
WADADLI SOLAR LLC

Solar + Garden Electrical Fundamentals Training Series

A six-module community workforce curriculum for urban agriculture, youth, and career-changing adults

Version 1.2

Community Infrastructure Training Edition

INSTRUCTOR-READY TRAINING DOCUMENT

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NABCEP PVSI | ITC Level 1 Thermography

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Designed for delivery in community gardens, urban farms, youth development sites, and workforce programs

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Program Purpose Statement

The Solar + Garden Electrical Fundamentals Training Series is a community-centered workforce curriculum designed to give people who have been historically excluded from the clean energy economy a practical, hands-on entry point into solar and electrical trades. The program treats the community garden as a living classroom — a place where participants learn electricity by touching real wire, measuring real voltage, and powering real garden infrastructure they helped build.

The curriculum is written for learners who have never opened a breaker panel, never held a multimeter, and never seen the inside of an inverter. It assumes no prior technical background. Every concept is introduced from first principles, reinforced with physical demonstrations, and connected to a decision a working solar technician would actually make on a job site.

The goal is not to produce certified installers in six modules. The goal is to build confidence, accurate mental models, job-site vocabulary, and a clear personal line of sight to a paid role in solar or the electrical trades. Participants leave the program knowing what solar is, what it is not, what credentials to pursue, and who is hiring in their region.

Program Delivery Overview

This section summarizes the delivery structure for funding partners, agriculture boards, community organizations, and workforce development stakeholders reviewing the program at a glance.

Total Instruction Time: 12 instructional hours delivered across six sessions.

Recommended Cohort Size: 10–18 participants.

Recommended Delivery Formats:

- Six-session training series — one module per week, the standard instructor-led format.
- Weekend workshop format — a condensed pilot version delivered across one or two weekends, useful for program previews and funder site visits.
- Garden-based infrastructure cohort format — full six-session delivery paired with installation of a demonstration system at the host garden site.

Intended Participants

This program is designed for:

- Community garden members.
- Urban agriculture volunteers.
- Youth technical exposure cohorts (recommended ages 16 and up).
- Sustainability program participants.
- Beginning workforce-entry participants.
- Environmental education organizations.
- Municipal resilience initiatives.

All content is delivered from first principles and assumes no prior electrical background. The curriculum is written to remain accessible to community learners while still meeting the expectations of workforce development funders and agriculture program reviewers.

Participant Learning Outcomes

By completion of the training series, participants will be able to:

- Distinguish between AC and DC electricity concepts.
- Identify core solar system components and their functions.
- Safely use a multimeter for voltage awareness demonstrations.
- Assemble a small off-grid solar learning system.
- Estimate energy needs for irrigation pumps and garden lighting.
- Understand greenhouse ventilation energy requirements.
- Explain seasonal solar production differences.
- Understand the role of battery storage in garden resilience systems.
- Identify entry pathways into solar workforce roles.

Instructor Qualification Statement

Instruction is delivered by experienced photovoltaic field professionals with commercial solar installation, inspection, and maintenance experience. Training reflects real-world solar infrastructure practices adapted for community-level learning environments.

The lead instructor for this series is Alexis Lewis, founder of Wadadli Solar LLC. Qualifications include NABCEP PVSI certification, ITC Level 1 Thermography, thirteen years in construction, and seven years in

commercial solar — spanning installation, inspection, and operations-and-maintenance roles on projects across New York City and the Caribbean. All hands-on content has been stress-tested against the realities of rooftop, ground-mount, and community-scale installations so that what participants learn in the garden matches what working technicians do on real job sites.

Pilot Deployment Model

This training series supports optional installation of a small demonstration off-grid solar garden infrastructure system following completion of instruction. The demonstration system reinforces learning outcomes and provides a long-term educational resource for the host garden site.

The demonstration system is sized to the host garden's specific needs — commonly a combination of drip-irrigation pumping, lighting, and a security camera — and is designed so that graduating cohort members can help commission it under supervision. Once installed, the system becomes a durable teaching asset: a working, visible example of the principles taught during the six-session series, available for future cohorts and for visiting partners. The pilot deployment model is optional and is scoped separately from the training engagement; it is offered to host sites that have the space, interest, and resources to maintain the installed system beyond the training period.

Community Impact Outcomes

Community-level outcomes supported by this program include:

- Increased energy literacy within garden networks.
- Improved resilience awareness for food production infrastructure.
- Introduction to solar workforce entry pathways.
- Exposure to safe small-scale solar system assembly.
- Support for climate-adaptive agriculture practices.
- Development of locally powered garden infrastructure awareness.

These outcomes extend beyond the individual participant and into the broader network the garden operates within. A graduating cohort brings back to its community a shared vocabulary for clean energy, a shared sense of what is possible on their own site, and a shared pathway toward the workforce roles that will carry out the energy transition in their own neighborhoods.

Host Site Requirements

Host sites are expected to provide:

- Outdoor or semi-outdoor teaching space.
- Table workspace for equipment demonstrations.
- Optional shaded instruction area.
- Nearby water access recommended.
- Access to a garden infrastructure example site when available — an existing irrigation pump, greenhouse fan, security camera, or lighting run that can be walked to during the session.

Instructor Equipment Provided

The instruction team provides:

- Portable solar training kit.
- Multimeters.
- Wiring demonstration materials.
- Small battery learning system.
- Instructional safety equipment for demonstrations.

A detailed master materials checklist and an expanded Delivery Equipment Requirements section appear later in this document for instructor reference during event setup.

Participant Learning Outcomes — Expanded View

The Solar + Garden Electrical Fundamentals Training Series is measured not by credentials issued but by the specific, durable capabilities participants carry back into their gardens, neighborhoods, and working lives. By the end of the program, every participant — regardless of prior background — should be able to demonstrate each of the outcomes below.

Participant learning outcomes include:

- A working understanding of DC vs AC electricity fundamentals, including when each is used, how they differ, and why solar systems move between the two.

- Safe multimeter measurement awareness — knowing how to set the meter, verify polarity, and confirm the state of a circuit before touching any conductor.
- The ability to wire a small off-grid solar learning system from panel to charge controller to battery to load, using the correct safe sequence.
- The ability to power real garden infrastructure — pumps, lights, fans, cameras, and charging stations — using solar energy sized for the actual load.
- Seasonal energy awareness, including how solar production changes between summer and winter and what that means for planning year-round garden operations.
- Battery storage concepts, including chemistry differences, depth of discharge, cycle life, and why storage matters for autonomy and resilience.
- Solar workforce entry pathway awareness — knowing which credential to pursue first, which local programs will support them, and what a realistic 90-day next step looks like for their specific background.

These outcomes are intentionally written at a level that is meaningful to the participant, legible to an employer, and verifiable by the instructor. They represent the floor of what every learner leaves with — not the ceiling.

Garden Infrastructure Relevance Statement

Urban agriculture runs on electricity — more than most people realize. Drip irrigation pumps, compost aeration blowers, cold-frame heat mats, wash-station lighting, greenhouse exhaust fans, security cameras, and phone- and tool-charging stations all consume power. In most community gardens, that power either doesn't exist (limiting what the garden can do) or comes from an extension cord run from a neighboring building (creating cost, safety, and dependency problems).

