in areas as Tubas and Qabatia as communities, that are cities linking to solar energy electric stations. Hence, some has worked with on-grid and off-grid, while most worked in on-grid solar energy projects.

Institutes has varied to include hospitals, community centres, municipalities and schools as the MOEHE has adopted a policy to use solar energy for electric generation of schools.

4.3 Solar energy sector as perceived by surveyed enterprises

Companies has noted growing demand for solar energy in electric generation, especially after the announced incentives for private sector or investors with regard to tax deduction and the new strategy by the PA calling for increasing the use of solar energy in electric generation by the year 2020. They also noted the demand by donors for off-grid installation in marginalised communities, and the need by the communities to maintain the system. With regard to cost, surveyed enterprises noted that cost varied between 1000 to 1500 USD per KWH per square meter, many has recorded 1200 per KWH as average. Many noted that price depends on the size of the project; the bigger the project the lower the cost. Price also depends on the type of equipment and material used and its origin, the European is more expensive than those of Chinese origin, both are widely used in the market, with additional variations between the different brands of same country of origin. Enterprises mentioned that repaid period for housing would be between 5-6 years, and that of factories and institutes could be of 3-4 years.

Within this regard, the box below noted the economic feasibility of using solar energy in generating electricity in Palestine.

Box 4-1: The economic feasibility of using solar energy in generating electricity in Palestine:
81% of the surveyed noted that have increased, they mentioned the following reasons:

- The increase of awareness,
- The increase of solar energy companies and consultation provided,
- The increase of equipment efficiency,
- The reduction of solar panel costs
- The incentive provided for investors, factories and private sector economic establishments in income tax reduction

9.5% noted that it has decreased, they mentioned the following reasons:

- The reduction of the cost of selling electricity from the incentive one (adopted through the Palestinian Initiative) and the net metering policy adopted by the PA

9.5% noted it is fluctuating, they noted the previous reason on the negative side and the reduction of cost of equipment on the positive side.

85.7% of the surveyed enterprises noted increase in their solar energy work during the past three years, only 14.3% noted its fluctuation and none noted its decrease or remaining at constant level. Reasons for fluctuation were recorded to be related to the economic and political situation, as well as increased competition, this was noted from the enterprises situated in the centre of the West Bank, while those from the North and the South has witnessed increase and getting into new markets other than their areas.

Surveyed enterprises have identified future development that could increase use of solar energy in generating electricity and suggested measures, illustrated in box 4.2.

Box 4-2: Future development that could increase use of solar energy in generating electricity:

- The reduction in prices of the equipment
- The technical development in the field that would increase efficiency and reduce required space
- Increased people's awareness
- The population growth and inability of the current resources to cover the growing demand
- Incentives for factories and private sector

Suggested Measures to increase the use of solar energy in generating electricity

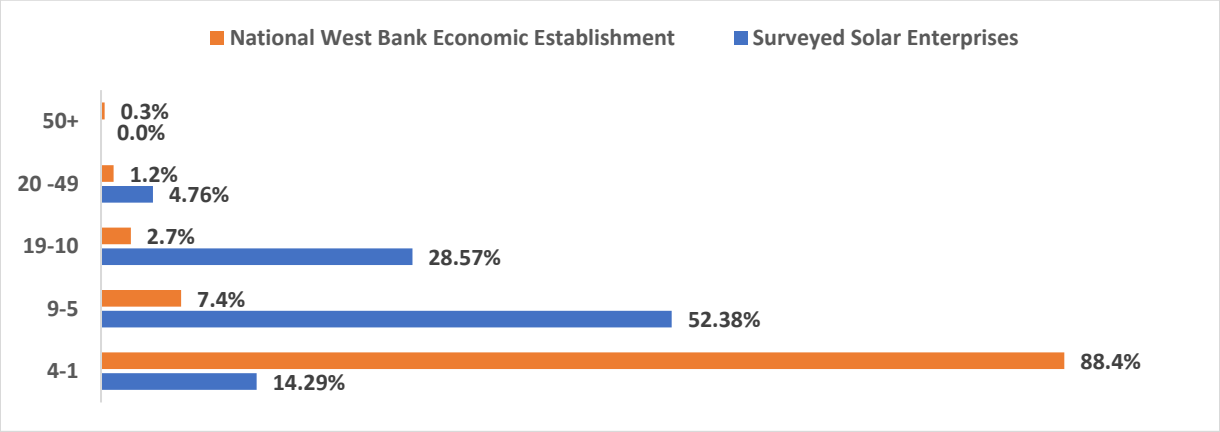
- Increase pricing of selling generated energy to the electricity companies
- The PA, municipalities and PPI policies and regulations to add housing
- Continuation of donor's support
- Enhance productivity and human resources in the sector
- Financial system and support from financial institutes for solar system installers

4.4 Market and social demand for employment and self-employment in the sector

4.4.1 Employment within the surveyed solar enterprises

Size of employment of surveyed private sector enterprises is higher than the national figures, as graph below indicates. Whereas 85.7% of the surveyed enterprises has more than 5 employees, while 88.4% of the national economic establishment had less than 5 employees.

