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Conversion Technology

Overview, Analysis Methods and Risk Allocation

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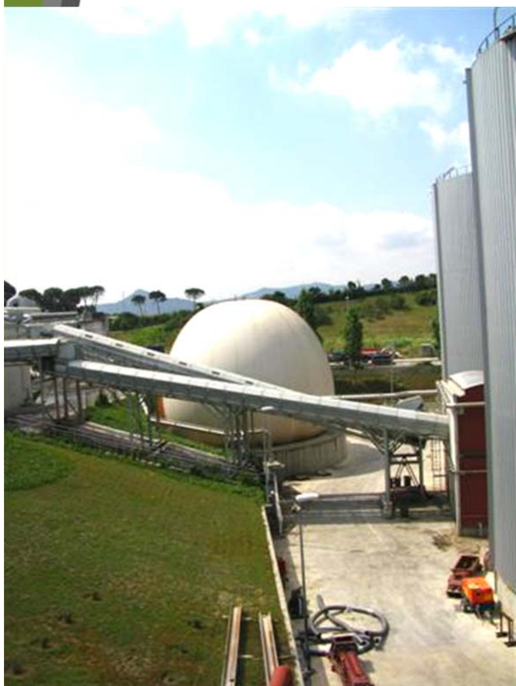
Introduction to Analysis Methods and Risk Apportionment

- Overview of Treatment Technologies, products and issues
- Analysis Methods and Case Studies
- Risk Allocation
- Summary

Overview of Conversion Technology Treatment Options







Feedstock is Key

- Mixed Municipal Solid Waste (MSW) and source separated feedstock
  - MSW prevalent but potentially challenging
- Construction and Demolition (C&D) wastes
  - High Btu values but commodity driven
- Industrial Wastes
  - High Btu values but commodity driven
- Source Separated Wastes (i.e.: Organics)
  - Simplifies facility but at added collection cost and capacity
- Ranges of Quantities (very small to large)

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Types of Technologies

- Thermal/Chemical
  - Commercial (mass burn, RDF)
  - Emerging (gasification, pyrolysis, plasma arc)
  - Developing (chemical hydrolysis, catalytic depolymerization, catalytic cracking, cellulosic ethanol)
- Biological
  - Somewhat Commercially Viable (anaerobic digestion, aerobic, dry fermentation)

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Technology Comparison Summary

Thermal/Chemical			
Combustion	Gasification	Pyrolysis	Hydrolysis
Excess Air	Deprived Air	No Air	Chemical
Heat to Power	Synthesis gas to Power	Synthesis gas to Power	Synthesis gas to Power

Biological
Anaerobic Digestion
Deprived Air
Biogas to Power

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Commercially Proven Facilities

Advanced Thermal Recycling (Waste-to-Energy)

Refuse to Energy Facility,
City of Commerce

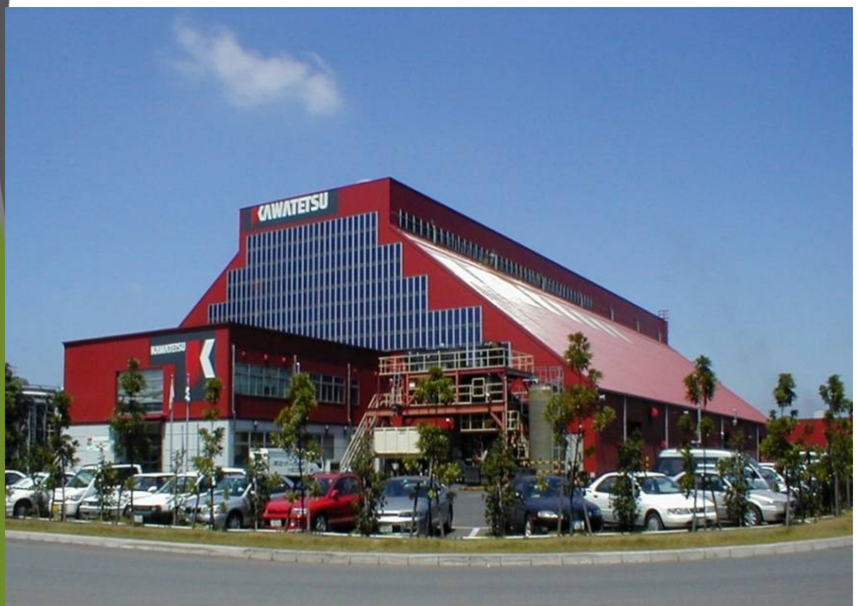
Tons per day	500-2000
Cost per ton	$150-200
Acres required	5-15