The specific infrastructure categories this curriculum connects to solar include:

- Irrigation pumps — DC surface pumps and submersible pumps that move water through drip lines, soaker hose, and fill tanks.
- Greenhouse ventilation fans — DC exhaust and circulation fans that keep seedling spaces and hoop houses within safe temperature ranges.
- Security lighting — path lighting, perimeter flood lighting, and motion-activated lights that protect tools, beds, and volunteers after dusk.
- Environmental monitoring sensors — soil moisture, soil temperature, air temperature, and humidity sensors that feed scheduling decisions and data-logging equipment.

- Camera systems — 24/7 security and wildlife monitoring cameras, including cellular-backhaul systems that stay online during grid outages.
- Tool charging stations — benches that keep cordless drills, trimmers, and small mowers ready for volunteer workdays.
- Seedling propagation equipment — heat mats, low-wattage grow lights, and small bench-top ventilation used in early-season seed starting.

Solar changes the equation. A correctly sized off-grid or hybrid solar system lets a garden operate independently: pumps run on schedule, lights come on at dusk, cameras stay online during storms, and volunteer tools stay charged without anyone paying a utility bill. For gardens operating on vacant lots, church properties, NYCHA grounds, or leased parcels where permanent grid service is not realistic, solar is often the only viable path to reliable power.

This curriculum teaches solar with the garden always in the frame. Every sizing example, every wiring exercise, and every component choice is tied to an actual garden use case — an irrigation pump, a compost blower, a security camera, a propagation bench — so participants finish the program able to look at their own garden and describe what a workable solar system would look like, what it would cost, and what it would power.

Workforce Alignment Statement

Solar is the fastest-growing energy sector in the United States, and New York State has positioned itself as a national leader through NY-Sun, NYSERDA workforce development programs, Local Law 97, and the IBEW Local 3 solar apprenticeship track. The industry needs installers, operations and maintenance technicians, system designers, project managers, inspectors, and sales staff — and it needs them from the communities where projects are being built.

This training series is explicitly aligned with that pipeline. Module content maps to the knowledge areas tested on the NABCEP PV Associate exam, which is the recognized entry-level credential for the solar industry. Safety content previews what learners will see in OSHA 10, OSHA 30, and NFPA 70E coursework. The career-pathways module connects directly to NY-Sun contractors, NYSERDA-funded training providers, Solar One youth programs, IBEW Local 3, and FAA Part 107 drone inspection certification.

Participants who complete this series are prepared to: (1) sit for the NABCEP PV Associate exam with a realistic 2–3 months of additional self-study, (2) apply for entry-level solar helper positions with small residential installers, (3) enter NYSERDA-sponsored workforce programs, (4) apply for IBEW

apprenticeship, or (5) pursue adjacent paths in solar sales, project coordination, and drone-based inspection where technical literacy is the differentiator.

Program at a Glance

Program Goals

1. Teach basic electrical literacy in both DC (direct current) and AC (alternating current) systems.
2. Teach how photovoltaic solar systems actually convert sunlight into usable electricity.
3. Provide supervised hands-on wiring experience with a complete working off-grid system.
4. Teach the specific ways solar powers garden and urban-agriculture infrastructure.
5. Teach battery sizing math and seasonal energy planning for year-round operation.
6. Introduce concrete workforce pathways into solar installation and the electrical trades.

Module Overview

Module	Title	Estimated Time
1	Electricity Fundamentals	90 minutes
2	How Solar Works	90 minutes
3	Hands-On Mini Off-Grid System Build	120 minutes
4	Solar Applications for Community Gardens	75 minutes
5	Battery Systems and Seasonal Energy Planning	90 minutes
6	Career Pathways in Solar and Electrical Trades	60 minutes

Audience and Access

This curriculum is written to be legible and useful for adult learners with no prior electrical experience. Specific audiences include:

- Community garden participants and urban agriculture volunteers who want to add or upgrade solar power at their site.
- Youth workforce-entry learners (ages 16+) exploring clean energy as a career.
- Returning citizens seeking on-ramps into trade careers with strong earning potential.
- Career changers from construction, maintenance, administrative, retail, and service-sector backgrounds.
- Adults with no prior electrical background who are curious, cautious, or both.

All content is taught from first principles. Jargon is defined before it is used. Every module includes a physical, sensory activity so that concepts land through the hands as well as the ears.

Delivery Format Options

The curriculum is designed to be delivered in three formats, depending on the host organization's calendar and the cohort's availability.

OPTION A — SINGLE-SESSION INTENSIVE (1 DAY, 6–7 HOURS)

Delivered as a full-day community event. Best for one-time workshops, festival programming, and garden open-house days.

Module 1 and Module 2 delivered in the morning. Lunch break. Module 3 hands-on build after lunch. Modules 4, 5, and 6 delivered as shorter blocks in the afternoon with an extended Q&A close.

Trade-off: less time per module, less take-home homework, but high momentum and strong community feel.

OPTION B — 3-WEEK WORKSHOP SERIES (3 SESSIONS OF ~2.5 HOURS)

Week 1: Modules 1 and 2 combined. Homework — participants bring their own utility bill to Week 2.

Week 2: Module 3 mini off-grid build, plus Module 4 applications discussion.

Week 3: Modules 5 and 6. Invite a local solar business owner, IBEW apprentice, or Solar One graduate as a guest.

Trade-off: moderate depth, works well for neighborhood programs with working-adult participants.

OPTION C — 6-WEEK FULL SERIES (6 SESSIONS OF ~90 MINUTES)

One module per week. Recommended for deep workforce-development cohorts, youth programs, and returning-citizen reentry programs.

Allows homework, guest speakers, site visits, and individual sizing projects between sessions.

At the end of Week 6 each participant completes a capstone: a written system design for a real community garden, sized for their actual loads and climate.

Trade-off: highest depth, strongest workforce outcome, requires consistent participant attendance.

MODULE 1**Electricity Fundamentals**

What electricity is, how to talk about it, and how to stay safe around it.

Estimated Time	90 minutes (flexible to 60 or 120)
Delivery Mode	Whiteboard instruction + benchtop demonstration
Prior Knowledge	None required
Group Size	8 to 20 participants

Learning Objectives

By the end of this module, participants will be able to:

- Define voltage, current, resistance, and power in everyday language, and explain the relationship $P = V \times I$.
- Describe the difference between direct current (DC) and alternating current (AC) and give one real-world example of each.
- Identify the positive (+) and negative (-) terminals of a DC source and explain what reverse polarity is.
- Explain what a fuse does, what a breaker does, and why both are required safety devices.
- State the core solar safety rule: a PV panel in sunlight is always energized, even when nothing else is switched on.
- Read DC voltage with a digital multimeter on a known source.

Core Concepts**VOLTAGE (VOLTS, V)**

Voltage is electrical pressure — the push that moves electrons through a wire. Water analogy: voltage is the pressure in the pipe. No pressure, no flow, even if the pipe is full.

CURRENT (AMPS, A)

Current is the rate of electron flow. Water analogy: gallons per minute. A thin wire can carry only a little current before it overheats, which is why wire size matters.

RESISTANCE (OHMS, Ω)

Resistance is anything that opposes current flow — the narrowness of the pipe. Loads (lights, pumps, fans) are intentional resistance; corrosion and loose connections are accidental resistance, and accidental resistance is where fires start.

POWER (WATTS, W)

Power is the actual work being done — light produced, water pumped, heat generated. The relationship is simple and it is the single most important equation in this course:

$$\text{Watts} = \text{Volts} \times \text{Amps}$$

A 12-volt pump that draws 5 amps consumes 60 watts. A 120-volt coffee maker that draws 10 amps consumes 1,200 watts. This equation is used in every module that follows.

