SAPVIA

South African Photovoltaic Industry Association

FINAL REPORT

SOLAR PV INDUSTRY JOBS REPORT

FORECASTING SCENARIO ANALYSIS

APRIL 2021



CSIR

Touching lives through innovation

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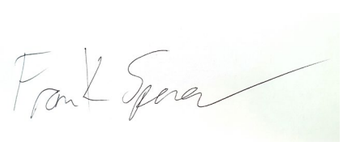
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LIST OF ABBREVIATIONS

CSIR	Council for Scientific and Industrial Research
DEFF	Department of Environmental Affairs, Fisheries and Forestry
DMRE	Department of Minerals, Resources and Energy
EPC	Engineering Procurement and Construction
FTE	Full Time Equivalent
GW	Gigawatt
I-JEDI	International Jobs and Economic Development Impacts
ILO	International Labour Organisation
IPPO	Independent Power Producers Office
IPPs	Independent Power Producers
IRENA	International Renewable Energy Agency
MW	Megawatt
MWp	Megawatt Peak
NREL	National Renewable Energy Laboratory
PPA	Power Purchase Agreement
PV	Photovoltaic
QC	Quality Control
REI4P	Renewable Energy Independent Power Producers Procurement Program
RFQ	Request for Quotation
SAPVIA	South African Photovoltaics Industry Association
SSEG	Small-Scale Embedded Generation

1. INTRODUCTION

The Solar PV market is broadly divided in two market segments; utility and embedded markets. The latter spans residential, commercial and industrial applications and is often referred to as small scale embedded generation (SSEG) or embedded captive projects, while the former mostly covers large utility scale ground mounted installations.

An important consideration in the planning and implementation of Solar PV is an understanding of the economic and job creation impact.

The objective of the study is to provide a quantified analysis of the existing and future job creation impacts of Solar PV in South Africa. This includes a comprehensive audit of jobs in the South African PV sector, including both the utility and the embedded markets.

The surveyed data has been analysed and converted to metrics as have been used to forecast the past and future job creation in the Solar PV value chain.

This report includes:

- Overview of the methodology employed in collecting, aggregating, and forecasting the jobs in the South African Solar PV sector.
- Overview and analysis of the jobs data collected during the survey of local companies working in the Solar PV value chain.
- Overview of the modelling inputs used in the forecasting of future jobs in the Solar PV sector as informed by four scenarios for the deployment of Solar PV in South Africa.
- The results of the forecasting of future job creation potential as informed by the job intensity results from the market survey and future deployment scenarios.
- Sense checking of the forecasted results as per comparison of the results with jobs numbers previously reported by the Independent Power Producer Office (IPPO) and results obtained from an input-output economic modeling tool.
- Conclusions on the results and key observations

2. METHODOLOGY

2.1. OVERVIEW

The methodology applied to calculate the existing and future jobs across the Solar PV sector in South Africa is summarised in **Figure 1**.

2.2. IDENTIFICATION OF PREFERRED METRIC

The literature review completed as part of the overarching study investigated international approaches for collecting and reporting PV sector jobs data[1]. Gaps identified in these approaches include a lack of standardised metrics, difficulties in comparing job numbers across technologies, and difficulties in distinguishing between construction and O&M jobs. Furthermore, it was identified that Full-Time Equivalent (FTE)[1] is the metric most commonly used internationally when reporting job numbers. Considering the abovementioned aspects identified in the literature review, and after review of options and alternatives, for the purposes of this study the chosen metric was determined as FTE jobs/MW/annum as a basis for estimating historical and future job creation in the deployment of Solar PV in South Africa. This approach is aligned with international best practice and provides a basis for the calculation and comparison on jobs in a quantifiable manner.

2.3. CONTACT LIST CONSTRUCTION AND SORTING

The application of the methodology requires the calculation of the job intensity (jobs per MW of Solar PV installed) of the local Solar PV sector in South Africa. That requires a suitably detailed understanding of the local Solar PV value chain and the local jobs that have been created in constructing and maintaining the presently installed Solar PV capacity in the country. Given the relative infancy of the Solar PV sector in South Africa, detailed reporting and breakdown of the job creation and economic impacts of the sector are not yet uniformly available. To determine the present job intensity of the Solar PV sector, a detailed survey of local companies was required. This necessitated the creation of a contact list database containing the details of the local companies working in portions of the Solar PV value chain.

Close to 1 000 company contact details (linked to the PV value chain) were collected to develop the contact database which enabled the collecting of historical

[1] *According to the International Labour Organisation's (ILO) definition [1], a full-time equivalent (FTE) job, "is a unit to measure employed persons in a way that makes them comparable although they may work a different number of hours per week". The FTE unit is obtained by comparing an employee's average number of hours worked to the average number of hours of a full-time worker.*

jobs data numbers in the Solar PV sector. These companies were searched and sorted across a defined Solar PV value chain as summarised in **Figure 2**. The data collected across this value chain was aggregated to calculate the jobs per MW metrics for the defined elements of the Solar PV value chain that would then enable the calculation of the South African Solar PV sector job intensity values for both the utility and embedded markets.

Further details on the value chain categories applied in the decomposition of the contact database is provided in Section 3.1.

2.4. DATA COLLECTION AND CALCULATION OF METRICS

All the companies in the contact database were then surveyed to collect jobs utilising a standardised questionnaire that collected key information pertaining to:

- Number of permanent employees
- Number of contract employees
- Installed capacity in MW per annum
- Number of projects in specified year
- Type of service or manufacturing provided

Annexure A contains the questionnaire applied in collecting the jobs data across the Solar PV value chain in South Africa. Data was collected for 2018 and 2019. The collection of jobs data prior to 2018 was not possible for the purposes of this study as initial application of the survey confirmed that many companies could not readily supply job numbers for earlier years.

The surveyed job numbers were collated and applied to calculate job/MW metrics for each category of the local Solar PV value chain for the years 2018 and 2019. A consolidated FTE jobs/MW metric was then calculated for application in the forecasting analysis to estimate the predicted job creation as dependent on the installed capacities to date and scenarios for the future further addition of Solar PV in the South African power system.

The metrics themselves are a combination of permanent and contract workers employed for a full year in 2018 and 2019. Where employees had been employed for a shorter period than 1 year, the metric was converted to a FTE based on the duration of temporary employment. It is important to note that very few respondents indicated contract workers employed for less than a full year between 2018 and 2019.

2.5. SCENARIO FORECASTING UTILISING REAL JOB NUMBER CALCULATED METRICS

The outcome of the Solar PV market survey provides an understanding of the local job intensity in the construction, installation, manufacturing, and operation of Solar PV facilities. To then calculate the total number of jobs that have historically been created in South Africa and estimate the future job creation potential, it is necessary to understand the historical and future installed capacities of the technology. This requires an understanding of the existing Solar PV installation base and a prediction of the possible or likely levels of future deployment. Given the uncertainties in the installed base (both present and future) a scenario-based approach was followed. Four key scenarios have been developed.

Annual job numbers are calculated by multiplying the annual installed capacities with the job intensity metrics developed via the survey. The calculated job numbers are split between the construction and O&M phases by applying the split outcomes obtained from I-JEDI modelling tool of 97% to 3% respectively, as is aligned with international metrics and experience. This was applied as follows:

- Annual O&M jobs additions (due to new installations) were cumulatively added to calculate the number of O&M jobs in each year. This illustrates how O&M jobs are sustained and grown through the cumulative growth in the total installed base. O&M jobs are there for sustained over the lifetime of the plant while construction jobs are assumed to exists only in the year in which the construction takes place.
- Annual construction jobs were calculated in each year based on the new capacity installed in each year. This illustrates how construction jobs change as linked to the specific capacities installed in particular years.
- The total jobs in each year is the sum of the annual O&M jobs and annual construction jobs.

Note: All jobs in these calculations are FTEs representing the estimated annual employment opportunities created and sustained across the Solar PV value chain in South Africa.

