SOLAR SKILL DEVELOPMENT & CAPACITY BUILDING IN TAMIL NADU

AN ASSESSMENT OF GOVERNMENT OF INDIA PROGRAMS

AurovilleConsulting

Sustainable Energy Transformation Series

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EXECUTIVE SUMMARY

Job creation and skill development in the solar industry are key priorities in order to meet India's ambitious renewable energy targets, climate commitments and economic targets. Meeting India's renewable energy target of 175 gigawatts (GW) by 2022 has the potential to create 1 million full time equivalent (FTE) jobs (Kuldeep, 2019).

The following are the five Government of India supported solar skill development programs that are operational in Tamil Nadu; Suryamitra, Varunmitra, Rooftop Solar Grid Engineer, Solar PV Installer- Electrical & Rooftop Solar Photovoltaic Entrepreneur. Suryamitra program has the highest training capacity with 3,152 participants that graduated from it over the past 5 years (NISE, 2016, 2017, 2018, 2019, and 2020). A survey conducted identified a number of gaps that will need to be addressed in order to (i) ensure better employability of the graduates from these programs, (ii) supply the solar industry with a skilled workforce and (iii) meet the Tamil Nadu's solar energy targets. Some recommendations to address these are:

- Arrange or enhance guided industry-visits, internships and/or apprenticeships programs in order to provide graduates exposure and hands-on experience on working in the solar industry.
- Address current gaps in communication skills among trainees by designing and implementing dedicated programs on improving English proficiency, along with other soft-skills and therefore employability.
- Create a thriving solar energy market in the state, and encourage banks and financiers to invest on a broader scale in the solar industry (installation and manufacturing) to create green jobs in the solar industry.
- Make solar investment an attractive option for a wide spectrum of consumers. A thriving solar industry will create ample green job opportunities. This could be done through a solar feed-in tariff for rooftop solar that reflects the real cost of solar energy generation, by utility facilitated solar rooftop programs, by providing capital subsidy for certain consumer segments and by facilitating access to low interest loans for consumers.

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1. INTRODUCTION

OBJECTIVES OF THIS PAPER

In the Paris Climate Agreement India has committed to reducing greenhouse gas (GHG) emissions of its Gross Domestic Product (GDP) by 33% to 35% below the 2005 levels by 2030, and to achieve 40% of installed electric power capacity from non-fossil sources by the same year. Accelerating renewables is a central solution in achieving India's multiple goals of economic development, Paris Climate Agreement targets, energy access and security, improved air quality, reduced climate pollution, and most importantly, job creation. As of May 2020 India's grid connected non-fossil fuel (including renewables, large-scale hydropower, and nuclear energy) installed capacity stands at 38% (Central Electricity Authority, 2020).

The Jawaharlal Nehru National Solar Mission (JNNSM) initially aimed at a solar energy target of 20 GW by 2022. In 2015 the solar energy target was revised to a new target of 100 GW by 2022. 40 GW of the total solar energy must come from rooftop solar. In 2019 the accumulated solar energy capacity in India stood at about 30 GW. Utility scale accounts for 26.2 GW of installed capacity, which is 43.7% of its projected target for 2022. Rooftop solar accounts for 3.8 GW, a 9.5% of its 2022 target (NISE, 2016, 2017, 2018, 2019, and 2020).

The Tamil Nadu Solar Energy Policy 2019 set a solar energy target of 9,000 MW for the year 2023. Of this target 40% or 3,600 MW, is to be met by the consumer category solar (rooftop solar). In order to meet the Tamil Nadu solar energy target, substantial solar energy capacity addition is required. As of January 2020, the installed solar capacity of solar PV in Tamil Nadu stands at 3,973 MW (TEDA, 2020). The installed capacity is split as follows: Utility-scale solar accounted for 3,509 MW and solar rooftop accounted for 464 MW (Bridge to India, 2019).

