



# **Renewable Energy @ Closed Landfills**

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## **Landfill Installation Considerations – Solar PV**

**By: Gary Garfield, PE, LSP  
URS Corporation  
Salem, New Hampshire**

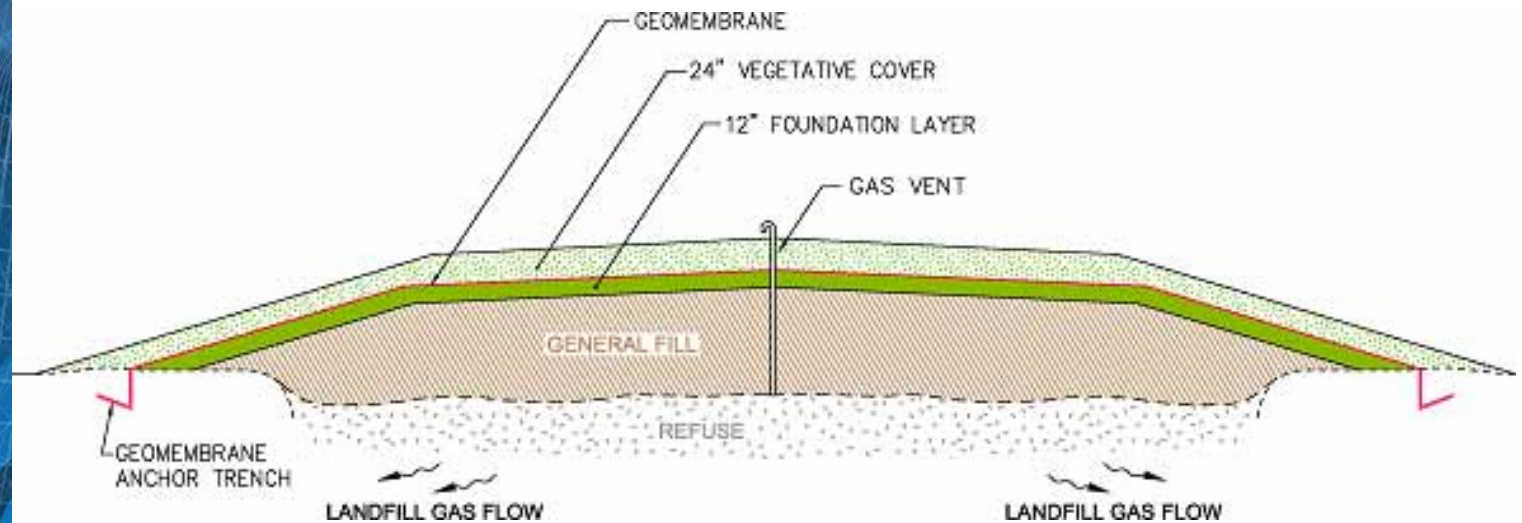
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# Landfills: An Underutilized Resource

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# Typical Landfill Cap



# Flexible Installations

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# Rigid Installation

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# Rigid Installations

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# Flexible vs. Rigid Panel Installation

Flexible solar panels	Rigid panels
<b>Low power production efficiency ca. 6%</b>	<b>Higher power production efficiency &gt; 13%</b>
<b>Light</b>	<b>Heavier (steel frame, glass)</b>
<b>Flexible, unbreakable</b>	<b>Stiff frame</b>
<b>Works well with diffuse light</b>	<b>Less efficient with diffuse light</b>
<b>Works well with temperatures above 40°C</b>	<b>Less efficient with temperatures above 40°C</b>

A vertical blue wireframe graphic on the left side of the slide, featuring a grid of lines that form a perspective view of a structure, possibly a dome or a large container, with lines converging towards a vanishing point.

# Factors to Consider

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- **Racking Systems**
- **Anchoring Systems**
- **Side and Top Slopes**
- **Settlement**
- **Landfill Gas Extraction Equipment**
- **Erosion and Vegetative Cover**

# Racking Systems

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- **Need to be elevated if installed on vegetative support layer**
- **Need to be adjustable**
- **Can be at grade if installed on stone layer**



# Anchoring System

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- **Auger System**

- **Ballast System**



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# Slope Considerations

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- **2% to 5% slopes preferred over 3:1 slopes**
- **If placement is on side slope you need to consider slope stability**
  - Static & Dynamic Loading
  - Snow and Ice loading
  - Side Slope Repairs
- **Side slope placement usually has less exposure time**

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# Settlement Consideration

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- **Landfills are heterogeneous**
- **Differential settlement will occur**
- **Mitigation can include:**
  - Use of geotextile or geonet reinforcement under stone dust or crushed stone
  - Use of Adjustable Racking Systems
  - Use of Shims

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# Erosion Control

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- **Changing the landfill surface changes surface water drainage capacity of:**
  - Drainage Swales
  - Down Chutes
  - Mid-Slope Berms
  - Access Road Ditches
  - Toe Drains
  - Detention Basins

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# Surface Cover

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- **Crushed Stone**
  - Kill vegetation
  - Apply geotextile
  - $\frac{3}{4}$  to 1  $\frac{1}{2}$  inch stone
- **Grassy Cover**
  - Mowing considerations
  - Insects
  - Healthy vegetative cover



# LFG System Considerations

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- **LFG equipment maintenance**
- **Subsurface LFG equipment includes**
  - Header lines
  - Drip Legs
  - Blanket Drains
  - Sumps

# Thank You

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The logo for URS, consisting of the letters "URS" in a bold, white, sans-serif font. The logo is positioned in the bottom left corner of the slide, overlaid on a blue background that features a faint, white grid pattern.