University *of* New Hampshire

Providing LFG for Campus Energy

Environmental Protection Agency
Landfill Methane Outreach Program Conference
January 12, 2010

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Assistant Vice President, Energy & Campus Development

University *of* New Hampshire

- 12,000 Undergraduates
- 3,000 graduate students
- 5.7 million square feet
- Flagship campus of the University System of New Hampshire


Field House
Whittemore Center
New Hampshire Hall
Hotel
NEC Conference Center
Jessie Doe
Lord Ballard St.
McLaughlin
Stillings
11 Brookway
Nesmith
Kendall
Taylor
College Rd.
Morrill
Pettee
Library Way
James
Main Street
Scott
Congreve
Craft
Stoke
Sawyer
Smith
Schofield
Garrison Ave.
Verrette
E. Demeritt House
Grant
Hersey
Batchellor
Robinson
Rice
Janetos
Town Lot
Wolff
Holloway Commons
Hamilton Smith
President's House
Health Services
Thompson Hall
Murkland
DeMeritt
Hewitt
Hewitt Annex
Conant
Telecom
Zais
Service
Combined Heat & Power Plant
Colovos Rd.
Ritzman
Chase Ocean Engineering
Service Rd.
Waterworks Rd.
Gregg
Redman
Spaulding
Dimond Library
Hood House
Huddleston
Morse
College Rd.
Academic Way
Fairchild
Memorial Union
Hetzel
Mills
South Dr.
Kingsbury
McDaniel Dr.
Paul Creative Arts Center
Horton
Randall
Devine
Alexander
C Lot
Arts Way
SERC
Parsons
Housing Office
Engelhardt
Mitchell Way
Quad Way
Grounds & Roads
Forest Park
Hitchcock
McConnell
Hunter
Babcock
Gibbs
Mill Rd.
Academic Way
Philbrook
Hubbard
B Lot
DeMeritt Cir.
Eaton
Williamson
Christensen
McDaniel Dr.
Richardson

