SYLLABUS AND
TEACHERS' REFERENCE

SOLAR PHOTOVOLTAIC INSTALLATION SUPERVISION

European Union

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DEUTSCHE ZUSAMMENARBEIT

USAID
FROM THE AMERICAN PEOPLE

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Solar PV Installation Supervision

Syllabus & Teacher's Reference for a 240-hours training course for electricians
3rd Edition • March 2017
Developed in pursuit of conformity with the Nigerian Competency Standards for Clean Energy | Release 2016 in the domain "Solar Photovoltaic Equipment Installation Supervision"

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Content

ABOUT

This document seeks to guide trainers on the delivery of the training course Solar PV Installation Supervision. The topics and subjects contained are a result of the needs expressed by the clean energy private sector in Nigeria in 2014 and Competency Standards evolved together with industry in 2015 and 2016. This document is expected to be reviewed periodically to reflect changing needs of the Nigerian market.

Course objective	Enable technicians **with formal educational background** to supervise and lead the installation, maintenance and troubleshooting of solar photovoltaic systems – in conformity with the requirements of the Nigerian Competency Standards for Clean Energy | Release 2016 in the domain "*Solar Photovoltaic Equipment Installation Supervision*".
Target group	**Technicians**
Recommended entry criteria	Must be within age group 18-40 years, possesses a minimum of 4 credits in (mathematics, English, integrated science and introductory technology) at JSSCE level or comparable evidence of competence. Evidence of technical competence via pre-qualification interview.
Duration	240 hours recommended (equivalent to 30 training days at 8 hours per day)
Classroom size	15-20 trainees recommended
Expected tasks and duties	▪ Size stand-alone PV systems ▪ Lead installation activities ▪ Install PV systems (off-grid & grid connected) ▪ Perform maintenance and troubleshooting tasks ▪ Maintain records required for monitoring PV systems ▪ Observe health and safety regulations ▪ Manage and maintain relationships with customers
Teaching methods	▪ Highly practical orientation ▪ Lectures (presentations & videos) ▪ Practical work ▪ Simulations ▪ Group work (homework, role play, presentation) ▪ Pop-quiz ▪ Laboratory-experiments & workshops ▪ Field trips ▪ Demonstration ▪ Discussion
Assessment methods	▪ Written examination ▪ Practical examination ▪ Oral examination

1.1 USING THE SYLLABUS

The content of each course module is broken down to topical levels. Key information guides the trainer on the following:

- **Competency levels** the student is expected to attain at the end of the module. There are four levels of competency detailed in this document:
  - Skills and competencies required by the trainee for knowledge purposes only are classified as "**To know**". This is the simple most level.
  - Skills and competencies required for explaining to third parties are classified as "**To understand**".
  - Skills and competencies required for day-to-day work on an as-is basis in respect of the handbook are classified as "**To use**". Training on practical examples, for instance, is essential to attain this.
  - Skills and competencies for day-to-day work which need to be adapted to practical contexts are classified as "**To apply**". This level is the most demanding and requires application in areas beyond what has been learned.
- Appropriate **teaching techniques and methods** for effective delivery of contents.
- **Activities** to aid effective knowledge transfer.
- **Materials and equipment** required for training activities.
- **Key resources** for trainers to study to ensure the depth and breadth of their knowledge exceeds that of the Course Handbook.

1.2 COURSE DURATION

The recommended contact hours for delivery of this course is **240 hours**. This would translate into 30 days of training for a fulltime delivery of 8 hours per day.

For effective delivery, the course is designed in modules, each with recommended duration of delivery. The recommended amount of time to be spent by the students in specific learning environments is suggested in the following groups:

- **Classroom:** Duration suggested in a classroom setting where techniques such as discussions, role plays, and interactive sessions, exercises presentations are deployed to *engage* the students apart from traditional teaching.
- **Lab/Workshop, Field trips:** Duration suggested for engaging in practical aspects. This could be field trips, site visits, laboratory experiments or any other form of engagement *practical* in nature.
- **Spare time:** Contingency kept aside to use at discretion of the trainer. The trainer decides what environment to use the spare time for based on the response of the class to course content.
- **Additional self-study:** Duration the student is expected to engage in self-study and research complementing classroom and practicals time.

