Strengthened Senior High School

DepED
DEPARTMENT OF EDUCATION

# Lesson Exemplars for Photovoltaic Systems Installation

## TECH-PRO ELECTIVE

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| **Learning Area** | PHOTOVOLTAIC SYSTEMS INSTALLATION | **Grade Level** | 11 |
| **Term** | FIRST | **Lesson Exemplar** | 1 |

| **I. OBJECTIVES** | |
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| **A. Content Standard** | The learners demonstrate an understanding of the concepts and principles of solar energy system in Photovoltaic (PV) Systems Installation. |
| **B. Performance Standard** | The learners perform site assessment with safety precautions. |
| **C. Learning Competencies** | Discuss the concepts and principles related to Photovoltaic Systems Installation. |
| **II. REFERENCES and MATERIALS** | **References:**<br>• Department of Energy (DOE) Philippines. (2022). *Philippine Renewable Energy Roadmap 2020-2040*.<br>• Republic Act No. 9513: Renewable Energy Act of 2008 (Philippines).<br>• Photovoltaic Systems Installation NC II Curriculum Guide (TESDA).<br>• Solar Energy International (SEI). (2021). *Photovoltaic Systems Fundamentals*.<br><br>**Materials:**<br>• Laptop/projector/TV for slide presentation<br>• Whiteboard and markers<br>• Printed copies of RA 9513 (Excerpts)<br>• Sample site photos (rooftop, open field, shaded area)<br>• Quiz handouts<br><br>**Tech Integration:**<br>• Google Earth or Google Maps (for visualizing site orientation)<br>• Interactive polling (Mentimeter or Kahoot for activation) |

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| **III. CONTENT** | • **Overview of Renewable Energy and Solar Power: Definition, types (solar, wind, hydro), why solar is ideal for the Philippines.**<br>• **RA 9513 (Renewable Energy Act of 2008): Key provisions: promotion of RE, net metering, incentives.**<br>• **Site Selection Criteria for PV Systems: Orientation (south-facing in N. Hemisphere), tilt angle, shading analysis, structural integrity, safety access.** | |
| **IV. OBJECTIVES** | At the end of the lesson, learners should be able to:<br><br>1. Identify at least three key provisions of RA 9513.<br>2. Explain why solar power is a strategic renewable energy source for the Philippines.<br>3. Analyze a given site photo and identify potential shading or orientation issues.<br>4. Articulate the basic principles of a photovoltaic system using correct technical terms (irradiance, array, module). | |
| **V. PROCEDURES** | | **ANNOTATIONS** |
| **A. Activating Prior Knowledge** | **1. Activating Prior Knowledge**<br><br>Teacher says: "Good morning, class. Before we talk about solar panels, let's do a quick mental exercise. Write down on a scratch paper: What are three ways our school or your home uses electricity every single day? Now, imagine a 12-hour blackout. Which ONE appliance would you miss most? Why?"<br><br>Teacher asks: "Now, who can tell me what 'renewable' means?" (Accept answers: not used up, comes from nature, etc.).<br><br>Teacher says: "Today, we connect that need for reliable power to the sun." | This activates the schema of energy dependency. The blackout question creates cognitive dissonance (need vs. lack of power), making the relevance of solar immediate and personal.<br><br>**Facilitation Note:** Allow 2-3 students to share. Do not correct wrong answers yet—just surface prior knowledge. |