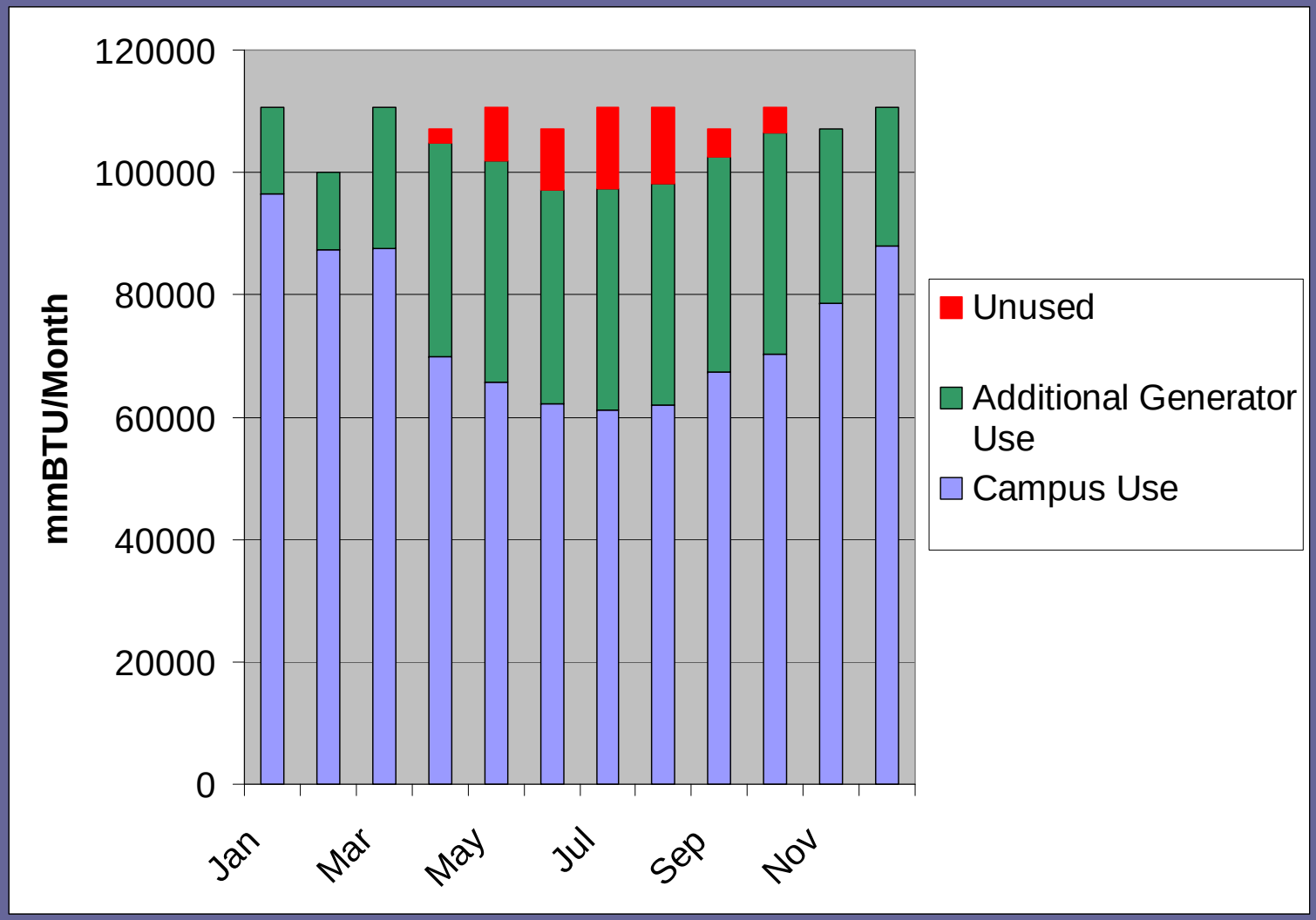
UNH Energy Initiatives

- 2001 DOE Recognition
  - UNH among top 5% of peer institutions for energy efficiency
- 2004 UNH Utility Infrastructure Project Approved
  - $28 million investment in modern technology
  - Combined Heat and Power (Co-Gen) plant
  - Siemens SGT300 7.9 MW Turbine

Landfill Gas
The Opportunity

- UNH need for fuel
  - Annual Natural Gas use ~ 750,000 – 800,000 mmBTU
- Large landfill nearby
- Constraints on landfill gas use on site
  - Air Permit restrictions
  - Local utility limitations