1.3 ACTIVITIES

Various activities are required for the successful delivery of the course. These include:

- **Demo:** Concepts or aspects are being demonstrated to students.

- **Exercise:** Activities that require the student to solve problems in the classroom.
- **Workshop:** The student engages in practical exercises meant to imitate real world conditions.
- **Experiment:** Carry out practical exercises in a controlled environment, usually the laboratory.
- **Interactive session:** Sessions where students are engaged in open discussions to share their views with the class, thus sparking intellectual debates.
- **Role play:** Students to perform roles they are expected to assume or encounter in the workplace.
- **Site visit**: Field trips that serve as a means of buttressing the point made in class by providing the students with tangible evidence/experience of concepts taught.
- **Video:** For introduction and support of concepts taught in class.

SPECIAL SYMBOLS

⌘ Indicates *material* available in softcopy in the package folder.

♦ Indicates *resources* available in softcopy in the package folder.

1.4 MATERIALS AND FACILITIES

To successfully deliver this training course – particularly in view of the skills acquisition, certain materials and equipment are required. A careful review of this section is strongly recommended well ahead of the delivery of the course to ascertain availability, verify operating status, initiate procurement or repairs and provide alternatives wherever the originally recommended item is unavailable. The success of this training course vitally depends on practice on such material and equipment encompassing:

- Power tools (drill, grinder, heat blower, cutting machine, etc.)
- Multimeters
- Complete electricians' toolbox - 1 per 5 participants
- 1 roof type/ shed to practice roof installation
- Space for on-ground-modules
- Rig labs
- Inverters
- Charge controllers
- Batteries
- PV modules
- Mounting clamps

Minimum requirements for a class of 20 students	*Quantity*	*Estimated unit cost (NGN)*	*Estimated cost (NGN)*
Cardboard strips			
Pin board	2		
Laptop for trainer	1		
Projector	1		
Whiteboard	1		
Whiteboard markers	Lot		

Minimum requirements for a class of 20 students	*Quantity*	*Estimated unit cost (NGN)*	*Estimated cost (NGN)*
Coloured pins	Lot		
Loud speaker	1		
Complete electricians toolbox	4	47,000	188,000
Power drill with bits	4	19,000	76,000
5 m measurement tape	4	600	2,400
AC/DC digital multimeter with clamp	4	10,000	40,000
Roofed barn structure	1		
100 W_P solar panels	4	20,000	80,000
180 W_P solar panels	4	38,000	152,000
1.5 kVA inverter	2	55,000	110,000
45 A charge controller	2	53,000	106,000
100 Ah battery	8	35,000	280,000
63 A MCCB	2	8,000	16,000
32 A MCCB	2	5,000	10,000
3 m step ladder	2	45,000	90,000
6 m extension ladder	1	60,000	60,000
Safety goggles	20	500	10,000
Hard helmets	20	500	10,000
Insulated hand gloves	1 per student		
Insulated safety boots	1 per student		
Spirit level	4	2,000	8,000
Compass	4	10,000	40,000
Electricians chalk line	4	3,000	12,000
Fishing tape	4	500	2,000
Long nose plier	4	1,000	4,000
Cable cutting plier	4	1,000	4,000
Set of screwdrivers	4	4,500	18,000
Set of spanners	4	5,000	20,000
Body harness	2	2,500	5,000
Class E fire extinguisher	1	9,000	9,000
2.5 mm^2 cables	50 m	100	5,000
4 mm^2 cables	50 m	140	7,000
6 mm^2 cables	50 m	300	15,000
10 mm^2 cables	50 m	500	25,000
16 mm^2 battery bank interconnection cables	4 pairs	2,000	8,000
Cable lugs for 16 mm^2	8	70	560
Crimping tool with dies	2		
Screws for wood/plastic/metal sheet	Lot		
Nuts and bolts	Lot		
Insulation tape	Lot		
Cable lugs for sizes 2.5 mm^2 -10 mm^2	Lot		

