

# Voluntary Greenhouse Gas Markets: What they Mean to Landfill Owners

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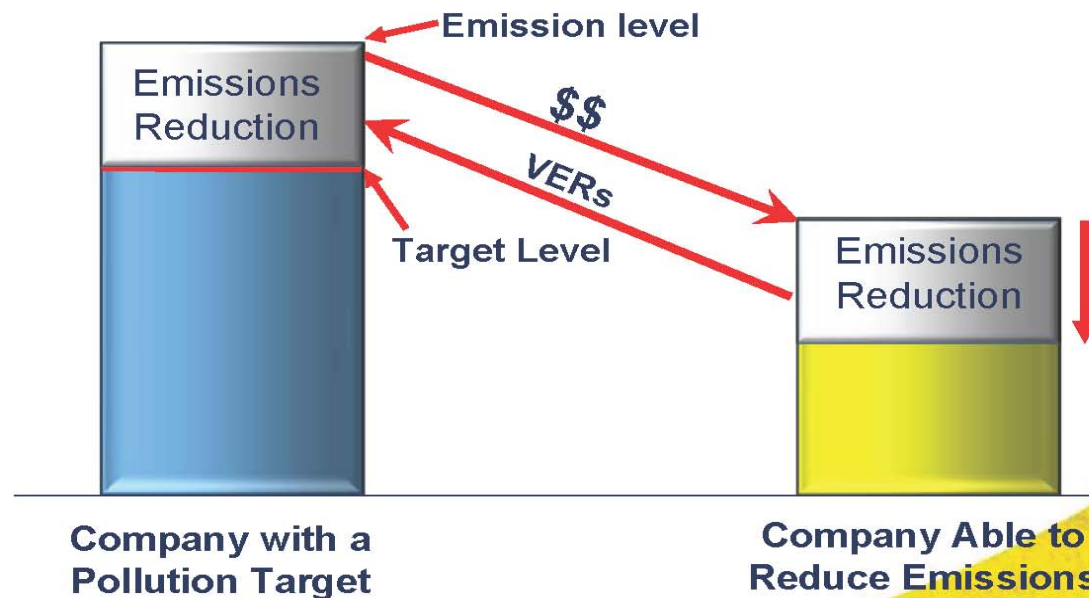
# Presentation Overview

- Emission Trading 101 and GHG Markets
- GHG Credit Development Process
- Eligible Landfills
- Quantification of GHG Credits
- Options for Market Participation
- Case Studies
- Considerations for Landfill Owners

# GHG Markets, How Do They Work?

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## How the Voluntary Market Works



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Carbon credits - origination to commercialisation

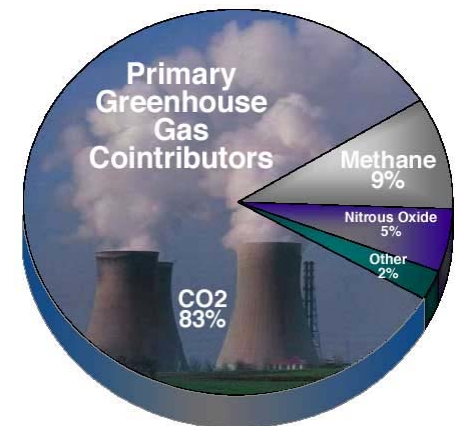
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# Who is Buying?

- **Corporations, Businesses, & Institutions**
  - Growing consumer demand for environmentally responsible companies
  - Offer new carbon neutral products and services
  - Competitive Positioning/Market Value for “green” organizations
  - Environmental Stewardship/Corporate responsibility
  - Compliance/Economic Risk Mitigation
- **Individuals (through retail GHG providers)**
  - TerraPass: Purchased offsets and RECs from LFGE projects at
    - CrossRoads LF, ME
    - Bavarian LF, KY
    - Tontitown LF, AR
    - Catawba Co. LF, NC
  - CarbonFund: Purchased offsets from LFGE at
    - New Bedford LF, MA
    - North Country LF, NH
  - Atmosclear: Purchased offsets from LFGE project at
    - Des Plains LF, Illinois
- **Speculators**

# Why Interest in Landfills?

- Methane has a global warming potential 21-23 times that of CO<sub>2</sub>
- Destruction of methane easily verifiable
- Technology already exists for LFG collection and control
- Landfills are the largest human-related source of methane in the U.S.
  - Approximately 34%