Figure 4-5: Size of employment of surveyed solar enterprises versus national economic establishments



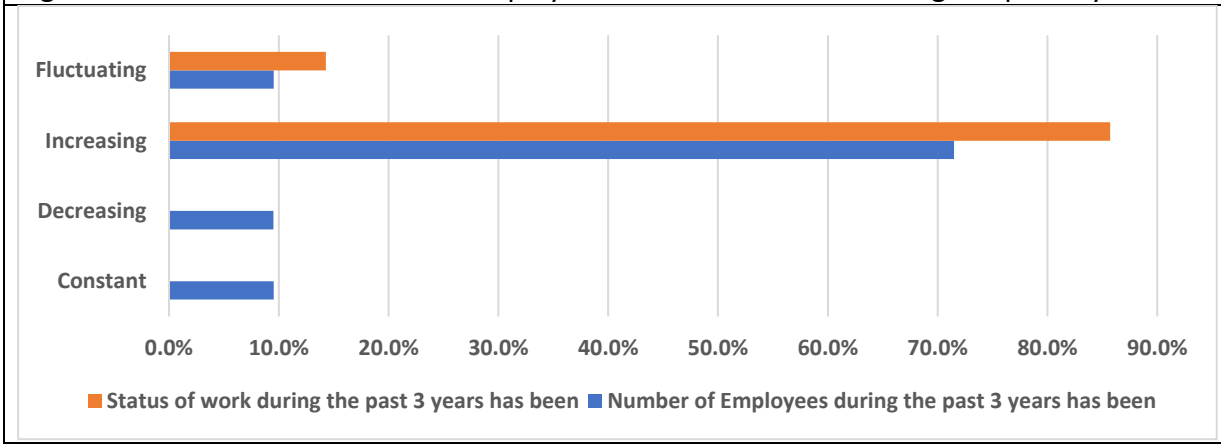
Source of info for national West Bank figures: PCBS. 2018. Establishment Census 2017, Ramallah

The above graph illustrates that almost half of the surveyed solar enterprises employ 5-9 and more than quarter employ 10-19 and almost 5% employ 20-49 employees.

Employment according to gender in the sector indicates a male oriented sector, especially in the vocational fields, females are present as engineers in the sector, or work in admin work.

Employment within 71.5% of the surveyed enterprises have increased during the past three years, only 9.5% noted the decrease in employment, same percentage noted its fluctuating. The status of employment during the last three years resembles that of business status as graph indicates.

Figure 4-6: Variation in number of employees and status of work during the past 3 years

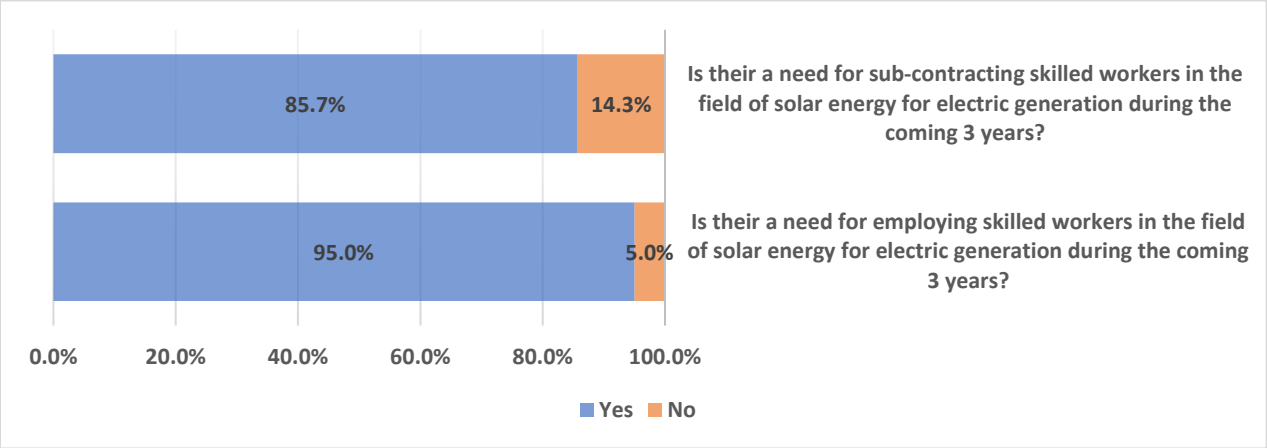


Most of those that witnessed increase in the enterprise's work witnessed increase in employment, the enterprises that did not increase their employment although work increased has sub-contracted the needed human resources, they noted the introduction of freelancers to the market during the past three years, the ones witnessed fluctuating in their work witnessed fluctuation or reduction in the number of their employees.

4.4.2 Market demand for employment and self-employment in solar energy field

Market demand for employing and self-employing skilled workers in the field of solar energy for electric generation was high according to the surveyed enterprises, as noted in the graph below. Vocationally trained graduates would fill the gap of skilled workers in the market.

Figure 4-7: Surveyed enterprises responses for employment and self-employment needs in the sector



All those surveyed employs skilled workers in the field, the number ranges between two to 12; at an average of 4.85 per enterprise. Only 71.4% of the surveyed sub-contract skilled workers, the number ranges between two to 20; at an average of 5.2 per enterprise.

Respondent enterprises planning to employ skilled workers stated their demand to employ between two to six within the coming three years, with an average of 3.1 per enterprise. Respondent enterprises planning to sub-contract skilled workers stated their demand to sub-contract between two to 50 skilled workers within the coming three years, with an average of 5.2 per surveyed enterprise.

Hence; the results indicate that most enterprises want to employ and self-employ skilled workers within the coming three years. The demand is estimated at an average of 8.3 skilled workers per enterprise.

Employers would employ male and female youth, although it's a male-oriented field, but some of the companies has indicated the added value for women in Bedouin communities' projects. As one noted;

I would like to engage women employees in my company, this is an added value when we work with Bedouin community, as women and children are the ones residing in the community, while men go out to sell products or buy supply. Hence, women had to empty their place when

a male technician arrive to do the instalment or the O&M, having a women technician will make our operation in these communities much easier.

Others noted the female skills in sales and would like to employ females in sales and marketing tasks, but would like female youth to be trained in the solar energy field as well as gain sales and marketing skills.

4.4.3 Social demand for employment and self-employment in the sector

Youth have voiced their demand for employment and self-employment in the sector as box below illustrates.

