FROM PUTRID TO PROFIT:

Finding Reusability in Landfill Gas

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BURNS McDONNELL

BACKGROUND

- All landfills produce landfill gas (LFG), but not all produce enough for reuse
- Traditionally, only large landfills produced enough LFG for reuse
- Feasibility studies make it possible for smaller landfills to find viable partners for reuse

ASSESSING A LANDFILL'S ABILITY TO REUSE LFG REQUIRES THREE STEPS:

1. **Reliability**
   What is your gas production?
2. **Viability**
   What are your options for reuse?
3. **Feasibility**
   What option is most financially and commercially sound?

1. RELIABILITY

As a first step, it's important to understand how much LFG is being produced at your site, how consistent that production is and how much LFG is required for reuse.

CONSISTENCY OF GAS PRODUCTION

Production of LFG should be monitored over time (see chart example) to determine reliability of production.

LFG PRODUCTION OVER TIME

Year	Annual Tonnage[1]	LFG Generated (scfm)	LFG Collected (scfm)
2015	50,269	504	289
2016	43,000	514	300
2017	46,965	516	309
2018	51,027	522	313
2019	51,282	532	319
2020	51,539	541	325
2021	51,796	550	330
2022	52,055	558	335
2023	52,315	566	339
2024	52,577	573	344
2025	52,840	580	348
2026	53,104	586	352
2027	53,370	593	356
2028	53,637	599	359
2029	53,905	604	363
2030	54,174	610	366
2031	54,445	615	369
2032	54,717	620	372
2033	54,991	625	375
2034	55,266	630	378
2035	55,542	634	381
2036	55,820	639	383

[1] Annual growth at 0.5%

LEACHATE RECIRCULATION

LFG production is affected by:

- Waste composition
- Age of refuse
- Presence of oxygen
- Moisture content
- Temperature

By adding a leachate recirculation system to increase biological activity, LFG production can accelerate. This also improves waste settlement, stabilization and leachate quality, reducing leachate disposal for your site.

2. VIABILITY

LFG collection is sometimes necessary for regulatory compliance, but considering options for reuse can be beneficial. In some cases, an existing pipeline or nearby industry must be in place to accomplish successful reuse.

DIRECT USE

LFG is converted to medium BTU and piped directly to an industrial production facility, heating, or various other manufacturing processes.

ELECTRIC GENERATION

LFG is piped to power generation plants to be burned in a generator or for combined heat and power (CHP).

CONVERSION TO NATURAL GAS

LFG is converted to high, pipeline-grade natural gas and added to an already existing pipeline and distributed to the national pipeline grid, used as compressed natural gas (CNG) or liquefied natural gas (LNG).

3. FEASIBILITY

After determining the reliability of LFG production and viability of reuse, a comprehensive study of cost is necessary to weigh each reuse option against one another.

CASE STUDY:

LFG Reuse Project: Shrimp or Ethanol?

Lyon County produced what they thought was a usable amount of LFG--but how much and for what purpose? BMcD conducted a site study to find the answers.

SITE BACKGROUND

- Landfill permitted by Minnesota Pollution Control Agency in 1970
- Receives approximately **50,000** per year of municipal solid waste
- Closed area: Approximately **21 acres**
- Open area: Approximately **13 acres**
- Leachate recirculation began in **2005**
- Performed original LFG reuse feasibility study in **2008**
- Installed active LFG collection system in **2010**
- Performed second LFG reuse feasibility study in **2015**

2015 FEASIBILITY STUDY

The 2015 feasibility study analyzed the LFG collection system data to determine that the landfill was creating and capturing a consistent, usable amount of LFG each year and would continue to do so in the decades to come.

REUSE OPTIONS

By examining the possibility for direct use, electrical generation and LFG conversion, we uncovered options for LFG reuse:

- Direct use LFG to Archer Daniels Midland, an ethanol facility
- CHP option for RALCO/TruShrimp
- Direct use to RALCO/TruShrimp (TruShrimp), a shrimp-farming facility (harbor)
- Leachate evaporation
- Combined direct use and leachate evaporation

FOCUSING THE STUDY

As part of TruShrimp's development plan, a harbor was already planned to be sited at the landfill property. Given this information, a partnership with TruShrimp was deemed to be a viable option.

We then further considered direct use options for CHP or use within boilers.

CHP OPTION

Pros

- Utilize 100% of supplied LFG
- Heat recovery offsets 90% of thermal demand
- Requires limited LFG treatment

Cons

- Costly grid transmission line upgrades
- Back-up/Standby power requirement is costly
- No downtime allowed due to shrimp mortality

BOILER USE OPTION

Pros

- LFG offsets 100% of thermal demands
- Requires limited LFG treatment
- Local economic development

Cons

- Varying seasonal demands limits operational efficiency
- Secondary fuel source required as backup
- Excess LFG to be burned off or flared

LANDING THE RIGHT OPTION

The decision? The CHP option was determined to be less feasible than the direct use option. Lyon County then pursued the recommendation of a direct use partnership with TruShrimp in combination with leachate evaporation.

LANDING THE RIGHT OPTION

Results:

- Generate 8 MMBtu/hour at 300 scfm (2015-2016). Increasing in future.
- TruShrimp average thermal demand 4.5 MMBtu/hour
  - Peak during winter
  - Lower demand during summer
- Leachate evaporation 4 MMBtu/hour = 400 gallons/hour
  - Peak during summer
  - Lower during winter
- Capital costs: $2.3M
- O&M -$92,000 annually
- Net Present Value: $197,000 15 year term
  - Assumes $4.00/MMBtu flat for term
  - Same leachate evaporation/hauling assumptions

3 KEY CONSIDERATIONS WHEN MAKING AN LFG PLAN

1. Determine priority of LFG reuse:
    - Greenhouse gas emission reduction
    - Reduce cost from reduced leachate hauling
    - Generate revenue through the sale of LFG
2. Continue engagement with reuse partner for further opportunities
3. Consider leachate evaporation:
    - Develop leachate evaporation system to incorporate future LFG reuse with potential reuse partner

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Michael is a project manager in the Environmental Services Group at Burns & McDonnell. His work focuses on providing municipal solid waste facilities in the Midwest with planning, siting and design, permitting, environmental reporting, and construction management services. His experience includes solid waste program planning, financial analysis for solid waste capital programs, construction management and oversight, and feasibility studies.

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