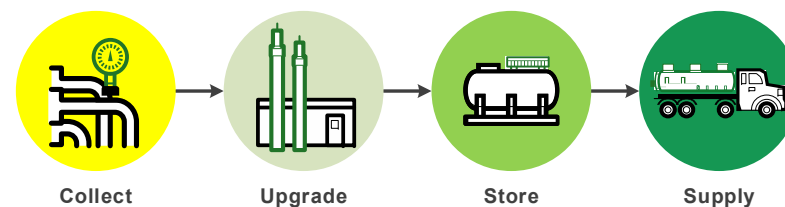


# Challenges and Solutions for Supplying Stable and Quality Landfill Gas to a Gas Processing Plant

LMOP Webinar

Leveraging Untapped Landfill Gas Potential

March 10, 2022



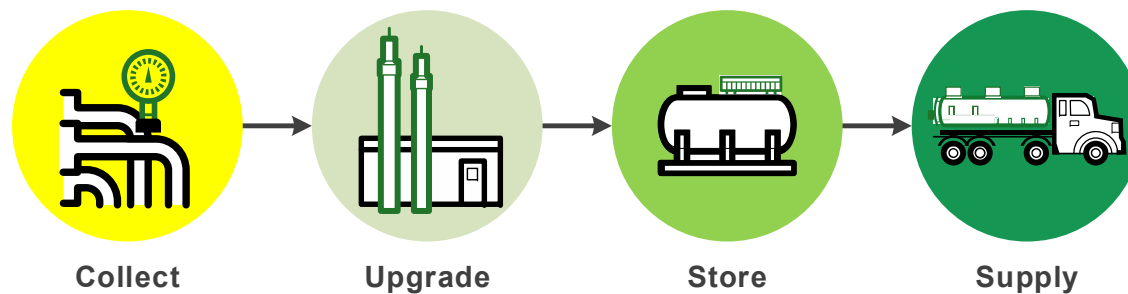
Charles Tremblay, President, Sysgaz Inc.

# Company Profile



Headquartered in Montréal, Sysgaz is an experienced Project Integrator and OEM Equipment Supplier specializing in RNG project development from landfills or anaerobic digesters.

As Project Integrator, Sysgaz provides integrated solutions throughout the whole RNG value chain to increase your RNG project profitability ([www.sysgaz.com](http://www.sysgaz.com)).



# Context & Contents

## Context:

- ✓ Gas processing plant requires stable landfill gas (LFG) for producing quality RNG
- ✓ Small landfills face challenges collecting & supplying stable and quality LFG

## Contents:



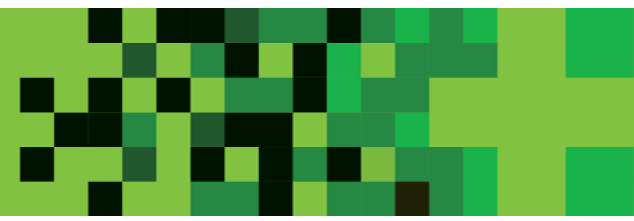
# 1 Basic of LFG Recovery

- ✓ Gas Recovery Systems collect a mixture of gases, liquids, and solids
- ✓ This mixture varies in proportions over time
- ✓ This mixture can also vary from one gas wellfield to another in the same landfill

## Typical mixture collected from landfills

Phases	Elements	Values (Typ.)
Gases (generation)	CH <sub>4</sub>	60% v/v in LFG
	CO <sub>2</sub>	40% v/v in LFG
	Others	Traces (ppm)
Liquids	Leachate	Variable
	Condensate	1 USG / 4 400 CF @ 30°C
Solid	Particle	Variable

## 2 Parameters Impacting LFG Quality



Smaller the landfill, higher LFG quality is impacted by the following parameters

### Landfill Cell Properties:

- Waste type & Compaction
- Elevated or perched liquids within the waste mass
- Waste decomposition / Cell settling
- Daily cover and final cover permeability (Clay or Membrane)

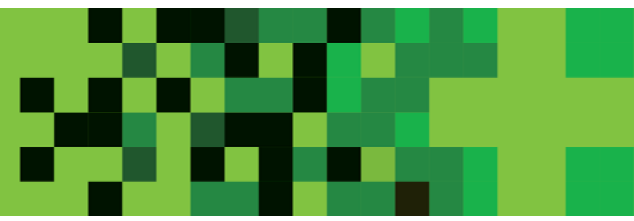
### Gas Recovery System:

- Piping failures & low points due to cell settling
- Wells, laterals, and headers blockage (Leachate, Particles, and Condensate)
- Air infiltration

### Environmental Parameters:

- Atmospheric pressure variations
- Freezing temperature
- Leachate (biological activities and acidification)

### 3 Nitrogen and LFG Quality



Nitrogen is always related to air infiltration

#### Air Infiltration Through Waste:

- Air goes through landfilled wastes
- The  $O_2$  is consumed by the bacteria
- The residual  $N_2$  impacts the LFG quality by reducing its %  $CH_4$

#### Air Infiltration Through External Piping:

- Air infiltrates through Wells / Laterals / Headers / Etc.
- $O_2$  ( 21% v./v.) and  $N_2$  (79% v./v.) enter directly in the gas recovery system
- The infiltrated air impacts the LFG quality by reducing its %  $CH_4$