Box 4-3 Voices of Youth:

Training in solar energy could present an opportunity for unemployed or underemployed electric installation graduates, as Moh'd from Arab-Rashaydeh city (central locality) stated:

I am a TVET graduate from electric installation specialisation, I work upon request as a self-employed electrician, I work sporadically and upon demand. The solar energy short course training will allow me to increase my capacities and hence increase my income, and I could serve the surrounding communities.

The TVET students at the YMCA found the integration of solar energy skills within the electric installation course an opportunity for their future employability, as the following was stated by the different students at the Electric Installation and Solar Energy Course at the YMCA:

I am from Tubas and I enrolled in the YMCA, as it will provide me with skills needed in my area with the increased number of solar power stations

The solar energy part of the training attracted me to the vocation, as solar energy is the future

It has an additional value for my future work

I will have 2 vocations in 1 training, the electric installations and the solar energy

Not many people have trained in solar energy

Students in the course were from Jericho, and other places of the West Bank.

On the other hand women in the Bedouin community has noted the importance of engaging the professional women whom are university, college or TVET graduate in employment, self-employment, income generation or even practicing their skills and knowledge, so as to present a model for younger generation, who opted for dropping-out of school, as they noted that the elder sister and brothers are not working in their profession or are not even practicing additional skills gained through their education or training.

Furthermore; the interviewed engineers in the sector has envisioned the need for research and development, the incubator for innovation situated in Jericho by the JEDCO training centre engaged youth who are integrating new technology to solar energy among other projects.

4.5 Required skills

Employed skilled workers were electricians with solar energy, additional skills in metal work, welding, control and personal skills in communication and working under pressure.

Surveyed enterprises have checked the prepared list of the technician skills, list was prepared based on the Arab Occupational Classification (AOC) and different international job descriptions and curricula. Table below indicates their agreement with the skill required for the skilled worker, and the current acquiring of those skills. The table below lists the electrical installation and the solar power energy skills.

Table 4-1: Required Skills of the solar power energy skilled workers

Skills	Respondents agreement
Reading the executive engineering plans	95%
Preparing work materials according to quantities and specification	90%
Pipe fitting for electric installation of different types	90%
Preparing, installation and maintenance of housing, industrial and commercial channels	100%
Electrical installations of housing and economic establishment	100%
Electrical installations and wiring networks for communities	86%
Electric installation and maintenance of commercial bill boards,	52%
Testing electrical installations using testing and measurement devices,	95%
Installation and maintenance of frame, solar panels and grids	90%
Installation and operation of solar power system components (battery, adapter and regulator)	100%
Maintenance of solar power system parts and units	86%
Calculate the cost of energy saving of solar power system	90%
Installation of external lighting circuits and light signals,	81%
Electrical wiring of the solar power system	**100%**
Earthing of household and industrial electrical installations, as well as installation, delivery and operation of machinery.	86%
Implementation of preventive maintenance schedules and filling of work forms	90%
Application of procedures and instructions of occupational health and safety	100%

All surveyed agreed on the importance of five main skills regardless of their operation, 90% and above agreed on the importance of another seven skills, depending on their operation, i.e. the enterprises that are not working in maintenance did not mark the maintenance skills as important. All skills except one got the agreement of 81% and above of the surveyed companies. Only half of the surveyed agreed on the importance of powering billboards.

These skills are important for future training in the field. In addition to the list, surveyed enterprises indicated the following technical skills, as illustrated in the box below. They were also asked to list the needed technology related skills or skills related to development in the field, personal and supportive skills listed in boxes below.

Box 4-4 : Technical and Technological Skills

Technical skills:

Surveyed enterprises have confirmed that the skilled worker for the employed and the sub-contracted should have the following skills:

- ✓ Electric installation skills
- ✓ Understanding the Solar Power System and its different parts
- ✓ Occupational health and safety
- ✓ Understanding on-grid, off-grid systems
- ✓ Additional other related skills noted in table 4.1 above and detailed in Annex 4
- ✓ How to install and operate generators, motors and air compressors

Additional skills:

- ✓ Welding and metal work skills
- ✓ Surveying skills
- ✓ Physical ability and Practical know how of installations and wiring of the system.
- ✓ Standards and regulations by electricity companies
- ✓ Load distribution
- ✓ Costing and calculations of energy

Skills of new technology or related to development in the field:

- ✓ Software related to the field, some for calculation and simulation, monitoring operations and others for drawing. Such as: AutoCAD, edraw, circuit breaker, PV system
- ✓ Work on Net-metering system,
- ✓ Circulation and tilting system for circulation of panels according to season
- ✓ Irrigation systems using off-grid solar power
- ✓ Methods of cleaning of panels for increase of system efficiency
- ✓ Ability to self-develop and search for new development

Box 4-5: personal and other supportive

Personal Skills	Other Supportive Skills
➢ Communication skills ➢ Know how to sell and promote the system ➢ Work under pressure ➢ Team work ➢ Organised ➢ Patience ➢ Honesty ➢ Physical ability	➢ Use of computers and software as excel ➢ Presentation skills

➢ Problem solving and leadership skills ➢ Ability to withstand hot weather and different weather conditions	

In addition to the above, surveyed enterprises were asked about the Level of proficiency by the skilled worker compared to required level and were given three options; less than the required level, as the required level and more than the required level. On average; results indicated that almost half of the surveyed noted that skills were below the required level. These skills are important to note when preparing the future training program. And in developing upgrading courses for the existing skilled workers.

