

University of New Hampshire Landfill Gas Project

Brief
For
LMOP

09.22.2006 08:55



Landfill Gas

The Opportunity

- Naturally occurring
 - By-product of landfill decomposition
- Contains ~50% CH₄ (methane)
 - Commercial natural gas is >96% methane
- Must be captured to control landfill odor
 - System of wells, piping and pumps already exists to collect gas
- Turnkey Landfill (TLF) in Rochester, NH producing more gas than Waste Management can use
- UNH Co-Gen Plant uses large quantity of natural gas for fuel

Landfill Gas

The Challenge

- Contains a variety of contaminants
 - H₂S, VOC's, siloxane, moisture
- Relatively low energy content (~500 BTU/scf)
- Turnkey Landfill is 12.5 miles from the campus
- Landfill gas volume steady year around. UNH energy needs vary seasonally.

Landfill Gas

The Benefit

- A renewable energy resource
- Will replace nearly all Co-Gen natural gas
 - 85% of campus energy can be from renewable energy
- Reduce exposure to energy market fluctuation
 - Improve cost stability and predictability
- Cost avoidance

Landfill Gas Project Concept



Dirty, low-energy gas



Processing Plant
(Remove Contaminates)



Flare Tail Gas and
Unused Gas

Raw Landfill Gas

Clean, medium energy gas



Electric Generators



UNH Co-Gen Plant

Project Elements

- Landfill Gas Processing Plant
Design/Construction/Operation
- Pipeline Design/Construction
- Wetlands and Air Permit
- Excess Gas Strategy*
- Risk
- Schedule and cost

Landfill Gas Processing Plant

- Raw landfill gas contains
 - ~500 BTU/scf
 - 45% CO₂
 - 4% N₂ & < 2% O₂
 - Saturated
- Process steps remove
 - Moisture
 - Sulfur compounds
 - Iron sponge
 - Siloxane, VOC's, & O₂
 - Temperature Swing Adsorption (TSA) using activated carbon bed, and Thermal Oxidizer
 - CO₂
 - Pressure Swing Adsorption (PSA) using molecular sieve

Processing Plant Steps

Raw Gas

50%

Methane

Spent Iron
Sponge (Solid
Waste to
Landfill)

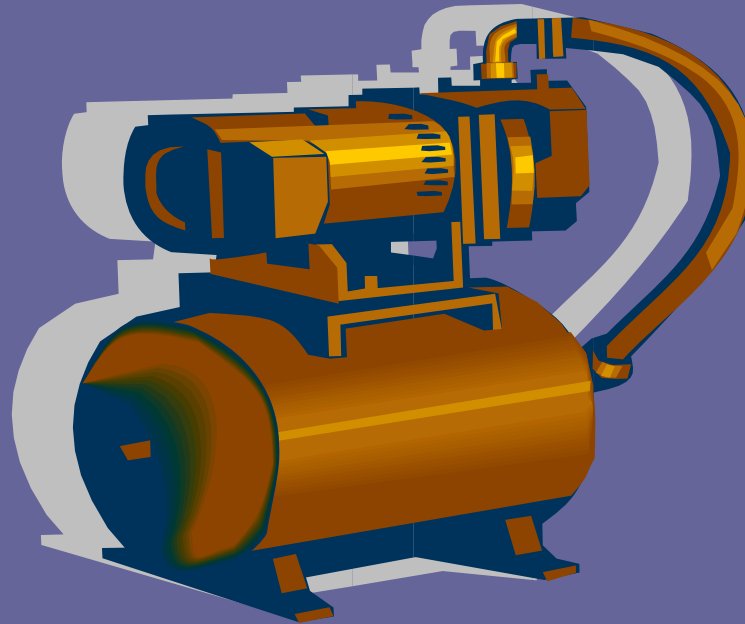


Thermal Oxidizer
(Destroys
contaminates)