India's skilled workforce across all sectors has struggled to keep up with its global competition comprising only 2-4% of the labour supply, while other countries such as China, Germany and South Korea maintain far more robust skilled labour forces (47%, 74% and 96%, respectively). Inadequacies in India's skilled workforce, among other reasons, could inhibit India's solar ambitions (Ghosh, 2016). Acceleration of skill development is critical for the growth of India's solar energy sector.

Renewable energy technologies are generally more labour-intensive and can provide a tremendous opportunity to create local jobs for a young and growing workforce (Cobenefits Study, 2019). If Tamil Nadu achieves its solar energy target by 2023, it will create as many as 97,110 FTE jobs (Kuldeep, 2017) (Refer to Table 1). Therefore comprehensive skill development programs in the solar sector to support a growing solar industry in the state are essential.

Table 1 Employment generation potential in FTE for Tamil Nadu

Solar	FTE (per MW)	Solar energy Target (MW)	Installed solar (MW)	Targeted solar addition by 2023 (MW)	Job creation potential (FTE)
Utility scale solar	6.05	5,400	3,509	1,890	11,435
Rooftop solar	27.32	3,600	464	3,136	85,675
Total		**9,000**	**3,973**	**5,026**	**97,110**

Source: Adapted from (Kuldeep, 2017)

This report aims to (i) review existing solar skill development programs in Tamil Nadu (ii) present results from surveys and interviews with training institutions and graduate students and (iii) identify potential gaps in the current solar skill development programs.

2. INDIA'S SOLAR JOB MARKET & SKILL DEVELOPMENT INITIATIVES

As the growing workforce in the solar PV sector requires different skill sets, it is important to understand the requirements for skilled, semi-skilled or low-skilled workers for the installation and plant operation related activities. Developing a skilled workforce requires a clear focus and commitment by the Government and the industry. In 2015, the Government of India created the Skill Council for Green Jobs (SCGJ) under the National Skill Development Mission. Its objectives are to identify the training needs of the green businesses sector, establish dedicated training centres, develop technical courses, and address the skill development needs of manufacturers and service providers within the sector. SCGJ also aims to implement nationwide industry-led collaborative skill development initiatives that will support India's emerging 'green' businesses (SCGJ, 2020). India will need the following skilled labour force in the solar PV sector by 2022:

- ~210,800 skilled plant designer and site engineers;
- ~624,600 semi-and low skilled technicians for construction & commissioning, most of whom will be needed to achieve the target of 40 GW rooftop solar capacity addition.
- ~ 81,000 highly skilled workers to carry out annual and ongoing performance data monitoring of solar projects totalling 100 GW.
- ~182,400 workers to carry out low-skill operation and maintenance functions for the numerous solar rooftop and utility scale projects (Ghosh, 2016b).

Due to its distributed nature, the construction, operation and maintenance of rooftop solar systems is more labour-intensive than other power generation technologies. It generates 24.72 direct job-years per MW in comparison to 3.45 direct job-years per MW for utility-scale ground-mounted solar (Cobenefits Study, 2019) (Auroville Consulting, 2019). The workforce employed in the Indian solar PV sector (excluding manufacturing) grew many-folds in the past five years, rising from 2,800 workers in FY14 to 76,553 workers in FY19 (refer to Table 1) (Ghosh, 2014) (Kuldeep, 2019).

Table 2 FTE jobs created for installed utility-scale solar & rooftop solar capacity until FY19

Jobs	Utility Scale Solar (26.2 GW)	Rooftop Solar (3.8 GW)
Business development	451	2,319
Design	1,660	13,417
Construction & commissioning	22,407	20,981
Operations & maintenance	13,431	1,923
Total	**37,913**	**38,640**

Adapted from: (Kuldeep, 2019)

3.SOLAR PV SKILL DEVELOPMENT IN TAMIL NADU

Qualification packs (QP) comprise a set of occupational standards including certified trainings and skills required to perform a specific job role. There are 47 QPs under SCGJ, out of which 20 QPs are dedicated to solar PV. These 20 QPs cover different National Skills Qualification Framework (NSQF) levels (2, 4, 5, 6, & 7). The NSQF is composed of ten skill levels, where level 1 represents the lowest and level 10 the highest skill qualification (refer to Annexure 2) (Cobenefits Study, 2019). Current Solar PV skill development programs in Tamil Nadu are Suryamitra (NSQF level 4), Solar PV installer – electrical (NSQF level 4), Varunmitra (NSQF level 5), Rooftop Solar Grid Engineer (NSQF level 5) & Rooftop Solar Photovoltaic Entrepreneur (NSQF level 6).