Table 4-2 Level of proficiency of the current skilled worker compared to required level by the enterprises

	Level of proficiency of the skilled worker compared to required level by enterprises		
	Less	**As**	**More**
Reading the executive engineering plans	48%	48%	5%
Preparing work materials according to quantities and specification	38%	43%	14%
Pipe fitting for electric installation of different types	33%	43%	19%
Preparing, installation and maintenance of housing, industrial and commercial channels	52%	33%	14%
Electrical installations of housing and economic establishment	52%	33%	10%
Electrical installations and wiring networks for communities	57%	14%	14%
Electric installation and maintenance of commercial bill boards,	48%	14%	5%
Testing electrical installations using testing and measurement devices,	57%	29%	19%
Installation and maintenance of frame, solar panels and grids	52%	29%	24%
Installation and operation of solar power system components (battery, adapter and regulator)	48%	29%	19%
Maintenance of solar power system parts and units	33%	48%	14%
Calculate the cost of energy saving of solar power system	57%	24%	14%
Installation of external lighting circuits and light signals,	52%	29%	10%
Electrical wiring of the solar power system	38%	43%	14%
Earthing of household and industrial electrical installations, as well as installation, delivery and operation of machinery.	33%	38%	24%
Implementation of preventive maintenance schedules and filling of work forms	57%	29%	10%
Application of procedures and instructions of occupational health and safety	29%	52%	19%
Average	**46%**	**34%**	**15%**

4.6 Readiness for cooperation with VET institutes

95.2% of the surveyed enterprises confirmed their readiness to employ graduates from vocational education and training institutes as the LWF or the YMCA, the remaining responded by maybe. In stating reasons for cooperation, they have indicated their demand of employing vocationally trained workers in the solar fields, which would be the graduates of these institutes, one stated that they have good relation with other TVET institutes, the Polytechnic (PPU) in Hebron, while one noted we tried TVET graduates before and were satisfied, others noted that they have practical experience and have high readiness to work.

All surveyed enterprises confirmed their need to train their employees on new techniques of solar energy, presenting an opportunity for upgrading training that can be provided by the VET institutes. Remote communities have specified the need for training of some of their unemployed youth to be a resource for the community in the future.

Interviewed VET institutes have indicated their plans to carry out trainings and their willingness to conduct upgrading as well as outreach training in the field.

4.7 VET provided in the field

Solar energy is newly integrated in some VET programmes during the last 2 years, the MOEHE through the BTC/ENABEL or GIZ support were able to integrate solar energy within the electric installation programmes of some VET institutes, including vocational schools and the YMCA-VTC. The MOEHE has updated their curricula to integrate solar energy within. Graduates of these systems are only introduced recently in 2017 or 2018 to the market, two of the surveyed enterprises were aware of these graduates, hence, most of the skilled labour were electricians who trained by practice or on-the-job.

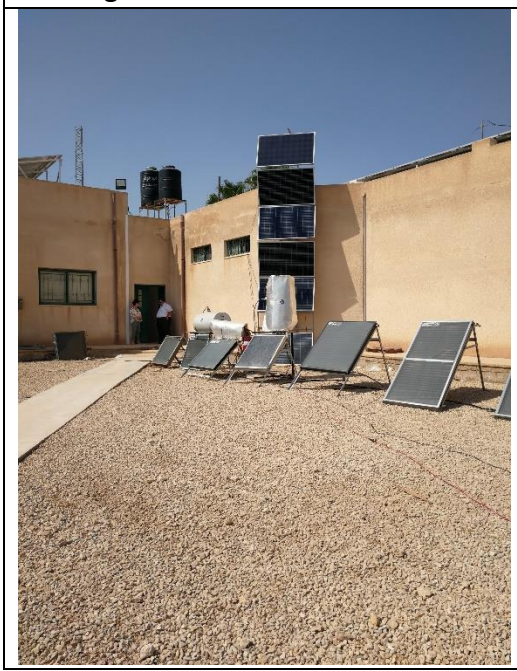
The EJ-YMCA-VTC is integrating solar energy within their electric installation program starting this year. This introduction was announced by the YMCA and attracted students to the VTC and the specialisation as students mentioned during the discussion. They are willing to start short courses in the field. They have been supported with 5KW solar system that supports the main building and part of the operations during the day and can be used for training, they also have training simulators and equipment, project was supported by the GIZ. Photos below illustrates the system and the workshop.

Photo 4-1: The solar system for the YMCA-VTC	Photo 4-2: The Solar energy training workshop
	

Female trainees are not present in the field nationally, none of the VET institutes are training females in electric installation profession or in solar energy, although the YMCA were the first to integrate women in non-traditional field of electronics mid-nineties and LWF integrated them in the year 2000, both have female youth in non-traditional fields, and would integrate female in this field.

The LWF-VTP provides electric installations as part of its short courses, its willing to integrate solar energy as part of its short courses, and to introduce Electric Installation and Solar Energy training, as part of its ongoing training programmes. Meantime, the IECD Jerusalem was conducting a needs assessment to integrate Solar Energy with the Salesian VET institute.

Some of the surveyed companies as Sera in Nablus have been training electrician in solar energy due to its needs for skilled workers in the field. The Electrician Union in Nablus conducted a training for its members, it was criticised for lacking the practical part. On the other hand; JDECO training centre in Jericho has installed solar power energy systems and has conducted various hands-on trainings in the field, their centre accommodates people while conducting their training. JDECO's role extends to train and certify electrician in the centre and the South of the West Bank, according to JDECO there are over 2000 partitioning electrician in Palestine.