Equivalent Global Warming Basis, AAPG April 2004

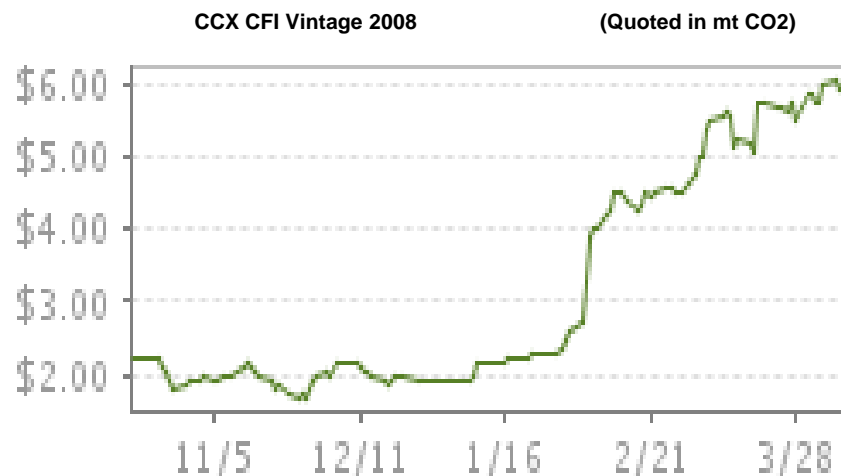
# What GHG Markets Exist?

- Voluntary Markets
  - Currently where most of the activity occurs
    - 23.7 M Tonnes in 2006
    - Expect > 40 M Tonnes 2007
  - Chicago Climate Exchange (CCX)
  - Over the Counter (OTC)
  - Auction/RFP process
- Compliance Markets
  - Rapidly evolving, could become dominant markets
  - Regional Greenhouse Gas Initiative (RGGI)
    - Regional cap-and-trade program in ten Northeast and Mid-Atlantic states
  - Federal cap and trade legislation



# The Times They Are a Changing...

- All three viable presidential candidates support a cap and trade system for reducing GHG emissions.
- Did the market respond?
  - Super Tuesday was February 5<sup>th</sup>



# GHG Credit Development Process

- Determination of Project and GHG Market
- Selection of Project Partners
- Due Diligence – Project Agreements
- Application of Protocol/Standard
- Development of Project Application or Design Document
- Validation of Project
- Generation and Quantification of Credits
- Verification of Credits
- Registration/Transaction

# GHG Protocols/Standards

- California Climate Action Registry
- Chicago Climate Exchange
- Environmental Resources Trust
- EPA Climate Leaders
- GE Greenhouse Gas Services
- Gold Standard
- Regional Greenhouse Gas Initiative (RGGI)
- Voluntary Carbon Standard

# Protocols/Standards Establish...

- Eligibility
- Monitoring
- Recordkeeping
- Calculations and Quantification
- Consideration of overall emission impact of project (in some cases)
- Reporting

# Which Landfills Can Participate in GHG Markets?

- GCCS must be “voluntary”
  - LFG collection and control must not be required by NSPS/EG/NESHAP
  - Early installation in advance of 2/5 year installation requirements
  - No consent orders in place

# Which Landfills Can Participate in GHG Markets? (cont.)

- GCCS commencement of operation date.  
Different dates under different protocols
  - 1/1/99 - CCX
  - 1/1/00 - GGS
  - 1/1/01 - CCAR
  - 1/1/02 – VCS 2007
  - 12/20/05 – RGGI

# Project Application / Design Documents

- Overall Project Scope
- Project Eligibility
- Project Boundaries and Baselines
- Monitoring Plan
- Recordkeeping
- Quantification
- QA/QC Procedures and Data Management

# Validation

- Project Design Document reviewed by GHG Program or Third-Party
  - Is the project eligible?
  - Correct M/R/R procedures?
  - All project aspects considered per applicable protocol?
- Establishes that GHG reductions from project are valid

# GHG Credit Generation and Quantification

- Monitoring of LFG flow rate
- Monitoring of LFG methane content
- Temperature, pressure
- Control device operation
- Overall energy use (if applicable)
- Calculations
- Regular calibration of measurement devices

# Verification

- Third-Party Review of GHG credits
- Confirms GHG project meets protocol requirements
- Review and approval of GHG credit quantification

# Registration and Transaction

- Verified GHG credits are the product
- GHG credits are given unique identifier if registered
- Some GHG buyers may not require registration
- GHG credits are accepted by buyer
- Landfill/project developer receives revenue