Maximize Landfill Gas Use

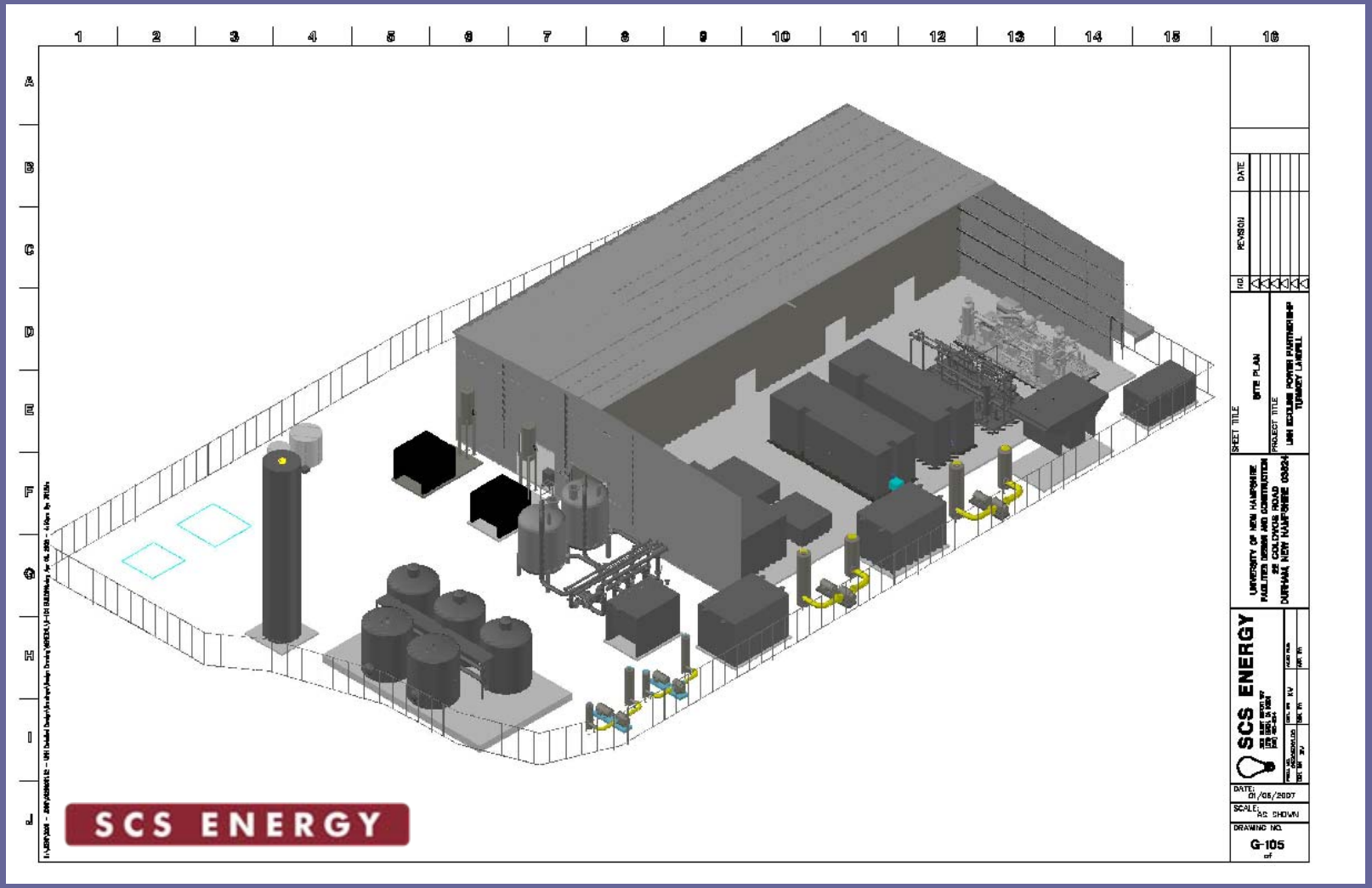


ECOLine™ Power Partnership

- Gas Source
  - Waste Management Turnkey Recycling and Environmental Enterprise
- Processing Plant
  - SCS Engineers - Design/Build/Operate
- Pipeline
  - R.H. White Construction - Design/Build
- Co-Gen Plant Modifications & 2nd Turbine Installation
  - EMCOR Energy Services - Design/Build/Operate

Turnkey Recycling and Environmental Enterprise

Gas Processing Plant



Processing Plant Steps

Raw Gas

(7000 scfm design capacity)

50% Methane

Processing Plant Steps

Raw Gas

50%
Methane

Sulfur Removal

Spent Iron Sponge (Solid Waste to Landfill)

Processing Plant Steps

Raw Gas

50% Methane

Sulfur Removal (Sulfa-Treat)

VOC, Siloxane Removal (TSA)

Spent Iron Sponge (Solid Waste to Landfill)

Processing Plant Steps

Raw Gas

50% Methane

Sulfur Removal

(Sulfa-Treat)

Spent Iron Sponge (Solid Waste to Landfill)

VOC, Siloxane Removal

(Temperature Swing Absorbtion-TSA)

High Temp Flare

(Destroys contaminates)

Processing Plant Steps

Raw Gas

50% Methane

Sulfur Removal

(Sulfa-Treat)

Spent Iron Sponge (Solid Waste to Landfill)

VOC, Siloxane Removal

(Temperature Swing Absorbtion-TSA)

Thermal Oxidizer (Destroys contaminates)

CO2 Removal

(Pressure Swing Adsorbtion-PSA)