Prices are as at March 2016

1.5 TRAINING COURSE OVERVIEW

Module 1. Introduction to solar photovoltaics	***16 hours***
Content	1.1 Solar resources 1.2 Solar resource in Nigeria 1.3 The photovoltaic effect 1.4 Photovoltaic technology and solar cells 1.5 Photovoltaic system configuration 1.6 Applications for solar photovoltaic systems
Recommended time allocation	8 hours Classroom 4 hours Lab/workshop, field trip 4 hours Spare time +0 hours Additional self-study
Learning outcomes	At the end of the module the learner is able to: ▪ Explain the basics of electricity related to photovoltaics ▪ Appreciate various applications of solar photovoltaics ▪ Describe the different configurations for module and battery interconnection

Module 2. Workplace safety and first aid	***24 hours***
Content	2.1 Risks and hazards 2.2 Site safety 2.3 Personnel safety 2.4 Working at rooftops and facades 2.5 Fire hazards 2.6 Lifting 2.7 Preventing electrical hazards 2.8 First aid
Recommended time allocation	15 hours Classroom 6 hours Lab/workshop, field trip 3 hours Spare time +0 hours Additional self-study
Learning outcomes	At the end of the module the learner is able to: ▪ Know common workplace safety rules and regulations ▪ Assess possible health and safety threats and how to avoid them ▪ Identify the different types of protective clothing and equipment ▪ Identify the different methods of fire fighting ▪ Recognise the signs and symbols in safety

Module 3. Components and electrical connections	***48 hours***
Content	3.1 Solar photovoltaic modules 3.2 Inverters 3.3 Batteries 3.4 Charge controllers 3.5 Protective measures
Recommended time allocation	0 hours Classroom 40 hours Lab/workshop, field trip 8 hours Spare time +8 hours Additional self-study

Learning outcomes

At the end of the module the learner is able to:

- Explain the functions of the system components
- Explain meaning and application of battery state of charge
- Identify and select protective devices

Module 4. Basic system sizing *16 hours*

Content

4.1 Electrical loads
4.2 Sizing a PV system

Recommended time allocation

0 hrs	Classroom
16 hrs	Lab/workshop, field trip
0 hrs	Spare time
+8 hrs	Additional self-study

Learning outcomes

At the end of the module the learner is able to:

- Distinguish between DC and AC loads
- Select appropriate system components for a solar photovoltaic system

Module 5. Site preparations *18 hours*

Content

5.1 Taking measurements
5.2 Shade analysis and sun path chart
5.3 Orientation of photovoltaic modules
5.4 Installation surfaces
5.5 Planning work schedules

Recommended time allocation

6 hours	Classroom
10 hours	Lab/workshop, field trip
2 hours	Spare time
+0 hours	Additional self-study

Learning outcomes

At the end of the module the learner is able to:

- Plan installation work schedule
- Understand and explain the requirements for photovoltaic system installation on different surfaces
- Identify suitable installation points for system components
- Plan to mitigate the effect of inter-row shading

Module 6. Installing a solar photovoltaic system *70 hours*

Content

6.1 Understanding electrical drawings
6.2 Required tools and equipment
6.3 Installing the photovoltaic array
6.4 Installing the battery bank
6.5 Installing the charge controller
6.6 Installing the inverter
6.7 Connecting the system components
6.8 Commissioning

Recommended time allocation

6 hours	Classroom
56 hours	Lab/workshop, field trip
8 hours	Spare time
+24 hours	Additional self-study

Learning outcomes

At the end of the module the learner is able to:

- Install photovoltaic system components and systems

- Explain how to wire PV system components, terminate cables and commission system
- Explain electrical installation tests

Module 7. Maintenance and troubleshooting	*24 hours*
Content	7.1 Maintenance 7.2 Troubleshooting
Recommended time allocation	4 hours Classroom 16 hours Lab/workshop, field trip 4 hours Spare time +0 hours Additional self-study
Learning outcomes	At the end of the module the learner is able to: ▪ Explain the steps involved in carrying out maintenance work on each solar system component ▪ Outline the procedure for maintaining different PV system components ▪ Identify the types of tools/ equipment used for maintenance and repair