# Measurement of Methane Content

- Continuous or periodic LFG sampling
  - GEM-500, GEM-2000
  - ASTM Methods
  - EPA Methods



# Measurement of LFG Flow Rate

- On-line measurement of eligible LFG flow rate before control device
  - SWANA manual of practice for landfill gas operations and maintenance
  - API, ASME, AGA methods

# Control System Efficiency and Operation

- Default Methane Destruction Efficiency
  - Open Flares (50% - 100%)
  - Enclosed Flares (90% - 100%)
  - Other combustion devices (98% - 100%)
  - Injection into NG Pipeline (98% - 100%)
- Monitor control device operation and operating parameters
  - to ensure continuous destruction of methane

# Calculations

- GHG Credit (metric ton of CO<sub>2</sub>e)
  - LFG flow \* methane % \* STP adjustment \*  
destruction efficiency \* global warming potential \*  
conversion constants
- Other considerations
  - Electrical Use
  - Methane Oxidation
  - Baseline Emission Reductions



# Gross Revenue Calculation

- 100 scfm average flow ~ 10,000 tonnes per year of CO<sub>2</sub>e
- Assume \$6.00/tonne CO<sub>2</sub>e
- 100 scfm ~ \$60,000/year market value

# “Typical” GHG Project Structures

## **Investment Project**

- Carbon Asset Developer provides resources
  - Carbon Asset Developer gets GHG rights for a set timeframe
  - Landfill owner receives GCCS, potential royalty payments, and GHG price upside provisions in some cases

## **Origination Project**

- Landfill owner provides resources
  - Originator gets GHG credits generated for agreed upon timeframe and pricing (may include upside provisions)
  - Landfill owner takes greater risk and reward

## **Hybrid**

- Project landfill owner and GHG buyer and investor form JV and share in risk and reward (e.g. public private partnership)

# Options For Market Participation

- Auction/RFP
- Bi-lateral or Over the Counter (OTC)
- Chicago Climate Exchange

# Auction / RFP Process

- Landfill or Project Developer accumulates verified GHG credits
- Open Auction or RFP used to generate market for GHG credits
- Sold to the highest bidder
- Rights to future years can also be sold “forward”

# Pros/Cons of Auction/RFP Process

- Advantages
  - GHG credit price determined through competitive bidding
  - Landfill/Project Developer retains ownership of credits until sale completed
  - Greater flexibility for Landfill/Project Developer
- Disadvantages
  - Landfill/Project Developer responsible for project investment and operating costs
  - Landfill/Project Developer responsible for GHG credit development process (e.g., validation, verification, etc)

# Bi-Lateral / OTC Process

- Carbon Asset Developers
  - Entities that develop, invest, acquire, and aggregate GHG credits
  - Many have established buyers in queue
  - Can participate in Investment or Origination Projects
  - Can offer long-term options for selling forward
- Brokers
  - Bring buyers and sellers together
  - No significant investment

# Pros/Cons of the OTC Approach

- Advantages
  - Potentially higher pricing for GHG credits
  - Potentially lower transaction pricing
  - No requirements of seller to reduce GHG emissions
  - Can sell GHG credits forward
  - May provide project investment
- Disadvantages
  - No definitive market index
  - Confidential contract negotiation process
  - Public entities may require RFP to participate



# Chicago Climate Exchange - CCX

- Integrated GHG emissions registry and trading system
- Its members make a voluntary but legally binding commitment to reduce GHG emissions
- Trades Carbon Financial Instruments (CFI)
  - Currently trading at ~ \$6.00 / tonne of CO<sub>2</sub>e



# Pros/Cons of CCX



- Advantages

- Transparent process
- On-line electronic transactions
- Older GHG credit “vintages” still have value

- Disadvantages

- May require a contractual obligation to reduce GHG emissions
- Credits treated more like a commodity, may result in lower revenue since credits are not identified to a specific project type
- Landfill/Project Developer responsible for investment and operating costs
- Cannot sell forward
- Future revenue subject to market value



Bob's Presentation Here

# Considerations Before GHG Market Participation

- If your GCCS may represent an eligible project:
  - Keep records of all data
  - Consider installation of electronic data acquisition and handling system
  - Measure methane at least once per week, and keep monitor calibrated
  - Calibrate LFG flow meter quarterly (**IMPORTANT!**)
- Goal is to generate verifiable GHG credits before market approach decided