DC VS AC

Direct current (DC) flows in one direction, steadily, like water through a garden hose. Batteries and solar panels produce DC. Alternating current (AC) reverses direction 60 times per second (in the U.S.). The grid delivers AC, and most household appliances run on AC. An inverter is the device that converts DC from a solar panel or battery into AC for household loads.

POLARITY

Every DC circuit has a positive (+) terminal and a negative (–) terminal. Connecting them backwards is called reverse polarity. Reverse polarity can destroy charge controllers and inverters in a fraction of a second. Modern charge controllers usually include reverse-polarity protection, but participants should never rely on the device to save them — they should always verify polarity with a multimeter before connecting.

FUSES AND BREAKERS

A fuse is a one-time sacrificial device: too much current melts a metal strip inside and opens the circuit. A breaker does the same job but is resettable — flip the switch and it is back in service. Every solar system has fuses or breakers on the DC side (between panels, charge controller, and battery) and on the AC side (between inverter and loads). These are not optional — they are the difference between a blown component and a fire.

SOLAR SAFETY AWARENESS

This is the most important point in Module 1. A PV panel in sunlight produces voltage the instant light hits it. There is no breaker on the panel itself. Covering the panel is not enough to fully de-energize it. Technicians working on active PV arrays treat every conductor as live, always verify voltage with a meter, and follow specific lockout/tagout procedures governed by NFPA 70E. In this course, participants will not handle energized conductors — but they must leave the module understanding why solar work is different from ordinary residential electrical work.

BEGINNER ELECTRICAL RESPECT

Before any tool is picked up or any wire is stripped, participants should internalize a small set of entry-level habits that working electricians treat as non-negotiable. These are the habits that keep new learners safe and that keep job-site mentors willing to take them on. The curriculum introduces them here and reinforces them every time a kit is opened.

- Treat every conductor as energized until you have personally verified with a multimeter that it is not — even wires your instructor just disconnected.
- Inspect insulation before use. Any wire with cracked, nicked, or heat-damaged insulation is removed from the kit and replaced, not taped over.
- Use insulated tools for any task near live conductors. Screwdrivers, pliers, and wire strippers rated for electrical work have clearly marked voltage ratings on the handle.
- Keep one hand in your pocket when probing DC voltage above 30 V. This is a long-standing trade habit that prevents current from crossing the chest if you slip.
- Remove rings, watches, and metal bracelets before any hands-on work. Conductive jewelry has caused more burn injuries than high-voltage arcs.
- Safety glasses on before the kit opens. Closed-toe shoes required for any hands-on station.
- Work in pairs. One person wires, one person watches — and roles swap on the next step. No one works alone.
- If something does not feel right — warm wire, odd smell, loose terminal, sudden meter reading you cannot explain — stop, step back, and ask. Stopping is a professional skill, not a failure.

These habits are simple, but they are the difference between a learner who becomes a professional and one who learns the hard way. Teach them at the start, refer back to them by name at every hands-on station, and model them yourself every time you handle equipment in front of the class.

HANDS-ON ACTIVITY — MULTIMETER INTRODUCTION

Materials: one digital multimeter per 3–4 participants, one AA battery per group, one small DC source (9V battery or bench power supply), red and black test leads.

Steps: (1) Set the meter to DC voltage, 20V range. (2) Touch the black probe to the negative terminal of a AA battery, red probe to the positive terminal. Read ~1.5 V. (3) Reverse the probes. Read -1.5 V. Use this moment to teach what polarity is. (4) Measure the 9V battery. Ask participants to predict the reading before they see it. (5) Measure a dead battery from a prop bin and compare.

Teaching point: the meter does not care if you are right. It reports what is actually there. This is the core habit of every electrical technician — measure, don't assume.

Materials Required

- Whiteboard or flip chart with markers (for Watts = Volts × Amps equation and water analogy).
- One digital multimeter per 3–4 participants (Fluke 101 or Klein MM300 level is sufficient).
- AA, 9V, and dead batteries (assorted) for voltage measurement practice.
- One 15A household fuse and one 20A breaker as show-and-tell props.
- One solar panel (20–100 W) kept covered until the end of class — used to preview Module 2.

Facilitation Notes

Lead with the water analogy before any electrical vocabulary. Most adults have intuition for water pressure and flow; that intuition transfers almost perfectly to voltage and current. Do not draw circuit diagrams until after the analogy is established. When introducing the safety rule about PV panels, uncover the covered panel, aim it at a window, and read the open-circuit voltage live on a multimeter — this single moment does more teaching than ten minutes of slides.

MODULE 2**How Solar Works**

From a photon hitting silicon to an outlet turning on — the whole journey, in plain language.

Estimated Time	90 minutes
Delivery Mode	Demonstration + small-group discussion
Prior Knowledge	Module 1 (voltage, current, DC vs AC)
Group Size	8 to 20 participants

Learning Objectives

By the end of this module, participants will be able to:

- Describe the photovoltaic effect in one or two sentences, using their own words.
- Trace the flow of energy from a solar panel through a charge controller or inverter to a load.
- Name three inverter types (string, microinverter, optimizer) and explain when each is used.
- Explain why even partial shade on one panel can disproportionately reduce a string's output.
- Define tilt and azimuth and state the approximate optimal values for the northeastern United States.
- Describe how high temperature reduces panel output (counterintuitive — hotter does not mean more power).
- Compare grid-tied, off-grid, and hybrid system architectures and identify which fits a given garden scenario.

Core Concepts**THE PHOTOVOLTAIC EFFECT**

Sunlight is made of particles called photons. When a photon strikes a silicon solar cell, it knocks an electron loose. The cell is engineered so that the freed electron has only one direction it can travel — through the external wire. A moving electron is electricity. No moving parts, no combustion, no noise. A solar panel is effectively a very quiet, very patient battery charger powered by light.

THE ENERGY FLOW

For a grid-tied system: panel (DC) → inverter (DC-to-AC) → main breaker panel → household loads → utility grid (for surplus). For an off-grid system: panel (DC) → charge controller (regulates DC) → battery (DC storage) → inverter (DC-to-AC if AC loads are needed) → loads. The order of the components matters. The charge controller must sit between the panel and the battery — never the other way around — because its job is to protect the battery from being overcharged by the panel.

INVERTER TYPES

Inverter Type	How It Works	Best Used When
String inverter	One inverter for all panels in a string. Cheapest option.	Full sun, no shade, simple rectangular roofs.
Microinverter	One small inverter on the back of each panel. Each panel operates independently.	Any shade; complex roof with multiple orientations.
Power optimizer	DC optimizer per panel, feeding one central inverter. Middle-ground solution.	Mostly sunny sites with occasional shade; cost-sensitive.

SHADE IMPACT

A single shaded cell on a single panel wired in series with others can drag down the entire string's output — in some cases by 50 percent or more for what looks like a minor shadow. This is why microinverters and optimizers exist: they isolate each panel so a shaded one only loses its own production, not the whole string's. For community gardens near buildings, trees, and fences, shade management is not a detail — it is often the single biggest design decision.

TILT AND AZIMUTH

Azimuth is the compass direction a panel faces. 180 degrees is due south, which is optimal in the northern hemisphere. Tilt is the angle above horizontal. For the northeastern United States, 30–35 degrees is roughly optimal for year-round production; a steeper tilt (closer to local latitude plus 15 degrees) favors winter production, which matters when your winter loads are highest. A garden with south-facing chain-link along 139th Street and a flat tool-shed roof has two very different production profiles — the curriculum teaches how to tell them apart.