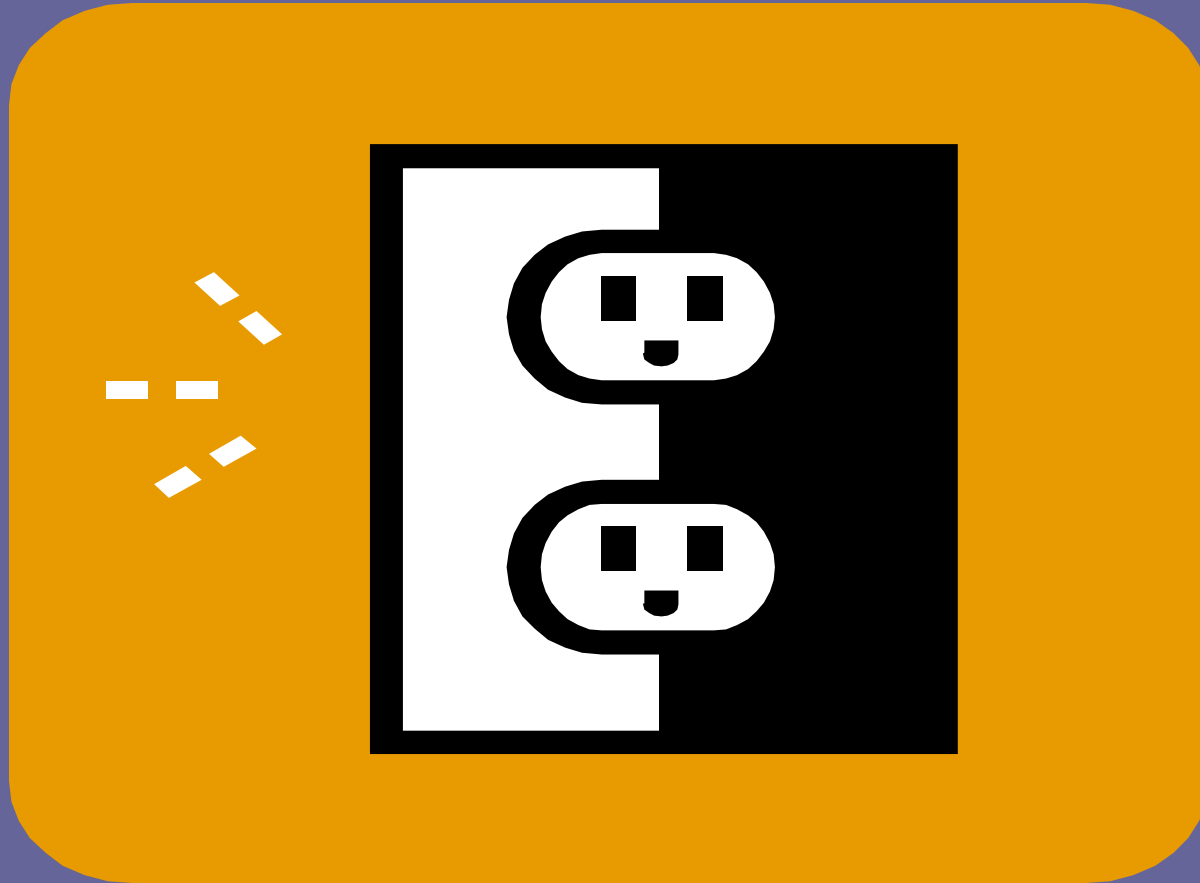
CO₂ to atmosphere



Compressors to 175 PSI



First step after sulfur treat- 3.5 MW
of power needed





McComas
Thermal
Oxidizer. High
temperatures
destroy VOC's.



Ultra-Low NOx Flare (TLF)

Processing Plant

- Gas leaving processing plant will be:
 - 810 to 950 mmBTU/scf
 - Nearly 0% siloxane
 - Very low levels of VOC's and sulfur
 - No CO₂
 - ~8% N₂
 - 150 psig
 - Bone dry
- Finished gas meets Co-Gen Turbine manufacturer specs for fuel