Suryamitra Skill Development Programme:
The Suryamitra Skill Development Programme was designed by National Institute of Solar Energy (NISE) with an objective to develop a skilled and employable workforce (Suryamitras) for catering to the needs of Solar PV industries and Engineering, procurement and construction (EPC) projects. These participants were trained to perform jobs related to Installation, Commissioning, and Operation & Maintenance of a Solar PV system in EPC projects. After completion of the training programme, Suryamitras were offered positions such as technicians, supervisors, and managers in Solar PV organizations and an opportunity to emerge as entrepreneurs in the Solar PV Industry. It is a 600-hour program, carried out over 3 months. It is free of cost residential program. Minimum required qualification of the trainee is 10th pass and ITI or Diploma (NISE, 2017, 2018, and 2019).

Varunmitra (Solar Water Pumping):
In order to create a trained workforce for solar water pumping systems, NISE, under the sponsorship of the Ministry of New and Renewable Energy (MNRE) has started a solar water-pumping course known as 'Varunmitra Training Programme'. The main objective of the programme is to impart knowledge in understanding site feasibility, groundwater table, efficiency, and different types of heads, solar water pumping components such as DC-DC converter, inverter, battery, motors, pump – motor set etc. It is a 120 hours course carried over 3 weeks. Minimum required qualification of the trainee is a diploma or pre-final engineering and technology (NISE, 2017, 2018, and 2019).

Rooftop Solar Grid Engineer:
The Rooftop Solar Grid Engineer Program was the first successfully launched by NISE in 2017. This course has been developed based on industry requirements for grid-tied solar rooftop installations. After completion of this course, the SCGJ conducts an assessment and provides certification for Green Jobs. It is an 80 hours course carried over 3 weeks. Minimum required qualification of the trainee is diploma (Electrical, EEE) (NISE, 2017, 2018, and 2019).

Solar PV rooftop for entrepreneurs and utility engineers:
NISE designed a comprehensive and standardized training programme on solar PV rooftop for entrepreneurs and utility engineers. This programme is supported by MNRE. This is a 120 hours course divided into 80 practical hours and 40 project work hours. The minimum educational qualification required is B.E. / B. Tech., or graduates with a science background (NISE, 2017, 2018, and 2019). There are over 450 solar training partners of SCGJ across India, 16 of them are in Tamil Nadu. Apart from Government-sponsored programs, private institutions also carry out solar skill development programs. Table 3 below shows the number of students graduated over different Government supported skill development programs in Tamil Nadu.

Table 3 Student graduates of the five Government of India solar skill development programs in Tamil Nadu

Course	2016-17	2017-18	2018-19	2019-20	Total	%
Suryamitra	201	704	725	1,522	3,152	56.20%
Varunmitra	Nil	Nil	56	Nil	56	1.00%
Solar rooftop grid engineer	Nil	158	78	Nil	236	4.20%
Solar PV Installer - Electrical	Nil	264	1,269	535	2,068	36.90%
Rooftop Solar Photovoltaic Entrepreneur	Nil	Nil	95	Nil	95	1.70%
Yearly Total	201	1,126	2,223	2,057	5,607	100.0%

Source: SCGJ questionnaire and (NISE, 2017, 2018, and 2019).