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| | **2. Establishing the Purpose of the Lesson**<br><br>Teacher says: "Today's lesson is the FOUNDATION of everything you will do as PV installers. You cannot install a single panel correctly unless you understand *why* solar matters legally (RA 9513) and *where* to place it (site assessment). By the end of this hour, you will be able to look at a roof and say, 'That is a good or bad spot for solar'—and cite the law that makes it profitable for the homeowner."<br><br>Teacher writes on board: *LEARNING TARGETS: 1. Quote RA 9513. 2. Spot shading. 3. Explain net metering.* | Connects the legal/technical content directly to the Performance Standard (site assessment) and future job role. Using "profitable" hooks practical-minded students.<br><br>**Facilitation Note:** Point to each target on the board twice. |
| **B. Instituting New Knowledge** | **1. Presenting Examples**<br><br>Teacher projects 3 images (printed or slide): 1. A house with a large, south-facing roof, no trees. 2. A commercial building with a north-facing roof, nearby tall palm tree casting shadow. 3. An open ground area with adjustable racking.<br><br>**Teacher says:** "Look at Image 1. Raise your hand if you think this is good for solar. Why?" (Student: "No shade."). "Look at Image 2. Show me a thumbs DOWN if it's bad. Why?" (Student: "Tree shadow."). "Image 3. Thumbs sideways—it's okay but requires land."<br><br>**Teacher states:** "These quick judgments? That's a basic site assessment. Today we learn the science and law behind that judgment." | Low-stakes, visual, non-verbal responses (thumbs) ensure 100% participation. This is a "concept attainment" strategy—students infer criteria before formal instruction.<br><br>**Facilitation Note:** Do NOT explain net metering yet. Let them wonder why Image 3 might be less ideal (land use cost). |

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| | **2. Discussing New Concept**<br><br>Teacher lectures directly from this script (using slides):<br><br>Slide 1: What is a PV System?<br>"PV stands for Photovoltaic. 'Photo' = light, 'Voltaic' = voltage. It's a device that converts sunlight DIRECTLY into electricity using semiconductors—usually silicon. No moving parts. No noise."<br><br>Slide 2: RA 9513 – The RE Act of 2008<br>"Open your printed excerpt. In 2008, the Philippines passed a law that changed everything. Key sections you must memorize:<br>- Sec. 2 (Declaration of Policy): The State shall accelerate the exploration and development of renewable energy.<br>- Sec. 7 (Net Metering): If your solar panels produce extra electricity, the utility company (like Meralco) buys it from you or credits your bill. This is how solar pays for itself.<br>- Sec. 12 (Fiscal Incentives): Tax holidays on importing solar equipment."<br><br>Slide 3: Why Solar in the Philippines?<br>"We are located near the equator. Average solar irradiance is 4.5-5.5 kWh/m²/day—that's HIGH. Compare to Germany (3.0), a solar leader. We have more sun, but we install less. Your job is to close that gap."<br><br>Slide 4: Site Selection – The 5 Non-Negotiables<br>"Write this acronym: S.O.I.L.<br>- Shadows: No shadows between 9 AM – 3 PM (peak sun hours).<br>- Orientation: In the Philippines (northern hemisphere), panels face TRUE SOUTH for maximum yearly output.<br>- Inclination: Tilt angle = latitude (e.g., Manila 14° = tilt 10- | This script ensures fidelity of instruction. The acronym (SOIL) provides a mnemonic for long-term retention. Linking local data (PH irradiance) to global context (Germany) builds analytical thinking.<br><br>**Facilitation Note:** Pause after each slide. Ask one concrete question: "What does 'net metering' do for a homeowner?" (Answer: Credits extra power). |

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| | 15°).<br>- Load-bearing: Roof must hold 15-20 kg/m².<br>Plus safety: Access for cleaning and firefighter access."<br><br>Teacher says: "Repeat after me: No shadows 9 to 3. Face true south. Tilt equals latitude. Roof must be strong."<br><br>**3. Developing Mastery**<br><br>**Activity: "Two Truths and a Lie – PV Edition"**<br><br>Teacher says: "On your notebook, number 1-3. I will read three statements. Identify the ONE lie."<br>1. "RA 9513 provides tax incentives for solar installers." (Truth)<br>2. "In the Philippines, solar panels should face north to catch the afternoon sun." (LIE – they should face south).<br>3. "Shading from a tree branch can reduce an entire panel's output." (Truth).<br><br>Teacher says: "Stand up if you said #2 is the lie. Keep standing. Now, why is it a lie? Tell your partner." | Gamification increases engagement. Immediate peer discussion (Think-Pair-Share) consolidates the orientation concept—a common source of installer error.<br><br>**Facilitation Note:** Walk around and listen to partner talk. Clarify: "True south, not magnetic south." |
| **C. Demonstrating Knowledge and Skills** | **1. Finding Practical Application**<br><br>Teacher projects a new photo: A house with a beautiful large roof, but with a chimney on the south side and a water tower casting a shadow.<br><br>Teacher says: "You are the PV installer. The homeowner says: 'Put panels everywhere on that big roof.' Using the SOIL acronym, what do you say? Write a 2-sentence response."<br><br>Teacher calls 3 students: "Read your response." (Expected: "We cannot place panels in the shadow of the chimney or | Direct alignment to Performance Standard "perform site assessment." Moves from theory to professional communication. This is a workplace simulation.<br><br>**Facilitation Note:** Praise students who say "no" to the client. Assertiveness in rejecting bad sites is a safety competency. |

