

Waste Heat for Powering a Community Greenhouse Project

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Superintendent of Solid Waste**



Department of Environmental Services

Air Quality

Water Quality

Sustainability

Clean Water Services

Environmental Compliance

Solid Waste Management



Solid Waste Management

Curbside Recycling (by private waste haulers)

Springfield Yardwaste Recycling Center

Household Chemical Collection Center

Information & Education

Market Development

Recycling Centers

Springfield Sanitary Landfill



Springfield Sanitary Landfill

- Current landfill opened in 1975
- Current permitted area of 134 acres
- Average annual tonnage 199,550 tons
(Average of 650/day)
- 6.1 million tons currently in place
- Average depth of waste 50 ft
- Anticipated closing 2030-2035
- Tipping fee \$30.94 per ton

Project Beginnings

- EPA Landfill Methane Outreach Program (LMOP)
www.epa.gov/lmop
- Who should we partner with? Local utility, rural electric coop, gas pipeline, local school?
- What will it cost and will it pay for itself?
- Environmental & Landfill Impacts?
- Feasibility Study, Shaw Emcon/OWT March 2004

LFG Production Potential

Flow	Electrical	Heat
450scfm (<i>actual</i>)	1.26MW	118,260MMBtu/yr
650scfm	1.82MW	170,820MMBtu/yr
1000scfm	2.81MW	262,800MMBtu/yr
*1200scfm	3.37MW	315,360MMBtu/yr

Methane Recovery Project Organization

- Joint Partnership between City of Springfield (COS) and City Utilities (CU)
- COS Sanitary Landfill responsible for gas collection and supply to CU
- CU responsible for generation facility and power distribution
- Equal partnership in success and/or failure

Project Breakdown

City of Springfield

- Gas Extraction Wells
- Associated Piping
- Condensate Management
- Blower/Flare Skid
- Gas Flow & Quality

City Utilities of Springfield

- Generation Facility
- Engine O&M
- Condensate Management
- Power Transmission & Distribution

Landfill Gas System Characteristics

- 81 vertical wells & blower/flare skid
- Total over 30,000 ft. pipe
- Installed cost approx. \$2,500,000
- Average LFG flow of 900-1200 scfm
- LFG avg. 50-60% methane and 40% CO₂

Engines: 2X Caterpillar G3520C
1,200 rpm
2,233 hp each

Generator: 1,600 KW each
480 Volt
13.2 KV Step-up

Capacity
factor: 95% target
90% achieved

O&M Completed by CU



Project Status

- Project was dedicated in May 2006.
- Steadily producing 2.5 to 3 MW of renewable energy for City Utilities customer.
- Gas quality and production has been relatively close to projections.

What's the next step?

- Engines are 35-40 percent efficient.
- Most of the energy produced is being lost as heat.
- How do we capture this valuable resource?

The Prototype

- Northern Tier Solid Waste Authority in Pennsylvania
- SWANA Gold Award in 2008 for landfill gas utilization.
- 14,400 ft² greenhouse utilizes 1.85 million btu/hour.
- Producing multiple varieties of lettuce using deep pool hydroponics.
- ONLY using jacket water from one Caterpillar 3520 engine.

How do we make this work here?

- City received \$40,000 from American Recovery and Reinvestment Act (ARRA) and the Transform Missouri Initiative administered by MDNR.
- Conduct market research and feasibility study.
- Includes multiple team members; City, CU, MSU, consultants, interested community members, others.
- Provided market research, financial analysis, basic facility design, and identified potential partners.



Initial Indications

- 95% of our produce is imported.
- Estimate approximately 14 million btu/hour of available waste heat from both sources. Also provides potential for 1000 tons of cooling.
- Based on prototype and interviews with other operations, enough heat is available to support up to a 4-8 acre greenhouse, depending on whether the heat was captured from both heat sources

Why do we think it will succeed?