Training of Trainers (TOT)
TOT is available for all the above-mentioned programs. Minimum qualification requirement for certified trainers is a 3 years of solar industry experience for ITI/Diploma holders or a 2 years of solar industry experience for B. Tech graduates. For new trainers, training on the domain knowledge and teaching skills is provided over a 10-day training of trainer program. To become a certified trainer a minim score of 80% is required in the final assessment. Previously certified trainers with a minimum experience of 500 teaching hours can directly undergo an assessment.

The certificate issued by SCGJ is valid for 2 years. TOT takes place once in every quarter. All the SCGJ approved training institutes should have a minimum of two SCGJ certified trainers for lecture and laboratory instructor per centre.

4.SURYAMITRA IN TAMIL NADU

The Suryamitra program is fully sponsored by the Central Government. Suryamitra program focuses on building a semi-skilled workforce for the solar PV installation market. NISE will release funds in three instalments of 30%, 50% and 20% for successfully graduated participants only. As a part of the agreement between NISE and training partner, a minimum of 70% placement is mandatory.

In order to assess the actual job placements in the solar industry of graduates after completion of Suryamitra, a survey of the skill development training institutes and former trainees was conducted. A structured questionnaire (refer to Annexure 1) was sent out to the 23 training institutes in Tamil Nadu and SCGJ. Responses from 5 training institutes and SCGJ were obtained. Of the five responses received, one is from a private institute and rest are from the Suryamitra skill development-training institutes. In parallel, a survey in English and Tamil was sent to the 3,152 graduates of the Suryamitra skill development program from Tamil Nadu. A response rate of 11% (347 responses) could be obtained.

According to SCGJ structured process to approve each training programme, course material, certification of trainers, training partners and assessors exists. Once the training programme along with required training content is approved, certified training partners are allocated the responsibilities to undertake training and subsequently certified assessors carry out the assessment process. Training partners largely mobilise the candidates through direct outreach including through diploma/ITI and other vocational institutes, along with advertisements in local newspapers.

4.1 Feedback from training institutes

Educational background of the trainees:
The educational background of students that graduated from different training programs in Tamil Nadu between 2016 and 2020 is provided in Table 4. Suryamitra is the major solar skill development program in the state. It may be noted that, students with a Bachelor of Technology degree (B. Tech) or any other higher education qualifications are not eligible to enrol under the Suryamitra program; this explains the lower number of undergraduate students graduating from these programs. The majority (83.70%) of graduates have 11th or 12th standard as their highest education level.

Table 4 Educational background of trainees graduated between FY 16-17 to 19-20

Educational background	Estimated no. of trainees	%
Undergraduate Degree	250	7.50%
Diploma holder	230	6.90%
ITIs	64	1.90%
11th and 12th as highest education	2,800	83.70%

Source: SCGJ questionnaire

Challenges in program administration:
Common challenges faced by Suryamitra training institutes are:

(i) Delay in payment by Government of India for up to a year or longer;
(ii) Lack of administrative support by respective Government departments;
(iii) Online support portals are not responsive to queries, lack of transparency and lack of clarity provided by the responsible Government department makes administration of programs challenging.

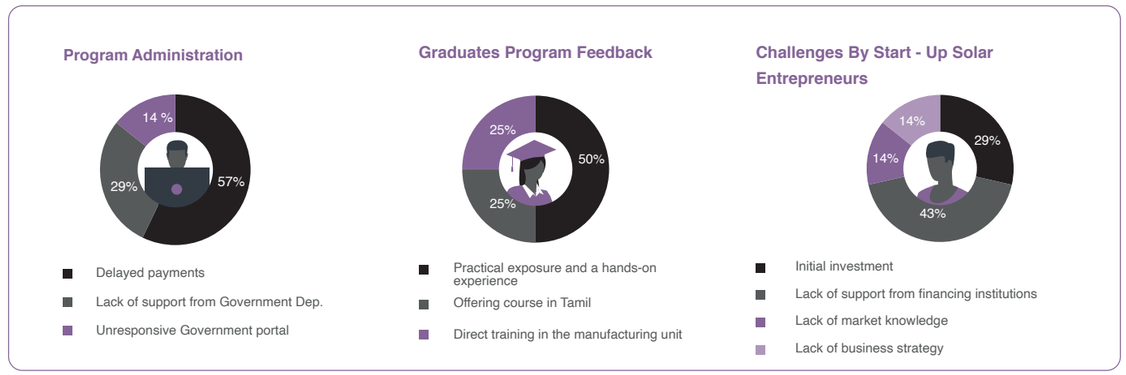
Challenges faced by start-up solar entrepreneurs that graduated from Suryamitra:
Common challenges faced by new entrepreneurs in the solar industry as mentioned by the training institutes are:

(i) Initial investment.
(ii) Lack of market knowledge.
(iii) Lack of business strategy.
(iv) Competitors that keep installation cost low by compromising on the quality of materials and workmanship.
(v) Lack of information to customers about installers that deliver good quality installations.
(vi) Government policies are diluted by a lack of support from the financing institutions in accessing finances for homeowners and installers.

Feedback from graduates:
Feedback from student's graduates was collected at the end of the training program by each training institute. The common feedback received is:

(i) Direct training in the manufacturing unit and installation site helped students to gain more knowledge about the solar manufacturing and solar system installation.
(ii) Practical exposure and hands-on experience of working in the solar industry would be very helpful.
(iii) Offering the course in Tamil would help students to better follow the course material and may attract a higher number of participants.

Figure 1 Feedback from training institutes



Source: Survey of solar training institutes in Tamil Nadu

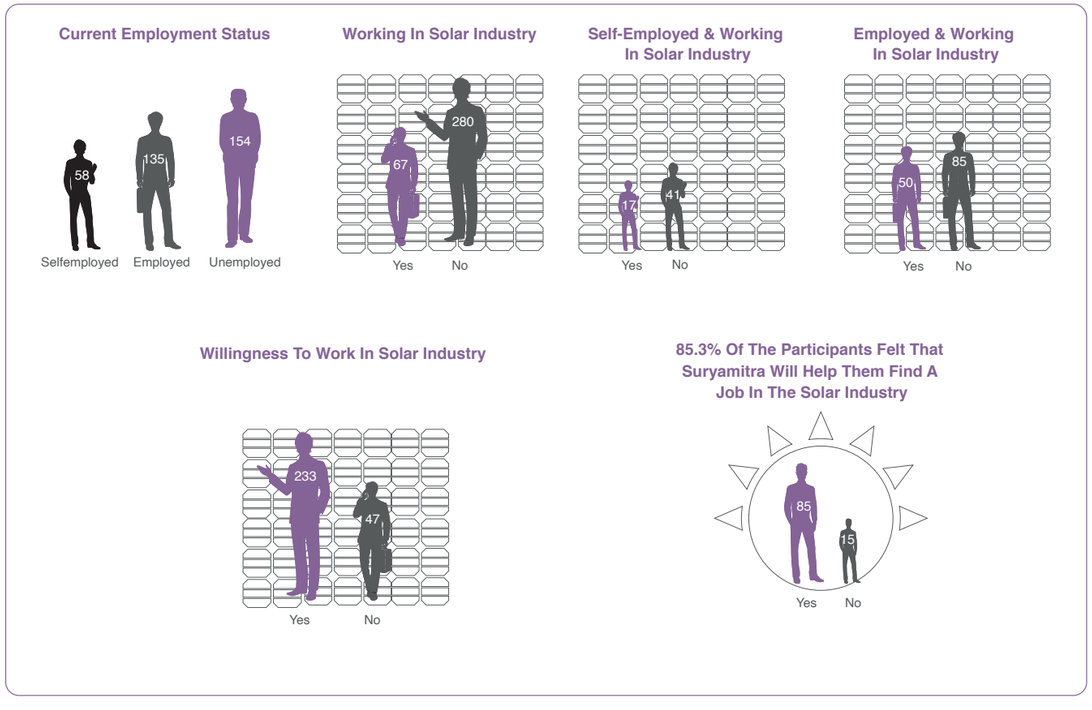
4.2 Feedback from Suryamitra program graduates

347 responses or about 11% of the total Suryamitra graduates were obtained. The Suryamitra questionnaire was initially sent in English, which received a lukewarm response. Later the survey was sent in Tamil & English, which helped in increasing the response rate.