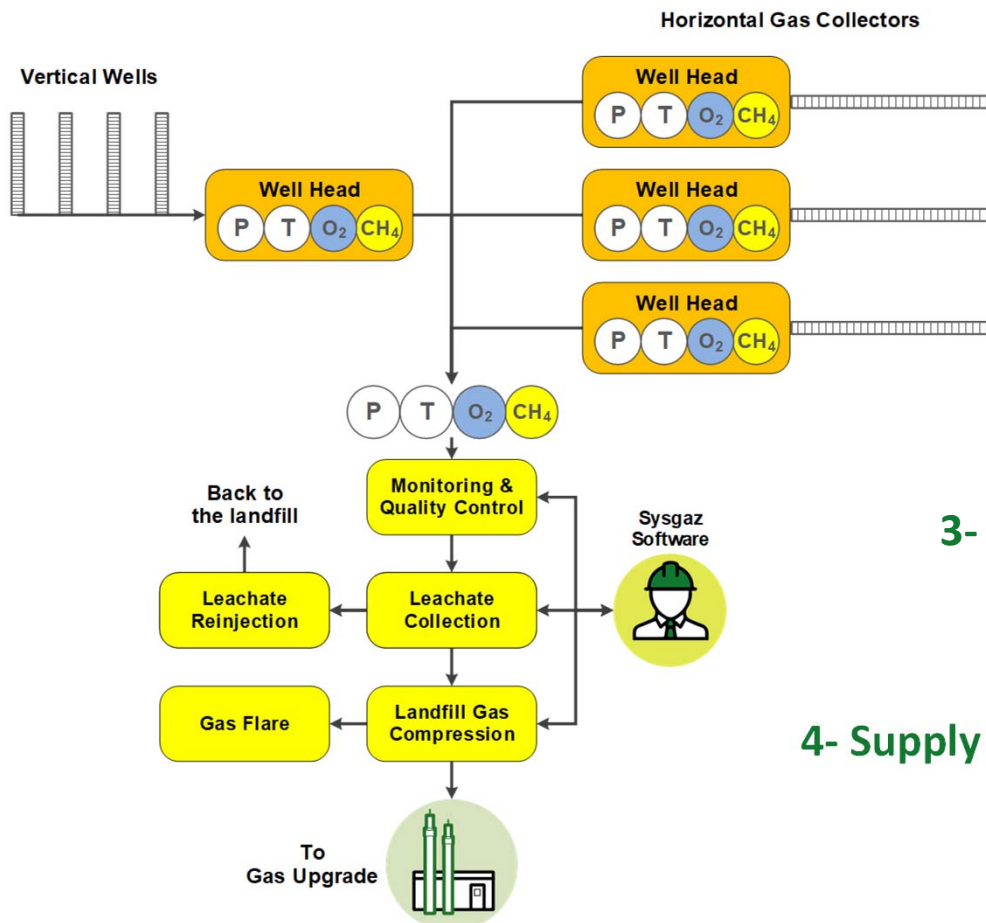
#### Air Infiltration Combined Impacts (Waste + External Piping):

- Air through waste:  $N_2$
- Air in piping:  $O_2 + N_2$
- Impact in the gas recovery system:  $N_2 + O_2 + N_2$  (Infiltration are additional)
- Impact on the LFG Quality: %  $CH_4$  decreases as air infiltration increase

## 4 Supplying Quality LFG Monitoring & Control Strategy



Supplying stable and quality LFG require gas wells 24/7 monitoring and Control



**1- Set** your LFG supply requirement

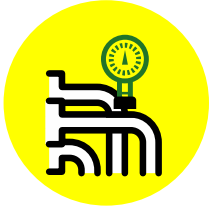
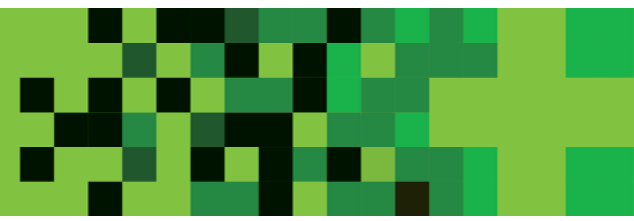
- %  $CH_4$  / %  $O_2$  /  $CH_4$  Flow Rate