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| | water tower from 9-3. We can place them on the west or east section, but output will be lower.")<br><br>**2. Making Generalization**<br><br>Teacher asks 3 culminating questions:<br>1. "What is one right that RA 9513 gives to a solar homeowner?" (Net metering / incentive).<br>2. "What is the most destructive enemy of a solar panel?" (Shade).<br>3. "If a roof faces north, can you still install?" (Yes, but lower output; or re-rack to ground).<br><br>Teacher says: "Complete this sentence in your notebook: 'Site assessment is not just about finding a roof, it is about finding the right…' (Finish it: '…orientation, structure, and sun access.')<br><br>**3. Evaluating Learning**<br><br>Teacher distributes printed quiz.<br><br>Quiz: Concepts & Principles of PV Systems<br><br>Instructions: Write the letter of the best answer.<br><br>1. What does "PV" stand for in PV Systems?<br>a. Power Voltage<br>b. Photovoltaic<br>c. Philippine Voltage<br>d. Passive Ventilation | Explicit summarization using incomplete sentences forces cognitive closure. The final phrase links the day's content directly to the course title.<br><br>**Facilitation Note:** Collect 3 random notebooks to check sentence completion.<br><br>Quiz is content-valid (maps directly to objectives: RA 9513, orientation, shading). Question types are recall and simple application—appropriate for first lesson. |

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| | 2. Which Philippine law promotes the development of renewable energy sources, including solar?<br><br>a. RA 7920 (Electrical Engineering Law)<br>b. RA 9513 (Renewable Energy Act)<br>c. RA 8749 (Clean Air Act)<br>d. RA 9003 (Ecological Solid Waste Act)<br><br>3. In the Philippines, for maximum annual energy production, solar panels should ideally face which direction?<br><br>a. North<br>b. South<br>c. East<br>d. West<br><br>4. What is “net metering”?<br><br>a. Measuring the physical size of a solar panel<br>b. A billing mechanism that credits solar system owners for excess electricity they add to the grid<br>c. The process of grounding a PV array<br>d. A type of solar inverter<br><br>5. During a site assessment, what is the critical time window to check for shading?<br><br>a. 6 AM – 6 PM<br>b. 9 AM – 3 PM<br>c. 12 NN only<br>d. Sunset only | **Facilitation Note:** Grade immediately in class via peer checking. Read answers aloud. |

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| | **ANSWER KEY:**<br>1. b<br>2. b<br>3. b<br>4. b<br>5. b<br><br>**4. Additional Activities**<br>**For Enrichment:** "Go to Google Earth. Find your own house or a relative's house. Use the ruler tool to measure your roof's orientation (N,S,E,W). Write a 3-sentence report: 'My roof faces [X]. It is good/poor for solar because…'"<br><br>**For Remediation:** "Re-read the handout on RA 9513 Sec. 7 (Net Metering). Then draw a simple diagram: House with panels → meter → grid. Label 'export' and 'import' arrows." | Differentiated tasks. Enrichment uses authentic tech (Google Earth) for real-world practice. Remediation uses drawing—a lower linguistic load but high conceptual clarity.<br><br>**Facilitation Note:** Post both tasks on your LMS or board. Do not frame one as "for weak students." |
| **VI. ASSESSMENT** | **Performance Task Title:** ***The Solar Site Assessor's Report***<br><br>Scenario: You are a junior PV installer at "Sikat Solar," Inc. A homeowner in your barangay has sent three photos of their property (provided by the teacher: Photo A – south-facing roof with a satellite dish; Photo B – east-west roof with a large acacia tree; Photo C – a sturdy metal garage roof, no shade, facing southwest). The homeowner wants panels installed but does not know where.<br><br>Task: Write a 1-page Site Assessment Memo addressed to the homeowner. Your memo must include:<br><br>1. Site Ranking: Rank the three locations (Best, Acceptable, Not Recommended) using the SOIL criteria. | |