Of the 347 (11%) responses received 154 (44.38%) were unemployed. 193 (55.62%) were either employed or self-employed, out of which only 67 (19.31%) people are working in the solar industry. 233 (67.15%) responses were recorded on willingness to work in the solar industry and 296 (85.30%) of the participants felt that Suryamitra will help them find a job in the solar industry (Refer Figure 2). In General, there was good feedback about the Suryamitra program among the graduated students. Based on the 11% response received for the questionnaire, only 19.31% of surveyed graduates were employed in the solar industry; hence it can be concluded that 70% placement target is not met. Job placement of graduates emerged as key issues. Only 25.37% (17) of graduates that are currently employed in the solar industry have become entrepreneurs, challenges faced by them have been elaborated earlier in this chapter (refer to figure 1). A mentoring system for start-up solar entrepreneurs may help them overcome some of these challenges.

In addition to the written survey, five in-depth telephonic interviews were conducted. Participants emphasized that more practical and hands-on exposure during the training program is required.

Figure 2 Response to Suryamitra questionnaire



Source: Survey of Suryamitra participants

5.RECOMMENDATIONS

The following are some recommendations for improving solar skill development that emerged from the surveys and interviews. The recommendations are divided into national level and state level recommendations.

National level		Organization
1.	The gaps between the state-level training centres and the solar industry, particularly in the rural areas, need to be addressed. In order to provide graduates exposure and hands-on experience of working in the solar industry, guided industry-visits, internships and/or apprenticeships programs are required at a larger scale.	NSDC, SCGJ and NISE
2.	Communication skills, proficiency in English in particular, are a major constraint for the surveyed graduates affecting their work performance and opportunities. Programs that address this skill gap can help increase employment.	SCGJ and NISE
3.	Payment delays from Government to the solar training institutes have consistently been named as a key operational issue. Addressing this will help the training institutes to function at more option capacity and focus on providing quality skill training.	NISE
4.	Review ongoing quality assessment of solar training institutes and trainers to ensure quality consistency in the training program and ensure constant update of training manuals to keep pace with the dynamic solar energy technology and market development.	SCGJ NISE
5.	Establish a continuous reporting mechanism on employment generation and skills required in the solar PV sector. Training programs can then be fine-tuned based on industry requirements.	NISE
6.	Address the low awareness among the youth and the employers about vocational training and solar skill development programs provided by the Government. The efforts of NSDC & NISE need further dissemination.	NSDC and NISE
State level		**Organization**
1.	An enabling and stable policy and market environment are required for the solar installation market to grow and absorb the trained graduates under the various skill development programs.	Energy Department Government of Tamil Nadu and TEDA
2.	Banks have a lower comfort level with solar rooftop investments because of the lack of public information available and need more data and statistics on project development, deployment, and performance. Currently, a lack of skilled personnel corresponds to the lack of a record of accomplishment of appropriate performance data from solar. Given that financiers base their lending decisions on the availability of such critical data, availability of trained and skilled personnel to record reliable, high-quality performance data can encourage financiers to invest on a broader scale in the solar industry.	TEDA
3.	Lack of information to the consumers on the cost of rooftop solar, gird connection application process, quality of workmanship etc. can be addressed by providing online information. Installers could be rated and ranked based on the quality of their services provided. Such an online portal may also provide the option to consum ers to receive quotes from multiple installers and to compare their offers	TEDA
4.	Promote domestic solar module manufacturing industry to boost employment since meeting the demand for solar modules required for 100 GW of solar capacity domestically, requires 45,000 additional workers (indirect jobs) (Ghosh, 2016).	Government of Tamil Nadu
5.	Empanelled solar installers should be able to verify that a minimum percentage of their employees for field engineering and installation have a certificate from these training institutes or similar institutes that provide solar skill development trainings.	TEDA
6.	Currently there are 5 solar skill development programs offered in Tamil Nadu focusing on field engineering and entrepreneurship. Dedicated skill development programs for solar PV design, solar PV project manage ment, solar PV manufacturing technician, solar PV site surveyor and solar PV operation and maintenance engineering are currently not offered in the state. Offering a more diverse set of solar skill development programs in the state provides the market with skilled workforce across the entire solar PV value chain is recommended.	TEDA

