

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. The shapes are primarily triangles and polygons, creating a dynamic, layered effect. The central text is positioned within a white, trapezoidal area that is slightly offset from the center.

# Environmental Benefits of the Jackson County Green Energy Park

What is Landfill Gas?

Methane Destruction and Control

Control of Trace Gases

Use of Waste Wood as Fuel

Use of Waste Vegetable Oil as Fuel

Electricity vs. Methane Use

Value of Environmental Benefits

# What is Landfill Gas?

Methane (CH<sub>4</sub>) - 68%

Carbon Dioxide (CO<sub>2</sub>) - 30%

Trace Gases - 2%

# Methane Destruction and Control

## Gas Destruction estimate

Typical Landfill Gas Flow:	40 cubic feet per minute (cfm)
Methane Content:	68%
Methane Gas Volume:	$40 \text{ cfm} \times 68\% = 27 \text{ cfm}$
Density of Methane:	0.0417 pounds/cubic foot (lbs/ft <sup>3</sup> )
Mass Flow Rate of Methane:	$27 \text{ cfm} \times 0.0417 \text{ lbs/ft}^3 = 1.126 \text{ lbs/min}$

**Total Methane Destruction = 56,223 lbs or 28 tons of methane yearly**  
[1.126 lb/min x 60 min/hr x 8,322 hr/yr (less 5% for maintenance)]

**CO<sup>2</sup> Offset (equivalent) = 1,405,575 lbs or 703 tons of CO<sup>2</sup> yearly**  
[56,223 lbs of methane/yr x 25X impact of CO<sup>2</sup>]

# Control of Methane Gas Movement

## Info

- ▶ Gas moves through gaps in waste mass and ground.
- ▶ Sample probes around property allow us to monitor and track gas movement.

## Methane levels at sample probe #3

- ▶ 85% (almost pure methane), March 1999.
- ▶ 0.1% (almost undetectable) April 2014.
- ▶ Reduction is a direct result of GEP's gas control efforts.

# Trace Gas Destruction

## Issues

- ▶ Three main contaminants of concern at Dillsboro landfill.
  - benzene, 1,1 dichloroethene, and 1,4 dichlorobenzene
  - poisonous, cancer causing chemicals
- ▶ Trace gas chemicals can move into groundwater and the Tuck.

## Solution

- ▶ Gases are drawn out with methane gas and condensate liquids.
- ▶ Industry standard method to destroy these chemicals:
  - burn at very high temperatures
  - mix well with air
  - keep gases in combustion chamber for at least 1 second
- ▶ *Exactly* what happens in GEP's glass and metal-working equipment, with normal operating temperatures 2200 - 2400° F.

# Control of Trace Gas Movement

## Info

Monitoring of sample probes have typically shown a **ten-fold decrease** in contamination since 1999.

## Sample probe #3 - 1,4 dichlorobenzene level

- ▶ NC Water Quality Standard - 6.0  $\mu\text{g}/\text{l}$  (micrograms per liter)
- ▶ 2005 - 19  $\mu\text{g}/\text{l}$
- ▶ 2013 - 1.8  $\mu\text{g}/\text{l}$

# Waste Wood as Kiln Fuel

## Info

- ▶ GEP's wood-fired ceramics kiln supports classes at WCU and SCC along with area artists.
- ▶ Fired using wood from waste trees removed by Public Works and others.
- ▶ Typically pine and knotted wood not suitable for firewood.
- ▶ No treated wood or other construction/demolition materials burned.

## Issues

- ▶ Burning wood at typical woodstove temps (700 - 1000° F) releases carbon dioxide, carbon monoxide and soot particles.
- ▶ Carbon monoxide and soot are harmful to human health.
- ▶ Buried trees and wood scraps decompose and release methane gas.



# Waste Wood as Kiln Fuel

## Solution

- ▶ GEP wood kiln burns extremely hot - over 2400° F.
- ▶ Carbon monoxide and soot are thermally “cracked”, becoming more fuel.
- ▶ Main emissions are CO<sup>2</sup> and water vapor.
- ▶ Even the wood ash melts at 2200° F, creating unique glaze effects on pots.
- ▶ Kiln creates minimal waste, ashes, and emissions.
- ▶ Allows students and others to make beautiful, unique pottery.



# Waste Vegetable Oil (WVO) as Kiln Fuel

## Info

- ▶ Waste vegetable oil (WVO) is a common kitchen byproduct that's difficult to dispose of properly.
- ▶ WVO contains nearly the same amount of energy as gasoline.

## Issues

- ▶ Emptying WVO into drains damages sewer or septic.
- ▶ WVO can kill pets or other animals if eaten in large amounts.

## Solution

- ▶ GEP kiln designed with supplementary WVO burner.
- ▶ WVO burns very cleanly when mixed well with air at high pressure.
- ▶ Able to reach 2200° F in kiln's secondary chamber using WVO alone.
- ▶ WVO donated by area restaurants and community members.
- ▶ Over 750 gallons of WVO recycled to date.



# Electricity vs. Methane Use

## Info

- ▶ GEP glass furnace (holds large pot of molten glass) is electrically heated - using about \$850 per month, March - December.
- ▶ Electric furnaces provide the best glass quality.
- ▶ Furnace is extremely well insulated - only 250° F on the outside while it's 2050° F on the inside.

## Issues

- ▶ Some question why a renewable energy park uses electricity.
- ▶ Not enough landfill gas available to run furnace and other equipment.
- ▶ Electric generation is very inefficient (30%) use of gas, so generating our own electricity doesn't make sense.

## Solutions

- ▶ Recent upgrade added another 1,000 pounds of insulating cement to increase furnace's ability to hold heat.
- ▶ GEP searching for *outside grants* to pay for solar panels that could help offset our electric use.





# Methane Use

## Info

- ▶ Methane gas from the landfill provides fuel for:
  - two (2) glass gloryholes (working ovens) \*
  - three (3) blacksmith forges \*
  - a metal foundry \*
  - six (6) frameworking torches \*
  - two (2) future ceramics kilns
- ▶ Gas burns extremely hot - new high temperature of 2480° F in gloryhole #1.
- ▶ Commercial glass studios spend \$1,000 - \$2,500 a month on propane.
- ▶ The GEP and our artists use landfill gas instead.

## Solutions

- ▶ Ongoing upgrades will provide better gas system monitoring and recording capabilities.
  - \* only such equipment in world using landfill gas



# Value of Environmental Benefits

- ▶ Tuckaseegee River is huge economic engine for Jackson County. [Fly fishing map, “Play On” campaign, rafting]
- ▶ Jackson County’s ongoing landfill gas collection efforts prevents chemicals and methane from polluting river and community.
- ▶ Haywood County facing **\$5 - \$7.5 million** in environmental cleanup costs for Francis Farm landfill, with no methane collection system.
- ▶ Value of clean water for fishing, boating and other recreation activities: **priceless.**

# Contact Information

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