CO2 to atmosphere

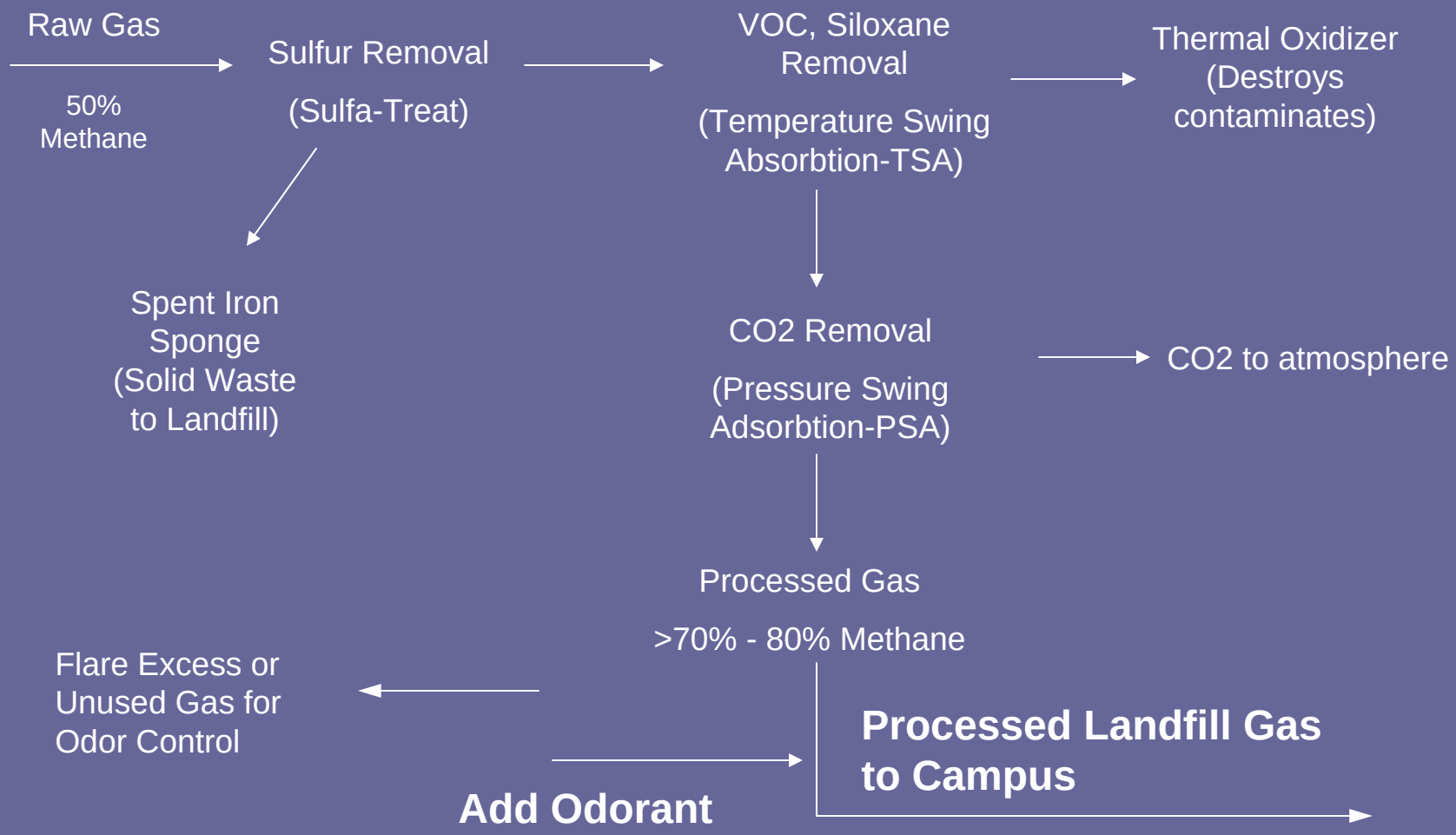
Processed Gas

70% - 80% Methane

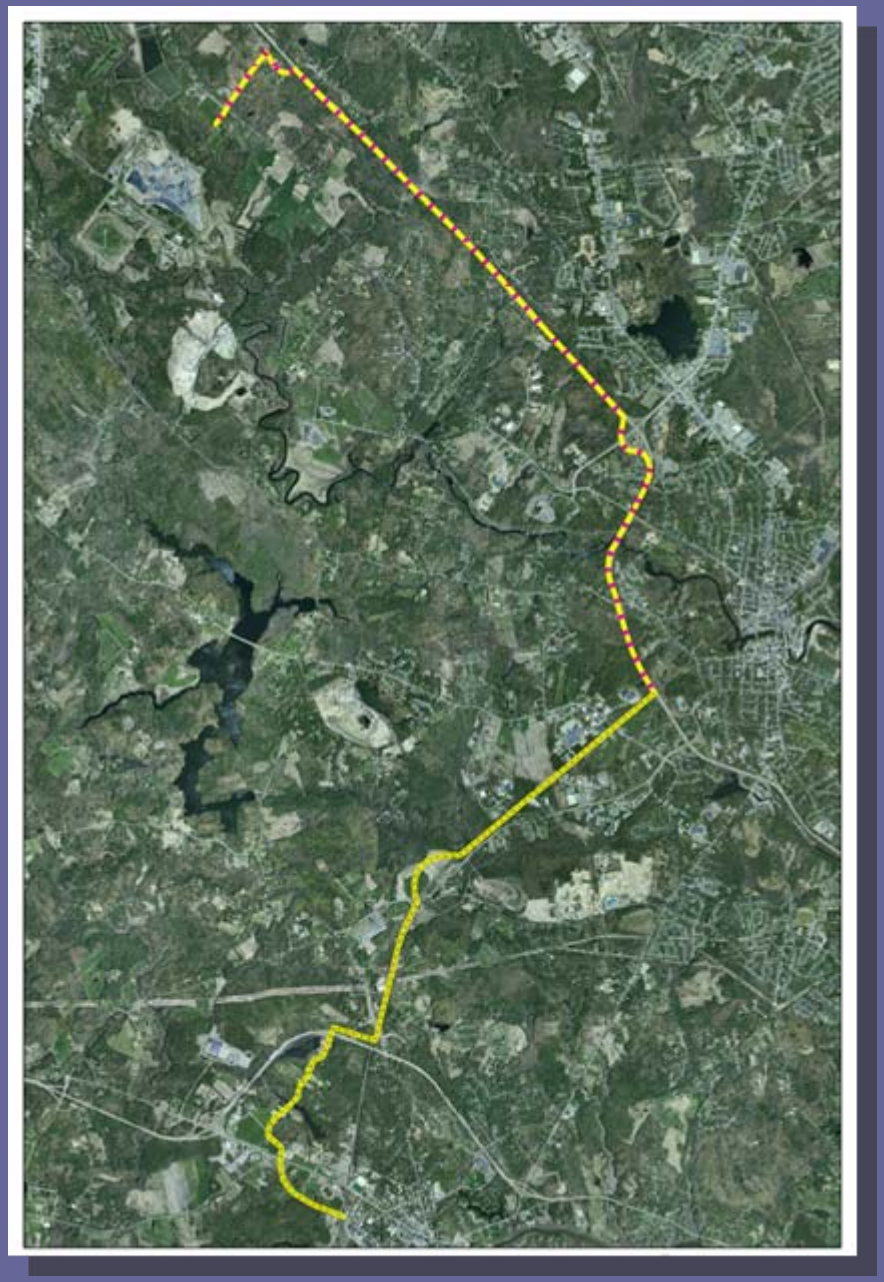
Processing Plant Steps

Flare Excess or Unused Gas for Odor Control

Processing Plant Steps



Pipeline Route



RHW Since 1923
R.H.WHITE COMPANIES, INC.

Pipeline Statistics

- 12.7 Miles 12” OD HDPE
- 125 psi Operating Pressure
- 20,000 L.F. Directional Drilling
  - 5,000 L.F. Rock
- 6 Directional Drilled River Crossings
- 2.1 Acres Wetland Disturbance
- 3 Major Right-of-Way Agreements
  - Lots of Small Easements & Joint Use Agreements

Co-Gen Plant First Turbine

Siemens SGT300 Modifications

- Originally High BTU Gas & #2 Oil Fuel
- Modified Combustion Control Logic for Lower BTU Gas
- Recommissioned Turbine
- Increased Inspection Frequency During Initial Operation

SGT300 Fuel Quality Management

- Modified Fuel Spec
  - Wobbe Index > 32 MJ/NM3 at reference temperature
  - Wobbe Index rate of change < 4% / minute
- System Elements
  - Add natural gas to meet minimum Wobbe Index
  - Lower gas temperature (reduce Wobbe Index Temp Correction)
  - Physical buffer to control rate of change

Fuel Quality Management

Second Turbine Installation

Challenges

- Fuel Quality Management
  - Highly variable gas from landfill
  - Tight fuel specification for turbine
- Approvals
  - Permits and Easements
- Coordination
  - 3 major contracts plus Waste Management agreement
  - Modification of existing, operating plant

Financing

- $45 million HEFA Bond
- $4 million internal fund borrowing
- Repay from savings in 10 years
- Stabilize Campus energy costs
- No State Funding
- No Tuition or Student Fee Increase

Major Milestones

- The “Big Idea” – Summer 2004
- Board of Trustee Project Approval – July 2007
- First Operation on Landfill Gas – May 2009

UNH Media Relations

8 Garrison Ave, Durham, NH 03824 www.unh.edu/news/

First University In Nation To Use Landfill Gas As Primary Energy Source

University Of New Hampshire Will Power Its Campus With Renewable Landfill Gas From The Turnkey Recycling And Environmental Enterprise Facility Owned By Waste Management

"By reducing the university's dependence on fossil fuels and reducing our greenhouse gas emissions, EcoLine™ is an environmentally and fiscally responsible initiative. UNH is proud to lead the nation and our peer institutions in this landmark step toward sustainability."

-- UNH President Mark W. Huddleston


Thank You