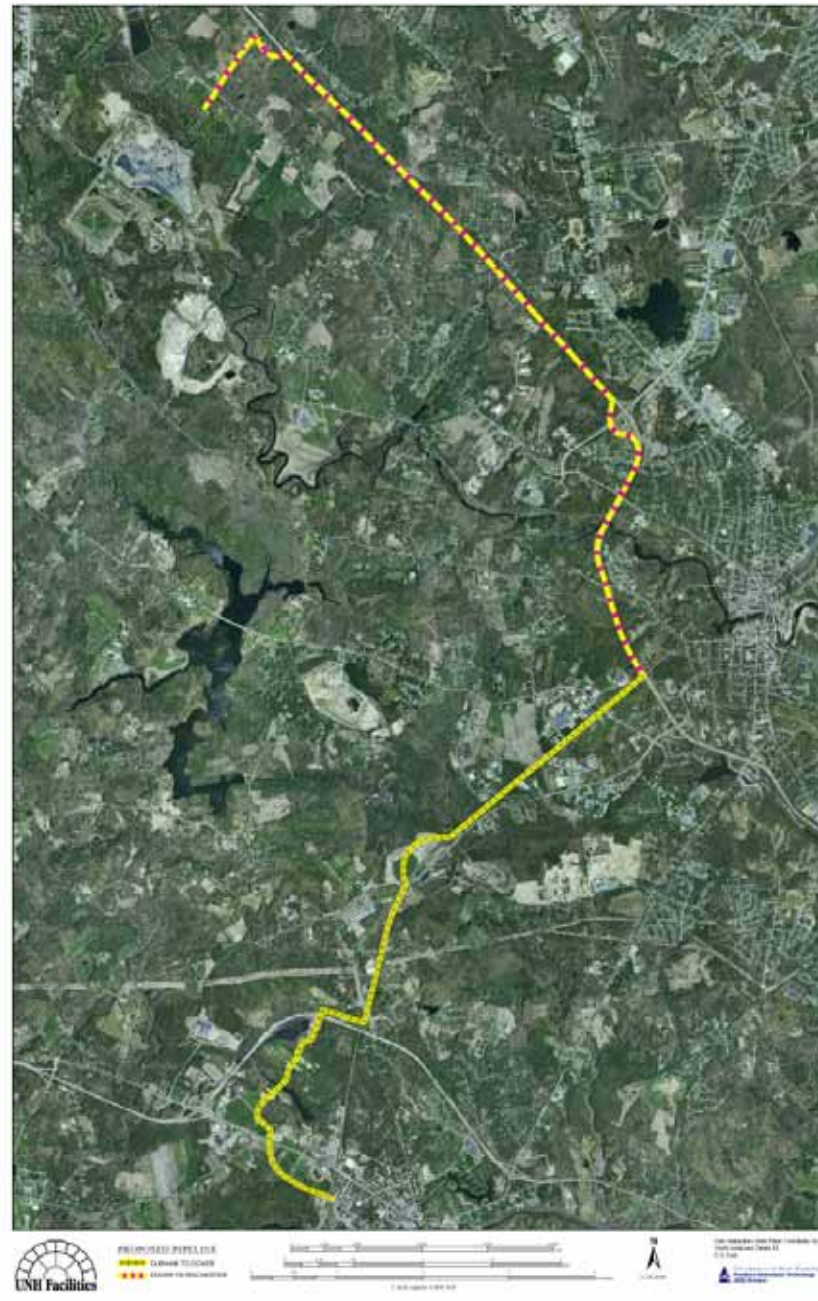
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Pipeline

- State Turnpike to Railroad bed to UNH
 - Four communities: Rochester, Dover, Madbury and Durham
 - Two town roads from landfill to State Turnpike
 - Two private landowner along RR
 - Two bridge crossings
- 12” diameter plastic pipe
 - Rated to maximum allowable pressure of 125 psig
 - Sized to maximum future gas volume

Pipeline Route



Pipeline (cont.)

- Design/build contractor.
 - Competitive process
 - Proposed innovative use of directional drilling to pass pipe under sensitive wetlands and at least one crossing of Cocheco River
- UNH Route mostly settled
 - No known issues
 - Each Community has been briefed several times including Conservation Commissions, Planning Board and Community staffs
 - RSA presentations to 4 community Planning Boards pending
 - Public Hearing on wetlands permit on 2 Nov.

Project Elements

- Landfill Gas Processing Plant
Design/Construction/Operation
- Pipeline Design/Construction
- **Wetlands and Air Permit**
- Excess Gas Strategy
- Risk
- Schedule and cost

Emissions-Air Permit

- Processing plant included under UNH emissions permit as “support facility”
- Four regulated pollutants-NO_x, SO_x, VOC's, CO
- UNH in nonattainment zone for NO_x and VOC's
 - Triggers stricter standards & additional regulatory review

Emissions- Air permit

- NHDES Review
 - 4-6 month process
 - We believe they will expedite for this project
- Arcane regulations
 - Several meetings with DES & outside consultant to understand
 - UNH/DES exchange of letters confirm understanding
- DES very supportive....net benefit to State
 - State-wide net reduction in emissions & fossil fuel use
 - Permit submitted