**2- Monitor** LFG quality ( $CH_4$ ,  $O_2$ , Temp.) from either vertical or horizontal wells

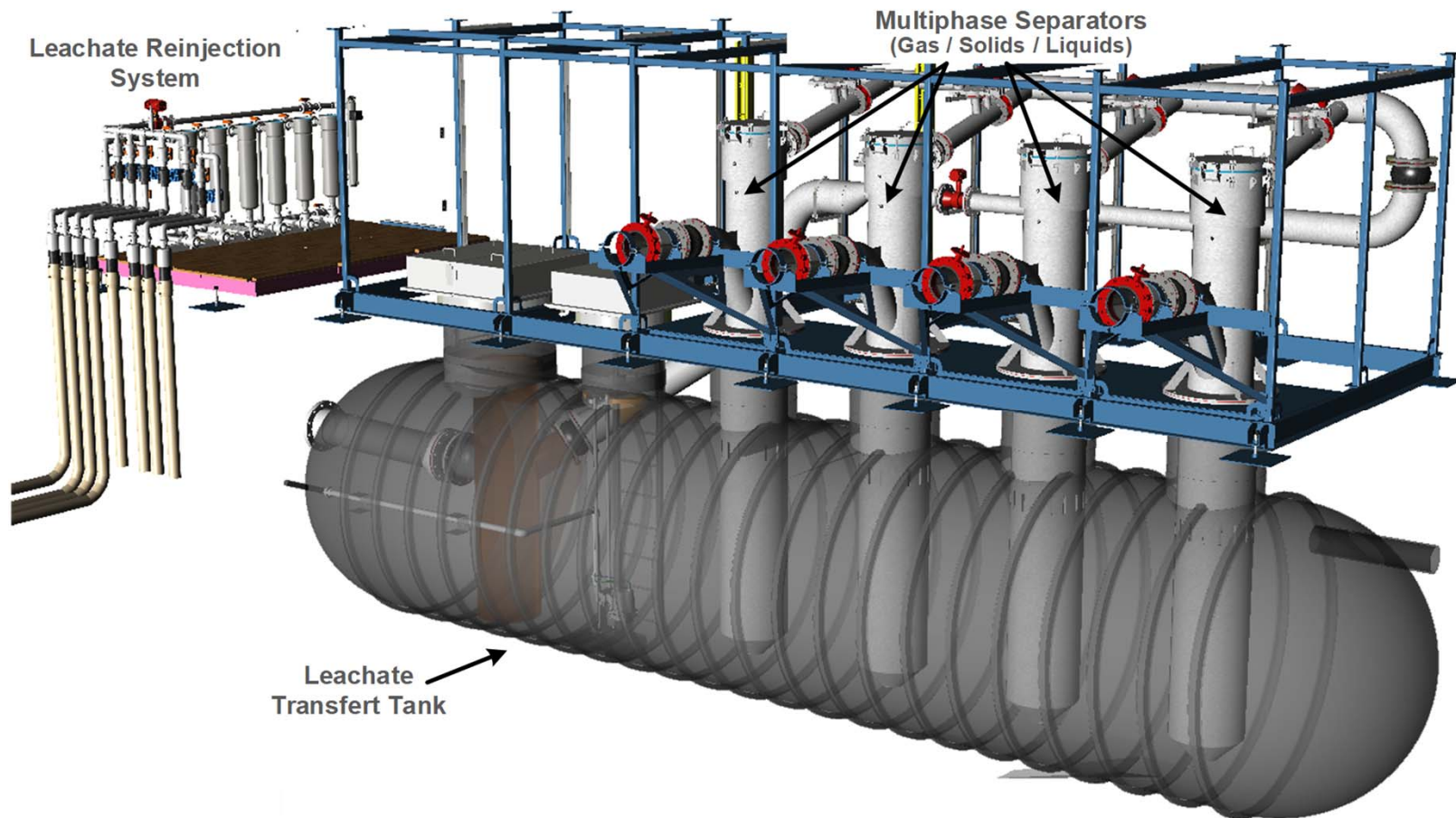
**3- Control** LFG quality from gas wells collecting higher %  $CH_4$

**4- Supply** stable  $CH_4$  flow rate by balancing gas wellfields

## 4 Supplying Quality LFG Gas Wellhead Station



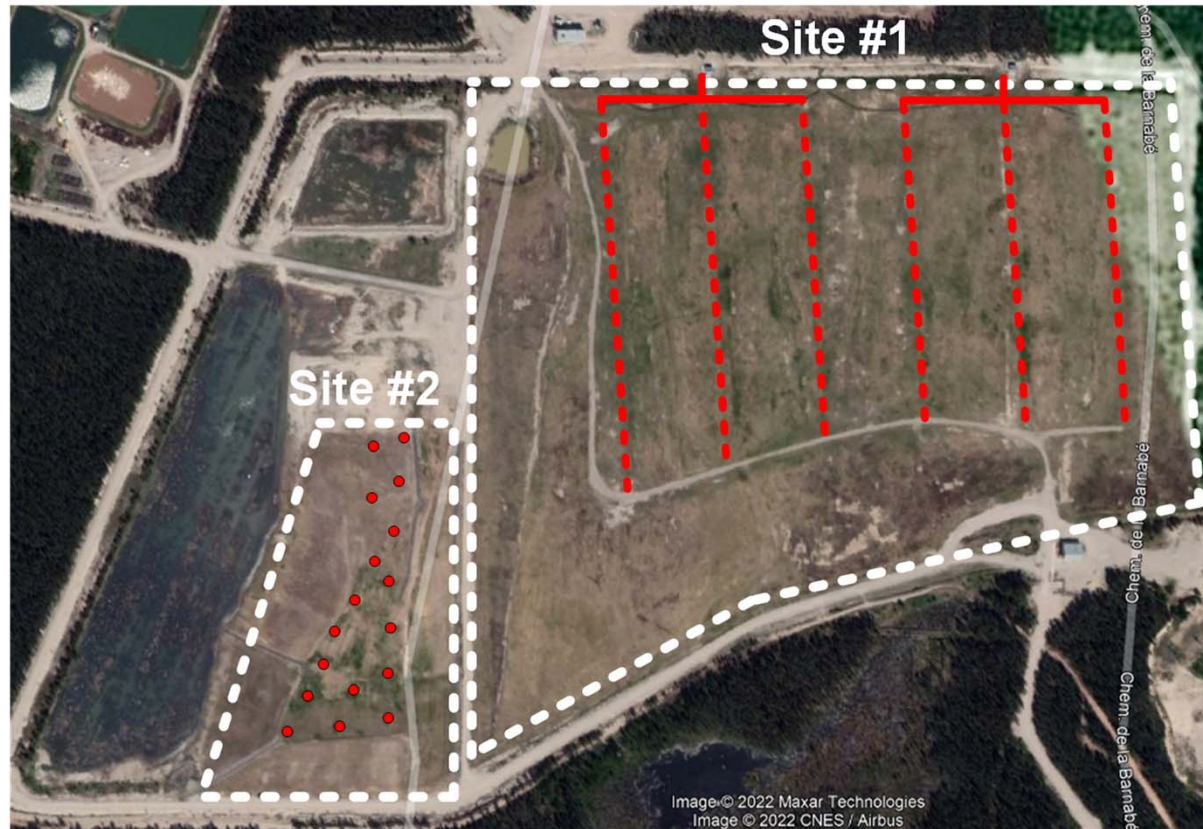
Gas Monitoring & Control Systems must be designed for managing gases, leachate, particles, and condensate associated with LFG recovery