Module 8. Entrepreneurship and customer relations	*8 hours*
Content	8.1 Marketing and sales 8.2 Simple economic calculations
Recommended time allocation	8 hours Classroom 0 hours Lab/workshop, field trip 0 hours Spare time +0 hours Additional self-study
Learning outcomes	At the end of the module the learner is able to: ▪ Understand marketing mechanisms and how to merchandise products in the field of solar photovoltaics ▪ Advertise products, skills and motivate customers to have solar photovoltaic products installed ▪ Compute basic life cycle cost analysis (LCCA), levelized cost of electricity (LCOE), return on investment (ROI)

Practice Test – In preparation of national certification	*16 hours*
Purpose	At the end of the course, the aptitude of each trainee should be assessed through a practice test in preparation of National Certification. The test should be based on the same benchmark: **Nigerian Competency Standards for Clean Energy** | Release 2016 in the domain "*Solar Photovoltaic Equipment Installation Supervision*".
Recommended duration and weightage	**Duration** — **Examination type** — **Weightage** 2 hours — Written examination — 30% 6 hours — Oral exam — 35% 8 hours — Practical examination — 35%
Grading	A candidate is deemed to have completed the course successfully (passed) if he/she attains a cumulative average **score of 70%** from all three examinations
Recommended certificate	Certificate of participation

MODULE 1: INTRODUCTION TO SOLAR PHOTOVOLTAICS

Content	Topics	Methods & materials	Key resources
1.1 Solar resources (4 hours workshop)			Competency level: To know
Introduction	- Common terminologies used in solar energy	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Video 1.1-1: How light rays reach the earth from the sun Video 1.1-2: How electricity is generated from solar panels ⌘Workshop 1.1-1: Students measure direct and diffuse irradiance ⌘Workshop 1.1-2: Students determine the optimal array orientation	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Energy from the sun	- Radiation and irradiance		
Estimating the available solar energy	- Annual solar energy received - Solar resource distribution in Nigeria - The concept of peak sun		
1.2 Solar resource in Nigeria (2 hours classroom)			Competency level: To know
Meteorological data	- Insolation tables - Sources for relevant data	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 1.2-1: Teacher introduces the students to insolation tables and shows them how to interpret	1. ♦ *The Nigeria energy sector study* • German Agency for International Cooperation (GIZ)

Content	Topics	Methods & materials	Key resources
1.3 The photovoltaic effect (1 hour classroom)			Competency level: To know
Photovoltaic principle	- Semiconductors - The photovoltaic effect	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
1.4 Photovoltaic technology and solar cells (2 hours classroom)			Competency level: To know
Solar cells	- Electrical characteristics of cells	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy Resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

Content	Topics	Methods & materials	Key resources
1.5 Photovoltaic system configuration (2 hours classroom)			Competency level: To know
Configurations	- Grid connected systems - Stand-alone systems - Hybrid systems	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
1.6 Applications for solar photovoltaic systems (1 hour classroom)			Competency level: To know
Purposes of PV systems	- Water pumping - Street lighting - Power plants - Residential systems	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

MODULE 2: WORKPLACE SAFETY AND FIRST AID

Content	Topics	Methods & materials	Key resources
2.1 Risks and hazards (2 hours classroom)			Competency level: To apply
General risks	- Injuries while working - Minimising electrical hazards	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 2.1-1: Teacher engages students to share experiences of accidents that have occurred on site Video 2.1-1: Teacher shows students accidents that occur on installations sites	1. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 2. *Construction site safety handbook* • OSHB Labour Department 3. ♦ *Electrical construction & maintenance safety manual* • ICAO-IBEW 4. ♦*Electrical workers safety handbook* • E-Contractors 5. ♦*Emergency safety & aid hand book* • Bhutan Ministry of Home & Culture 6. ♦*Safety signs & signals guide* • Health & Safety Executive
2.2 Site safety (2 hours classroom)			Competency level: To apply
Safety symbols	- Interpreting safety symbols	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 2.2-1: Students briefly discuss their experience with site safety	1. ♦*Safety signs & signals guide* • Health & Safety Executive
2.3 Personnel safety (2 hours classroom)			Competency level: To apply
Safety equipment	- Personal protective equipment (PPE)	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Eye goggles, Hand gloves	1. *Construction site safety handbook* • OSHB Labour Department 2. ♦ *Electrical construction & maintenance safety manual* • ICAO-IBEW 3. ♦*Electrical workers safety handbook* • E-Contractors