TEMPERATURE EFFECTS

This one surprises almost every new learner. Hot panels produce less power than cool panels. Every panel has a temperature coefficient, typically around -0.35% per $^{\circ}\text{C}$ above 25°C . On a 95°F rooftop in July, a panel rated for 400 W at Standard Test Conditions will produce closer to 340–360 W. This is why panel spec sheets always list two numbers: STC (idealized lab conditions) and NOCT (more realistic outdoor conditions). Always size with real-world numbers.

SYSTEM TYPES

System Type	Description	Typical Garden Use
Grid-tied	Panels feed an inverter that feeds the building panel. Surplus goes back to the utility for net-metering credit. No power during a grid outage.	Community garden attached to a building with Con Ed service — offsets the host's utility bill.
Off-grid	Panels feed a charge controller, which charges batteries. Loads pull from the battery through an inverter. No utility connection at all.	Vacant-lot gardens, NYCHA lots with no available service, rural or Caribbean sites.

System Type	Description	Typical Garden Use
Hybrid	Grid-tied plus batteries. Runs grid-tied normally, runs off batteries during outages.	Gardens in food-security or storm-resilience roles — keeps pumps and cold storage running when the grid goes down.

HANDS-ON ACTIVITY — PANEL + MULTIMETER SHADOW EXPERIMENT

Materials: one 20–50 W solar panel, one digital multimeter set to DC voltage, a clipboard for recording readings. Outdoor or strong-window setting required.

Steps: (1) Place the panel in full direct sun. Measure Voc (open-circuit voltage) and write it on the clipboard. (2) Have a participant shade one-quarter of the panel with their hand. Re-measure. (3) Shade a single cell with one finger. Re-measure. (4) Remove all shade and verify voltage recovers.

Teaching point: Voc responds almost instantly to light. This is also the moment to remind participants that the panel is live — they just watched it work — and to reinforce the Module 1 safety rule. A panel is always an energized source the moment light hits it.

Materials Required

- One 20–100 W solar panel with MC4 leads.
- One digital multimeter with DC voltage setting.
- Printed panel spec sheet for the panel being used (to illustrate STC vs NOCT).
- Compass or phone compass app (for azimuth demonstration).
- Printed single-sheet diagram of the three system types (grid-tied, off-grid, hybrid).

Facilitation Notes

Hand the panel to a participant before discussing any spec numbers. Adults and youth alike retain more when they have physically held the equipment. When discussing shade, walk the group outside and point to actual shadows cast by chimneys, trees, and adjacent buildings. If the host garden already has a solar installation, Module 2 is the natural place to walk over to it and read the labels on the inverter together.

MODULE 3**Hands-On Mini Off-Grid System Build**

Assemble a complete, working solar power system from panel to load — and measure every step.

Estimated Time	120 minutes (can extend to 150 with full debrief)
Delivery Mode	Small-group hands-on stations (3–4 participants per kit)
Prior Knowledge	Modules 1 and 2
Group Size	8 to 16 participants, minimum one kit per 4 people

In this module, participants assemble and test a functioning off-grid solar learning system capable of powering real garden infrastructure equipment. The kit is not a toy — it is a scaled-down but fully operational version of the systems they will encounter on a working community garden site. By the end of the module, every group will have energized a panel, charged a battery, and powered a live load they can see, hear, or feel. This is the moment the curriculum stops being theoretical.

Learning Objectives

By the end of this module, participants will be able to:

- Name the four core components of an off-grid system and describe the role of each.
- Connect a panel → charge controller → battery → load in the correct sequence, with correct polarity, under instructor supervision.
- Measure DC voltage at each connection point and interpret the reading.
- Measure DC current draw of a load and calculate its power in watts.
- Calculate the watt-hour consumption of a given load over a 24-hour day.
- Describe what happens (and what modern charge controllers do to prevent damage) when polarity is reversed.

Core Concepts**THE SAFE WIRING SEQUENCE**

Every off-grid install follows the same sequence, and this sequence is not arbitrary — it is designed so that no component ever sees voltage before it is ready. Participants must follow it every time:

7. Mount the panel. Keep it covered or face-down until step 5.
8. Connect the battery to the charge controller **FIRST**. The controller needs to see battery voltage to know what system (12 V / 24 V / 48 V) it is working with.
9. Connect the load output of the charge controller to any DC loads (if applicable).

10. Verify all connections visually and with a multimeter. Confirm polarity everywhere.

11. Only then — connect the panel to the charge controller, and uncover the panel. Watch the charge indicator come on.

Reversing this sequence (connecting the panel before the battery) can permanently damage many charge controllers. Teach this sequence as muscle memory.

REVERSE POLARITY DEMONSTRATION

Under controlled conditions, and with a charge controller that is specifically rated to handle it (most modern units are), demonstrate what happens when panel polarity is reversed. Most controllers will show a fault code or simply refuse to engage. Use this moment to explain that the protection is a second line of defense, not the first — the first line is the technician verifying with a meter.

LOAD MEASUREMENT EXERCISE

Once the system is wired and the LED or fan is running, have each group measure the current draw of their load. Set the multimeter to DC amps, put it in series with the load (this is the only time in the class where the meter goes in series, and it is worth pausing to explain the difference between series and parallel measurement).

WATT-HOUR CALCULATIONS

Watt-hours is how energy is billed, how batteries are sized, and how production is compared across systems. The math is simple:

$$\text{Watt-hours per day} = \text{Watts} \times \text{Hours of Use per day}$$

A 10 W LED that runs 4 hours per day uses 40 Wh per day. A 20 W drip pump that runs 6 hours per day uses 120 Wh per day. Total daily consumption = sum of all loads. This total is the number that drives panel sizing and battery sizing for every example in Modules 4 and 5.

HANDS-ON STATION — MINI OFF-GRID KIT BUILD

Materials per kit (one per 3–4 participants): one 50–100 W solar panel with MC4 leads, one PWM charge controller (Renogy Wanderer 10A, EPEver VS-1024A, or equivalent), one 12 V 7 Ah sealed lead-acid or small LiFePO4 battery, one 12 V LED strip or small 12 V fan as the load, pre-cut 10–12 AWG wire with appropriately sized ring or fork terminals, one digital multimeter, one in-line fuse holder with 10 A fuse, safety glasses for each participant.

Process: Instructor walks through the full safe wiring sequence with one kit in front of the whole group. Then small groups repeat the sequence on their own kits with an instructor at each station. Each group measures voltage at the battery terminals, voltage at the panel terminals under load, and current through the load. Each group records all three numbers and calculates power.

Payoff moment: after the full circuit is energized, the LED lights up (or the fan spins). This is the single most memorable moment of the entire curriculum. Pause here. Let it land. Take a group

photo.

Materials Required

- One complete mini off-grid kit per 3–4 participants (see station description above).
- One digital multimeter per kit (ideally a second meter per kit for parallel-vs-series measurement).
- Safety glasses for every participant — non-negotiable.
- Printed wiring diagram, one per participant, showing the four components and correct connection order.
- Printed watt-hour calculation worksheet, one per participant.
- Incident response kit (basic): gloves, insulated screwdriver set, fuse replacements.