Forecasting of job creation potential was completed across 4 different scenarios. The base case scenario takes a historical view of the number of jobs created based on verifiable installed capacities. The IRP 2019 and accelerated scenarios take a future view only without considering historical installation to unpack the next 10 years of Solar PV development's job creation potential.

The high road scenario provides the best possible development of Solar PV considering historical figures based on import data as well as the elements of the accelerated scenario. Further details on the assumptions informing the installed capacities applied in each of the forecasted scenarios is provided below.

BASE CASE SCENARIO (HISTORICAL VIEW BASED ON CSIR ANALYSIS)

This scenario is a representation of the historical number of MWs of Solar PV installed to date for both utility and embedded generation until 2018. These figures are the existing installed capacity assumptions broadly applied in CSIR energy modelling studies and has no relation to the published IRP document in any way. Source documents utilized to obtain the installed capacity figures include:

- CSIR Analysis of IPP procurement announcements[2]
- CSIR analysis of the Eskom medium term adequacy outlook 2019[3]

IRP SCENARIO (FORECASTED SCENARIO ONLY)

This scenario is based on the Integrated Resource Plan's Policy Adjusted scenario as gazetted by the Department of Mineral Resources and Energy (DMRE) in 2019[4].

This scenario was used to estimate the future job creation potential up to 2030 for both utility and embedded generation scales based on installed Solar PV capacities included in that plan. The current generation gap of 2 500 MW is assumed to be developed by the embedded scale between 2019 to 2022 with 625 MW of embedded Solar capacity added in each year over this time period.

ACCELERATED SCENARIO (FORECASTED SCENARIO ONLY)

The Solar PV deployment in the IRP2019 may underestimate the possible Solar PV deployment in South Africa as may require accelerated deployment to support increased decarbonisation of the power system and the accelerated retiring of aging and poor performing coal-fired power stations. This scenario is informed by the "modest renewable energy industrialisation" [5] scenario developed by the CSIR using the same modelling methodology, assumptions and tools as the DMRE IRP2019 but with the removal of specific constraints and the application of further boundary conditions as reflects an accelerated decarbonisation of the power system as compared to the IRP2019.

The scenario developed by the CSIR results in increased installation levels of renewable energy (including Solar PV) as associated with more progressive decarbonisation and cost reduction objectives.

HIGH ROAD SCENARIO (HISTORICAL AND FORECASTED SCENARIO)

The SSEG data applied in the "Base case" scenario is likely to underestimate the actual presently installed embedded Solar PV capacity given the uncertainty in actual installation levels due to the lack of registration of these facilities and an associated consolidated national view.

This scenario applies Solar PV import data obtained from Quantec [6] and adjusts the estimated installed capacity of existing Solar PV installations. Quantec is a paid for data platform that consolidates South African economic and socio-economic data from different government entities such as StatSA, and the South African Revenue Service (SARS).

The import data for PV modules into South Africa (as obtained from SARS source documents captured in Quantec) was applied to calculate the estimated total Solar PV capacity that could have been installed in South Africa assuming that all panels have been installed locally. Import data obtained from Quantec was quoted in annual rand value which were then converted to MW by utilising specific Rand/Watt figures provided by industry experts at SAPVIA.

Utility scale projects completed are then subtracted from the overarching figure leaving an assumed figure of embedded generation.

The utility scale projects are assumed to increase slightly as per the Renewable Energy Independent Power Producer Procurement Programme (REI4P) bid windows constructed in 2018/2019.

The difference between the estimated total Solar PV capacity (based on total panel imports) and REI4P utility scale capacities is then the assumed embedded market capacities in South Africa.

The adjusted as-is installation base assumptions are combined with the same forward looking "modest renewable energy industrialisation" [5] scenario applied in the "accelerated scenario" to provide this "high road scenario" that may be more reflective of the present and future Solar PV capacities in South Africa.

3. LOCAL SOLAR PV JOBS SURVEY

3.1. SURVEY STRATIFICATION

Close to 1 000 company contact details (linked to the PV value chain) were collected to develop the contact database. The data collected through the creation of the contact database indicates that active participation in this sector commenced from the year 2010.

Delays in conclusion of the IPPs power purchase agreements (PPA) beyond bid window 3 have had a clear impact on the number of jobs created by the Solar PV industry. The phasing of bid window contracts awarded is as follows:

- 2012 bid window 1
- 2013 (bid window 2 and 3)
- 2018 (bid window 3.5 and 4)

It is assumed that there would be a delay from the date of bid window awarding to construction starting. The substantial delay in procurement between 2013 and 2018 resulted in uncertainty in the Solar PV sector. Several companies did not remain in business in the period between 2013 and 2018. Therefore, the survey of jobs in the sector was focused on the years 2018 and 2019, whereby active companies could supply jobs data as can be used to estimate job intensity (jobs per MW) and thereby calculate total jobs.

The survey responses were classified into categories according to the different roles the companies perform in the value chain, as include: IPPs, Services, Manufacturers and Equipment Providers, EPC Utility, EPC Commercial and Industry (C&I) and SSEGs as summarised in **Table 1**. The categorisation was applied in a manner whereby the contribution to each of the embedded and utility market segments can be assessed which in turn supported the calculation of a jobs intensity metric for each of these market segments.

3.2. SURVEY RESPONSES

Table 2 summarises the survey sample and response rate across the different categories. The overall survey response rate was 11,4%, whereby, of the 936 companies contacted, 107 companies completed the survey. This response rate aligns with industry norms for such surveys and is considered adequate for the purposes of this analysis.

The EPC C&I category has the highest response rate of 23%, followed by IPP at 13%. The EPC Utility has the lowest response rate at 1% (with only one company out of 101, responding) as reflects a lack of willingness to share information that may be perceived to be of a commercially sensitive and competitive nature.

3.3. SURVEY RESULTS

The survey results across the value chain categories (for the years 2018 and 2019) are summarised in **Table 3**. Each sub-category adds to the overall value chain with additional jobs and performing unique services to build and operate the same installed capacity.

The following key observations can be noted in the changes in the surveyed data between 2018 and 2019:

- IPP project companies contributed the largest proportion to the overall Solar PV employment and employment levels did not significantly change between 2018 and 2019. Most of the jobs in this category are permanent.
- Miscellaneous services such as training recruitment and facility management contributed the largest proportion to the overall services employment and did not significantly change between 2018 and 2019. Most of the jobs in this category are permanent jobs, with an increase in the proportion of permanent vs contract jobs between 2018 and 2019.
- Panel assembly and manufacture contributed the largest proportion to overall manufacturing job creation and increased between 2018 and 2019. Most of the jobs in this category are permanent jobs.
- EPC Utility contract job creation substantially increased in 2019 with a large increase in contract jobs as would logically be linked to utility scale project construction activities.
- EPC C&I job creation substantially increased in 2019 with increases in both the permanent and contract jobs. Most of the jobs in this category are contract jobs.
- The number of jobs created in the SSEG value chain segment appears low when compared to other value chain segments but relates to only 6 and 16 MWs of installed capacity. There has been a substantial increase in both permanent and contract jobs.

Given the survey response rate, the absolute numbers collected only reflect the jobs in a sub-set of companies working in the Solar PV sector. To apply these survey results to a South African level calculation of total jobs, the survey results were translated into the job intensity values for both permanent and contract jobs for each of the categories as summarised in **Table 4**.

Figure 3 summarises the number of FTE jobs per MW for the different value chain categories as split between the utility and embedded scale installations. The category that has the highest jobs per MW is SSEG, contributing 18 FTE jobs/MW. This is followed by EPC C&I with 11 FTE jobs/MW. The IPP category had the lowest jobs per MW. Figure 3 further illustrates that the embedded market creates more than twice the number of FTE jobs per MW installed as compared to the utility scale market. This confirms the opportunity for job creation in the SSEG market.