		Activities Demo 2.3-1: Teacher introduces students to the different PPE and showing students how to use them Video 2.3-1: Teacher shows students the risks and dangers of not using PPE	4. ♦*Emergency safety & aid hand book* • Bhutan Ministry of Home & Culture
2.4 Working at rooftops and facades (2 hours workshop)			Competency level: To apply
Working at heights	- Fall protection - Using a ladder - Using a body harness	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Ladder, Body harness **Activities** Demo 2.4-1: Teacher introduces students to the different types of ladders and how to use them safely Video 2.4-1: Teacher shows students the risks and dangers of not using adequate fall protection Demo 2.4-2: Teacher introduces students to the body harness and teaches students how to use it	1. ♦*Electrical workers safety handbook* • E-Contractors
2.5 Fire hazards (2 hours classroom)			Competency level: To apply
Types	- Classes of fire extinguishers - Using a fire extinguisher	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Class E fire extinguisher **Activities** Demo 2.5-1: Teacher shows the students a typical Class E fire extinguisher Video 2.5-1: Teacher shows how to use fire extinguishers	1. www.mfs.fire-extinguishers.co.uk

		Video 2.5-2: Teacher introduces students to the different types of fire extinguishers	
2.6 Lifting (2 hours classroom)			Competency level: To apply
Manual lifting	- Factors that make lifting dangerous - Safe lifting practices	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 2.6-1: Teacher invites students to lift a heavy load using proper lifting posture	1. *Construction site safety handbook* • OSHB Labour Department 2. ♦ *Electrical construction & maintenance safety manual* • ICAO-IBEW 3. ♦*Electrical workers safety handbook* • E-Contractors 4. ♦*Emergency safety & aid hand book* • Bhutan Ministry of Home & Culture 5. ♦*Safety signs & signals guide* • Health & Safety Executive
2.7 Preventing electrical hazards (1 hour classroom)			Competency level: To apply
Causes of electrical hazards	- Direct contact - Indirect contact	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Construction site safety handbook* • OSHB Labour Department 2. ♦*Electrical construction & maintenance safety manual* • ICAO-IBEW 3. ♦*Electrical workers safety handbook* • E-Contractors 4. ♦*Emergency safety & aid hand book* • Bhutan Ministry of Home & Culture 5. ♦*Safety signs & signals guide* • Health & Safety Executive

2.8 First aid (4 hours classroom + 4 hours workshop)			Competency level: To apply
First aid box	- Contents	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, First aid kit **Activities** <u>Demo 2.8-1:</u> Teacher shows students procedures for basic first aid for common construction site injuries <u>Workshop 2.8-1:</u> Students practice first aid for common site injuries	1. ♦*Construction site safety handbook* • OSHB Labour Department ♦*Electrical construction & maintenance safety manual* • ICAO-IBEW 2. ♦*Electrical workers safety handbook* • E-Contractors 3. ♦*Emergency safety & aid hand book* • Bhutan Ministry of Home & Culture
First aid for common site injuries	- Steps to take - CPR		

MODULE 3: COMPONENTS AND ELECTRICAL CONNECTIONS

Content	Topics	Methods & materials	Key resources
3.1 Solar photovoltaic modules (16 hours workshop)			Competency level: To apply
Solar photovoltaic modules	- Electrical characteristics and structure - Important parameters of a solar panel - Measuring short circuit current (Isc) - Measuring open circuit voltage (Voc) - Performance of solar modules, STC vs. real life conditions - Interpreting datasheet - Shading and hotspots	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Solar panels, Digital multimeter, Complete electrician's toolbox **Activities** ⌘Workshop 3.1-1: Students measure the *Isc* and *Voc* of various solar panels ⌘Workshop 3.1-2: Students interconnect solar panels in various series/parallel combinations and measure the *Isc* and *Voc* ⌘Workshop 3.1-3: Students connect mismatched solar panels and measure the *Isc* and *Voc* ⌘Workshop 3.1-4: Students investigate the effect of irradiance on solar panel output ⌘Workshop 3.1-5: Students investigate the effect of temperature on voltage ⌘Workshop 3.1-6: Students investigate the effect of temperature on output current ⌘Workshop 3.1-7: Students investigate the effect of temperature on output power	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Types and technologies	- Monocrystalline - Polycrystalline - Amorphous (thin-film)		
Connecting solar panels together	- Connecting similar panels in an array - Mismatching solar panels in an array		
Solar panel datasheet	- Interpreting		