2. Legal Justification: Cite one specific provision of RA 9513 (e.g., net metering) to explain how they will benefit financially.
3. Safety Note: Mention one safety precaution you will take during installation (e.g., "We will use a fall arrest system because the roof pitch is steep.").
4. Recommendation: Recommend ONE site and explain why in 2 sentences.

**Rubric for Site Assessment Method**

| CRITERIA | Excellence (4 points) | Satisfactory (3 points) | Developing (2 points) | Needs Support (1) |
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| **Technical Accuracy (SOIL)** | Correctly identifies orientation, shade, tilt, and load for all 3 sites. | Correctly identifies 3 of 4 criteria for all sites. | Correctly identifies 2 criteria or misapplies one rule. | Major errors (e.g., says north is best). |
| **Use of RA 9513** | Quotes specific section (e.g., Sec. 7) and explains net metering correctly. | Mentions RA 9513 by name and describes net metering generally. | Mentions solar law but no section or incorrect effect. | No mention of the law or completely wrong. |
| **Safety Precaution** | States a specific, realistic safety precaution relevant to PV installation. | States a general safety precaution (e.g., "be careful"). | States an irrelevant precaution (e.g., wear a hard hat for office work). | No safety precaution mentioned. |
| **Professional Communication** | Memo format, clear, respectful, no spelling errors. | Memo format, minor errors. | Lacks memo format, some unclear parts. | Unprofessional or confusing. |

**Teacher's Note: A score of 12-16 = "Pass" (ready for actual site visit simulation in Lesson 2).**

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| **VII. REFLECTION** | **To be filled out by the teacher after the lesson.**<br><br>1. Which part of the lesson (e.g., the SOIL acronym, the quiz, the site photo analysis) engaged students the most? Cite specific student behaviors.<br>2. Did any student struggle with the concept of "true south" vs. "shadows"? What misconception appeared in their quiz or memos?<br>3. For the next class, will I modify the lecture length, add a physical demonstration (e.g., using a flashlight and a toy house), or re-teach net metering? What specific action will I take? |
| **VIII. USE OF GENERATIVE AI** | In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE. |

| LESSON EXEMPLAR | | | |
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| **Learning Area** | PHOTOVOLTAIC SYSTEMS INSTALLATION | **Grade Level** | 11 |
| **Term** | FIRST | **Lesson Exemplar** | 2 |

| **I. OBJECTIVES** | |
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| **D. Content Standard** | The learners demonstrate an understanding of the concepts and principles of solar energy system in Photovoltaic (PV) Systems Installation. |
| **E. Performance Standard** | The learners perform site assessment with safety precautions. |
| **F. Learning Competencies** | Perform site assessment procedures. |
| **II. REFERENCES and MATERIALS** | **References:**<br>• TESDA Training Regulations for PV Systems Installation NC II.<br>• Photovoltaic Systems by James P. Dunlop (Chapter on Site Assessment).<br>• Philippine Electrical Code (PEC) 2017 Edition (Articles on working space and PV systems).<br>• National Renewable Energy Laboratory (NREL) PVWatts Calculator (Online tool)<br><br>**Materials:**<br>• Laptop/Projector for presentation<br>• Whiteboard/Markers<br>• Printed copies of a "Site Assessment Checklist"<br>• Compass (physical or on smartphone)<br>• Clinometer or smartphone app (e.g., "Angle Finder")<br>• String, measuring tape<br>• Sample photos of different roof types (flat, slanted, metal, tile)<br>• Sample shade analysis tools (e.g., Solar Pathfinder or printed sun path diagrams)<br>• Student Activity Sheets |
| **III. CONTENT** | **Site selection criteria** |
| **IV. OBJECTIVES** | At the end of the lesson, learners should be able to:<br>1. Calculate shading losses, verify orientation azimuth and tilt, and test structural load capacity as critical criteria for PV site selection. |