4. SCENARIO CONFIGURATION AND ASSUMED SOLAR PV CAPACITIES

As described in section 2, the quantification of historical and future jobs creation potential in the South African Solar PV industry requires input assumptions for the amount of Solar PV capacity installed and to which South Africa job intensity metrics can be applied. The specific assumptions applied in determining the installation capacities are described in section 2.5.

Table 5indicates the annual Solar PV installed capacity added to the grid historically and capacity that will be added over the next 10 years on a utility scale. Furthermore, a substantial drop in installed capacity can be observed in 2015 due to a gap in procurement and a lack of signed PPAs in both the base case and high road scenarios.

Table 6 summarises the annual installed capacity added to the grid historically and capacity that will be added over the next 10 years on an embedded scale. Please note that for the base case scenario that no installed capacities are listed in 2019 as there was no reliable information that could reference the correct amount of MWs installed in this year. It is assumed that all embedded generation stipulated in the IRP relates to Solar PV. Embedded generation installation figures were split between C&I and Residential market segments based on a 82%/18% assumption which was based on verifiable data in the base case scenario.

5. SCENARIO JOB ANALYSIS RESULTS

5.1. GENERAL

Multiplying the installed annual capacities (section 4) with the job intensity metrics calculated from the survey data (section 3.3) provides an estimate of the number of construction and O&M jobs created across the Solar PV value chain in the evaluation period. It is important to note that O&M jobs make up roughly 3% of new employment opportunities (based on an I-JEDI modelling assumptions) but has a cumulative effect as those jobs are sustained across the entire modelling time frame and increase with every new annual installation. Results are presented for each of the scenarios evaluated.

5.2. BASE CASE SCENARIO

The number of construction and O&M jobs created across the Solar PV value chain between 2011 and 2018 for the base case scenario are as summarised in **Figure 4**.

Job creation in the PV sector was in its infancy during 2011 and 2012 with rapid acceleration in the number of jobs created in 2013 and 2014 due to the construction of PV plants as part of the REI4P. The delays in signing further IPPs in 2015 resulted in a decrease of more than 9 000 jobs in the PV sector (a decrease of 70.75% year on year). The job losses were primarily incurred in the IPP, EPC Utility and manufacturing value chain segments with SSEG increasing in the same year as many companies explored options in the embedded market.

Job creation increased again in 2016 as further utility scale projects were constructed. This shows the resilience of the PV sector and its ability to scale up job creation quickly when demand for PV is stimulated. The base case scenario is limited in 2017 and 2018 as no sourced reference could be found for utility scale generation addition.

The figures for these years represent an extremely conservative estimate of utility scale new generation addition and the embedded market but further assumptions are made in the high road scenario to test the implications of increased utility and embedded market installation in this period.

5.3. IRP 2019 SCENARIO

The number of construction and O&M jobs forecasted to be created across the Solar PV value chain between 2019 and 2030 for the IRP 2019 scenario are as summarised in **Figure 5**.

The Solar PV sector's contribution to power sector employment is expected to grow steadily until a peak of 38 758 FTE jobs is reached in 2022. This peak in job creation potential relates to 2 025 MW of new installed PV capacity. Significant job losses are expected in 2024, 2026 and 2027 due to no planed procurement of utility scale projects in these years (as per the IRP 2019).

These jobs losses are expected to exceed 15 000 FTE jobs when compared to 2025, a decrease of 50.6%. The bulk of these job losses are incurred in the EPC utility value chain segment. The forecast quantifies the importance of a consistent build out plan for new Solar PV generation capacity for sustained job creation as large reductions in new build capacity build in future years will result in job losses. The results furthermore raise the qualitative risk that such changes are likely to

lead to instability in the sector and inhibit the ability of the sector to ramp up when new installation capacity increases in future years. Construction jobs are the backbone of job creation potential for the Solar PV industry in the short to medium term, with O&M jobs growing in the longer term as cumulative installed capacities grow.

The impact of the SSEG market and increased O&M jobs effects can be seen in 2026 and 2027 as no new utility scale capacity is planned for these years.

5.4. ACCELERATED SCENARIO

The number of construction and O&M jobs forecasted to be created across the Solar PV value chain between 2019 and 2030 for the accelerated scenario are as summarised in **Figure 6**.

In this scenario there is a constant build of new utility scale Solar PV with no years of zero capacity addition as compared with the IRP 2019 scenario. As such a consistent increase to power sector employment can be observed by the Solar PV sector beyond 2023. There is a substantial loss in the number of jobs (38%) from 2022 to 2023 which is due to the deployment of 1 450 MW of embedded capacity in 2022, dropping to 500 MW in 2023.

The large embedded generation capacity addition in 2022 is due to the assumption applied in this scenario that the current gap in capacity of the South African power system will be partly offset via the embedded market for Solar PV given the fast deployment timelines of this technology.

A cumulative addition of O&M jobs can be observed between 2023-2030 as there is a consistent procurement of 1500 MWs each year, and the O&M jobs cumulatively increase with total installed capacity. This is seen by a linear increase in total jobs between 2023 and 2030 while the same annual amounts of new capacity are installed each year. See section 5.6 for further analysis of the O&M jobs.

5.5. HIGH ROAD SCENARIO

The number of construction and O&M jobs forecasted to be created across the Solar PV value chain between 2011 and 2030 for the high road scenario are as summarised in **Figure 7**.

In this high road scenario, the application of the solar panel import data obtained from Quantec slightly increases the installed capacity of the embedded Solar PV market as compared to the base case scenario. This in turn slightly increases the overall number of annual jobs created between 2011 and 2018 as compared to the results of the base case scenario. The import data further adds to the embedded generation capacity in 2019 which is then supplemented with the accelerated scenario case for utility scale capacity addition. These modified assumptions result in the creation of 48 756 FTE jobs in 2019.

Furthermore, by 2022 the total jobs are forecasted to increase to 53422 as the embedded market for Solar PV deploys to fill the capacity gap in the South African power sector and further utility scale Solar PV is constructed. The cumulative addition of O&M jobs can again be observed between 2023-2030 as there is a consistent procurement of 1500 MWs each year and the O&M jobs grow with the cumulative increase in Solar PV capacity.

5.6. O&M AND CONSTRUCTION JOBS

The creation of O&M jobs over time is critically important to the long-term sustainability of the solar PV sector. O&M jobs make up roughly 3% of new employment opportunities (based on an I-JEDI modelling assumption) but has a cumulative effect as those jobs are sustained across the entire modelling time frame and increase with every new annual installation. This section unpacks the annual job creation potential across construction and O&M project phases.

Figure 8 illustrates the total job creation for all scenarios analysed. These figures include construction and O&M jobs created in each modelling time frame. It is evident that the high road scenario creates the most FTE jobs when compared to the IRP 2019 and accelerated scenarios. The high road scenario has also created more jobs opportunities in the past due to higher levels if installed capacity assumed.

Figure 9 illustrates the annual constructing jobs created year on year between 2011 and 2030. When comparing Figure 8 and Figure 9 it can be seen that the Solar PV industry is heavily dependent on construction jobs between 2011 and 2022 after which O&M jobs start to play a larger role in total job creation due to the cumulative summation of these jobs over time. Gaps in procurement and their associated effect on annual job creation can be observed for the IRP 2019 scenario in the years 2024,2026 and 2027.

The cumulative addition of O&M jobs over time can be observed in **Figure 10** across all scenarios. The creation of new O&M jobs every year adds to existing O&M jobs created in previous years which contributes to the long-term stability of the industry. Gaps in procurement of new installed capacity of Solar PV will not hinder O&M jobs in the same manner as construction jobs as they are sustaining existing capacity procured in previous years.

6. VALIDATION OF STUDY RESULTS

6.1. GENERAL

The comparison of the study results with other data sources, studies and models is an important check to validate the results and increase the credibility thereof.