Photo 3: Solar Training systems at JDECO training centre	Photo 4: Solar Training halls at JDECO training hall
	

5 Chapter 5: Overall Conclusion and Recommendations

5.1 Overall Conclusions:

- Although, the PA decided in 2012 to support and encourage households and the private sector to start investment in the clean energy in general, and solar energy in particular. Its strategy, which was drafted in 2012 was very ambitious and lacked the procedures needed for implementation. One of the points the strategy lacked is a positive approach towards the private sector to convince them in the feasibility of investment in the solar power.
- The private sector started investing heavily in the field only 2 years ago, after realizing the feasibility of installing solar panels. Now there is a strong trend in the field, especially in the industrial and commercial sector. This is due to the strong feasibility of installing solar panels on their premises. Large industrial establishment like Royal, Saniora and APC. Other industrial establishments are now in the process of installing solar panels.
- Electricity Distribution Companies have serious concerns on the Palestinian solar initiative and the dictated prices of the solar generated electricity. The EDCs think that prices set are inflated and they should be subject to free competition.
- Most of the engineers interviewed in the EDCs and the renewable energy research centre think that the cost of solar generated electricity should not exceed 0.25 NIS, this is compared with 0.34 NIS it is being sold now. The EDCs who are also buying electricity from household at prices between 1.07-0.54 NIS, think that the initiative should have not forced to buy electricity at such higher prices.
- The EDCs engineers complained about the possible damage to the electrical equipment due to the alteration in the electricity due to the variable supply of the solar generation stations. Further studies are needed to examine the capability of the local grids and the effect of Variable solar supply on the grids.
- The EDCs complained of the Wheeling strategy (to generate in different area than the area of power consumption), consumers are using, in one case PALTEL signed an agreement with JDECO to generate 10 MW in Jericho, and consume the same amount of power in other areas such as Ramallah and Bethlehem. This will create an extra load on the Jericho grid, with small possibility of transmitting the surplus to other areas.
- People interviewed from the private sector showed very strong enthusiasm for the instalment of solar panels. Although they have complained of the lengthy procedures for licensing the solar systems, and the complications in connecting them to the grid. As a solution some of the people interviewed showed interest in working off grid.

- Various donor projects have been implemented to encourage solar power energy, or as part of their support to the community, institutes or as part of a bigger development initiative. The PA has worked towards encouraging investment in the sector as noted by PIPA, encouraging investments through solar power stations and the 500 schools' rooftops project.
- The business of private sector enterprises working in selling, installing and maintaining solar systems has been growing, commercial viability in the sector is increasing due to the increased awareness, promotion and available investments and projects, in addition to the reduction of the cost of the system over the past few years. The number of enterprises working in the field and the spread of their work has increased, competition was noted by some. Equipment is mainly purchased from Europe (Germany or Italy) or from China, with variant levels of quality and price. Cost is around 1000-1200 per KWH, with a repayment period of 3-5 years.
- 95% and 87.5% of the businesses expressed the need for employment and self-employment respectively within the coming three years, indicating high demand for employment and self-employment in the sector. All of them will cooperate with VET institutes and would train and employ graduates.
- Identified skills were technical related to electricity instalment and solar energy instalment, and maintenance. Personal skills were mostly related to communication, sales and promotion, these are important skills for the self-employed. Entrepreneurial skills to be added for self-employment.
- Businesses showed interest in training their employees. One of the surveyed businesses provide training to youth and to employees to cover the skills gap in the market. Other institutes as the Electrician Union are interested in training their members, as well as JDECO, both has run short courses in the past.
- The existing and potential solar power generation stations are relatively new, but would need technical capacities for O&M in the future.
- Vulnerable Bedouin communities have been managing their operation and maintenance cost of their solar energy systems through different methods. But two issues need attention the high cost of batteries that needs replacement after 4 years of operation, and the natural growth of the communities, both are beyond the communities' abilities. Investment in providing maintenance service as commit me was accepted by some businesses, while others find it difficult to reach. Investment in these areas for generation of electricity is harder and would need transmission infrastructure and permits to work in Area C.

5.2 Overall Recommendations

Overall recommendations are divided into two main parts. First; overall recommendations related to the potential investment opportunities. Second; overall recommendations related to skills training, support for jobs and entrepreneurship opportunities and related to capacity building.

5.2.1 First: overall recommendations related to the potential investment opportunities

The following recommendations presents potential opportunities for investment and engagement of the private sector in the solar power energy sector;

- Expanding solar power generation stations in different areas, while investing in the infrastructure of the electricity networks, and Exerting needed political pressure for enabling the use of Area C on the long term. On the short-term use Area B and link with the IEC network, following Jenin power station model. Attracting investors and facilitating access to local and international financial systems could also expand such opportunities.

- There is a great need in more understanding between the EDCs and the investors in solar power. Such cooperation is needed during the licensing stage and when connecting to the grid. There is a need to review the pricing strategy of solar power, in order to keep the incentive for all parties, including the private sector, investors, the EDCs and the final consumer.

- Provide support for technical and feasibility studies, as the private sector need help in the preparation of technical and feasibility studies. When such studies are completed the private sector will be more convinced to invest in this field, understanding the savings they will have when using solar power.

- Duplicating the model of the 500 schools through investors to provide electricity and income for the institute, through the commercially viable opportunity for the investors, in addition to making use of the financial incentive scheme. The model could be duplicated to other schools, educational institutes and other public sector and NGOs.

- Assist solar power energy private sector investors in marketing. By promoting the financial incentive scheme for economic establishments among private sector establishments such as factories and hotels, to invest and use the incentives, this would need providing marketing and technical training of companies' engineers and marketing staff or those that they could employ or sub-contract with, and developing of tools such as feasibility plans for different model. The scheme would also require linkages with financial mechanism, such as Bank of Palestine green loans.

- Spread the solar system to housing in rural areas, using the available spaces in Area B communities for housing rooftops solar system, rooftops and land are larger in rural areas compared to limited urban areas in Area A. such spread would require developing a financially viable model and would need sub-contractors and financial system, it can also

make use of Tubas experience when relevant of the multi-stakeholder engagement. as most rural areas are spread and not heavily populated, according to PCBS (2018a) there are 606 localities, 31% of which has population that is less than 1000 and 73% has less than 5000.

- Provide financial incentives (such as income tax deduction similar to industrial and commercial buildings) for investors in big housing projects and work with the engineering association and the initiative for green building to include the solar system within their investment, housing is the highest electricity consumption in Palestine, yet spaces are limited in Area A and cost of land is high, which could overburden the investor, a financial model could be developed.