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| | 2. Use basic assessment tools and visual inspection techniques to evaluate a site and determine its suitability for solar panel installation.<br>3. Present accurate site assessment findings with objectivity, attention to detail, and proper justification of observations. | |
| **V. PROCEDURES** | | **ANNOTATIONS** |
| **D. Activating Prior Knowledge** | **1. Activating Prior Knowledge**<br><br>**"Think-Pair-Share"**<br><br>Teacher says: "Good morning, class! To start us off, let's have a quick Think-Pair-Share. Think about this: You're planning to install solar panels on your own home. Where is the first place on your roof you would not want to put them? On a whiteboard or a piece of paper, quickly sketch a simple house and put an 'X' on the spot you think is the worst for solar panels. (Give students 1 minute to think and sketch). Now, share your sketch with your seatmate and explain your choice."<br><br>After the pair discussion, the teacher calls on 2-3 students to share their partner's reasoning. Common answers may include "north side" (in the Northern Hemisphere), "under a big tree," or "where there's a chimney."<br><br>**2. Establishing the Purpose of the Lesson**<br><br>Teacher says: "Excellent observations! You've intuitively touched on the most critical part of our job as PV installers. You can have the most expensive, high-efficiency panels in the world, but if you put them in the wrong place, they will not perform. Today, we are going to move from 'gut feeling' to a professional, systematic process. By the end of this lesson, you won't just guess where to put panels; you will be able to conduct a proper site assessment. This is the foundation of a successful and safe PV installation. The | Facilitation: This activity activates prior knowledge by asking students to connect personal experience (or intuition) to the concept of site suitability.<br><br>Rationale: It surfaces common misconceptions (e.g., assuming any roof is good) and creates a "need to know" for the formal criteria that will be taught. The sketch allows for non-verbal expression and immediate engagement.<br><br>Facilitation: The teacher explicitly connects the student's prior knowledge to the professional skill of "site assessment." The phrase "move from 'gut feeling' to a professional, systematic process" sets the tone for the rigor of the lesson.<br><br>Rationale: This establishes relevance and purpose, increasing student motivation. It frames the lesson not |

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| | skills you learn today are exactly what you will use on the job to determine if a project is even feasible before you start." | just as an academic topic but as a core professional competency. |
| **E. Instituting New Knowledge** | **1. Presenting Examples**<br><br>**"Rate the Site!"**<br><br>Teacher says: "Let's look at some real-world examples. I'll show you four pictures. For each one, I want you to give me a thumbs-up if you think it's a good site for solar panels, and a thumb-down if it's a bad site."<br><br>(Teacher shows images)<br><br>1. A south-facing, clean, asphalt shingle roof with no visible obstructions.<br><br> <br><br>*Image generated by google Gemini (OpenAI), March 27, 2026, from the prompt "Create an image for this solar panel: A south-facing, clean, asphalt shingle roof with no visible obstructions.".*<br><br>2. A beautiful roof covered by the large shadow of a neighboring building.<br><br>*Image generated by google Gemini (OpenAI), March 27, 2026, from the prompt "Create an image for this solar panel: A beautiful roof covered by the large shadow of a neighboring building."*<br><br> | Facilitation: The teacher uses visual examples and a simple, low-stakes polling method to engage the entire class.<br><br>Rationale: This activity scaffolds the concept by moving from simple visual judgments to the underlying principles. It allows the teacher to identify misconceptions (e.g., a structurally sound roof is not automatically a good solar site) and primes students for the detailed discussion that follows. |