Products/By-Products
Combustion heat for energy
Metals
Ash for beneficial use

MRV Waste to Energy
Hamburg, Germany

Emerging Thermal/Chemical Facilities

(Plasma Arc/Gasification/Pyrolysis, Depolymerization)



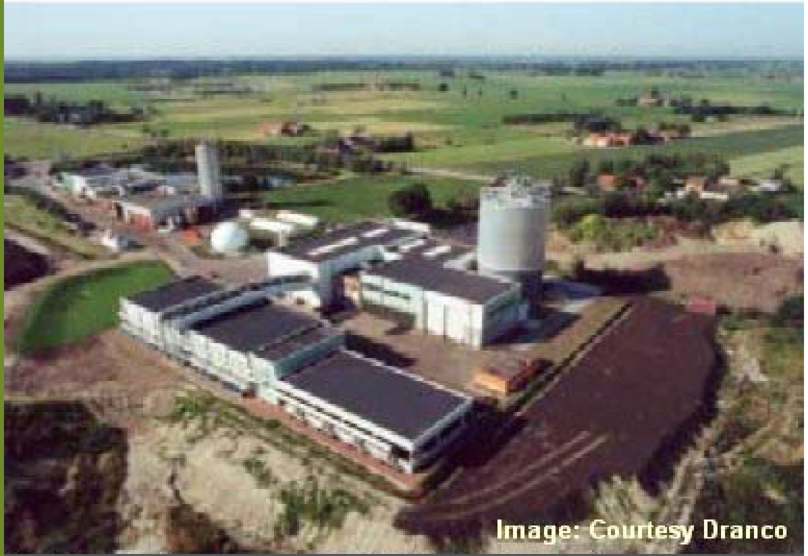
JFE Thermoselect - Chiba, Japan

Tons per day (High Btu)	**10-500**
Cost per ton	**$150-250+**
Acres required	**1-5**

Products/By-Products
Synthesis for energy **Ash for beneficial reuse** **Chemicals**

Plasco Conversion System - Ottawa, Canada

Biological (Anaerobic Digestion) Facilities



Dranco, Brecht, Belgium

Tons per day	100-400
Cost per ton	$100-130
Acres required	10-15


Valorga Process, Barcelona, Spain

Products/By-Products
Biogas for energy Digestate for compost

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Technology Summary

Technology	Advantages	Disadvantages
WTE/EFW/ATR	Proven using MSW, Commercially viable, No pretreatment of MSW required	Historical/political stigma from public perceptions from the 1970's Transformation counts as disposal in CA
Gasification, Pyrolysis, PAG	Emerging using wood waste and MSW Small Scale (Feedstock) Somewhat politically accepted	Not commercially proven using MSW in US Pretreatment of MSW required
Chemical, Catalytic Depolymerization	Somewhat politically accepted	Bench/Demo testing level only Not commercially proven using MSW
Biological	Lowest cost CT in the US, Politically acceptable	Relevant for Fixed Base only AD and DF judged as composting diversion

Small Scale Gasification potentially promising for some applications

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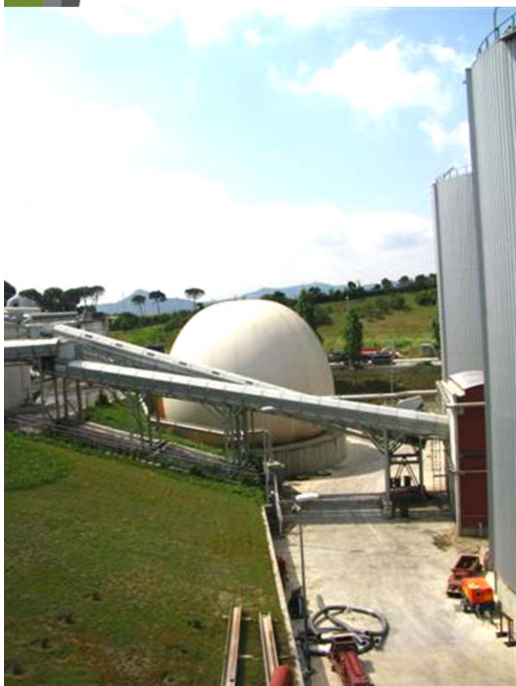
Summary - Facility Capacity and Cost