- Facilitate national and international financial support systems for investors and private sector working in the sector, through encouraging other national financial systems and linking with international financial opportunities for investment support as the European Investment Bank (EIB), and the European development bank for reconstruction and development (EBRD), or through identifying international investors, which require a detailed study.

- Encourage research and piloting opportunities such as the use of hybrid model and piloting different community or housing models.

- Provide system development for the solar energy enterprises to enable O&M services for the remote areas in Area C and the Bedouin communities, such as commit-me, and link through tracking software systems, system to include payment methods of communities. Added to which, build the capacities of entrepreneurs to act as sub-contractors for the enterprises.

- Setting a national fund for the new off-grid requests in remote areas and Bedouin communities in Area C, to be fed with extra payment on electricity bills by consumers, donors' funding and international funds as the green fund. Fund to be managed by multi-stakeholders. In addition to approaching international funds that provide support for green initiatives.

5.2.2 Second; overall recommendations related to skills training and support for jobs and entrepreneurship opportunities and capacity building

- Integrate the training of "Electric Installation and Solar Power Generation" within the provided trainings at the TVET institutes, within their 1 year and 2 years system

- Ensure the TVET institutes interaction with private sector companies during the training through:
    - The Work-Based Learning element in the training, as all surveyed companies has welcomed training and employment of graduates.

  - Engage the private sector in curricula development, join them in an advisory board for the two TVET institutes, and arrange for inviting them for special sessions at the TVET institute.
  - Train the staff of the Solar Power Companies on upgraded technologies and health and safety through short courses, cooperate with JDECO training centre.

- Outreach training for Bedouin communities and Area C communities:
  - Provide outreach full training in solar power for Bedouin communities, at the skilled worker level, at least one training per area (North, Centre and South of West Bank)
  - Provide outreach short course that have 1-2 participant (could include unemployed female graduates) from each small community. Such participant can act as the know-how person in the remote community and can do the initial diagnoses, preventive maintenance and link with technicians or companies
  - Develop the curricula for the outreach and short courses training.
  - Other than solar:
    - Engage youth from these communities in other vocations (such as carpentry, auto-mechanics, metal work), through targeted awareness programmes and integrate entrepreneurial skills and support after graduation.
    - Provide Water Networks, plumbing and sanitation outreach courses for the communities.
    - Explore trainings that could enhance communities' economic status depending on their resources, such as leather work. As a first step; conduct a training needs assessment study to explore the opportunities.

- Training to spread the use of solar energy among the population in East Jerusalem and remaining West Bank:
  - Provide short courses for practicing electricians in East Jerusalem will enable the possibility of spreading the system in East Jerusalem (J1 and J2) and the surrounding, could be conducted by LWF.
  - Provide short courses for practicing electricians in the West Bank for spreading the awareness and know-how in regulations, quality control and new techniques, partner would be JDECO and Electrician unions.

- Provide Technical and entrepreneurship training, as well as access to finance and support for entrepreneurial opportunity, so that entrepreneurs can have their own work in their communities as sub-contractors with companies to sell the product, and provide operation and maintenance services, this could be viable for rural communities to spread the system and find jobs for youth. Building on the ILO (2013b) best practice in Bangladesh. Access to finance have to be identified through Micro-Finance or bank opportunities for flexible loans, a model could be established.

- Work with JDECO as partner that could also provide support and interaction with companies, as well as training to their staff on systems, tariffs and regulations.
- Some capacity building is needed for a group of engineers to be able to conduct a technical grid study, which includes and not limited to, the effect of the alteration in solar power on the grid, consumers and connecting points with Israel.

6 Recommended design of the VET training to meet the labour market demand and recommended intervention

This chapter will present the projection of the number of the required male and female VET graduates based on the private sector demand in general and the projection for female youth in specific, it will also present the way forward for interaction with the private sector throughout the training, and the elements requested in the curricula review, the additional measures to be integrated for engaging women and youth in the sector, and possible scenarios for intervention for the DCA/NCA and partners.

6.1 Projection of number of TVET graduates requested by the private sector

The projection of demand and supply would provide needed information for providing the adequate supply for the requested demand by the solar energy private sector enterprises. The projected supply would be the base for the development of the relevant training programs by the TVET institutes and its stakeholders.

6.1.1 The Projection of the Demand:

- The demand for employing skilled graduates (VET graduates) is estimated at an average of 8.3 skilled workers per enterprise, reaching at least 340, that could increase to over 650 within the coming 3 years, sub-divided as;
    - Demand to employ between two to six within the coming three years, with an average of 3.1 per enterprise. **reaching at least 340, that could increase to over 650.**
    - Demand to sub-contract between two to 50 skilled workers within the coming three years, with an average of 5.2 per surveyed enterprise **reaching at least 340, that could increase to over 650.**
- Opportunities of short courses and upgrading courses for electricians: (at least 1000 during coming 3 years)
    - All surveyed enterprises confirmed their need to train their employees on new techniques of solar energy
    - Over 2000 practicing electricians in Palestine, youth interviewed showed willingness

6.1.2 Suggestions for planning the supply:

With other TVET providers; the suggested long and short-term VET trainings, to be provided by partners of the DCA/NCA, is expected to cover the gap within the next 3 years. The suggested number of graduates would be at a rate of 40 graduates annually from the 1 year (2 groups

morning and afternoon from LWF-VTCR) and 40 from the 2 years system (LWF-VTC and YMCA) will graduate in the second year of the project. The remaining would be covered from conducting at least 5 short courses per year for 15-20 electricians from different locations including the North, Centre and the South of the West Bank.