6.2. REI4P JOB STATISTICS

The South African IPP Office provides a reliable source of the number of jobs created by the REI4P. Unfortunately, the IPP office does not aggregate results down to a job per technology level but rather only provides the number of jobs created by the entire programme. Nevertheless, this will still provide a comparison of the extent to which the job creation estimated in this study relates to the job numbers reported by the IPP office for the utility scale market.

According to the IPP Office Q4 Report (2016/2017) the REI4P programme had created 31 207 total job years for South African citizens during construction and operations [7]. Note that this total jobs figure includes the jobs created for the entire REI4P programme (onshore wind, concentrated solar thermal, solar PV, biomass solid, biogas, landfill gas and small hydro) and not only the Solar PV value chain.

The reported figures for the REI4P programme has no obvious disconnect with the calculated job numbers obtained from the audit conducted. The results of this study estimates that as of 2017 a total of 8 636 FTE jobs were created by the Solar PV value chain (base case scenario). It is expected that the jobs audit number will be lower than the IPP office number as the latter relates to all renewable technologies on a utility scale while the jobs audit conducted only relates to the solar PV value chain. A more detailed comparison of numbers is not possible given the lack of stratification of the published IPP Office numbers.

6.3. I-JEDI MODEL PROJECTIONS

The CSIR completed a comprehensive modelling exercise of the IRP 2019 with the aim to quantify the number of jobs that will be created by the entire power sector through the implementation of the IRP 2019 as using the I-JEDI model. I-JEDI has the capability of quantifying positive and negative impacts associated with the deployment and decommissioning of different power generation technologies. The model is customised using country specific data on regional installation costs, regional average annual salaries per industry and regional social accounting matrix. The model requires input data on the project size in megawatts (MW) and the percentage of labour and materials sourced locally. The model outputs include the number of jobs, the earnings, the economic output as well as GDP contribution.

Figure 11 shows general alignment with the jobs data forecasting results shown in Figure 5. The figures between 2022 and 2027 are within 2% - 15% of one another across overlapping years which is a positive sign of the methodology used on the surveyed data forecasting. Differences are higher for years 2019-2021 and 2028-2030 due to minor differences in installations capacity assumption and modelling methodologies. The CSIR phased back constructing jobs of Solar PV in future years (2031-2033) which affected annual job creation between 2028 and 2030 in their I-JEDI methodology.

The scale of procurement to fil the generation gap identified in the IRP 2019 document was filled in different ways through the 2 modelling methodologies. The scenario forecasting of the IRP 2019 using the data collected provided a job number of 38 758 in 2022 compared to 34 776 in the I-JEDI modelling exercise. The gap in procurement of Solar PV (2024,2026 and 2027) and the associated loss of jobs created aligns well with the results of the forecasting analysis completed in section 5.3.

The validation completed in the section above indicates that the methodology employed in this study aligns well with other sources that speak to Solar PV job creation in South Africa.

6.4. INTERNATIONAL BENCHMARKS

The literature review completed as part of this overarching study reference various international reports that outline forecasting methodologies and reporting metrics when considering Solar PV job creation potential. While these methodologies do not align completely with the methodology employed in this study, some general alignments can be observed.

These alignments include:

THE UNIVERSITY OF ZARAGOZA (FORECASTING JOB CREATION OF A 1MWP FACILITY)

A similar methodology was developed by the University of Zaragoza to determine future job creation using job intensity metrics but limited the value chain to only the technology components and directly associated services[8]. In essence the bulk services sector will be excluded from their study as compared to this study.

The methodology further differs by not distinguishing between utility and embedded scale and focuses on the job creation potential for a typical 1MWp facility.

This study found that an average of 29.46 jobs were created for the construction and operation of this 1 MWp facility. This relates well to SSSEG value chain segment supported by the necessary manufacturing and service segments creating an average of 28 FTE jobs/MW (See **Figure 3**).

MASDAR INSTITUTE OF SCIENCE AND TECHNOLOGY (JOB CREATION POTENTIALS AND SKILL REQUIREMENTS)

The Masdar Institute of Science and Technology in the United Arab Emirates conducted a similar study to that of the university of Zaragoza with the aim of quantifying job creation potential of RE across their respective value chains[9]. This study builds on the jobs per unit measure of energy principle by conducting interviews and surveys with key industry stakeholders to obtain the required metrics across different technology value chains.

The value chain developed in this study differs from both the University of Zaragoza and CSIR methodologies and again does not split between utility and embedded markets.

As such direct value chain segment cannot be compared as the specific description of each value chain assumed in this study was not defined.

The study found that an average of between 33-39 job years were created for every MWp developed, constructed, and maintained. This again relates well to the 28 FTE jobs/MW (See **Figure 3**) related to the SSEG value chain segment supported by the necessary manufacturing and services segments.

Considering the above international benchmarks, the results obtained from the study completed by the CSIR relates well to international findings and provides international verification of the methodology used in this study.

7. SUMMARY AND CONCLUSION

The study has estimated the number of jobs that have been created and are forecasted to be created in the South African Solar PV sector for a range of scenarios. The following is summarised as regards to the methodology applied in this study:

- A review of international practices has confirmed that a suitable methodology for the estimation of jobs in the Solar PV sector is via the calculation of FTE jobs as based on job intensity linked to the amount of capacity installed i.e., FTE jobs per MW installed.
- The South African Solar PV value chain was decomposed into categories. A contact database was established of almost 1 000 companies working in the local Solar PV sector. Companies were categorised according to the sector within which they work.
- The companies in the contact database were surveyed to obtain information on both permanent and contract employees. The survey collected data for the 2018 and 2019 years.
- The survey methodology and response rate are acceptable for the purposes of the calculation of job intensity numbers.
- The calculated job intensity numbers resulting from the survey are aligned with international norms.
- The results of the I-JEDI modelling were used as the basis for the ratio between construction and O&M jobs. The methodology applied then calculates construction jobs based on the installed capacities added in each year. The O&M jobs are calculated based on the cumulative total installed capacity in each year.
- Four scenarios of existing and future Solar PV capacity were applied to calculate the estimated jobs in each year using the job intensity values obtained from the survey.
- The results were benchmarked against other data sources and models, verifying that the outcomes are reasonable and credible.

The Solar PV market has played a critical role in power sector employment over the last 9 years and is expected to grow substantially over the next decade across all of the scenario's analysed in this study. The analysis completed has highlighted several key observations and outcomes:

- The Solar PV industry stakeholders were well captured by constructing a contact database of nearly 1 000 companies and sorting them across a specified value chain.
- The data collected can be viewed as reliable due to an intensive data collection process via email, phone calls and direct interviews. Further validation of the data collected through follow up calls adds to the data's validity.
- Data gaps in the EPC Utility value chain segment should be filled in future studies by providing companies with a method to provide data to an independent third party that has agreed not to share their information with any stakeholder within the Solar PV value chain
- The job intensity of the SSEG market (39 FTE jobs per MW) is substantially higher than the utility market (17 FTE jobs per MW) as confirms the increased job creation potential of the SSEG market.
- The calculated job intensities reflect the historical market structure and levels of local content. The validation of the study results with the I-JEDI model indicate that increased local content and increasing job intensity have the potential to add substantial further new jobs in the Solar PV sector. Localisation of the manufacturing value chain is hence critical to additional job creation.
- The substantial delay in procurement between 2013 and 2018 resulted in uncertainty in the Solar PV sector. This impacted on both permanent and contract workers, whereby the industry reduced permanent workers and shifted to increased application of contract workers.
- The bulk of jobs created by the Solar PV industry are in project construction, while O&M jobs are created at a much lower rate but grow cumulatively year on year as the total Solar PV installed base increases.
- As based on the results of the IRP 2019 scenario, the Solar PV industry is expected to create between 33 000 and 35 000 FTE jobs between 2028 and 2030, but with considerable variation between years. In years of zero utility scale installation the job numbers are substantively impacted. The forecasted minimum jobs of 14 407 occur in 2024, with no utility scale Solar PV capacity planned in the IRP 2019 in that year. O&M jobs are forecasted to grow to between 6 000 and 8000 by 2030.
- In the accelerated scenario the Solar PV industry is expected to consistently create between 36 000 and 38 000 FTE jobs per year between 2028 and 2030, supporting between 9 000 and 11 000 O&M jobs per year by 2030. The higher annual job figures are attributed to the increased installed capacity of Solar PV, as results in increased construction jobs and increased O&M jobs as compounded by annual cumulative growth in the total installed capacity. The sustained build out of new Solar PV capacity results in sustained and predictable job growth.
- In the high road scenario, the Solar PV industry is expected to consistently create between 38 000 and 40 000 FTE jobs per year between 2028 and 2030, supporting between 11 000 and 13 000 O&M jobs per year by 2030.