Facilitation Notes

Safety glasses on before any kit is opened. Instructor-to-kit ratio should be 1:1 where possible, 1:2 absolute minimum. Do not let participants proceed past any step until an instructor has visually confirmed polarity. Expect at least one group to wire something backwards — this is a teaching moment, not a failure, but only if the charge controller includes reverse-polarity protection, which is why the materials list specifies models that do.

If a participant is visibly nervous about handling wire and tools, pair them with a more confident partner and give them the multimeter role first. Measuring builds confidence; the wiring follows.

MODULE 4**Solar Applications for Community Gardens**

Seven real garden uses for solar power — with sizing examples participants can defend.

Estimated Time	75 minutes
Delivery Mode	Case-study walkthroughs + small-group sizing exercises
Prior Knowledge	Modules 1–3 (especially watt-hour math)
Group Size	8 to 20 participants

In this module, participants estimate energy needs for pumps, lighting systems, cameras, and ventilation loads commonly used in gardens. Each load category is introduced with a realistic wattage range, a typical duty cycle, and a worked watt-hour estimate — so participants leave with a practical method for turning any garden's wish list into a defensible daily energy budget. This is the bridge between Module 3's hands-on build and Module 5's battery and seasonal sizing math.

Learning Objectives

By the end of this module, participants will be able to:

- Identify seven common solar-powered applications in an urban agriculture setting.
- Estimate daily watt-hour consumption for each application using realistic run-time assumptions.
- Match each application to an appropriate system architecture (DC-only, AC-inverter, hybrid).
- Identify the two or three applications best suited to the learner's own garden.

Seven Garden Applications**1. SOLAR IRRIGATION PUMPS**

A 12 V or 24 V DC surface pump or submersible pump runs directly off a solar-charged battery bank. Typical drip irrigation for a ¼-acre garden plot needs 20–60 W of pumping power running 2–6 hours per day — which is 40 to 360 Wh per day. A dedicated 100 W panel and a 50 Ah lithium battery will run this workload comfortably in summer.

Sizing example: 40 W pump × 4 hours/day = 160 Wh/day. Add 20 % margin for pipe resistance and inefficiency = 192 Wh/day. A 100 W panel produces ~400 Wh/day in summer sun, so the pump has 2× production margin.

2. COMPOST AERATION BLOWERS

Active aeration shortens compost cycles from months to weeks. A small 12 V DC blower (30–60 W) runs on a duty cycle — typically 15 minutes on, 45 minutes off, around the clock. That's 6 hours of total run time per day.

Sizing example: 50 W blower × 6 hours/day = 300 Wh/day. This is a continuous year-round load, so it is the application most affected by seasonal variation — Module 5 addresses this directly.

3. GARDEN LIGHTING

LED path lights, tool-shed lighting, and event lighting. Loads are low (5–20 W per fixture) but run at night, so every watt-hour comes out of the battery, not directly from the panel. This is the simplest sizing exercise in the curriculum.

Sizing example: 10 W LED × 4 hours/night = 40 Wh/day. Ten fixtures = 400 Wh/day. Round up for winter — Module 5 math — and this is a 1,000–1,200 Wh/day system before you account for any other loads.

4. SECURITY CAMERAS

Always-on, 24/7 loads. Even a low-power 5 W camera is 120 Wh/day, every day, winter included. A four-camera installation is approaching 500 Wh/day on its own. Security loads are small but relentless — the curriculum treats them as the baseline load the system must carry year-round, regardless of what else is running.

5. GREENHOUSE VENTILATION FANS

Summer-heavy load. A 60 W DC exhaust fan runs 6–10 hours a day in July but near-zero in January. Solar works exceptionally well here because production matches demand seasonally — the fan needs the most power on the sunniest days.

Sizing example: 60 W fan × 8 hours/day (summer peak) = 480 Wh/day — but only for 3–4 months of the year.

6. PHONE CHARGING STATIONS

Community-facing amenity. Often the first thing a garden wants to add because it is low-cost and visibly valuable to visitors. A 6-port USB charging station pulls 30–50 W when fully loaded — but is rarely fully loaded. Plan for 50 W × 3 hours/day average = 150 Wh/day. A single 100 W panel and a 20 Ah battery runs this easily.

7. TOOL CHARGING STATIONS

Battery-powered drills, trimmers, and mowers. Loads are intermittent but high: a cordless mower charger can pull 300–400 W for 60–90 minutes. Sizing should assume one charge cycle per day: 400 W × 1 hour = 400 Wh/day, concentrated in one burst. This argues for a battery bank that can deliver high current, which means LiFePO₄ is generally preferable to lead-acid (see Module 5).

APPLIED SIZING EXERCISE — PICK YOUR THREE

Each participant picks the three applications most relevant to their own garden. They calculate daily Wh for each and sum the total. Groups of 3–4 then compare totals and discuss why they differ.

Most participants will land somewhere between 400 Wh/day (small volunteer plot with lights only) and 2,500 Wh/day (active food-production site with pumps, security, tools, and greenhouse fans).

This total becomes the starting point for Module 5's battery-and-autonomy sizing math.

Materials Required

- Printed one-page reference card for each of the seven applications, with a realistic wattage range and a sample sizing calculation.
- Calculators (or participants' phone calculators).
- Optional: physical examples of two or three load types — a 12 V LED strip, a 12 V computer fan, a USB charging hub — to pass around.

Facilitation Notes

This is the module where the curriculum connects to the participant's real life. Resist the urge to sell solar. Instead, help participants find honest answers — including the answer 'this load isn't worth solarizing, run it off a small generator on event days.' Credibility comes from accurate recommendations, not universal ones.

MODULE 5

Battery Systems and Seasonal Energy Planning

How batteries actually work, and how to size them for a real New York winter.

Estimated Time	90 minutes
Delivery Mode	Whiteboard math + worked examples
Prior Knowledge	Modules 1–4 (especially watt-hour calculations)
Group Size	8 to 20 participants

In this module, participants compare summer vs winter solar production expectations and understand how storage supports multi-day resilience planning. The seasonal swing in New York is nearly 3× between June and December, and the implication is not theoretical — it determines how many panels a garden needs, how much battery capacity it needs, and whether the system will still be running when the first cold snap arrives in late November. Storage is the hinge that connects daily production to multi-day resilience when clouds, storms, or winter reduce what the panels can deliver.

Learning Objectives

By the end of this module, participants will be able to:

- Compare lead-acid and LiFePO₄ batteries across cost, weight, usable capacity, and cycle life.
- Define depth of discharge (DOD) and explain why 80 % DOD is the LiFePO₄ working standard and 50 % DOD is the lead-acid working standard.
- Size a battery bank for a given daily load and a specified number of days of autonomy.
- Estimate the seasonal difference in solar production between June and December for a New York latitude.
- Identify safe indoor and outdoor storage practices for lead-acid and lithium batteries.

Core Concepts

BATTERY CHEMISTRY: LEAD-ACID VS LIFEPO₄

Attribute	Flooded / Sealed Lead-Acid	LiFePO ₄ (Lithium Iron Phosphate)
Cost per kWh	\$100–\$180 / kWh (low upfront)	\$400–\$600 / kWh (higher upfront)
Usable depth of discharge	~50 % (cycle life drops fast below this)	80–95 % (designed to be used this way)
Cycle life	300–1,200 cycles	3,000–6,000+ cycles
Weight per kWh	Heavy — ~30 kg / kWh	Light — ~7 kg / kWh

Attribute	Flooded / Sealed Lead-Acid	LiFePO4 (Lithium Iron Phosphate)
Cold-weather behavior	Loses ~30 % capacity at 0 °C; tolerates freezing	Must not charge below 0 °C without built-in heater
Failure mode	Gradual capacity loss, sulfation	Sudden shutdown at low SOC; BMS protection
Current standard for new installs	Budget / legacy use only	Industry standard for new off-grid work

DEPTH OF DISCHARGE (DOD)

DOD is the percentage of rated capacity the system is designed to actually use. For lead-acid, dropping below 50 % DOD repeatedly halves the battery's lifespan. For LiFePO4, 80 % DOD is the working assumption and 90 % DOD is acceptable occasionally. This number is not a detail — it changes every battery sizing calculation.