Table 6-1: Scenarios of planned supply

	Scenario 1			Scenario 2		
	Y1	Y2	Y3	Y1	Y2	Y3
1-year system	40	40	40	40	40	40
2-year system	0	40	40	0	40	40
Short Courses	85	85	85	105	105	105
Sub-Total	125	165	165	145	185	185
Total	**455**			**515**		
Entering the labour market (85%-90% LFPR)[1]	**387-410**			**438-464**		

The employment rates of the graduates participating in the labour force would reach 95%, based on the survey findings and the previously conducted YMCA and LWF graduates' tracking survey (Hilal,2018a).

The Salesian would add the additional students in the VTC and the Vocational School. Also; the Palestine Polytechnic University (PPU) has graduates at the technical level, mainly from the south of the West Bank. Added to one private sector institute providing the training.

VTCR operates in Ramallah, where most of the companies are concentrated, youth from Ramallah join the VTCR in addition to some youth from other nearby areas. While the YMCA and the LWF-VTC has boarding section and accepts students from all over the West Bank.

There are other providers from Vocational Schools at MOEHE, at a maximum rate of 160 students, yet one third to half of the vocational schools' graduates will continue their higher education.

In addition to above skilled labour entrees to the market, the informal trained apprentice from the market would also enter the labour market within the sector.

As such, it is expected that at least 550 skilled workers will be available in the market within the coming 3 years in scenario 1, while the required 650 will be in the market in scenario 2, the ongoing communication with private sector and meetings via the vocational committee could increase the numbers through increase of short courses based on their request.

6.2 Projection of female graduates and outreach

Although the sector is male oriented sector, with females working in office or design work mainly conducted by university graduates, there are opportunities for vocational and technical work to be conducted by female graduates as follows:

[1] Based on previous graduates' tracer studies of the institute

- Female youth could work in technical and vocational support through hotline services or through computer monitoring system for O&M from the office.
- They could also work as part of the team in the field in the calculation for the design, as part of the installation and calibration team, or/and as part of the O&M team.
- Female youth could work in sales and marketing as female youth in sales is an attracting factor for the employers
- Female youth could be self-employed in their Bedouin or remote communities using off-grid solar energy to provide O&M or at least initial diagnostic service.

Hence, female youth should be engaged in the training as follows:

- Female youth should be part of the training of "Electric Installation and Solar Power Generation" within the TVET institutes (LWF, YMCA), at least 20% of the trainees should be females.

- Training unemployed female university, college or TVET graduates in the Bedouin and remote communities (1-2 participant from each community reaching maximum 62). To provide the initial diagnoses, preventive maintenance and link with technicians or companies.

Table 6-2: Scenarios of planned supply of female graduates

	Scenario 1			Scenario 2		
	Y1	Y2	Y3	Y1	Y2	Y3
1-year system	8	8	8	8	8	8
2-year system	0	8	8	0	8	8
Outreach Courses	15	15	15	20	20	20
Sub-Total	23	31	31	28	36	36
Total	**85**			**100**		

Additional measures during the training and Support after training is needed for female graduates, in addition to raising the awareness of the private sector and engaging females in training within the market place, as will be presented in the coming sections.

6.3 Interaction and communication with the private sector

Interaction and communication with the private sector by the VET institutes should take place during developing the training and throughout the training in various modes, either through systematic or through demand-oriented interaction and communication. Private sector enterprises were enthusiastic on the idea of cooperation to enable the supply of the demanded VET graduates.

6.3.3. First: Systematic interaction with the private sector:

Work-Based Learning (WBL): School-based Work-Based Learning scheme is adopted nationally by TVET, it includes school-Based apprenticeship scheme adopted by the LWF-VTP, and internship scheme adopted by the YMCA-VTC, both schemes acquire training in the labour

market before graduation in a systemized way, with supervision of a mentor in the labour market and a trainer at the VTC.

Vocational Committee: Vocational committee is a committee for certain vocation, it constitutes of private sector employers of the VTC graduates in the specified vocation. The committee usually discuss curricula, development within the vocation, as well as schemes and assessments, members could engage in open days, counselling of potential graduates as well as training of apprentices and interns in the market place, members could request training or exposure for upgrading their enterprises and the sector. The committee could meet 3 times annually with clear agenda, while ongoing communication could take place. One committee could be set for both institutes.

Market-Relevant Curricula Development: Developing market-relevant curricula requires the full integration of private sector and in different stages, subject-matter experts from the market are also engaged.

6.3.4. Second: Demand-oriented interaction:

Graduates' roaster: for employers and consumers to access graduates' roaster for employment and self-employment, an online roaster is under development by the DCA/NCA for the YMCA-VTC graduates.

Using social media for interaction: Private sector enterprises could be linked through social media groups to enable contact when needed by the employers with the VET institute or vice versa. The NGO-VET League Portal could be used for such interaction, or special groups on other social media method could be initiated.

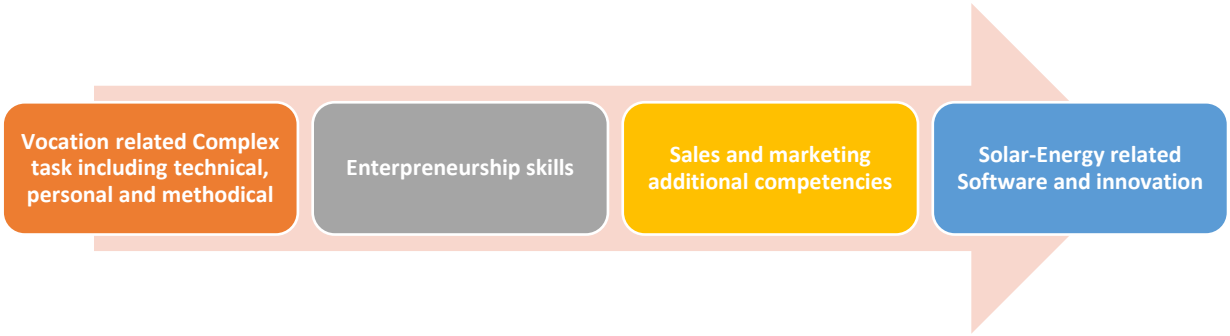
6.4 The recommended Solar Energy training

The solar energy training should be integrated within the Electric Installation training to be "Electric Installation and Solar Power Generation" within the TVET institutes (LWF, YMCA). Training should be designed according to the identified skills by the labour market illustrated in section 4.5 of the report. The YMCA has developed the curricula with the support of the GIZ during the past year for employment. The developed curricula should also be aligned with the two different modes of training the one-year and the two-year systems at the LWF carried out through apprenticeship training.