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| | 3. A flat commercial rooftop with HVAC units and other equipment scattered around.<br><br> <br><br>*Image generated by google Gemini (OpenAI), March 27, 2026, from the prompt "Create an image for this solar panel: A flat commercial rooftop with HVAC units and other equipment scattered around."*<br><br>4. A north-facing roof (in the Northern Hemisphere) that appears structurally sound.<br><br>*Image generated by google Gemini (OpenAI), March 27, 2026, from the prompt "Create an image for this solar panel: A north-facing roof (in the Northern Hemisphere) that appears structurally sound."*<br><br> <br><br>After each image, the teacher pauses, asks for thumbs, and calls on a few students to explain their reasoning. Teacher asks: "For image 4, many of you gave a thumb-down. But why? The roof looks new and strong. What's the problem?" This leads to a discussion about orientation.<br><br>**2. Discussing New Concept**<br><br>Teacher says: "Now let's get into the specifics. The four pictures we just saw represent the four pillars of site selection criteria. I want you to take notes in this format on your activity sheet." | Facilitation: The teacher presents the information in a structured, lecture-based format but uses a conversational tone and real-world examples. Key terms are emphasized verbally.<br><br>Rationale: This section provides the detailed, technical knowledge base required for the competency. The lecture is organized into four clear pillars, which helps students categorize and retain the information. The teacher explicitly links back to the examples used earlier, reinforcing the learning. The inclusion of regional context (magnetic declination) and local codes (PEC) grounds the learning in the students' context. |

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| | (Teacher displays a slide or draws on the board: SITE ASSESSMENT CRITERIA)<br><br>1. Solar Resource & Shading Analysis<br>- Teacher says: "This is the most important. It answers the question: 'How much sunlight actually hits this surface?' We're not looking for a little bit of sun; we need a location that receives unobstructed sunlight from 9:00 AM to 3:00 PM—the peak solar window. This is non-negotiable for a viable system."<br>- "Shading is the enemy. It's not just the tree in the yard. We look for 'shading objects': trees (especially evergreens that don't shed leaves), chimneys, vent pipes, dormers, power lines, and even the shadow from an adjacent building. A tiny bit of shade on one panel can reduce the output of the entire string of panels. We use tools like the Solar Pathfinder (a reflective dome that shows the sun's path) or digital tools like SunEye or Helioscope to quantify shading."<br><br>2. Structural Integrity & Roof Condition<br>- Teacher says: "Solar panels are heavy. A typical system adds 3-5 lbs. per square foot. Can the roof support that? We need to assess the roof's age and material. If a roof is older than 10-15 years, it might need replacement *before* we install panels. We wouldn't want to install a 25-year system on a roof that needs to be replaced in 5 years."<br>- "We also inspect the roofing material. Asphalt shingles are the easiest. Clay or slate tiles are more complex and require special mounting hardware. We must also check for any signs of existing damage, like sagging, rot, or water stains in the attic." | |

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| | 3. Orientation & Tilt<br>- Teacher says: "This is about pointing the panels in the right direction. Here in the Northern Hemisphere, the sun is always in the southern part of the sky. Therefore, true south is the optimal orientation. Using a compass, we find *magnetic* south, but we must account for 'magnetic declination'—the difference between true north and magnetic north—which is about 2-3 degrees east here in our region. A roof facing due south is ideal."<br>- "Tilt is the angle of the panels relative to the ground. The optimal tilt angle is generally equal to the latitude of the location (e.g., about 14 degrees here). We use a clinometer or a smartphone app to measure the roof's pitch. While a perfectly optimal tilt is great, a roof that is off by 15 degrees in orientation or tilt will only reduce production by about 5-10%."<br><br>4. Accessibility & Safety<br>- Teacher says: "Finally, we must consider how we will do the work. Is the roof accessible? Do we need a boom lift, or can we safely use ladders? Are there electrical lines nearby that pose a hazard? There must be adequate working space around the main electrical panel as required by the Philippine Electrical Code (PEC). We also need a safe, clear pathway to mount and install the panels and run conduit. If we can't install it safely, we can't install it at all."<br><br>Teacher concludes the lecture: "These four criteria are interconnected. A south-facing roof with a great tilt is worthless if it's shaded. A structurally sound roof is not an option if it's unsafe to access. Our job as assessors is to weigh all these factors together." | Facilitation: The teacher facilitates group work by providing clear scenarios and a structured checklist. The teacher acts as a coach, asking Socratic questions to deepen student analysis rather than giving direct answers.<br><br>Rationale: This activity moves students from passive listening to active application. The checklist scaffolds their analysis, ensuring they consider all four criteria. The scenarios present realistic, non-ideal situations that require critical thinking and justification, moving beyond simple recall. |