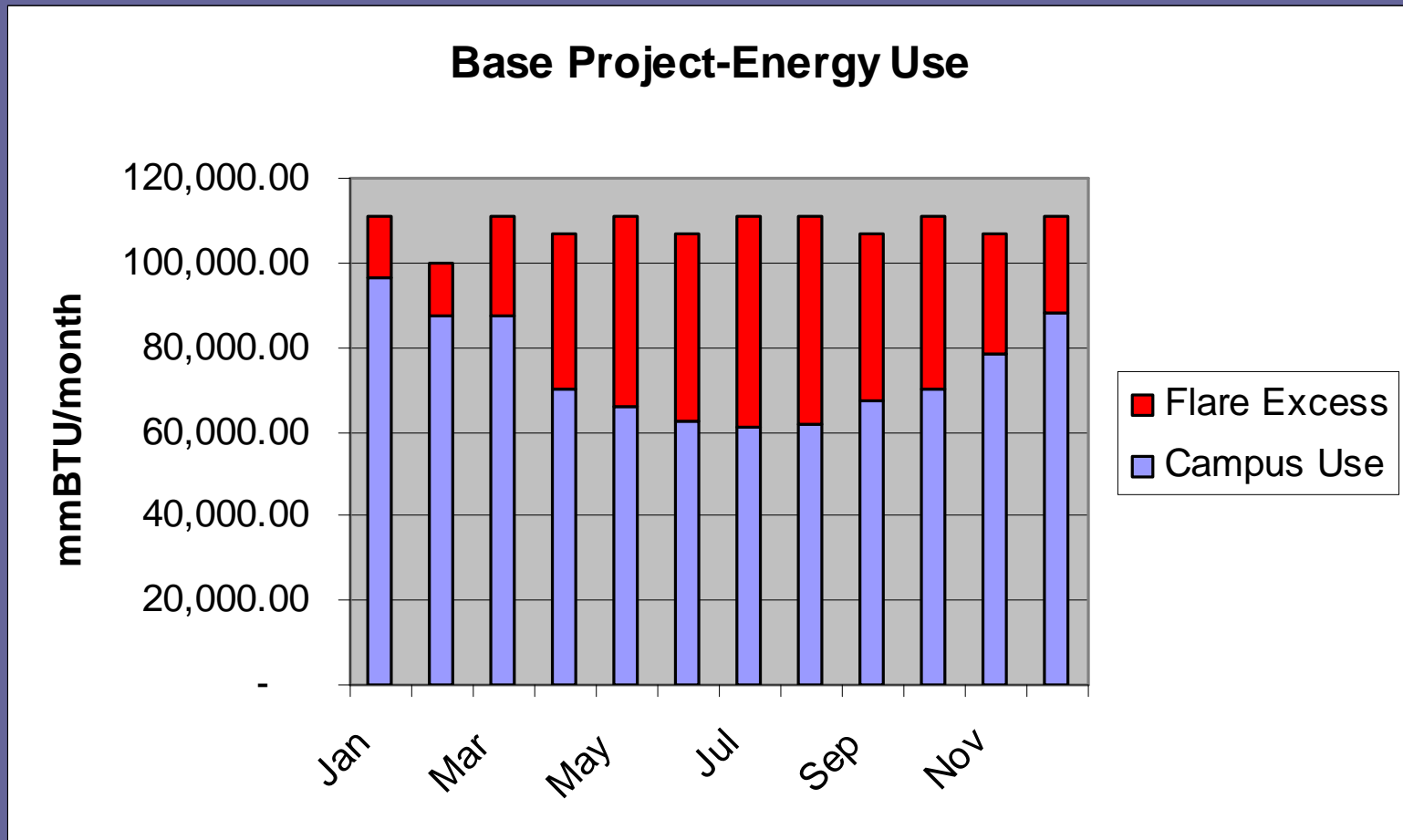
Wetland Permit

on target

Project Elements

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Processed Gas vs. Campus Use