Additional modules should be added; as almost 2/3 of the demanded labour force would be sub-contracted to carry out vocational tasks, and others required to carry out sales and marketing tasks. Hence, additional skills of entrepreneurship, personality building, sales and marketing should be embedded within the course as additional modules.

The addition of the computer aided software in the profession would require an additional module that could add advantages to the graduates and align them with the market demand.

Figure 6-1 Graph of the modules within the training:



Short courses should be designed for unemployed youth electricians, or youth who were trained on electric installations and wants to gain the solar energy competencies before entering the labour market. Short courses could be devised to include the vocational modules, in addition to the entrepreneurial and computer-aided modules in the training. Such courses could be provided by the DCA/NCA partners, the LWF and the YMCA VTCs, courses would need 600 hours distributed over6 months period with 20 around training hours per week, to enable acquiring the recommended competencies.

The long and short-term training should integrate work-based learning to ensure hands on and practicing of the learned skills in the market place. Although the YMCA has got their small system for generating off-grid electricity, and the LWF is in the process of obtaining one, training in the market place would provide graduates with real-life hands-on experience and will enable their employment after the training, especially for females and marginalised youth. The WBL should also be part of the entrepreneurship, sales and marketing modules.

The vocational modules would be enough when training the long-term practicing electricians or the private sector employees, to be trained by JEDCO.

Innovation elements should be integrated within the training. This training is within a new growing field and sector, encouraging innovation among the students within the sector is important and could present added value to the graduates.

The outreach training for Bedouin and marginalised communities, could be provided by the YMCA-VTC through its link with the YMCA-Women Training Program (WTP) who works in the different communities and have worked with the Bedouin communities, an added value for the YMCA-VTC, not available within other institutes. The YMCA (WTP) would work with the communities to prepare for the training and ensure the support of the community and the use of the trained women skills afterwards, while the YMCA-VTC would provide the vocational training and the after-training technical support. The YMCA-WTP work in various marginalised communities, such training and needs for off-grid solar systems could be investigated and added. Such model will ensure the use of the training within the community. Female youth could be unemployed graduates, training would be 150 hours for four months to include the basics at a limited skilled worker level, tasks for the initial preventive maintenance, calibration and the initial diagnostic work needed for the maintenance, and contact skilled worker or company.

The upgrading training to be provided by JEDCO to practitioner electricians and engineers on the solar energy regulation, measures and new technology could also enhance the quality of the service and spread the use of the system.

6.5 Additional measures for engaging women and youth in the sector

Engaging women and youth in the solar energy sector during and after their short-term and long-term training at the institute would surely require the systemized WBL and interaction with the private sector, and would also require integrating additional measures.

Measures would include post-training services, in the form of support services for the graduates in findings employment or self-employment opportunity through links with the labour market, support in providing career counselling, legal and financial counselling and links to other requested services in business development or access to finance if needed by the graduate. Hence, a support centre for the employed and mainly the self-employed would be needed. Post-training services could be integrated within the partners existing structures.

Additional measures for female youth training: due to long experience in dealing with women training in non-traditional fields within VET, additional affirmative measures would be needed to be integrated before, during and after the training, as follows:

- Quota should be set for females to include them in at least 20% of the seats available for training.
- Careful selection of female trainees to ensure their potential ability for the training, WBL and employment
- Additional module for assertiveness and empowerment to be provided for female trainees to guarantee their understanding of their roles and abilities.
- Awareness raising for the private sector for the integration of women in the sector through workshops, showing models and most importantly through engaging females' trainees in training within the work place, through the WBL scheme.
- Follow-up of the female graduates and work towards creating women successful models of female graduates working in the sector.

6.6 Scenarios of the DCA/NCA and partners engagement in the sector

The study highlights various opportunities for interventions for the DCA/NCA and its partners and engagements in the sector. These opportunities are presented here as scenarios, where the DCA/NCA and partners could select one or a combination of scenarios.

Scenario 1. Invest in VET:

- By rehabilitating VET institutes to enable partners to provide long-term and short-term solar energy, through providing Equipment, Curricula, TOT and Infrastructure rehabilitation.
- By engaging with private sector through the training (through various methods as noted in 6.3, including engaging them in the training, WBL, Curricula development and committees).

- By integrating measures before, during and after the training to integrate women and youth in the sector and ensure their participation.

Scenario 2. **Develop promotional capacity building**, tools and service system development for the private sector solar companies, so as to further develop the sector and ensure their engagement, in a win-win situation, parts of the suggestions could be implemented, not necessary all of it.

Scenario 3. **Build financial schemes and models** for different groups to spread the use of solar energy, this could be beyond the scope of the DCA/NCA, but has emerged as part of the private sector needs. This could be picked up by another donor or project.

Scenario 4. **Advocate for other recommendations**. Partners can play an important role here by being active in the relevant networks of the sector to advocate for the remaining issues raised in the study.

The DCA/NCA and partners could mix scenario 1 and 4 by enabling the required VET provision, while advocating for the sector, as discussed during the final workshop with the DCA/NCA and partners. They could add items from scenario three such as providing training in new technology or regulations for the private sector companies' employees.

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