The analysis conducted identified key risks and opportunities for the Solar PV market. These include:

- In the long term the Solar PV industry has the potential to create substantial sustained O&M jobs. Job creation in the scaling up of Solar PV until 2030 will continue to be dominated by jobs in the construction of new capacity. Periods of no or low new utility scale Solar PV capacity addition will negatively impact on the sustainability of jobs in the sector.
- The rate of growth of jobs in the Solar PV sector is linked to the localisation of manufacturing and the opportunity to increase the job intensity. Increasing local content (as will increase job intensity) requires a consistent year on year new build of capacity, as is evident from the modelling results. A lack of certainty on new capacity additions in each year is expected to negatively impact on job intensity and total jobs.
- The SSEG market present considerable opportunity for increased job creation, but the ability to achieve such will be dependent on related policy certainty and enabling frameworks. The stimulation of this market presents considerable opportunities for sustained job creation.
- The ability of local Solar PV developers and supply chains to support both the utility scale and embedded SSEG markets will provide agility to move between these markets and sustain jobs in periods where new build capacity in one market may be lower in any particular period of time.

FIGURES AND TABLES

Figure 1
METHODOLOGY EMPLOYED TO CALCULATE FUTURE PV JOB CREATION POTENTIAL USING SURVEYED JOBS DATA

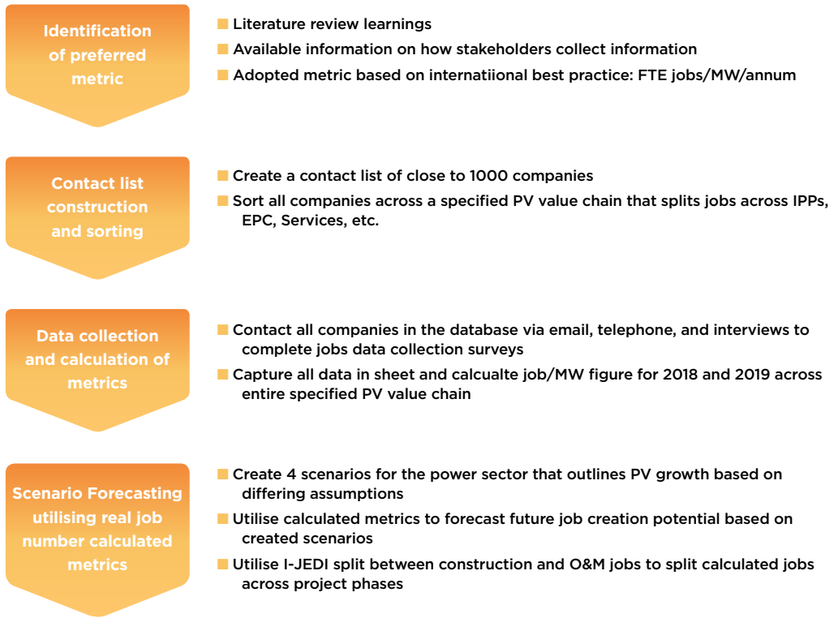


Figure 2
SOLAR PV VALUE CHAIN UTILIZED TO CATEGORISE SURVEYED JOBS DATA

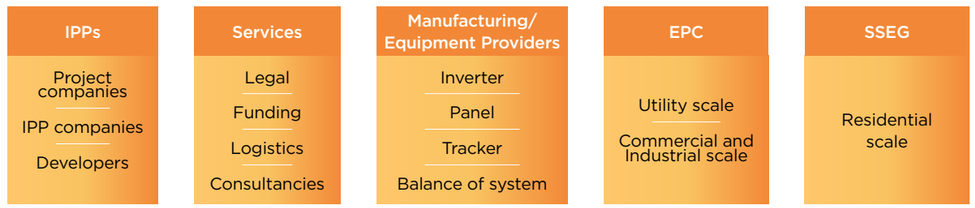


Table 1
SURVEY COMPANY CATEGORIES

Category	Embedded	Utility	Description
IPP		x	IPP companies, IPP project companies and developers that all play a role in the development, funding, management, and construction of a solar PV facility
Services	x	x	Funders, legal institutions, logistics companies, consultants, and recruitment and training companies providing essential services to the solar PV industry
Manufacturers	x	x	Manufacturers or assemblers of inverters, PV panels, tracker systems, and other products required in the balance of the PV system
EPC Utility		x	Engineering, procurement, and construction companies servicing utility scale solar PV projects
EPC C&I	x		Engineering, procurement, and construction companies servicing commercial and industrial scale solar PV projects
SSEG	x		Smaller companies developing installing and servicing residential solar PV projects

Table 2
SURVEY SAMPLE SIZE AND RESPONSE RATE

Category	Number surveyed	Number of responses	Percentage responses
IPP	116	15	13%
Services	243	29	12%
Manufacturers	91	16	6%
EPC Utility	101	1	1%
EPC C&I	66	15	23%
SSEG	319	31	10%

Table 3
SURVEY RESULTS PER VALUE CHAIN CATEGORY

	2018			2019		
Value chain segments	Installed capacity	Permanent Jobs	Contract Jobs	Installed capacity	Permanent Jobs	Contract Jobs
IPP						
IPP project companies	546	341	33	546	373	31
IPP companies	365	96	70	365	108	37
Developers	419	39	40	313	38	37
Services						
Legal	52	10	10	52	10	10
Funders	52	23	50	52	46	9
Logistics	52	6	-	52	8	-
Consultants	52	23	50	52	46	9
Miscellaneous	52	61	21	52	64	24
Manufacturers and equipment providers						
Inverter	-	-	-	160	14	4
Panel	284	225	162	359	239	147
Tracker	70	53	-	70	53	-
Balance of system	395	203	58	1029	271	160
EPC Utility						
EPC Company	75	64	53	75	43	695
EPC C&I						
EPC Company	49	190	391	93	268	664
SSEG Residential						
SSEG Company	6	69	71	16	107	114

Table 4

VALUE CHAIN CATEGORY JOB INTENSITY IN FTE JOBS/MW (2 YEARS AVERAGE FOR 2018 AND 2019)

Category	Permanent FTE jobs/MW	Contract FTE jobs/MW
IPP	1.0	0.3
Services	4.2	2.5
Manufacturers	2.2	0.8
EPC Utility	0.7	5.0
EPC C&I	3.4	7.6
SSEG	9.0	9.4