Maximize Use of Available Renewable Resource

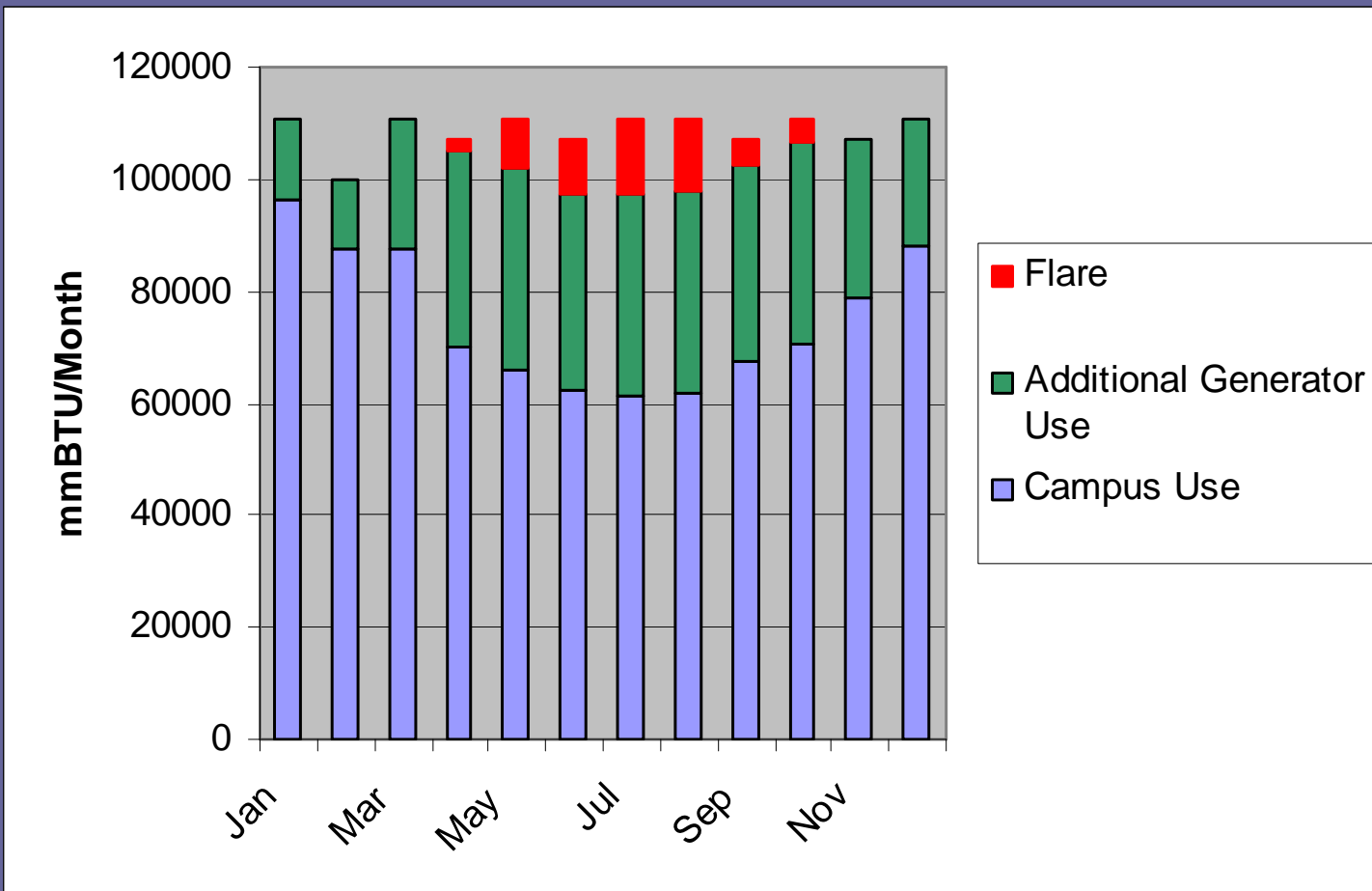
- Evaluated and Discarded Several Options
 - Generate Electricity at Turnkey Landfill
 - \$11M PSNH Upgrade required
 - Liquefaction
 - Technology not proven enough
 - Refine to pipeline quality & sell to Northern Utilities
 - NU system limitations

Excess Gas

Current Strategy

- Add generator in CHP
 - Most likely a Solar Mercury 50 Turbine
 - Requires engineering feasibility study before final recommendation
- Sell excess KWH to NEPool grid
- Sell Renewable Energy Credits
- Goal: On line for Summer '08