CYCLE LIFE

One cycle = one full charge + one full discharge. A LiFePO4 battery cycled once a day at 80 % DOD will last 8–16 years before it reaches 80 % of its original capacity. A lead-acid battery cycled the same way at 50 % DOD will last 1–3 years. Over the life of a community-garden install, LiFePO4 is almost always the cheaper option — the upfront-vs-lifetime math is worth working through with the class.

BATTERY SIZING MATH

The core formula:

$$\text{Battery capacity (Wh)} = \text{Daily Load (Wh)} \times \text{Autonomy Days} \div \text{DOD}$$

Autonomy is how many days the system must run without any solar production — typical values are 2 days for mild climates and 3 days for New York winters. Worked example: a garden uses 500 Wh/day, wants 2 days of autonomy, and uses LiFePO4 at 80 % DOD. Required capacity = $500 \times 2 \div 0.80 = 1,250$ Wh, which rounds up to a standard 100 Ah / 12 V LiFePO4 battery (1,280 Wh).

WINTER VS SUMMER PRODUCTION

At New York's latitude (~41 °N), a fixed south-facing array tilted at 35 degrees produces roughly 4.5–5.5 peak sun hours per day in June and only 2.0–2.5 peak sun hours per day in December. That is nearly a 3× seasonal swing. Panel sizing must be driven by December, not June — or the system simply stops working in January. A year-round off-grid garden system in NYC typically needs 2–2.5× as much panel wattage as the summer math alone would suggest.

AUTONOMY PLANNING

Autonomy = days of no sun the system can cover on battery alone. Three days of autonomy is standard for New York off-grid installations (cloudy stretches in January and February routinely last 3+ days). For Caribbean installations, 1.5 days is often sufficient because of more consistent year-round production.

STORAGE PLACEMENT AND SAFETY

Lead-acid batteries outgas hydrogen during charging and must be stored in a ventilated enclosure, never sealed. LiFePO4 batteries do not outgas and can be installed indoors, but must not be allowed to charge below 0 °C (~32 °F) without an internal heater or thermal management. In a garden tool shed in Queens, this means LiFePO4 with self-heating BMS is the right call for winter use. Neither chemistry should be stored on bare concrete floors (cold sink), near combustible material, or in direct sun.

APPLIED SIZING EXERCISE — FOUR LOADS, ONE BATTERY BANK

Each participant sizes a battery bank for the following combined load: LED garden lighting (400 Wh/day), irrigation pump (200 Wh/day winter / 400 Wh/day summer), one security camera (120 Wh/day year-round), one phone/tool charging station (300 Wh/day average).

Total average daily load: 1,020 Wh (winter) / 1,220 Wh (summer).

Design criteria: 3 days autonomy, LiFePO4 at 80 % DOD.

Required capacity (winter case): $1,020 \times 3 \div 0.80 = 3,825 \text{ Wh}$ → round up to 4,096 Wh → that's 2 × 200 Ah 12V LiFePO4 batteries in parallel, OR 1 × 100 Ah 48V LiFePO4.

Participants who finish early: size the panel array for the same system using a 2.5 peak-sun-hour December assumption.

Materials Required

- Whiteboard or flip chart for working the math live.
- Printed battery comparison sheet (the lead-acid vs LiFePO4 table).
- Printed sizing worksheet with 4 blank load lines and a summary calculation block.
- Solar production chart or printed reference showing peak sun hours by month for the local zip code (NREL PVWatts data — free).
- Optional: one representative lead-acid battery and one LiFePO4 battery for hands-on weight comparison (participants are always surprised).

Facilitation Notes

Let participants hold the lead-acid and lithium batteries back-to-back if at all possible. The weight difference — a 100 Ah AGM is ~65 lb, a 100 Ah LiFePO4 is ~30 lb — makes the chemistry tradeoff tangible in a way no spec sheet can. Work the sizing math slowly and deliberately on the board. Many adult learners disengage from math-heavy content, so break the calculation into three clearly-labeled steps (daily load → capacity required → round up to real product) and let participants call out each step as you go.

MODULE 6

Career Pathways in Solar and Electrical Trades

From this workshop to a paid role — specific credentials, specific programs, specific next steps.

Estimated Time	60 minutes
Delivery Mode	Presentation + individual pathway conversations
Prior Knowledge	Modules 1–5 (so participants have technical vocabulary to discuss roles)
Group Size	8 to 20 participants

Learning Objectives

By the end of this module, participants will be able to:

- Name five distinct career tracks in the solar industry and describe the focus of each.
- Match their own background (construction, electrical, administrative, student, no trade background) to a realistic entry path.
- Identify the one credential most appropriate for them to pursue first.
- Name at least three NY State programs or organizations that provide free or low-cost training.
- Describe a 90-day action plan for their next steps.

Entry-Level Career Roles to Target First

Before reviewing the five major tracks, participants should understand the specific entry-level job titles that are realistic first steps out of this program. These are the roles most likely to hire learners with this curriculum on their résumé, and each connects directly to one of the tracks described below.

- Solar installer helper — on-crew entry role, 3–6 months typical to move to installer. Hires with no experience at many residential shops.
- Electrical apprentice — formal apprenticeship through IBEW Local 3 or a state-registered program. Paid learning with full benefits on day one.
- Maintenance technician — O&M role on completed systems. Service calls, diagnostics, periodic inspections. Strong path for anyone with mechanical or electrical aptitude.
- Energy auditor assistant — supports certified energy auditors on residential and commercial building audits. Adjacent to solar and a strong credential-building role.
- Community resilience technician — emerging role with nonprofits, community solar developers, and municipal resilience programs. Installs, maintains, and educates on community-scale solar-plus-storage systems in underserved neighborhoods.

Each of these roles maps to one of the five tracks described next. Treat the tracks as the longer career arc and these titles as the realistic first paycheck.

The Five Career Tracks

Track	What You Do	Entry Path	Key Credentials
Solar Installer	Physical install work — mounting panels, wiring, commissioning. Entry-level, on-site, crew-based.	Helper → Installer → Lead → Foreman. Most residential installers started as helpers with no experience.	OSHA 10, NABCEP PV Associate
O&M Technician	Operations and maintenance — diagnostics, service calls, thermal inspections on live systems.	Electrical or construction background is a major advantage.	NABCEP PVSI, ITC Level 1 Thermography, NFPA 70E
System Designer	Engineering role. Energy modeling, PVsyst / HelioScope / AutoCAD layouts, interconnection permitting.	Engineering degree or strong field experience. Mid-career transition is common.	NABCEP PVA + software proficiency
Project Manager	Runs jobs — permits, crews, subcontractors, utility interconnection, schedule.	Construction-PM or general-contractor background transfers directly.	PMP (optional), OSHA 30
Electrical Apprenticeship	Union path — journeyman electrician with solar specialization. Highest earning ceiling.	IBEW Local 3 apprenticeship (5 years, paid).	Journeyman license, NFPA 70E, state electrical license

Entry Paths by Background

IF YOU HAVE CONSTRUCTION EXPERIENCE

You are already qualified to be a helper on a solar crew. Most residential installers started exactly here. Next steps: (1) get OSHA 10 — free or low-cost in NYC through the OSHA Education Center. (2) Study for the NABCEP PV Associate exam, 2–3 months of self-study is realistic. (3) Apply to small residential installers first — they hire faster than large commercial EPCs.