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| | **3. Developing Mastery**<br><br>Teacher says: "Now it's your turn to apply this knowledge. In your groups, you will become site assessors. I have given each group a 'Site Scenario Card' that describes a property. Using the criteria we just discussed, you will fill out the 'Site Assessment Checklist' I've provided. For each criterion, you'll note whether it's a 'Go,' 'Caution,' or 'No-Go' and write a brief justification."<br><br>Group Task:<br>- Scenario 1: A new house with a south-facing asphalt shingle roof. There's one large oak tree on the south side of the property, but it's 30 feet away and the roof peak clears its shadow after 10:00 AM.<br>- Scenario 2: A flat, rubber membrane roof on a commercial building. It has no shading, but there is visible ponding water (puddles) and the building is 40 years old with no record of roof inspection.<br>- Scenario 3: A north-facing roof in good condition with a steep pitch. The homeowner is insistent on installing panels because it's the "only roof they have."<br><br>The teacher circulates, listens to group discussions, and asks probing questions: "You marked 'Caution' for the tree. What tool would you use to verify that the 9 AM-3 PM window is truly clear?" or "For the flat roof, why is ponding water a major concern?" | |
| **F. Demonstrating Knowledge and Skills** | **2. Finding Practical Application**<br><br>Teacher says: "Let's bring this closer to home. Take out your phones and open the compass app. Or, if you don't have one, use the paper compass on your desk. Now, imagine this classroom has a south-facing wall. Where would that be? (Students find south). Good. Now, using a clinometer app or the paper protractor tool, estimate the tilt of the roof outside our window." | Facilitation: The teacher guides a practical, hands-on activity using the immediate environment and simple, accessible tools (smartphone apps).<br><br>Rationale: This connects the abstract criteria to a tangible, real-world |

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| | Teacher then asks: "Based on our quick assessment, if we were to install panels on this building's roof, what would be our primary challenge? Would it be orientation, shading from that tree, or structural integrity?"<br><br>Teacher says: "This simple exercise shows you that a site assessment begins the moment you arrive at a property. You don't need a solar pathfinder to notice the big tree casting a shadow at 10 AM. This skill of observation is your most important tool."<br><br>**2. Making Generalization**<br><br>Teacher asks: "We've covered a lot today. In your own words, what is the single most important question a site assessment must answer? (Allow 2-3 students to answer). A great answer might be: 'Is this location safe and will it generate enough energy to meet the client's needs and be a good financial investment?'"<br><br>Teacher says: "The generalization we can make is this: A successful PV installation is not just about the quality of the panels, but about the quality of the marriage between the system and its environment. A site assessment is like a compatibility test. It ensures that the location, the structure, and the solar resource are all compatible for a long-term, productive, and safe relationship. Remember, we are not just selling solar panels; we are selling long-term energy solutions, and that starts with a solid foundation—a proper site assessment." | context. It demonstrates that the skills learned are not just theoretical but can be applied immediately. It reinforces the idea that site assessment is a hands-on, observational skill.<br><br>Facilitation: The teacher uses a guided questioning technique to lead students to synthesize the day's learning into a concise, memorable takeaway.<br><br>Rationale: This helps solidify the core concept in the students' long-term memory. The generalization moves beyond the facts ("list the four criteria") to the overarching principle of compatibility and value, which is crucial for their professional mindset. |

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| | **3. Evaluating Learning**<br><br>Teacher says: "Let's take a short quiz to check our understanding."<br><br>Quiz:<br>1. What is the "peak solar window" time frame that a site should ideally be free from shading?<br>2. In the Northern Hemisphere, what is the optimal orientation for a fixed-tilt PV array to maximize energy production?<br>3. Why is assessing the age and condition of a roof a critical part of the site assessment process?<br>4. Name two potential shading obstacles an installer should look for during a site visit.<br>5. A client has a roof that is perfectly oriented and free of shade but has a severe termite infestation affecting the roof rafters. Would you consider this site suitable for PV installation? Justify your answer.<br><br>**4. Additional Activities**<br><br>Remediation: For students who scored below 80% on the quiz, provide them with a copy of the lecture slides and the "Site Assessment Checklist." Ask them to re-watch a 5-minute YouTube video on "Solar Site Assessment" and then re-evaluate one of the in-class scenarios, writing a one-paragraph explanation of their findings.<br><br>Enrichment: For students who mastered the quiz, assign them to research and compare two professional site assessment tools (e.g., Solar Pathfinder vs. DroneDeploy). Have them create a simple one-page infographic that compares the features, cost, and benefits of each tool for a small PV installation business. | Facilitation: The teacher administers a short, focused quiz to measure attainment of the learning objectives.<br><br>Rationale: This is a formative assessment to measure individual student understanding of the core concepts. It provides immediate feedback for both the teacher and the student before moving on to the culminating performance task.<br><br>Facilitation: The teacher provides differentiated activities based on quiz performance.<br><br>Rationale: This ensures all students are supported. Remediation reinforces foundational concepts, while enrichment challenges advanced learners to explore the field's professional tools and technology. |