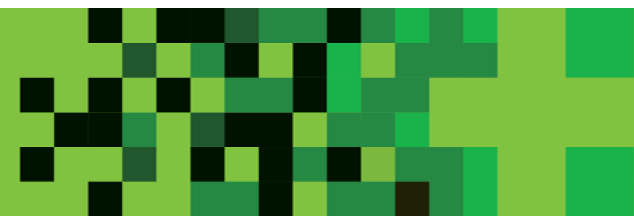


## 5 Case Study – Sites Descriptions

Sites	Status	Tons in Place	Area (sq. ft)	Height (ft)	Capping	Gas Well Types	Gas Well Quantity
# 1	Closed (1982 - 2008)	1,000,000	2,800,000	40	Clay	Horizontal	6
# 2	Closed (2009 - 2014)	450,000	525,000	45	Membrane	Vertical	18



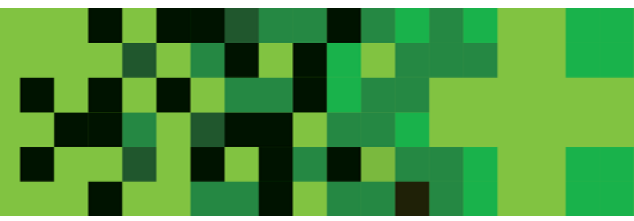
## 5 Case Study – Project Challenges



1. **Site #1:** Collecting CH<sub>4</sub> using 6 horizontal wells from a small closed landfill (1982 – 2008 )
2. **Site #2:** Collecting CH<sub>4</sub> using 18 vertical wells from a small closed landfill ( 2009 – 2014 )
3. Supplying stable CH<sub>4</sub> flow rate to a boiler room through a 5-mile pipeline

LFG Recovery Challenges	Site # 1 Horizontal Wells	Site # 2 Vertical Wells
Final Cover	Clay	Membrane
A. Pressure Variations	+ + +	+
Air Infiltration - Waste ( N <sub>2</sub> )	+ + +	+
Air Infiltration - Piping ( O <sub>2</sub> + N <sub>2</sub> )	—	+ + +
Elevated / Perched Water	—	+ + +
Condensate Blockage	—	+ +
Well Head Freezing	—	+ +