Facility Type	Capacity Range (tpd)	Cost Range (per ton)
Local Landfill	NA	$35-50
Remote Landfill	NA	$80+
Advanced Thermal Recycling/WTE	500-2000	$150-200
Emerging Conversion Technology Thermal/Chemical (Gasification, Pyrolysis, etc.)	10-500	$150-250+
Biological (Anaerobic Digestion)	100-400	$100-130

Conversion Technology Analysis Methods







Methods of Analysis – Overview of Categories

- Technical Analytical Criteria
- Financial Terms
- Regulatory Compliance
- Environmental Review
- Examples of Analysis Methodologies (Case Studies)

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Information/Data Request

- Mass and Energy balance
- Thermodynamic Characteristics
- Operating performance
- Regulatory history
- Maintenance records

Visit Reference Facilities

No substitute for visiting facilities, seeing feedstock and operations first hand and asking questions.

- Prepare questionnaire, information request
- Research existing data
- Interview facility owner, operator, regulatory personnel, neighbors
- Observe- Feedstock, setting, visual, odor, noise
- ‘Look under hood and kick the tires’

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Technical Analysis – Facility Performance

- Proof of Technology Using Defined Feedstock
  - Similarity of feedstock to committed feedstock
  - Performance history related to feedstock
  - Likely variability in feedstock over time (Btu, moisture, etc.)
- Throughput Capacity
  - Ideal throughput capacity per key facility component
- Scale-up/down Factors
- Availability Factors

By products

- Power Generated (Gross and Net)
  - Parasitic power requirements (feedstock specific)
- Heat Reuse
- Ash/Slag
  - Treatment required for beneficial use
  - Geographic/regulatory affect on market value of ash/slag
- Air Emissions
  - Toxic Air Contaminants
  - Criteria Air Pollutants
  - GHG

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Company Credibility/Strength

- Operational History
- Experience with Regulatory Framework
- International Support
- Guarantees
- Externalities

Financial Analysis

- Parent Company Net Worth
  - Commitment of Equity
  - ‘Skin in the game’
  - Not shielded by LLC or JV
- Bonding Capacity
- Financial Partners/Assurance Guarantors
- Bankable/Financeable

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Site Selection Issues

- Public Support/Acceptance
- Sensitive Receptors
  - Defined locally
  - Influenced locally
- Access to Arterial Roads – Local Traffic
- Local Air Quality Impacts/Modeling
- Utilities (Power Interconnection, Water)
- Local Aesthetics
- Neighborhood Noise
- Odor
- Environmental Justice

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Regulatory Issues

- Air (Emission Levels Within Air Basin, Offset Credits, GHG, etc.)
- Water and wastewater (Requirements, Discharge Rates, etc.)
- By-Products/Residuals (State/Federal Definitions re Hazardous, Beneficial Use, etc.)
- Land Use
  - Traffic
  - Aesthetics
  - Noise
- Environmental Justice

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Case Study - City of Los Angeles

Background

- L.A. BOS issued RFQ (2 Phase) & RFP (2007)
- RFP Proposed Two Facility Capacity Ranges
  - 200-1,000 tpd Commercial (7);
  - <200 tpd "Emerging" (2)
- Worldwide Facility Tour of Reference Facilities (2008)
  - Canada, Europe, Asia, and Middle East

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City of Los Angeles

Key Evaluation Criteria and Objectives of RFP

Criteria	Points Allocated in the RFP
1. Landfill Diversion	25
2. Service Fee	15
3. Reference Facilities	10
4. Operational Experience	10
5. Engineering	10
6. Credibility	10
7. Marketing Experience	10
8. Environmental Impact	10

Key Objective was for Technology to Provide No Less Than 80% Diversion from Landfill

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City of Los Angeles
Pricing/Financial Terms Sought in RFP

- Company solely responsible for financing, design, permitting, construction, operation & ownership of facility
- Charge the City a SERVICE FEE based on a per ton fee arrangement payable on a monthly basis, reflecting the following components:
  - Debt Service
  - Monthly Service Fee (subject to escalation)
  - Cost of Residue Disposal
  - Revenue from Recovered Products (electricity, recyclables, others)
  - Other Adjustments

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City of Los Angeles
Current Status

- Emerging Technology Vendor (ArrowBio) selected in 2010 – in contract negotiations
- Successful Commercial-Scale Facility Vendor identified in May/June 2011 –
  - Green Conversion Systems (ATR Technology),
  - Urbaser (Keppel Seghers)
  - Wheelabrator (Von Roll)
- Contract negotiations with GCS and Urbaser (commercial-scale) to begin in late-2011
- City has initiated the Site Selection Study