Figure 3

COMPARISON OF THE JOBS PER MW IN THE UTILITY AND EMBEDDED MARKETS

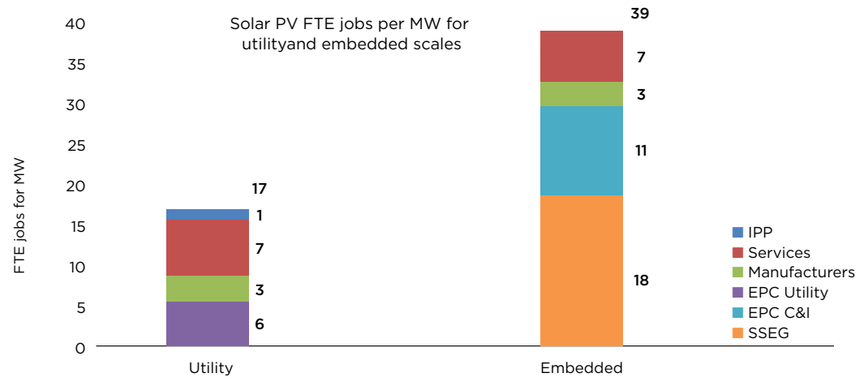


Table 5

INSTALLED CAPACITIES (UTILITY SCALE) IN MW BY SCENARIO

Scenario	Utility scale installed MW2019																			
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Base case			210	750	5	509	-	-	-												1474
IRP 2019										114	300	1400	1000		1000			1000	1000	1000	6814
Accelerated									1594	325	423	1000	1000	1000	1000	1000	1000	1000	1000	1000	11342
Best case			210	750	5	509	275	275	1869	325	423	1000	1000	1000	1000	1000	1000	1000	1000	1000	13641

Table 6

INSTALLED CAPACITIES (EMBEDDED SCALE) BY SCENARIO

Scenario	Embedded scale installed MW																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Base case	2	2	12	25	132	135	135	140													593
C&I	2	2	19	19	57	115	115	117													446
Res	-	-	3	6	75	20	20	23													147
IRP 2019									625	625	625	625	500	500	500	500	500	500	500	500	6500
C&I									514	514	514	514	411	411	411	411	411	411	411	411	5348
Res									91	91	91	91	73	73	73	73	73	73	73	73	948
Accelerated									584	775	1150	1450	500	500	500	500	500	500	500	500	7959
C&I									480	638	946	1193	411	411	411	411	411	411	411	411	6548
Res									104	137	204	257	89	89	89	89	89	89	89	89	1411
Best case		129	129	129	129	129	129	129	713	775	1150	1450	500	500	500	500	500	500	500	500	8991
C&I		106	106	106	106	106	106	106	587	638	946	1193	411	411	411	411	411	411	411	411	7397
Res		23	23	23	23	23	23	23	126	137	204	257	89	89	89	89	89	89	89	89	1594

Figure 4

ANNUAL JOB CREATION FOR SOLAR PV BETWEEN 2011 AND 2018 (BASE CASE)

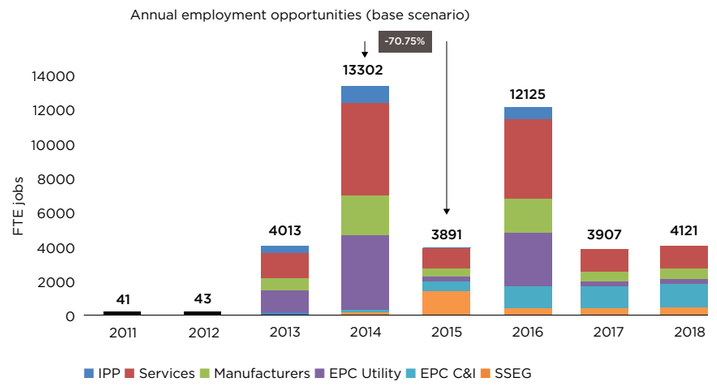


Figure 5

ANNUAL JOB CREATION FORECAST FOR SOLAR PV BETWEEN 2019 AND 2030 (IRP 2019

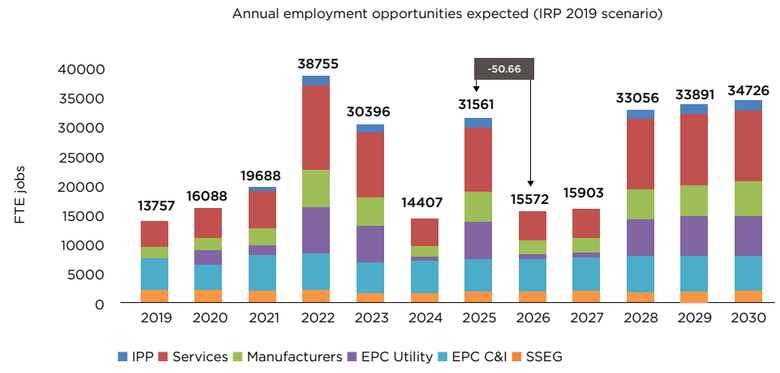


Figure 6

ANNUAL JOB CREATION FORECAST FOR SOLAR PV BETWEEN 2019 AND 2030 (ACCELERATED SCENARIO)