Maximize Landfill Gas Use



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Risk

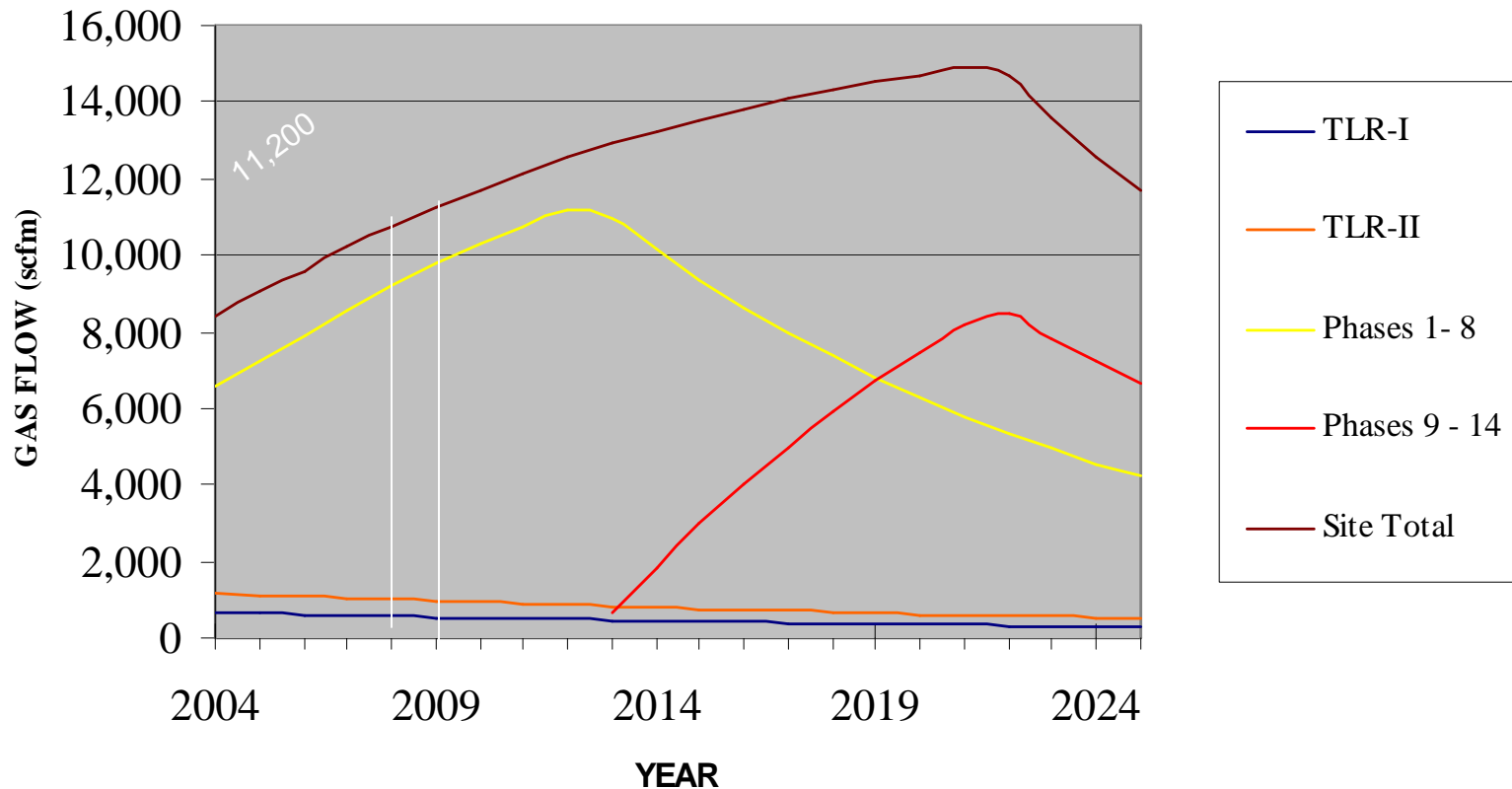
Community Concerns

- Repeated briefings to Conservation Commissions, Planning Boards, Town Staffs all well received
- Formal RSA presentation to Planning Boards & DES Permit Hearings required
 - Opportunity for objections
 - Abutters to pipeline
 - Safety & Construction impact
 - Wetlands Impacts
 - Processing Plant Safety, Appearance & Noise
 - Emissions
- Mitigate through public outreach/information

Risk

Landfill Gas Quantity

ESTIMATED LANDFILL GAS GENERATION AT TREE SITE



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Project Schedule

Begin Construction in spring 07
Operational spring/summer 08

Budget-Base Project

(Project Cost in \$000)

Processing Plant	\$18,000
Pipeline	\$15,000
Total Project	\$33,000
Less WMNH Contribution	(\$1,200)
Net After WMNH	\$31,800

Project Rewards

Why Should UNH Do This?

- Leadership in renewable energy
 - State role
 - National leader among higher ed
 - 85% of campus energy from renewable
- Reduce dependence on non-renewable energy
 - Exposure to market fluctuation dampened
- Reduce annual cost of operations

A bronze statue of a cougar, likely the mascot for the University of Wisconsin-La Crosse, stands on a large, light-colored rock. The cougar is depicted in a walking or striding pose, facing left. The background features a landscaped area with dark mulch, green grasses, and trees. In the distance, a building with a sign and an American flag are visible under a clear blue sky.

Questions?

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