## 5 Case Study – Systems: Gas Wellhead Station



Site #1 –: Gas Wellhead Station Monitoring & Controlling Horizontal Wells

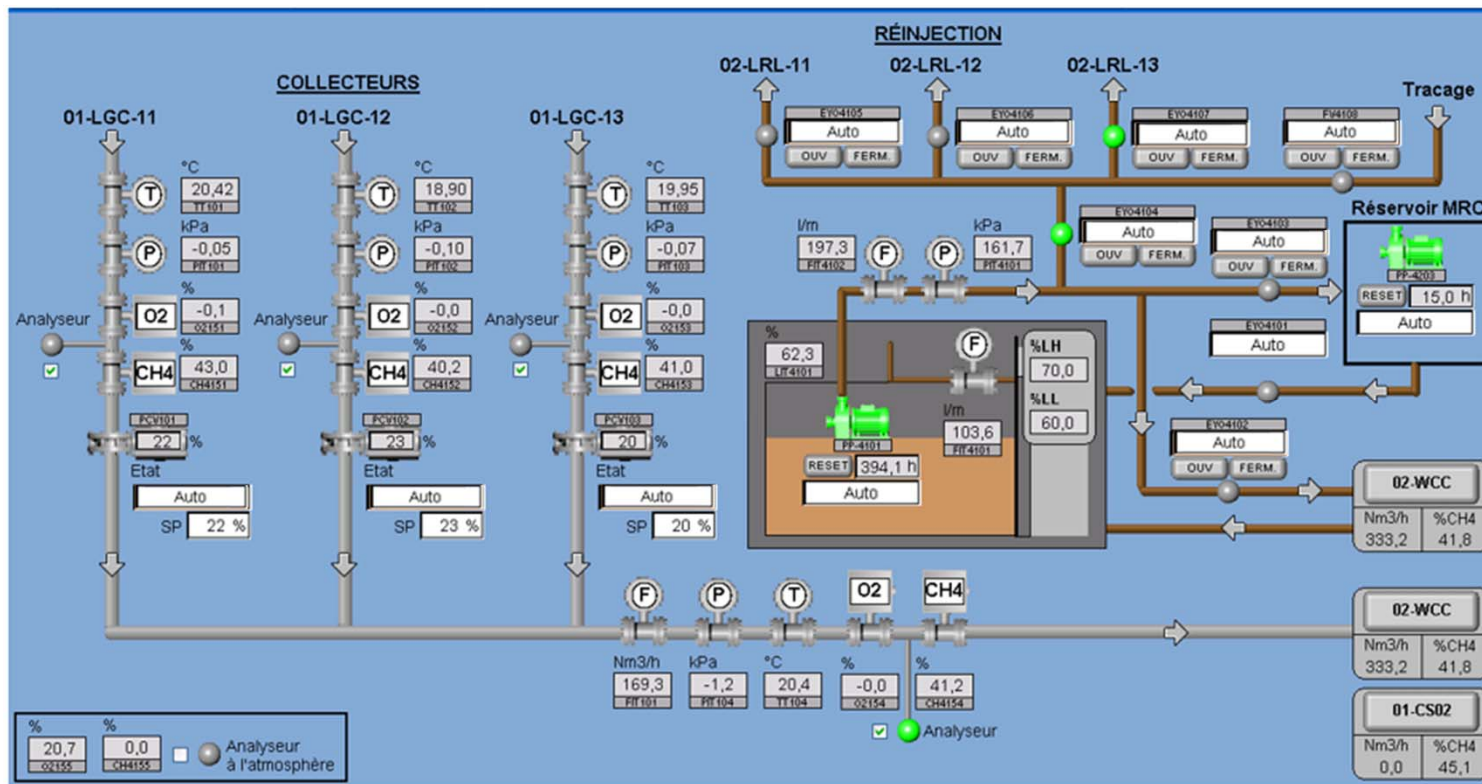


Ascension Landfill Site, Québec



## 5 Case Study – Systems: Software

Site #1 – HMI of the Gas Wellhead Station (Horizontal Wells + Leachate reinjection)