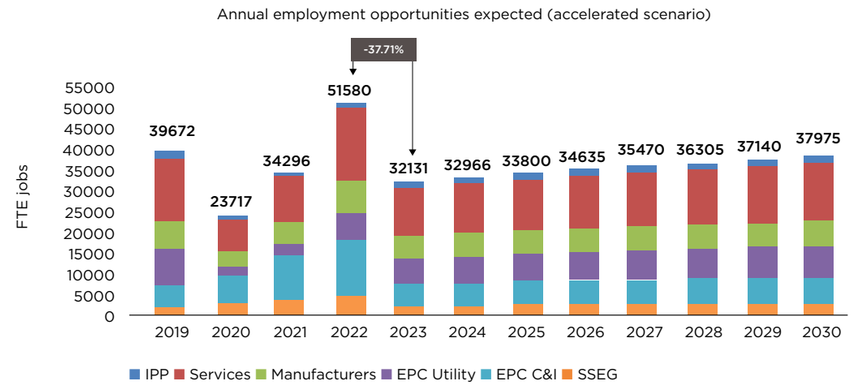


Figure 7

ANNUAL JOB CREATION FORECAST FOR SOLAR PV BETWEEN 2011 AND 2030 (HIGH ROAD SCENARIO

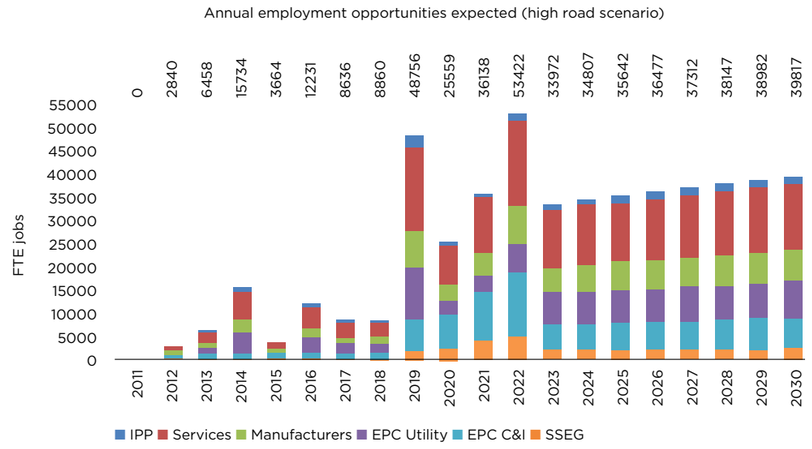


Figure 8

TOTAL FTE JOBS CREATED ACROSS ALL SCENARIOS BETWEEN 2011 AND 2030

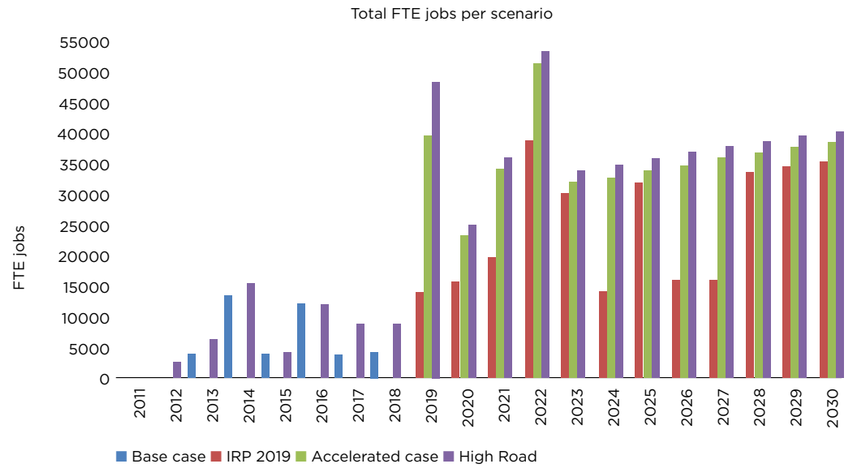


Figure 9

ANNUAL CONSTRUCTION FTE JOBS CREATED ACROSS ALL SCENARIOS BETWEEN 2011 AND 2030

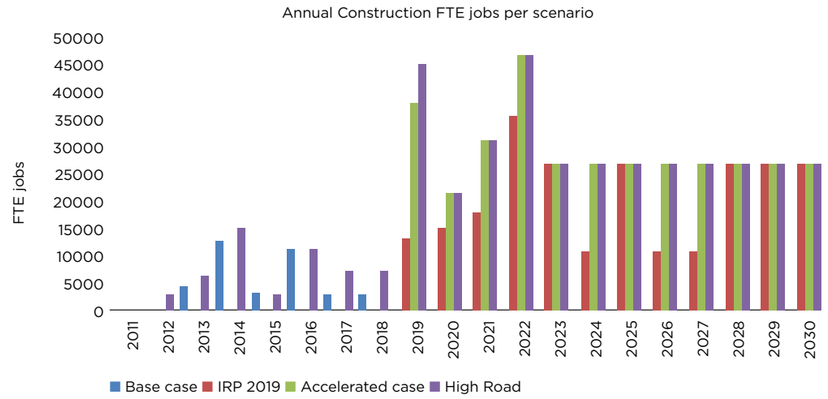


Figure 10

ANNUAL O&M FTE JOBS CREATED ACROSS ALL SCENARIOS BETWEEN 2011 AND 2030

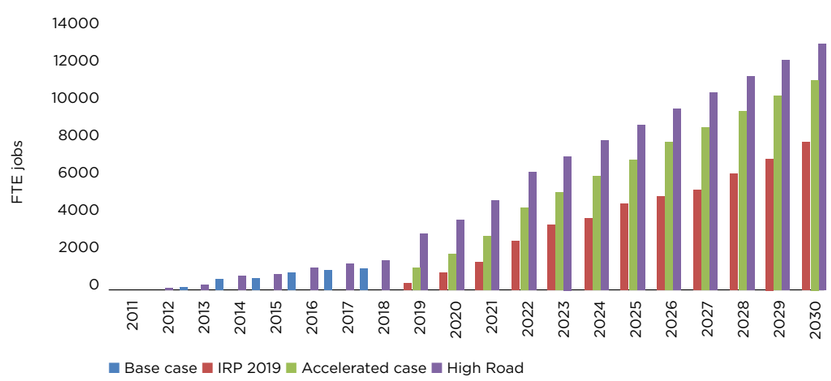
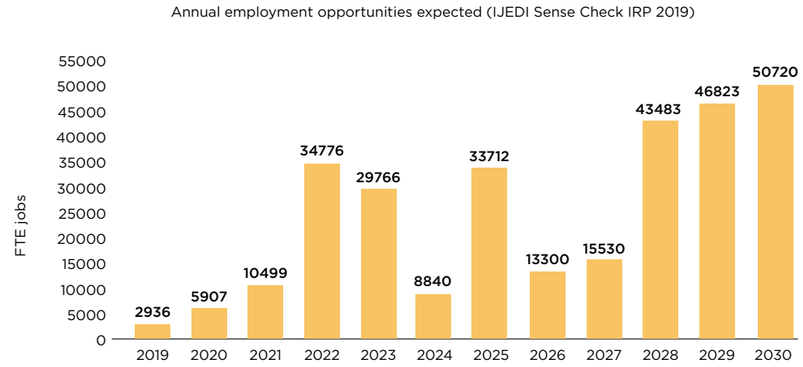


Figure 11

SOLAR PV DIRECT AND INDIRECT JOB CREATION POTENTIAL BETWEEN 2019 AND 2030 BASED ON I-JEDI MODELLING (CSIR ANALYSIS)



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ANNEXURE A1

A1.1: QUESTIONNAIRES

Table 7

IPP VALUE CHAIN SEGMENT QUESTIONNAIRE

SAPVIA SOLAR PV JOBS STUDY (IPP'S)				
Company Name			SAPVIA South African Photovoltaic Industry Association / CSIR Touching lives through innovation	
Year	**Number of projects in specified year**	**Installed capacity completed in year (MW)**	**Number of permanent employees during specified year**	**Number of contract employees during specified year (excl EPC)**
2018	50	100MW	25	200
2019				

Table 8

SERVICES VALUE CHAIN SEGMENT QUESTIONNAIRE

SAPVIA SOLAR PV JOBS STUDY (SERVICES)					
Company Name			SAPVIA South African Photovoltaic Industry Association / CSIR Touching lives through innovation		
Year	**What type of service does your company provide to the PV industry**	**Number of PV projects serviced per year**	**Number of permanent employees during specified year attributed to PV services**	**Number of contract/temporary employees during specified year attibuted to PV services**	**Percentage of workforce attributed to Solar PV business**
2018	Legal, Logistics, Funding	50	25	200	0%
2019					

Table 9

MANUFACTURERS AND EQUIPMENT PROVIDERS VALUE CHAIN SEGMENT QUESTIONNAIRE

SAPVIA SOLAR PV JOBS STUDY (MANUFACTURING)					
Company Name			SAPVIA South African Photovoltaic Industry Association / CSIR Touching lives through innovation		
Year	**What type of manufacturing componenets do you supply**	**KW Supplied per year**	**Number of permanent employees during specified year**	**Number of contract/ temporary employees during specified year**	**Percentage of workforce attributed to Solar PV business**
2018			25	200	0%
2019					

Table 10

EPC VALUE CHAIN SEGMENT QUESTIONNAIRE

SAPVIA SOLAR PV JOBS STUDY (EPC)				
Company Name		SAPVIA South African Photovoltaic Industry Association / CSIR Touching lives through innovation		
Year	**Number of projects serviced per year**	**Installed capacity completed in year (MW)**	**Number of permanent employees during specified year**	**Number of contract employees during specified year (excl EPC)**
2018	50	100MW	25	200
2019				

Table 11

IPP VALUE CHAIN SEGMENT QUESTIONNAIRE

SAPVIA SOLAR PV JOBS STUDY (SSEG)				
Company Name			SAPVIA South African Photovoltaic Industry Association / CSIR Touching lives through innovation	
Year	**Number of projects serviced per year**	**Installed capacity completed in year (MW)**	**Number of permanent employees during specified year**	**Number of contract employees during specified year (excl EPC)**
2018	50	100MW	25	200
2019				

A1.2: JOB NUMBER TABLES

TOTAL ANNUAL CONSTRUCTION AND O&M JOBS PER SCENARIO

Table 12

TOTAL ANNUAL FTE JOBS (BASE CASE)

Base Case	2011	2012	2013	2014	2015	2016	2017	2018
IPP'S	0	0	218	787	35	560	46	46
Services	8	9	1041	2522	714	3019	807	845
Manufacturers	9	10	1100	3705	793	3214	894	937
EPC Utility	2	2	343	1191	163	949	189	196
EPC C&I	7	7	1112	3838	365	3081	630	649
SSEG Res	15	16	171	203	1116	1093	1125	1198
Total Jobs	**41**	**43**	**3985**	**13423**	**3186**	**11914**	**3691**	**3871**

Table 13

TOTAL ANNUAL FTE JOBS (IRP 2019)

