**Guide to Implementing Solar Panels as a Potential End-Use for Brownfields**

**Introduction:** Because siting a PV system on a brownfield would not require clean-up costs as high as other end-uses, it is important to consider Solar PV systems as a viable end-use for brownfields. Though the original article focuses on the implementation of Solar PV systems on landfills, many of the same considerations are applicable.

**What is PV?**

- **Solar PV technology** converts energy from solar radiation directly into electricity using solar PV cells using three basic elements:
    - **PV modules** (Solar panels), which are traditionally from crystalline silicon, but can also be made with thin film PV cells to provide unique mounting options and higher efficiency.
    - **Inverters** convert energy generated from the solar array (DC) into energy usable for household devices via the utility grid (AC).
        - **String inverters** are most commonly used, are highly efficient, and are available in various sizes and capacities.**Microinverters,** on the other hand, only convert the power output of a single PV module. Since Microinverters are the most expensive per watt, they are best for smaller projects with irregular modules and shading.
    - **Balance-of-system (BOS) components** include mounting systems and wiring for electrical connections. The selection of BOS components depends on various factors including installation size, electricity rates, government incentives, land constraints, latitude, and local weather.

** For details concerning PV technology selection and technology design, visit section 3 of chapter 4

**Technical considerations for installation**

When selecting and designing foundation types, mounting systems, PV module types, and effective area for the PV system installation, consider the following characteristics of the brownfield:

- **Steeper slopes** require heavier mounting systems and lighter solar arrays, and **slope orientation** can affect energy production. View the table on page 37 (PDF 47) for details.
- **Stormwater and waste collection systems** below the surface may limit the layout of PV systems. Additionally, **removing vegetation** during construction may temporarily expose soil to rainfall, and staging materials could temporarily interrupt overland flow and swales.
- **Underground trenches** may require that PV system wiring run through above-ground conduits.
- Examine the **general physical setting**, including use of neighboring lands, ecological conditions, and the transportation and electrical transmission infrastructure available for equipment transport during construction.

- **Meteorological conditions**, such as rainfall and atmospheric pressure, will also affect the solar resource viability of the site.

For a discussion concerning other factors that affect the selection of other PV materials (such as the anchoring and mounting systems, modules, and PV system weight considerations), view chapters 5.2-5.5 of the document

**Thinking ahead**

Below are a few factors to guide discussion about how long-term conditions of the brownfield will affect maintenance practices:

- **Wind and snow loading** can impact the foundation of the PV system, especially via support structure tilt angles and balancing of design criteria.
- Systems in cold climates should especially consider installing **frost protection measures** for anchoring systems
- To address **security** concerns, consider perimeter fencing.
- To protect PV from **lightning strikes and electrical surges**, refer to the National Electric Code (NEC) to learn safety standards for grounding electrical equipment here (2017): https://www.nfpa.org/NEC/About-the-NEC/Explore-the-2017-NEC
- Consider **maintenance** costs and services, such as panel washing, vegetation upkeep, etc.

Review the table on pages 55-59 ( PDF 65-69) of section 8.1 for a detailed summary of technical considerations, challenges, and best practices for siting PV projects.

**Assessing project feasibility**

**Step 1: Conduct a Preliminary Feasibility Assessment**

1. Develop a conceptual design of the PV system by characterizing the PV system components you wish to use
2. Use the conceptual design to develop estimates of the system's costs, benefits, and performance characteristics
3. Determine of the project warrants further consideration based on economic metrics, Operational requirements, and regulatory considerations.

**Step 2**: Conduct an **Investment- Grade Technology AND Economic Feasibility Study,** requiring a greater rigor of analysis, including:

1. A verification of original assumptions in the first assessment
2. Collecting and analyzing additional information as necessary
3. Developing a preliminary engineering design, including detailed performance modeling

**Community Engagement**

- To open a transparent and open dialogue with the community, it may be helpful to discuss land use options with local planning authorities and community members during the Investment Grade Feasibility Assessment.
- **Net-metering** is a utility policy incentive that encourages customers to develop of renewable energy systems, including PV, to offset customer consumption. This may result in customers receiving compensation for excess generation or carrying over the

excess energy forward into the next billing cycle. Some states allow virtual or remote net metering (VNM).

  - If you are considering Net-metering for your PV project, contact the local distribution utility to obtain a copy if it's net-metering policy.

- Strategies for mitigating the **visual impact concerns** raised by the public comment process include ensuring that security lighting is motion- activated, or that barbed/razor wire fence tops are not publicly visible.