Salinas Valley Solid Waste Authority Procurement Process Summary

- Authority issued an RFQ for non-combustion based conversion technologies (9 responses received)
- RFQ responses evaluated to published criteria
- Authority short-listed 4 vendors - 3 responses received:
  - IWT (Thermoselect Gasification)
  - Urbaser (MRF/ Ebara Gasification/Valorga Anaerobic Digestion)
  - Plasco (Plasma Arc Gasification)
- RFP issued and responses reviewed through weighted Evaluation Criteria
- Tour of reference facilities in Japan and Canada conducted by Authority and HDR
- Term Sheets developed for negotiations purposes with Top 2 vendors: Plasco and Urbaser
- Risk analysis conducted
- January 2011 – SVSWA selected Plasco Energy Project to move ahead with CEQA process

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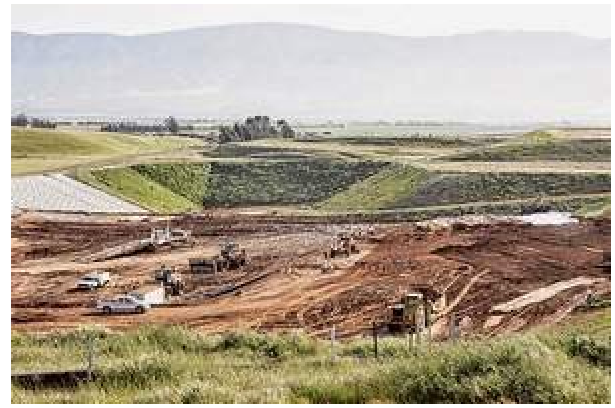
Salinas Valley Solid Waste Authority
Key Evaluation Criteria and Objectives of RFP

- Key Evaluation Criteria
  - Qualifications
  - Financial
  - Technical
  - Marketing
  - Environmental
  - Schedule
  - Cost Proposal
  - Completeness of RFP Forms
  - Site Visits
- Community Objectives
  - Maximize diversion: Goal of 75% Diversion by 2015 and 50 years of sustainable processing/ disposal capacity
  - Comparable gates fees to landfill options, and Financially self sustaining
  - Reduce impact on climate change
  - Form a Public-private partnership to develop a non-combustion based conversion technology



Project Site – Johnson Canyon Landfill

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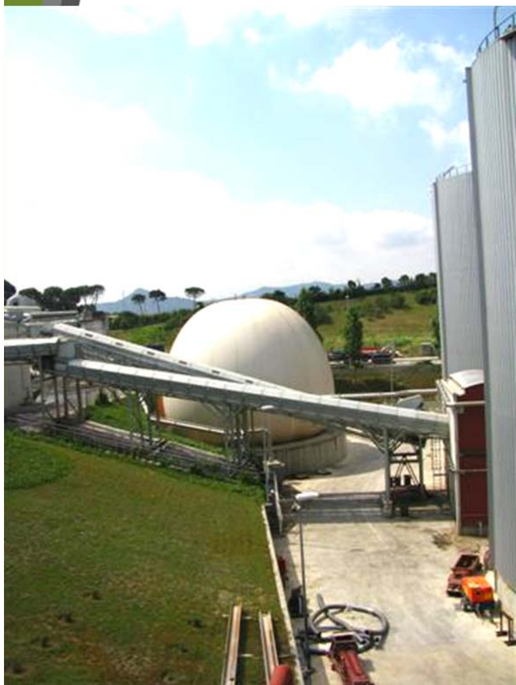
Conversion Technology Risk Allocation



Risk Allocation – Private Responsibility

- Demonstrated Facility Performance Treating Similar Feedstock
- Proof of Scale-Up
- Design/Performance Guarantees
- Environmental & Emission Performance
- Securing Permits
- Realistic Economics

Requires a Viable Technology

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Risk Allocation – Owner Responsibility

- Defined Quantity of Feedstock at Set Fee (Put or Pay Risk)
- Defined Range of Feedstock Composition
- Management / Champion

Requires Waste Flow Commitment/Support

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Risk Allocation – Shared Responsibility

- Site Selection
- Environmental Review/Land Use
- Power Purchase Agreements
- Political Support
- Financial Commitment

Requires Cooperation and Championing from both Public and Private

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Lessons Learned

- Purpose: Define the Overriding Goal/Purpose Prior to Considering Conversion Technology
  - Anticipate need to resolve waste flow control
  - Cost
  - Diversion hierarchy
  - Value of public support