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7.ANNEXURES

Annexure 1 Questionnaire

1. Are you currently providing any course related to solar PV?
2. How many students have you successfully trained?
3. How many students have enrolled in your courses over the last few financial years?
4. How many trainees were able to find jobs in the solar sector?
5. Do some of your graduates go on to take up entrepreneurship in the solar sector? If yes, how many of them have taken that step?
6. What are the common challenges faced by entrepreneurs in the solar PV sector?
7. Has the course material been updated?
8. What are some of the important feedbacks you receive from students who completed the course?
9. Do you think the rooftop solar market has been adversely affected by the latest Solar Policy 2019, which replaced net metering with net feed-in tariff?
10. Do you have tie-ups with companies to employ the graduates? If so, which companies do you have tie-ups with?
11. Are you able to access the funding available from the Government for the courses? What issues are you facing, if any?
12. Recommendations to improve the skill development program in Tamil Nadu?

Additional questions for SCGJ only

13. What is the target for solar PV skill development in TN (No. of people to be trained)?
14. How many students have enrolled in your courses over the last few financial years?
15. How many trainees were able to find jobs in the solar sector?
16. Are other programs being developed to meet future skill development needs?
17. How do you promote your programs among the public?
18. Can you provide the breakup on the educational qualification level of the students who completed solar PV skill development in TN?
19. Are feedbacks collected from students and training institutions regarding the solar PV skill development courses in TN? If so, can you share the feedback received for each program?

Annexure 2: NSQF levels

The NSQF organizes qualifications according to a series of levels of knowledge, skills and aptitude. These levels are defined in terms of learning outcomes which the learner must possess regardless of whether they were acquired through formal, non-formal or informal learning.

Table 5 NSQF level description

Level	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
2	Prepares person to carry out processes that are repetitive, on a regular basis, with little application of understanding, more of practice.	Material, tools and applications in a limited context, understands the context of work and quality.	Service skills used in limited context; select and apply tools; assist in professional works with no variables; differentiate good and bad quality.	Receive and transmit written and oral messages, basic arithmetic, personal financing, and understanding of the environment.	Work under instruction and close supervision.
4	Work in a familiar, predictable, routine, situation of clear choice.	Factual knowledge in the field of work or study	Recall and demonstrate practical skill, routine and repetitive in a narrow range of application, using appropriate rules and tools, using quality concepts.	Language to communicate, written or oral, with required clarity; skill to basic arithmetic and algebraic principles; basic understanding of the social-political and natural environment	Responsibility for own work and learning.
5	The job that requires well-developed skill, with a clear choice of procedures in a familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study.	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill; understanding of social, political; and some skill of collecting and organising information, communication.	Responsibility for own work and learning and some responsibility for others' works and learning.
6	Demands a wide range of specialised technical skill; clarity of knowledge and practice in a broad range of activity involving standard and non-standard practices.	Factual and theoretical knowledge in broad contexts within a field of work or study.	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	Reasonable good in mathematical calculation, understanding of social, political and reasonably good in data collecting organising information, and logical communication.	Responsibility for own work and learning and full responsibility for other's works and learning.
7	Requires a command of wide-ranging specialised theoretical and practical skills, involving variable routine and non-routine contexts.	Wide-ranging factual and theoretical knowledge in broad contexts within a field of work or study.	Wide range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	Good logical and mathematical skill understanding of social political and natural environment and organising information, communication and presentation skill.	Full responsibility for the output of group and development.

Source: Adapted from NSQF 2020

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