IF YOU HAVE AN ELECTRICAL BACKGROUND

You are immediately competitive for O&M technician roles and command a higher starting wage. Next steps: (1) target NABCEP PVSI, the professional-level credential — that's the gold standard. (2) Apply directly to Bright Power, SunPower, EDF Renewables, and any of the major NYC-area EPCs. (3) If you are already an IBEW member, ask your local about the Local 3 solar apprenticeship track.

IF YOU HAVE NO TRADE BACKGROUND

You are not behind — you are at the most common starting point. Next steps: (1) sit for the NABCEP PV Associate. No prerequisites. This is the credential that tells employers you are serious. (2) Look into NYSERDA's clean-energy workforce programs and the nonprofit training ecosystem (SUNY programs, Solar One). Many are free to NYC residents. (3) Sales and project-coordination roles do not require a

trade background — technical knowledge is your differentiator. (4) Community-solar programs (like the ones operated under NY-Sun) hire customer-facing staff with no prior solar experience.

FOR YOUTH AND STUDENTS (16–24)

(1) Solar One (solar1.org) runs free youth solar training in NYC — this is the single best on-ramp for NYC teens. (2) CUNY has a Sustainable Building and Energy Management track at several campuses. (3) FAA Part 107 drone pilot certification (roughly \$150 and a single exam) paired with solar knowledge opens inspection and survey roles — this is an underrated fast path. (4) Volunteer or intern on a community installation (including this one) — that is legitimate resume experience.

FOR RETURNING CITIZENS

Solar is one of the most returning-citizen-friendly trade sectors — it is young, fast-growing, chronically short-staffed, and many employers have explicit fair-chance hiring policies. Strong entry points: NYSERDA-funded workforce programs, Solar One, the Center for Employment Opportunities (CEO) solar tracks, and small residential installers where the hiring manager is often the owner. The NABCEP PV Associate is a credential that speaks on your behalf before any conversation about background.

Credentials That Matter

Credential	Purpose	Cost	Time to Earn
NABCEP PV Associate	Entry-level industry credential, no prerequisites, strong signal to employers.	~\$150 exam fee	2–3 months self-study
NABCEP PVSI (Installation Specialist)	Professional-level credential. Requires documented installation experience.	~\$375 exam fee	1–2 years field + prep
OSHA 10	Construction safety. Required on most solar job sites.	\$65–\$100 (often free)	10 hours online
OSHA 30	Supervisor-level safety. Required for site leads and PMs.	~\$180	30 hours online
NFPA 70E Awareness	Electrical safety in the workplace. Critical for O&M roles.	\$200–\$500 course	1–2 days
FAA Part 107	Drone pilot license — inspection and thermography survey work.	\$175 exam fee	1–2 months self-study
ITC Level 1 Thermography	Qualifies you to perform infrared inspections on PV arrays.	~\$1,500–\$2,000 course	4-day course + field hours

New York State and NYC Programs

- NY-Sun — statewide solar incentive program administered by NYSERDA; most NY-Sun contractors hire from NYSERDA training pipelines.
- NYSERDA Clean Energy Workforce Development — funds training scholarships and cohort programs; start at nyserdera.ny.gov.

- Solar One — NYC nonprofit running free youth programs, Green Workforce Training, and community solar outreach (solar1.org).
- IBEW Local 3 — electrical apprenticeship with a solar track. Five-year paid program, full benefits, direct path to journeyman status (ibewlocal3.org).
- CUNY Sustainable Building and Energy Management — associate and bachelor programs at LaGuardia, BMCC, and Queensborough campuses.
- Center for Employment Opportunities (CEO) — employment services with direct trade-to-solar placements for returning citizens.

CLOSING CONVERSATION — INDIVIDUAL PATHWAY MAPPING

Allow 20 minutes at the end of the module for one-on-one conversations. Ask each participant: what is your current situation? Construction? Electrical? Administrative? Student? No trade background? Returning citizen?

Then give each person a specific, named answer: the one credential to pursue first, the one program to apply to this month, and one person or organization to contact. Write it down on an index card and hand it to them.

This is the single highest-impact part of the entire curriculum. More than the panels, more than the wiring, more than the math — this is the module participants remember a year later. Block the time.

Materials Required

- Printed career pathways handout — one page, front and back, covering the five tracks and the credentials table.
- Resource sheet with URLs and phone numbers for NYSERDA, NY-Sun, Solar One, IBEW Local 3, CUNY SBEM, and CEO.
- Index cards and pens for the one-on-one closing.
- Optional: invite a guest — a current IBEW Local 3 apprentice, a Solar One graduate, or an O&M tech from a NYC installer — for a 15-minute Q&A. The guest is often more persuasive than any slide.

Facilitation Notes

This module is delivered last for a reason. By Module 6, participants have held the equipment, done the math, and completed a working install. When the career conversation opens, they have earned the right to see themselves in it. Do not skip the one-on-one close. If time is short, cut content from Module 4 first, not Module 6's closing conversation.

Your own story belongs here. A 13-year construction career that became a 7-year commercial solar career that became Wadadli Solar LLC is exactly the arc most participants are hoping for themselves. Tell

it specifically — name the projects, name the companies, name the certifications, name the months of study. Specificity is what makes career paths feel real.

Master Materials Checklist

Full equipment and consumable list across all six modules. Quantities assume a cohort of 16 participants in groups of 4.

Permanent Equipment (reusable across cohorts)

- 4 × solar panels, 50–100 W each, with MC4 leads (one per hands-on group).
- 8 × digital multimeters with DC voltage and DC current settings (Fluke 101 or Klein MM300 level).
- 4 × PWM charge controllers, 10–20 A, with reverse-polarity protection (Renogy Wanderer or EPEver VS-series).
- 4 × 12 V batteries — mix of 7–20 Ah sealed lead-acid and small LiFePO4 for chemistry comparison.
- 4 × DC loads (12 V LED strip, 12 V computer fan, or small 12 V bulb).
- 16 × safety glasses.
- 4 × in-line fuse holders with assorted 5 A, 10 A, and 15 A fuses.
- 4 × compass or compass app (phone-based is fine) for azimuth demonstrations.
- 1 × presenter's 20–50 W demonstration panel for Module 1 safety demo.
- 1 × full-size lead-acid battery and 1 × full-size LiFePO4 battery for weight-comparison demo.
- Assorted AA, 9V, dead batteries for multimeter practice (Module 1).
- Basic hand tools: insulated screwdrivers, wire strippers, crimpers, terminal block set.

Consumables (refreshed each cohort)

- Pre-cut 10–12 AWG wire with ring or fork terminals for each kit.
- MC4 connectors (male + female) — spare set per cohort.
- Zip ties, electrical tape, labels.
- Printed handouts (see below).
- Index cards for Module 6 pathway mapping.