- Understand Conversion Technology Limitations Due to Differences in Feedstock

- Consider the Use of Diverse Analytical Methodology to be Assured of Facility Performance Over Time

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Lessons Learned - Continued

- Allocate Risk According to the Entity Controlling Performance

- Technology Provider/Development Partner
  - Technical performance and related guarantees should be assumed by a strong Private Guarantor that offers
  - Financial Strength
  - Expertise Operation of the Technology
  - Construction strength
  - Sufficient Contractual limits of liability

- Both Parties Should Secure Performance Relief for Uncontrollable Circumstances (UCCs)

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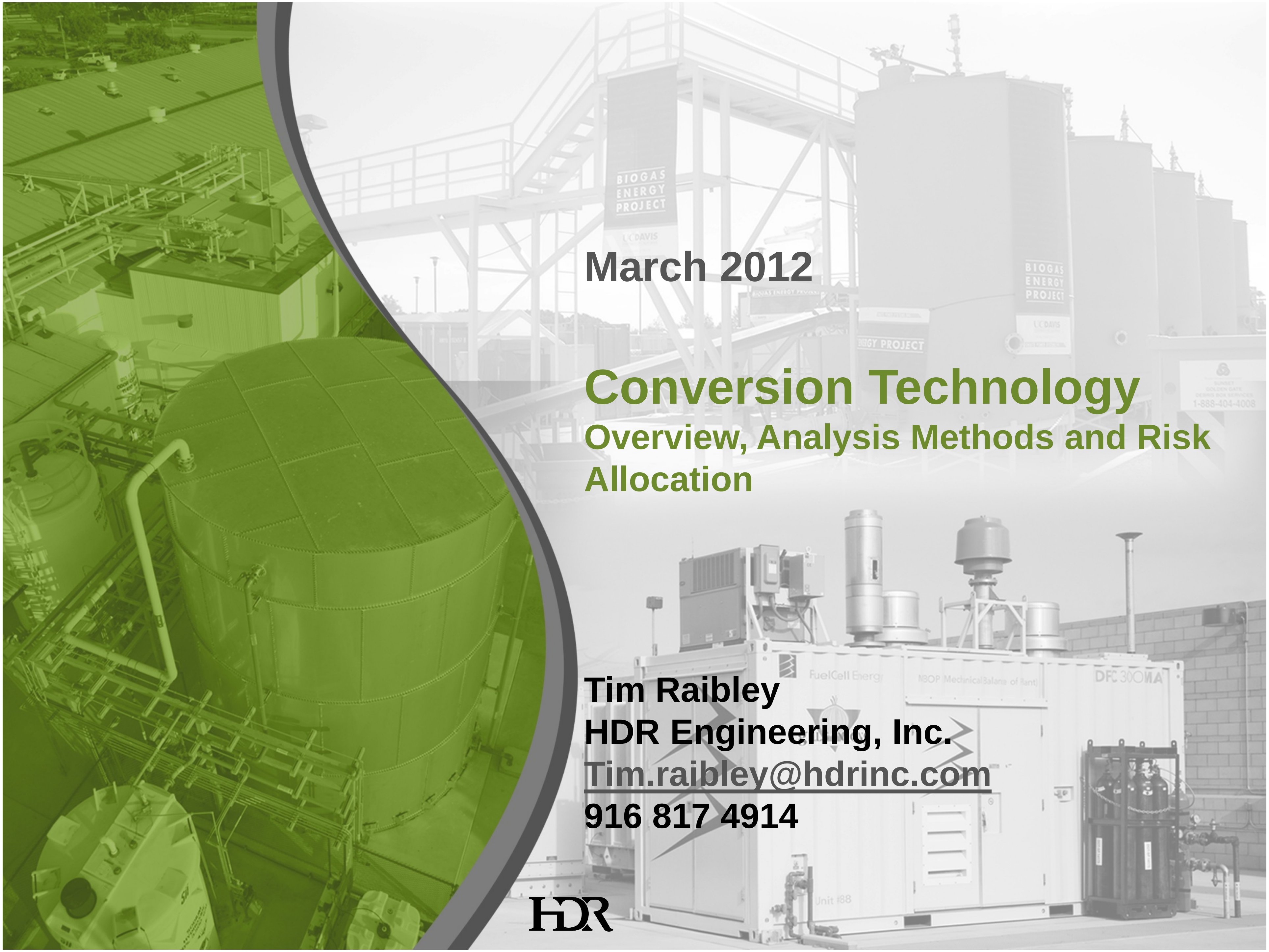

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