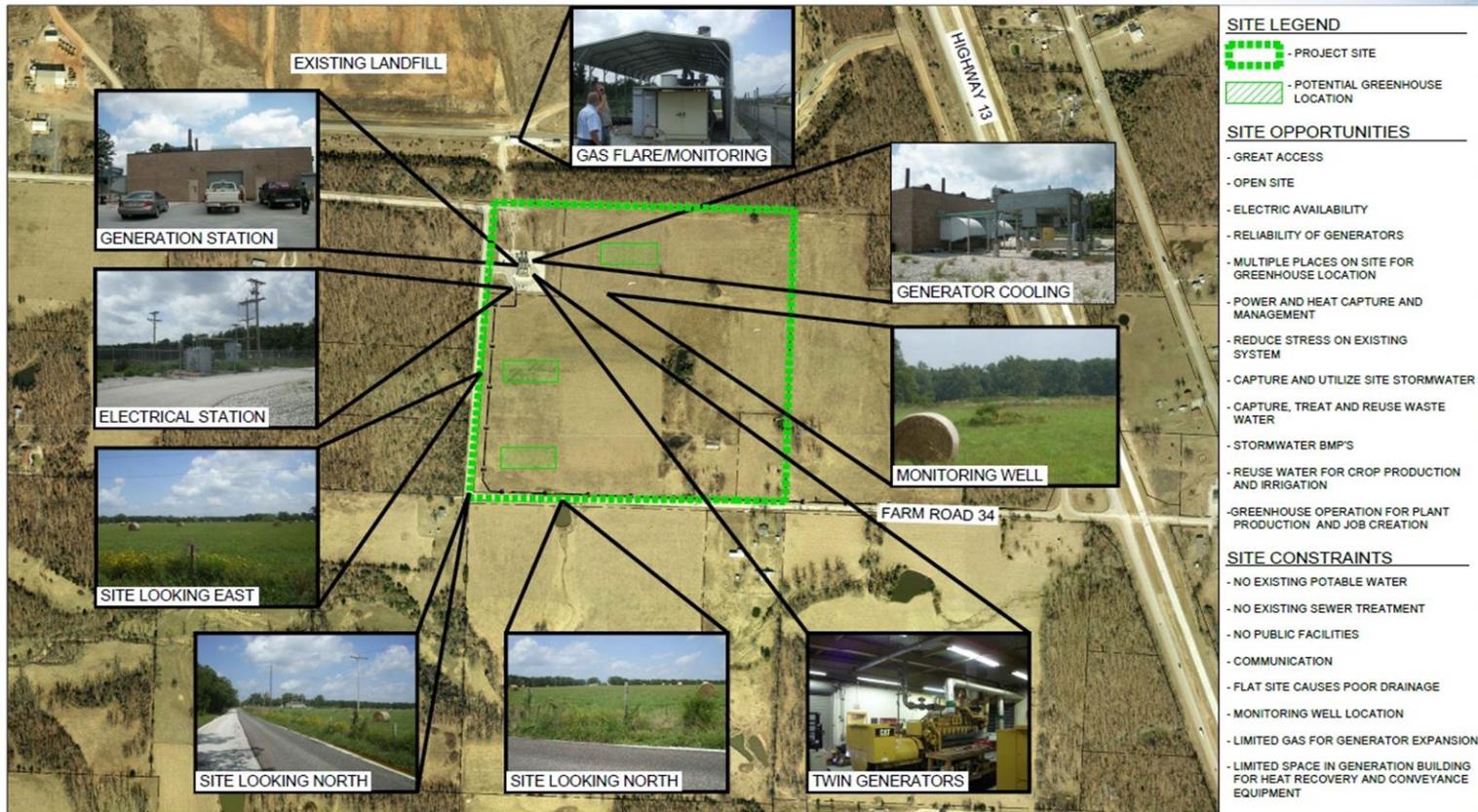
- A minimum of 25% of greenhouse operation cost is energy.
- City owns the property – no land costs
- Potential exists to produce locally grown organic produce or other products.
- Demonstrates positive impact on the environment through renewable energy and eliminating long haul imports.
- Creates local jobs and eliminates some dependency on outside food sources.
- Increasing public interest in local, fresh, organically grown products confirmed by study.



Site Details

CITY OF SPRINGFIELD, MISSOURI

SOLID WASTE MANAGEMENT DIVISION
RENEWABLE ENERGY/SUSTAINABLE FOOD PROJECT FEASIBILITY STUDY



SITE OPPORTUNITIES AND CONSTRAINTS



AUGUST 2011

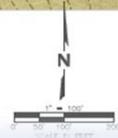
Possible Project Layout

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SITE CONCEPT PLAN



AUGUST 2011

Continued Research

- Initial Market research and feasibility study were completed in 2011.
- Community input
- Site visit to confirm project approach
- Guiding Principles – Overall Principles
 - Whatever we do should help local farmers and not compete unfairly with local farmers.
 - Results should benefit the citizens.
 - The project should increase the awareness of the benefits of local food production, in general.

Current Project Status

- Fall 2015 news article
- RFP based on guiding principles
 - Partner(s)
 - Design, build, and operate
 - 4-8 acre commercial greenhouse operation
- Responses due April 29, 2016!



Questions??