Content	Topics	Methods & materials	Key resources
3.2 Inverters (8 hours workshop)			Competency level: To apply
Classification	- Based on input source - Based on output waveform	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Inverter, Connecting cables **Activities** ⌘Workshop 3.2-1: Students investigate the efficiency of two different brands of inverter	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
3.3 Batteries (8 hours workshop)			Competency level: To apply
Common types and technologies	- Lithium ion - Lead-acid battery	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Deep cycle batteries, Connecting cables, Digital multimeter **Activities** ⌘Workshop 3.3-1: Students interconnect batteries in various series/parallel combinations Workshop 3.3-2: Students investigate the effect of interconnecting differently rated batteries together ⌘Workshop 3.3-3: Students investigate the battery capacity discharge	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Classification	- Based on usage/application - Based on cell type		
Connecting batteries together	- Connecting batteries in series - Connecting batteries in parallel - Mismatching batteries in a battery bank		
Battery datasheet	- Interpreting		

Content	Topics	Methods & materials	Key resources
3.4 Charge controllers (4 hours workshop)			Competency level: To apply
Types and functions	- Pulse width modulation - Maximum power point tracker	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, PWM charge controllers, MPPT charge controllers **Activities** Demo 3.4-1: Teacher passes around the two different types of charge controller for students to familiarise themselves with physical appearance ⌘Workshop 3.4-1: Students investigate the operation of charge controllers	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* •UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
3.5 Protective measures (4 hours workshop)			Competency level: To apply
Overcurrent protection devices	- AC circuit breaker - DC circuit breaker - Battery fuses - Disconnect switches - Combiner box - AC surge arrestors - DC surge arrestors	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Electrical protective devices **Activities** Demo 3.5-1: Teacher passes around the various electrical protective devices (each one clearly labelled) for students to familiarize themselves Interactive session 3.5-1: Teacher invites up to 5 students to share their experiences on grounded and ungrounded systems	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Lightning protection systems	- External lightning protection - Internal lightning protection		
Grounding	- Why do we ground - Equipment grounding - System grounding		

MODULE 4: BASIC SYSTEM SIZING

Content	Topics	Methods & materials	Key resources
4.1 Electrical loads (1 hour workshop)			Competency level: To apply
Types and specifications	- AC loads - DC loads	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** ⌘Workshop 4.1-1: Students investigate the effect of efficient lighting on power	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
4.2 Sizing a PV system (15 hours workshop)			Competency level: To apply
Developing a load profile	- Evaluate the energy demand	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Demo 4.2-1: Teacher solves some sizing calculations in the classroom ⌘Exercise 4.2-1: Students are given various system sizing exercises to complete	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel
Sizing the battery bank	- Deciding the depth of discharge - Deciding the days of autonomy - Deciding on the system voltage - Choosing the right type and quantity of batteries - Choosing the right battery bank configuration		

Content	Topics	Methods & materials	Key resources
Sizing the PV array	- Estimating the available solar resource - Sizing the PV array - Choosing the right type and quantity of solar panels - Choosing the right solar array configuration		6. ♦*Stand-alone solar electric systems* • Earthscan
Sizing the charge controller	- Determining the right voltage and current - Choosing the right type of charge controller		
Sizing the in-verter	- Determining the right power output and DC voltage - Choosing the right type of inverter		
Cable sizing	- Choosing the right type and size of cable under consideration of voltage drop		
System optimi-zation	- Eliminating unnecessary loads and runtimes		