**VI. ASSESSMENT**

**Performance Task: "The Solar Site Assessment Report"**

- Scenario: You are a PV system installer assigned by your company, "Solar Solutions Inc.," to conduct a preliminary site assessment for a potential client. Your manager has provided you with a Site Profile Packet containing photos, a simple map, and written notes about the property. Your task is to create a professional Site Assessment Report to present to your manager and the client.
- Task: Based on the provided Site Profile Packet (which includes: a photo of the roof from the street, a photo from the attic showing rafters, a photo of the main electrical panel, a simple sketch of the property showing the location of a large tree and a two-story neighbor's house, and notes that the client has a tile roof), you will:
    1. Analyze the site using the four criteria (Solar Resource, Structural Integrity, Orientation/Tilt, Accessibility/Safety).
    2. Fill out the "Site Assessment Checklist" provided.
    3. Write a 1–2-page formal report summarizing your findings.
    4. Conclude with a clear recommendation: "Site Suitable," "Site Unsuitable," or "Site Suitable with Conditions." If conditions are required, you must specify them (e.g., "Suitable, pending a structural engineer's inspection of the roof rafters").

**Scoring Rubric for Performance Task**

| CRITERIA | Excellence (10-9 pts) | Proficient (8-7 pts) | Developing (6-5pts) | Needs Improvement (4-0 pts) | Score |
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| **Analysis of Criteria** | Accurately and thoroughly analyzes all four criteria (Solar, Structural, Orientation, Access). Identifies subtle or potential issues. | Accurately analyzes all four criteria. Identifies major issues. | Analyzes only 2-3 criteria. May miss obvious issues or inaccurately assess a criterion. | Fails to analyze most criteria. Analysis is inaccurate or missing. | |

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| | **Data Utilization** | Effectively uses all provided data (photos, notes, sketch) to support analysis and conclusions. | Uses most of the provided data to support analysis. | Uses some data, but may ignore or misinterpret key pieces of evidence. | Fails to use the provided data. | |
| | **Recommendation & Justification** | Provides a clear, decisive recommendation (Suitable/Unsuitable/Conditional). Justification is logical, detailed, and directly linked to the criteria and data. | Provides a clear recommendation. Justification is present and linked to the criteria. | Recommendation is vague or not fully supported by the analysis. Justification is weak. | Recommendation is missing or illogical. No justification is provided. | |
| | **Professionalism & Format** | Report is well-organized, professionally formatted, uses correct terminology, and is free of spelling/grammar errors. | Report is organized and uses mostly correct terminology. Minor errors present. | Report is disorganized or has significant errors in terminology, spelling, or grammar. | Report is poorly presented and difficult to understand. | |
| | **TOTAL SCORE** | | | | | |

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| **VII. REFLECTION** | **To be filled out by the teacher after the lesson.**<br><br>1. Did the learners achieve the lesson objectives on PV site assessment?<br>2. Which activity was most effective in helping learners understand the lesson?<br>3. What challenges did learners encounter, and how can instruction be improved? |
| **VIII. USE OF** | In preparing this Learning Exemplar (LE), the author used Generative AI to assist in structuring and drafting instructional content and assessment items. The author reviewed, edited, and finalized the writing of the content to ensure alignment with curriculum standards and contextual relevance. The author takes full responsibility for the final content of this LE. |