

# What is a solar energy landfill cover system?

By Judy DeVita, Kanishka Perera and Mark Roberts

HISTORICALLY, landfill closures have consisted of a protective soil cover material placed over a barrier layer consisting of compacted clay or a geosynthetic liner. These caps can be maintenance-intensive due to upkeep of turf and replacement of protective cover soil where erosion has occurred and offer little in the way of post-closure benefits.

HDR's innovative approach uses a highly durable geosynthetic cover equipped with laminate solar panels reducing cap construction, maintenance costs and providing a renewable source of power for a beneficial reuse of a closed landfill site.

## Solar energy covers versus traditional systems

Traditional landfill caps include a geomembrane layer placed over a compacted soil base, a drainage layer (geocomposite/freely-draining sand), a protective soil cover, topsoil then grass to resist erosion and promote evapotranspiration (Figure 1). Failures of traditional caps often occur on sideslopes and are a result of slippage of closure components along an interface of dissimilar material.

A solar energy cover consists of an exposed geomembrane cover (EGC) upon which laminated solar panels are directly adhered.

An EGC provides a clean, stable, and relatively inexpensive closure system that reduces infiltration of precipitation

into the waste mass and requires less maintenance with the benefit of being easily inspected to confirm its integrity and impermeability.

The EGC is attached to the landfill surface using anchor trenches to resist wind uplift forces. After installation, the EGC can be easily removed to access the waste or subsurface piping and reinstalled without the effort and expense of removing the soil cover and established vegetation.

Installation of an EGC can reduce the cost of closure by negating the requirement for vegetative support soil and top soil layers (useful when soil would otherwise be imported).

The effects of long-term exposure to the elements are well understood for many geomembrane materials, and these products can be used with confidence and warranted against failure for periods up to 30 years.

## Laminate solar panels

Laminate panels can be adhered directly to a geomembrane on any area of the landfill where storm water does not pool. Their inherent flexibility is also more forgiving for undulated surfaces caused from surface grading or differential settlement due to waste decay/consolidation.

The efficiency of laminate panels has recently improved, and they can be spaced with higher density utilising a greater area as they can be placed on the crown and the sideslopes of landfills.

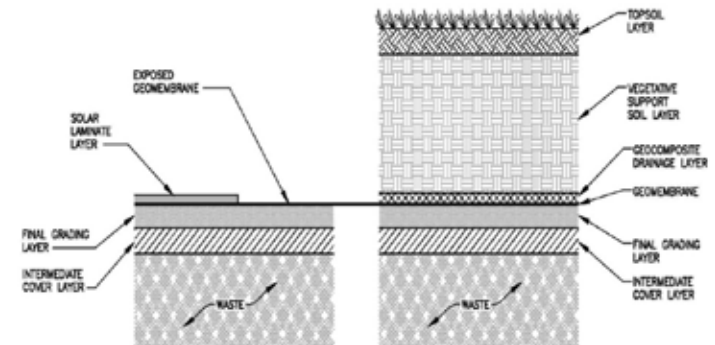


Figure 1: Solar energy cover vs. traditional landfill cover

## Maintenance and useful life

Panels will require cleaning, especially in arid climates, where dust from landfill operations tends to accumulate on the panels. Design life for laminate panels is approximately 20 years.

One manufacturer, First Solar, guarantees that their panels will produce 90% of the nominal power for 10 years, and 80% for 20 years (First Solar, 2009b).

## Power generation

One of the most attractive features of a solar EGC is that it can be a source of revenue beyond the active life of the landfill.

Potential on-site uses include reducing the parasitic load of pumps, compressors and other equipment at landfill gas to energy facilities. The energy can also be used to power remediation systems and site operations or returned to the grid.

## Case studies

HDR provided design, permitting and construction support services for the Hickory Ridge Landfill solar EGC (Atlanta, Georgia, USA). This project

utilised an EGC design over 19.4ha with 4ha used for solar energy generation consisting of 7000 laminate panels to generate 1MW of renewable electricity.

The project provided benefits that include generating renewable energy, creating a revenue stream and eliminating erosion and dust.

The laminate panels proved ideal because they are flexible, lightweight, require no bracing and thereby don't add point load to the surface of the settling waste mass.

The laminated photovoltaic panels are approximately 6mm thick and generate electricity year round under high and low light conditions and temperatures. The system is designed so the panels can be easily replaced at the end of their useable life (with 20-year standard product guarantee to meet 90% of their rated capacity).

HDR has also completed a detailed concept study for a solar EGC at a landfill in Brisbane, Queensland. The study looked at applying a 2MW system to an area of approximately 4.5ha and the study indicated upside benefits of clean stormwater runoff and the ability to offset site generation needs whilst also feeding back into the grid.

Solar EGCs are increasingly being considered and successfully implemented at landfills throughout the world due to their significant benefits over a traditional cover.

The benefits that these covers offer landfill owners/operators include a more cost effective cover, improved stormwater runoff, and a renewable source of energy.


*Judy DeVita, HDR principal civil engineer, is based in Brisbane while Kanishka Perera, HDR environmental engineer and Mark Roberts, HDR principal waste engineer, are based in Jacksonville, Florida. More: [www.hdrinc.com](http://www.hdrinc.com)* 



Figure 2: Hickory Ridge solar energy cap (Credit: Keith Philpott).