MODULE 5: SITE PREPARATION

Content	Topics	Methods & materials	Key resources
5.1 Taking measurements (2 hours classroom)			Competency level: To apply
Measurement groups	- Solar irradiance - Lengths - Angles - Electrical characteristics	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Demo 5.1-1: Teacher introduces students to measurements taken in solar installation showing how they are taken	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
5.2 Shade analysis and sun path chart (2 hours classroom)			Competency level: To apply
Shade analysis	- Effect of shading	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Sun path chart **Activities** Demo 5.2-1: Teacher introduces the students to the sun path chart and teaches them how to interpret	1. *http://solardat.uoregon.edu/SunChartProgram.html* 2. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 3. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 4. ♦*Solar photovoltaic systems technical training manual* • UNESCO 5. ♦*Renewable energy resources* • John Tidwell and Tony Weir 6. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 7. ♦*Stand-alone solar electric systems* • Earthscan
Sun path chart	- Generating the sun path chart - Interpreting the sun path chart		

Content	Topics	Methods & materials	Key resources
5.3 Orientation of photovoltaic modules (4 hours workshop)			Competency level: To apply
Inclination and azimuth	- Obtaining data about solar path at planned site	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Deep cycle batteries, Connecting cables, Digital multimeter **Activities** Workshop 5.3-1: Students determine the optimal array orientation	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Inter-row shading	- Factors to consider - Required area for inter-row spacing		
5.4 Installation surfaces (6 hours workshop)			Competency level: To apply
Possible surfaces	- Roof mounting - Ground mounting top of pole mounting - Building integrated	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, PV modules, Mounting racks **Activities** Workshop 5.4-1: Students are asked to install a PV module on a roof top	*1.* ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. *2.* ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan *3.* ♦*Solar photovoltaic systems technical training manual* • UNESCO *4.* ♦*Renewable energy resources* • John Tidwell and Tony Weir *5.* ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

Content	Topics	Methods & materials	Key resources
5.5 Planning work schedules (2 hours classroom)			Competency level: To apply
Factors to consider	- Equipment delivery - Identification of tasks - Complexity of task - Required tools and materials	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Exercise 5.5-1: Teacher divides students into groups and asks students to develop a work plan	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

MODULE 6: INSTALLING A SOLAR PHOTOVOLTAIC SYSTEM

Content	Topics	Methods & materials	Key resources
6.1 Understanding electrical drawings (4 hours classroom)			Competency level: To apply
- Types of electrical diagrams	- Block - Circuit - Single line - Wiring - Installation drawings - As built drawings	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Demo 6.1-1: Teacher shows the different electrical diagrams to the students Demo 6.1-2: Using the basic electrical floor plan and the symbol chart, the teacher explains the electrical symbols to the students ⌘Exercise 6.1-1: Students are given a standard photocopy of a floor plan that includes a kitchen and have them draw one or two 12-device circuits Exercise 6.1-2: Students draw two outlets that require separate circuits for a fridge and a TV that go directly back to panel (homerun shown as short line directed toward the panel with an arrow on it) Exercise 6.1-3: Students draw a legend of symbols for their drawing	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

Content	Topics	Methods & materials	Key resources
6.2 Required tools and equipment (2 hours classroom)			Competency level: To apply
Types of tools	- Measurement instruments - Installation tools - Other tools	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Demo 6.2-1: Teacher shows as many of the installation tools as possible Exercise 6.2-1: Students familiarize themselves with the measurement instruments by taking readings	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
6.3 Installing the photovoltaic array (16 hours workshop)			Competency level: To apply
Handling modules on shingle roofs	- Safe handling - Dos and don'ts	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 6.3-1: Students discuss any other surfaces that they may have seen ⌘Workshop 6.3-1: Students investigate the effect of shading on a solar panel ⌘Exercise 6.3-2 to 6.6.1: Students practice installing solar panels	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Roof top installation	- Preparing a shingle roof - Using prefabricated mounts		

Content	Topics	Methods & materials	Key resources
6.4 Installing the battery bank (8 hours workshop)			Competency level: To apply
Handling of batteries	- Safe handling - Dos and don'ts - Precautions when handling batteries	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, Deep cycle batteries **Activities** ⌘Exercise 6.3-2 to 6.6.1: Students practice installing a battery bank	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
6.5 Installing the charge controller (4 hours workshop)			Competency level: To apply
Installing the charge controller	- Mounting site - Electrical connections - Setup	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** ⌘Workshop 6.3-2 to 6.6.1: Students practice installing a charge controller	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan
6.6 Installing the inverter (4 hours workshop)			Competency level: To apply
Installing the charge controller	- Mounting site - Electrical connections - Setup	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO

Content	Topics	Methods & materials	Key resources
		Activities ⌘Workshop 6.3-2 to 6.6.1: Students practice installing an inverter	4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
6.7 Connecting the system components (4 hours workshop)			Competency level: To apply
Solar system circuits	- Solar source circuit - Solar output circuit - Charge controller input circuit - Charge controller output circuit - Inverter output circuit	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Cabling and wiring	- Types of cables and wires - Rules for wiring solar systems	**Activities** ⌘Workshop 6.7-1: Students investigate the effect of voltage drop in cables	
6.8 Commissioning (20 hours workshop)			Competency level: To apply
Commissioning requirements and activities	- Visual inspection - Electrical inspection - Filling the job card	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards, PV modules, Inverters, Charge controllers, Batteries, Wires, Protective devices, Mounting systems **Activities** Workshop 6.8-2: Students carry out commissioning tasks	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir

Content	Topics	Methods & materials	Key resources
		Workshop 6.8-1: Students connect a system by themselves	5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

MODULE 7: MAINTENANCE AND TROUBLESHOOTING

Content	Topics	Methods & materials	Key resources
7.1 Maintenance (2 hours classroom + 8 hours workshop)			Competency level: To apply
Categories of PV system maintenance	- Mechanical - Electrical	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 7.1-1: Teacher asks students to share any experiences on maintenance of electrical equipment Interactive session 7.1-2: Teacher discusses various maintenance tasks with students ⌘Workshop 7.1-1: Students define preventive maintenance tasks carry out maintenance on system components	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan
Specific maintenance activities	- Battery maintenance - Solar panel maintenance - Inverter and charge controller maintenance - Maintenance of cables and connections - Documenting maintenance activities - Maintenance schedule		
7.2 Troubleshooting (2 hours classroom + 8 hours workshop)			Competency level: To apply
Faults	- Common solar system faults - Fault finding - Troubleshooting steps	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Workshop 7.2-1: Teacher demonstrates various scenarios of failed or faulty systems to students who shall carry out troubleshooting ⌘Workshop 7.2-2: Students analyse a given failure and define troubleshooting steps	1. ♦*Photovoltaic design and installation for dummies* • Wiley Publishing Inc. 2. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan 3. ♦*Solar photovoltaic systems technical training manual* • UNESCO 4. ♦*Renewable energy resources* • John Tidwell and Tony Weir 5. ♦*Wind and solar power systems: Design, analysis and operations* • Mukund R. Patel 6. ♦*Stand-alone solar electric systems* • Earthscan

MODULE 8: ENTREPRENEURSHIP AND CUSTOMER RELATIONS

Content	Topics	Methods & materials	Key resources
8.1 Marketing and sales (4 hours classroom)			Competency level: To apply
Marketing your product	- Developing a marketing concept - Marketing tools	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Interactive session 8.1-1: Teacher engages students to share experiences selling any product Role play 8.1-1: Students engage in role play activities representing the system installer and the customer	1. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects* • Earthscan
Selling your product	- Creating the bridge - Crossing the bridge - After the bridge		
Closing the deal	- Agreeing on price - Managing expectations		
After the deal	- Customer relationship management		
8.2 Simple economic calculations (4 hours classroom)			Competency level: To apply
System costing	- Cost of components - Cost of installation - Additional costs	**Methods** Instruction, Discussion **Materials** Laptop, Projector, Speakers, Whiteboard, Markers, Metaplan cards, Metaplan pin boards **Activities** Exercise 8.2-1: Teacher introduces students to financial forecasting and gives a simple exercise for them to do Exercise 8.2-2: Teacher introduces students to financial statements and gives a simple exercise for them to do	1. ♦*Planning and installing photovoltaic systems: A guide for installers, engineers and architects*• Earthscan
Financial forecasting	- Life cycle cost analysis - Cost-benefit analysis - Payback periods		
Financial statements	- Profit & loss account - Balance sheet		