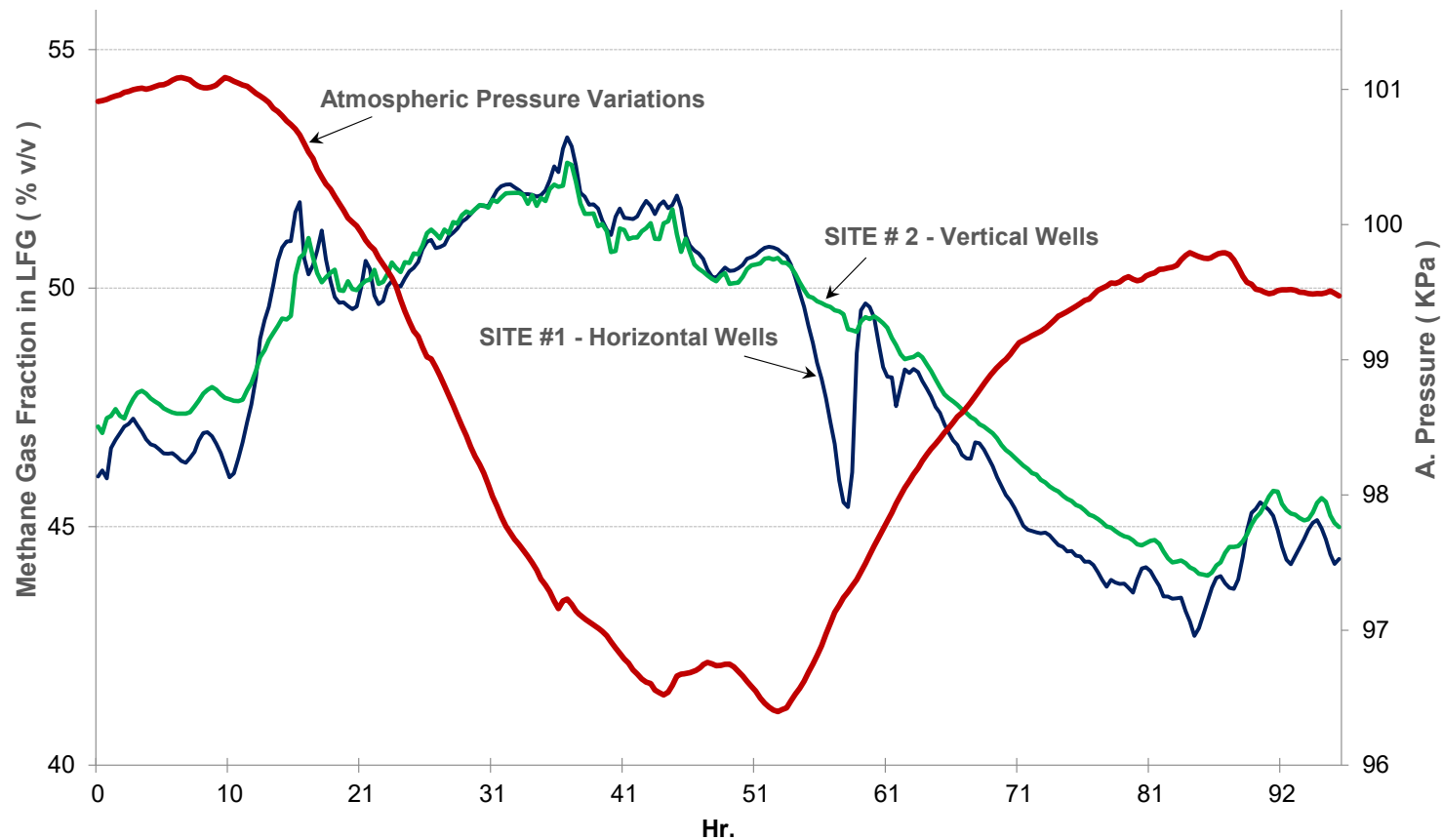


Ascension Landfill Site, Québec

## 5 Case Study – Monitoring & Controlling LFG Quality

### Example #1:

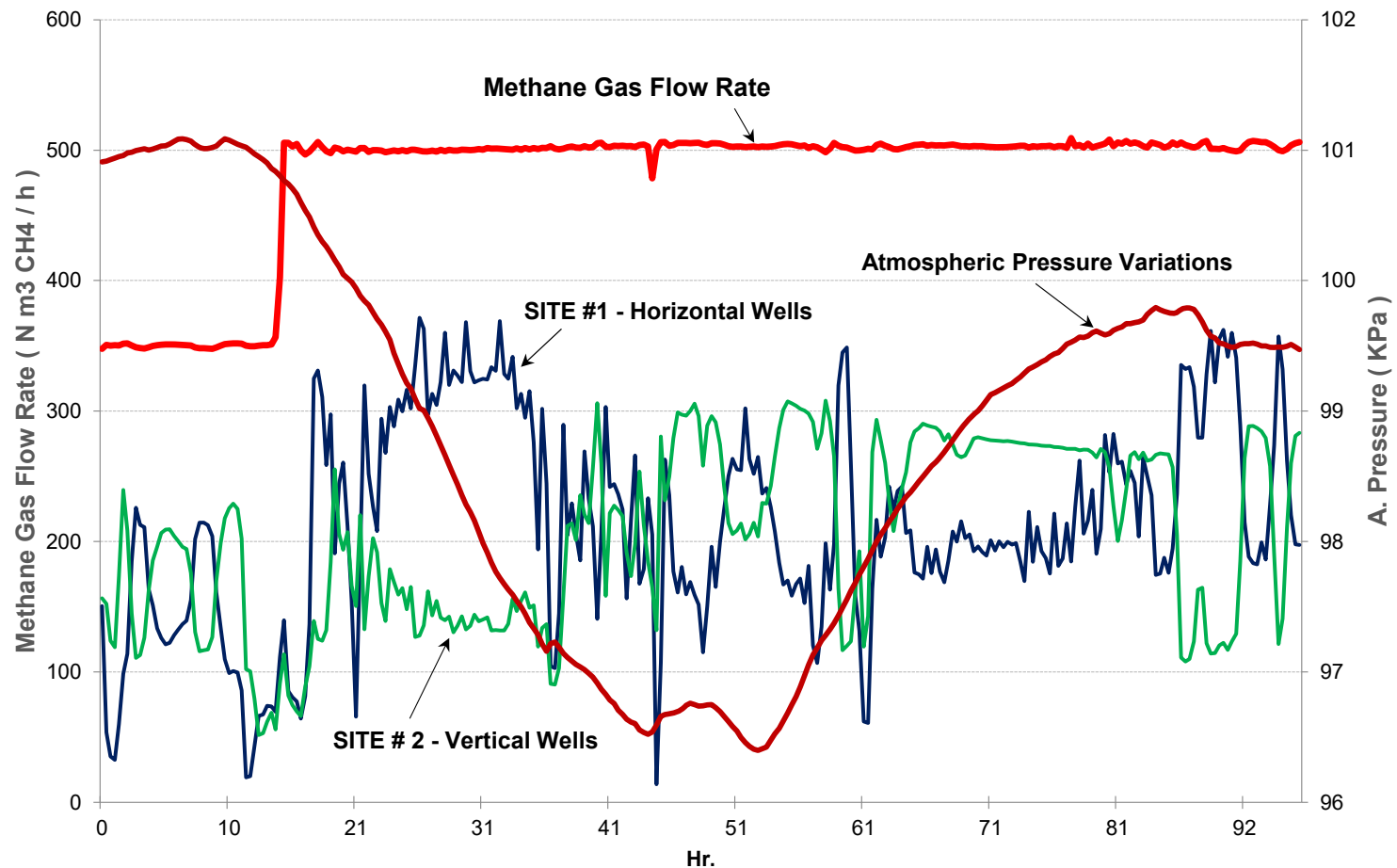
- ✓ The LFG Quality is impacted by atmospheric pressure variations
- ✓ LFG quality control is performed by favoring gas wells collecting higher % CH<sub>4</sub>