Printed Handouts (one per participant unless noted)

- Program overview and module schedule (one-sheet).
- Safety rules card — PV panels are always energized in daylight.
- Watt-hour calculation worksheet.
- Seven garden applications reference card.
- Battery sizing worksheet with 4 load lines.
- Lead-acid vs LiFePO4 comparison table.
- Peak-sun-hours-by-month chart for the local zip code.
- Career pathways handout (front and back).

- Resources list (NYSERDA, NY-Sun, Solar One, IBEW Local 3, CEO, CUNY SBEM).

Instructor Notes and Facilitation Tips

Tips for a Mixed Audience

- Lead with something physical. A solar panel in their hands before any slide, every time.
- Ask the room what they already know before presenting anything. Adjust depth accordingly.
- Youth participants respond strongly to competition. Turn the Module 3 build into a friendly race between groups — fastest correctly-wired kit wins.
- Adults with utility bills respond to cost. Have a payback calculation example ready if they ask about their own homes.
- Returning citizens often want to know if their background disqualifies them — the answer is no, and Module 6 is where that answer is delivered specifically.
- For anyone skeptical of solar, acknowledge the real limitations up front: interconnection wait times, upfront cost, HOA restrictions, hail risk. Credibility comes from honesty, not advocacy.

Common Participant Misconceptions to Address

- "Solar doesn't work in winter." Correct: solar works in winter, but it produces roughly one-third of summer output. This is a design problem, not a technology problem.
- "Hotter means more power." Incorrect: panels produce less on very hot days. Module 2 covers this.
- "Solar lets me stay on during a blackout." Incorrect for standard grid-tied systems — only hybrid systems with batteries provide backup power.
- "Solar is maintenance-free." Partially correct — panels last 25+ years with only light cleaning, but inverters fail at 10–15 years and batteries at 3–15 years depending on chemistry.
- "I need a perfect south-facing roof." Incorrect: east, west, and even flat roofs all work — just with a production penalty of 10–20 percent.

Your Story Is Curriculum

A 13-year construction background that moved into commercial solar, earned NABCEP PVSI, worked at Bright Power, and became Wadadli Solar LLC is exactly the kind of specific, real career arc that teaches more than any slide. Tell it early, tell it specifically, and tell it before asking participants to picture themselves in the industry. Name the companies, name the projects, name the certifications, name the months. Participants — especially those from communities historically underrepresented in clean energy — need to see that path started somewhere familiar before they can imagine walking it themselves.

Resources and Further Study

Credentials and Training

- NABCEP — nabcep.org — PV Associate exam, PVSI exam, study guides, credential verification.
- Solar Energy International (SEI) — solarenergy.org — online and in-person courses, strong PV Associate prep.
- Solar One — solar1.org — NYC youth programs, Green Workforce Training, community-solar outreach.
- SUNY Clean Energy Programs — suny.edu/academics — multiple campus options.
- CUNY Sustainable Building and Energy Management — at LaGuardia, BMCC, and Queensborough CUNY campuses.

New York State Programs

- NYSERDA Clean Energy Workforce Development — nyserda.ny.gov — scholarship funding, cohort programs, and employer partnerships.
- NY-Sun — ny-sun.ny.gov — statewide solar incentive program; most certified contractors hire from NYSERDA training pipelines.
- IBEW Local 3 — ibewlocal3.org — electrical apprenticeship with solar track (5-year paid program).
- Con Edison net metering and clean energy — coned.com/en/save-money/solar-and-other-clean-energy.
- Center for Employment Opportunities (CEO) — ceoworks.org — returning-citizen workforce services with trade placements.

Safety and Standards

- OSHA 10 and OSHA 30 — through the OSHA Education Center or authorized online providers.
- NFPA 70E — nfpa.org — Standard for Electrical Safety in the Workplace.
- NEC Article 690 — solar-specific section of the National Electrical Code.
- NABCEP Code of Ethics — nabcep.org — mandatory reading before sitting for any NABCEP exam.

Technical References

- NREL PVWatts Calculator — pvwatts.nrel.gov — free solar production estimator by zip code, used in Module 5 sizing math.
- Solar Reviews (solarreviews.com) and EnergySage (energysage.com) — consumer-facing but useful for understanding residential market pricing.
- Home Power magazine archives — deeply technical, often free online — excellent for self-study between this course and the NABCEP PV Associate exam.

Caribbean and Offshore Context

- IRENA renewable energy data — irena.org — Caribbean solar resource data.
- Caribbean Development Bank energy programs — caribank.org.
- Wadadli Solar LLC — wadadlisolar.com — Caribbean solar development and community training.

Delivery Equipment Requirements

This section clarifies which pieces of the delivery setup are the responsibility of the host site versus the Wadadli Solar instructor team. Agreeing on this division of responsibility before the event is the single most effective way to make sure the program runs on time and that hands-on stations function as designed. Share this page with the host at the booking stage.

Host Site Provides

- Outdoor teaching space — level ground sufficient to seat the cohort comfortably and to position solar panels in direct sun during Modules 2 and 3. A small open area of the garden works well; a nearby parking lot or courtyard is acceptable as a backup.
- Table workspace — at least one sturdy table per hands-on group of 3–4 participants, plus one instructor demonstration table at the front. Folding banquet tables are ideal. Surfaces must be dry and stable.
- Shade option recommended — a pop-up tent, tree canopy, or covered pavilion for instruction segments where participants are seated and taking notes. Direct sun is required for the panel demonstrations but is not appropriate for the 45-minute lecture segments.
- Nearby water access recommended — a hose bib, water cooler, or accessible spigot within a short walk. Training days are typically warm, often full-sun, and water access is both a comfort and a safety requirement for participants.
- Optional but appreciated: electrical outlet access for the instructor's laptop or a portable printer; restroom access; and a secure indoor space to store kits between sessions when the curriculum is delivered as a multi-week series.

Instructor Provides

- Portable solar training kit — one 50–100 W panel per 3–4 participants, panels with MC4 leads, and a rolling case or tote for transport.
- Multimeters — one digital multimeter per hands-on group, plus two spare meters at the instructor table. DC voltage and DC current ranges are required.
- Wiring demonstration materials — pre-cut 10–12 AWG wire with appropriate terminals, MC4 connectors, in-line fuse holders, assorted fuses, zip ties, electrical tape, and labels.
- Small battery system — one 12 V battery per hands-on group (mix of sealed lead-acid and LiFePO₄ for Module 5 comparison), plus one full-size lead-acid and one full-size LiFePO₄ battery for the weight-comparison demonstration.
- PWM charge controllers — one per group, all with reverse-polarity protection (Renogy Wanderer, EPEver VS-series, or equivalent).
- DC loads — 12 V LED strips or small 12 V fans, one per group, as the visible payoff for Module 3.

- Safety equipment — safety glasses for every participant, insulated hand tools, gloves, and a basic first-aid kit.
- Printed materials — all handouts, worksheets, resource lists, and the Module 6 career-pathway cards, in quantities matching the registered cohort.
- Curriculum binder and instructor copy of this document, Version 1.2 or later.

Before-Event Coordination Checklist

One week before the session, the instructor and host site contact should confirm in writing:

- Final participant count (affects kit quantity and handout print run).
- Exact location of the teaching space on the property and where vehicles can be staged for kit unloading.
- Weather contingency plan — which indoor or covered space is available if the forecast turns.
- Any accessibility accommodations requested by participants.
- Photo and video policy for the session, especially when youth are participating.

Solar + Garden Electrical Fundamentals Training Series

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