IRP 2019	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	-	54	410	1910	1426	114	1466	155	155	1507	1547	1588
Services	4201	5093	6492	1402	10952	4533	11355	4936	5037	11859	12161	12464
Manufacturers	1906	2311	2946	6386	4970	2057	5153	2240	2286	5382	5519	5656
EPC Utility	-	650	1729	8051	6010	481	6181	652	652	6352	6523	6694
EPC C&I	5618	5786	5955	5123	5168	5303	5438	5573	5708	5842	5977	6112
SSEG Res	2033	2094	2155	2216	1870	1919	1968	2016	2065	2114	2163	2211
Total Jobs	**13757**	**16088**	**19688**	**38758**	**30396**	**14407**	**31561**	**15572**	**15903**	**33056**	**33891**	**34726**

Table 14

TOTAL ANNUAL FTE JOBS (ACCELERATED CASE)

Accelerated Case	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S												
Services												
Manufacturers												
EPC Utility												
EPC C&I												
SSEG Res												
Total Jobs												

Table 15

TOTAL ANNUAL FTE JOBS (ACCELERATED CASE)

SSEG Best Case	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S												
Services												
Manufacturers												
EPC Utility												
EPC C&I												
SSEG Res												
Total Jobs												

TOTAL ANNUAL O&M FTE JOBS PER SCENARIO

Table 16

O&M ANNUAL FTE JOBS (BASE CASE)

Base Case								
	2011	2012	2013	2014	2015	2016	2017	2018
IPP'S	0	0	7	30	30	46	46	46
Services	0	1	32	136	154	240	257	274
Manufacturers	0	1	34	144	163	255	274	294
EPC Utility	0	0	10	46	49	76	80	83
EPC C&I	0	0	34	148	154	242	254	266
SSEG Res	0	1	6	12	45	77	108	141
Total Jobs	1	2	122	516	596	935	1018	1104

Table 17

O&M ANNUAL FTE JOBS (IRP 2019)

IRP 2019												
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	-	5	17	74	114	114	155	155	155	195	236	276
Services	126	275	462	870	1172	1273	1576	1676	1777	2080	2382	2685
Manufacturers	57	125	209	395	532	578	715	761	807	944	1081	1218
EPC Utility	-	19	71	310	481	481	652	652	652	823	994	1165
EPC C&I	169	337	506	674	809	944	1079	1213	1348	1483	1618	1753
SSEG Res	61	122	183	244	293	341	390	439	488	537	585	634
Total Jobs	413	883	1447	2566	3401	3731	4566	4897	5227	6062	6897	7731

Table 18

O&M ANNUAL FTE JOBS (ACCELERATED CASE)

Accelerated Case												
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	65	78	95	136	176	217	257	298	338	379	420	460
Services	439	661	978	1472	1775	2077	2379	2682	2984	3287	3589	3892
Manufacturers	199	300	444	668	805	943	1080	1217	1354	1492	1629	1766
EPC Utility	273	328	400	571	742	913	1084	1255	1426	1597	1768	1939
EPC C&I	57	366	677	1068	1202	1337	1472	1607	1742	1877	2011	2146
SSEG Res	57	133	245	386	435	484	533	581	630	679	728	777
Total Jobs	1190	1866	2839	4301	5136	5971	6806	7641	8476	9310	10145	10980

Table 19

O&M ANNUAL FTE JOBS (HIGH ROAD)

SSEG Best Case																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	-	-	9	39	39	60	71	82	158	171	188	229	269	310	351	391	432	472	513	553
Services	-	26	94	272	299	427	509	590	1111	1333	1650	2144	2446	2749	3051	3354	3656	3958	4261	4563
Manufacturers	-	12	43	123	136	194	231	268	504	605	749	973	1110	1247	1385	1522	1659	1796	1934	2071
EPC Utility	-	-	36	164	165	252	299	346	666	721	794	965	1136	1307	1478	1649	1820	1991	2162	2333
EPC C&I	-	35	70	104	139	174	209	243	436	645	955	1346	1481	1615	1750	1885	2020	2155	2290	2424
SSEG Res	-	13	25	38	50	63	76	88	158	233	345	487	536	585	633	682	731	780	828	877
Total Jobs	-	85	276	740	828	1170	1394	1618	3032	3708	4681	6143	6978	7813	8648	9482	10317	11152	11987	12822

TOTAL ANNUAL CONSTRUCTION FTE JOBS PER SCENARIO

Table 20

CONSTRUCTION ANNUAL FTE JOBS (BASE CASE)

Base Case								
	2011	2012	2013	2014	2015	2016	2017	2018
IPP'S	0	0	275	984	7668	0	0	
Services	13	13	1513	5053	893	4199	880	913
Manufacturers	6	6	686	2293	405	1905	399	414
EPC Utility	0	0	1161	4147	28	2814	0	0
EPC C&I	21	21	201	201	604	1219	1219	1240
SSEG Res	0	0	53	107	1335	356	356	409
Total Jobs	40	40	3890	12784	3271	11160	2854	2976

Table 21

CONSTRUCTION ANNUAL FTE JOBS (IRP 2019)

IRP 2019												
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	-	150	393	1836	1312	-	1312	-	-	1312	1312	1312
Services	4075	4818	6031	13202	9779	3260	9779	3260	3260	9779	9779	9779
Manufacturers	1849	2187	2737	5991	4438	1479	4438	1479	1479	4438	4438	4438
EPC Utility	-	630	1659	7741	5529	-	5529	-	-	5529	5529	5529
EPC C&I	5449	5449	5449	5449	4359	4359	4359	4359	4359	4359	4359	4359
SSEG Res	1972	1972	1972	1972	1577	1577	1577	1577	1577	1577	1577	1577
Total Jobs	13345	15205	18240	36191	26995	10676	26995	10676	10676	26995	26995	26995

Table 22

CONSTRUCTION ANNUAL FTE JOBS (ACCELERATED CASE)

Accelerated Case												
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	2091	426	555	1312	1312	1312	1312	1312	1312	1312	1312	1312
Services	14200	7171	10255	15973	9779	9779	9779	9779	9779	9779	9779	9779
Manufacturers	6444	3255	4654	7249	4438	4438	4438	4438	4438	4438	4438	4438
EPC Utility	8813	1797	2339	5529	5529	5529	5529	5529	5529	5529	5529	5529
EPC C&I	5092	6757	10027	12642	4359	4359	4359	4359	4359	4359	4359	4359
SSEG Res	1842	2445	3628	4574	1577	1577	1577	1577	1577	1577	1577	1577
Total Jobs	38482	21851	31457	47	79	26995	26995	26995	26995	26995	26995	26995

Table 23

CONSTRUCTION ANNUAL FTE JOBS (HIGH ROAD)

SSEG Best Case																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
IPP'S	-	-	275	984	7	668	361	361	2 451	426	555	1 312	1 312	1 312	1 312	1 312	1 312	1 312	1 312	1 312
Services	-	841	2210	5731	874	4159	2634	2634	16833	7171	10255	15973	9779	9779	9779	9779	9779	9779	9779	9779
Manufacturers	-	382	1003	2601	396	1888	1195	1195	7639	3255	4654	7249	4438	4438	4438	4438	4438	4438	4438	4438
EPC Utility	-	-	1161	4147	28	2814	1520	1520	10334	1797	2339	5529	5529	5529	5529	5529	5529	5529	5529	5529
EPC C&I	-	1125	1125	1125	1125	1125	1125	1125	6216	6757	10027	12642	4359	4359	4359	4359	4359	4359	4359	4359
SSEG Res	-	407	407	407	407	407	407	407	2249	2445	3628	4574	1577	1577	1577	1577	1577	1577	1577	1577
Total Jobs	-	2754	6181	14993	2836	11061	7242	242	45724	21851	31457	47279	26995	26995	26995	26995	26995	26995	26995	26995

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