## 5 Case Study – Monitoring & Controlling LFG Quality

### Example #1:

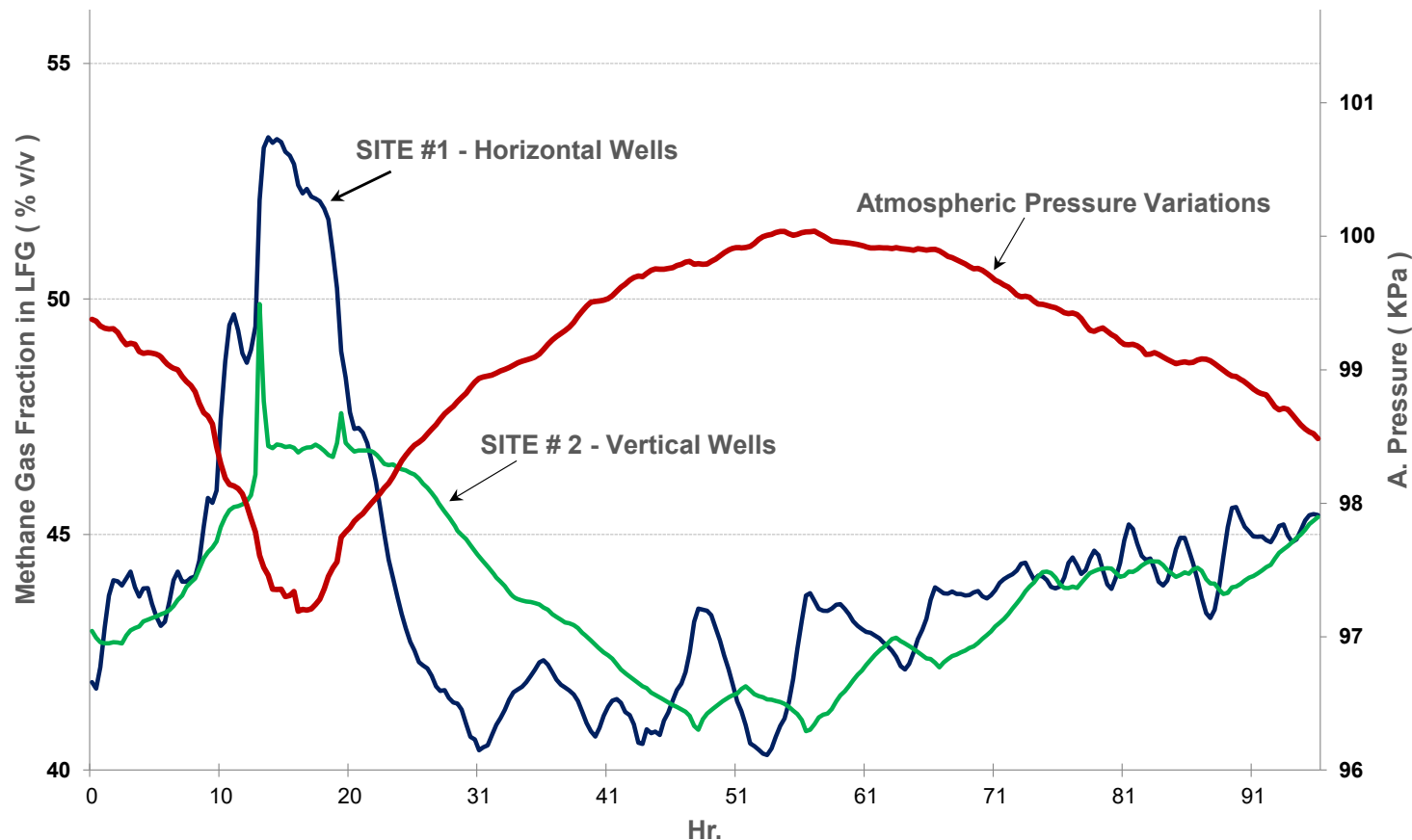
- ✓ The CH<sub>4</sub> flow rate is stabilized by controlling vacuum pressure between gas wellfields



## 5 Case Study – Monitoring & Controlling LFG Quality

### Example #2:

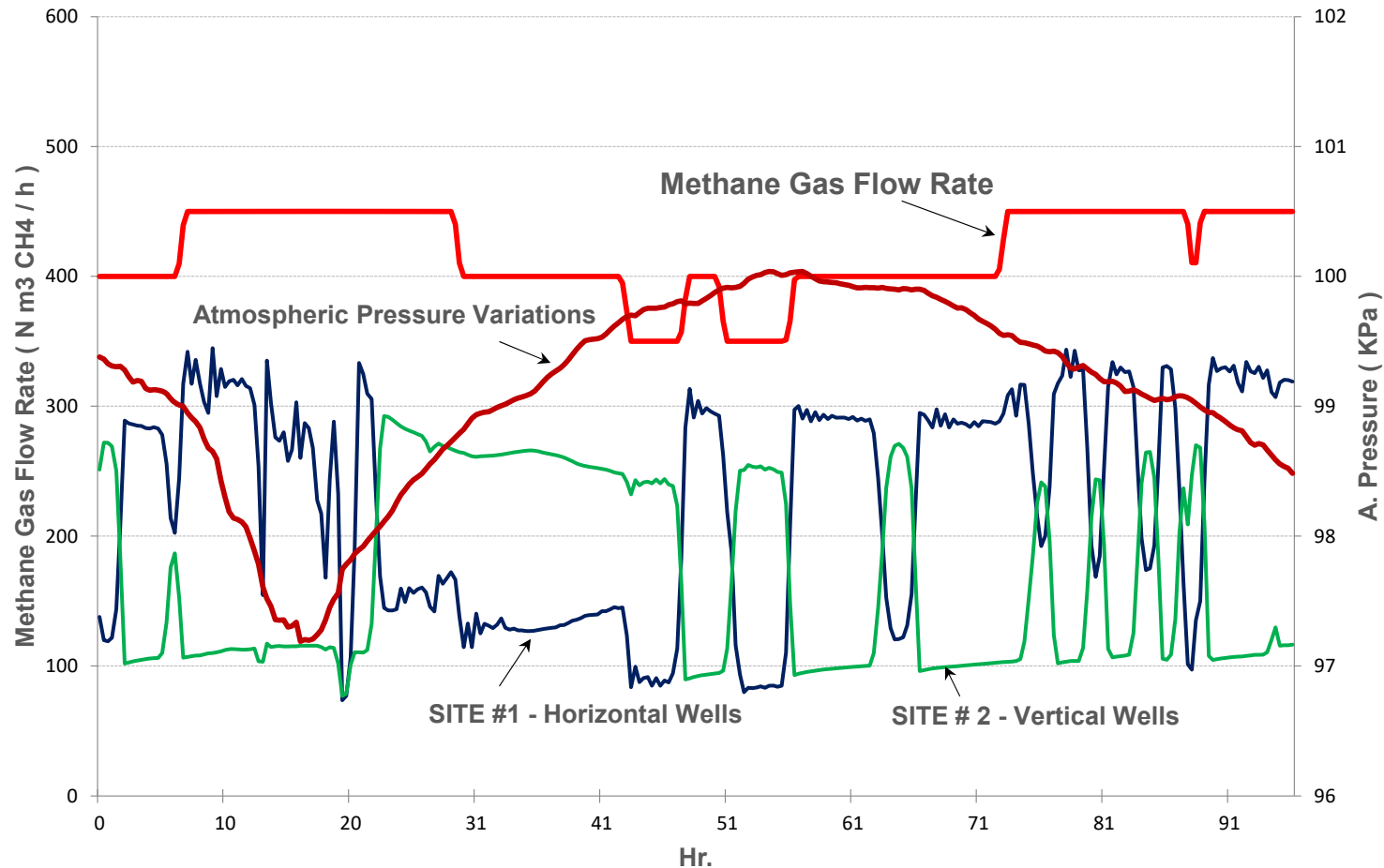
- ✓ The LFG Quality is impacted by atmospheric pressure variations
- ✓ LFG quality control is performed by favoring gas wells collecting higher % CH<sub>4</sub>



## 5 Case Study – Monitoring & Controlling LFG Quality

### Example #2:

- ✓ The CH<sub>4</sub> flow rate is stabilized by controlling vacuum pressure between gas wellfields





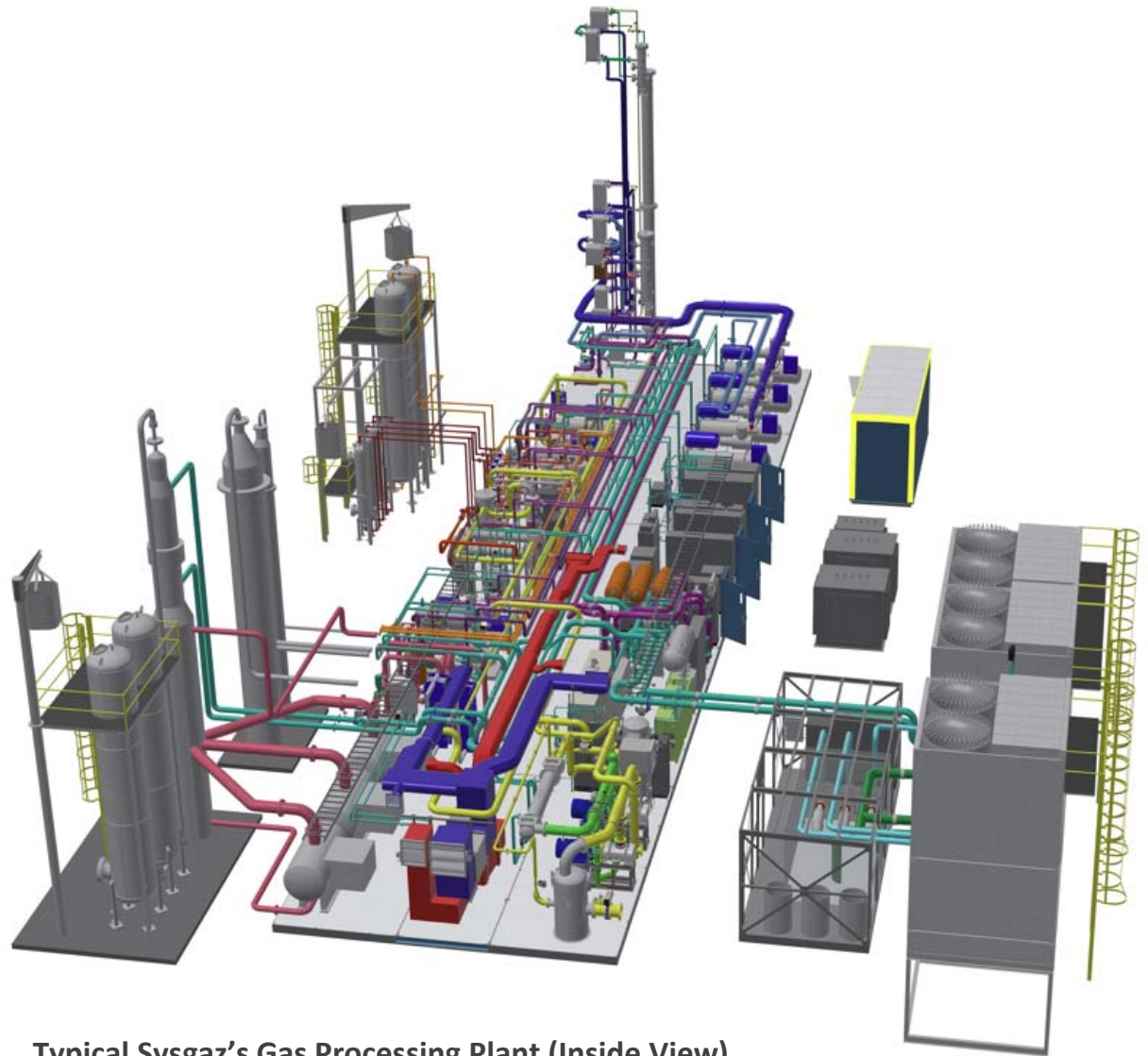
# Thank You

Charles Tremblay, President

6528 Waverly  
Montréal, Québec, H2V 4M3  
Office: (514) 798-0480  
Cell.: (514) 269-0672

[ctremblay@sysgaz.com](mailto:ctremblay@sysgaz.com)

[www.sysgaz.com](http://www.sysgaz.com)



Typical Sysgaz's Gas Processing Plant (Inside View)