Sustainable Materials Management in Manufacturing

Presenter: Chadwick Learned of Republic Services

Speaker: Walker Modic of Bells Beer

Agenda

- Introduction of Presenters
- The evolution of manufactures materials handling
- Required steps to adopting sustainable waste practices in plant
- Recyclable waste streams, ongoing commodity values
- Exploring intelligent recycling options, challenges and success's
- Finding the path to Zero Landfill Waste
- Regulatory Impacts effecting recycling options
- Beneficial reuse of scrap materials
- Exotic Recycling possibilities, options for non-standard materials
- The impact of employee behavioral habits on your business sustainability goals
- Continuous Improvement programs to implement in order to achieve Zero Landfill Waste.
- Environmental Impact of Incineration vs. Landfill Gas to Energy

Chadwick Learned – Republic Services

Manufacturing and Environmental Services Executive

In my current role I work to help manufactures meet their sustainability goals through increased recycling and intelligent materials management. Through in plant audits we explore current material handling process's, goals and options.

Prior to joining Republic, I worked in the commercial and residential remodeling field and was a BPI certified energy auditor helping clients meet energy efficient building design goals.

I am husband to my wife Amy with two boys Caleb (14) and Logan (11). We enjoy many activities including coaching & playing soccer, gymnastics, golfing, mountain and road biking, amateur woodworking, and I volunteer as a board member for the Zoning Board of Appeals in Portage, MI.

Walker Modic– Bell's Beer

Sustainability Manager

Overall awesomeness…

The Evolution of Materials Handling in Manufacturing

1910's-1930's – With the popularity of the assembly line starting and exploding. Automotive and steel related manufacturing booms. The war efforts also caused a shortage of material and actual recycling rates were HIGH. Saving all salvageable material was key.

# of different Materials used relatively low, resources were more scarce so recovering scrap was important. Very little exotic material design.

1930's and 1940's - Government rationing of materials for Wartime manufacturing was encouraged and mandated. Metal, rubber, nylon etc… were in limited production.
Overall culture and availability of materials meant less total one time use items. Higher value commodity's were scarce so used wisely.

1950's early 1960's - As middle class wealth grew and manufacturing for consumers became more prevalent one time use throw away items became popular. More exotic plastics were introduced and an era of "whatever is cheaper" in terms of material management generally took hold in plant. The lower quality goods scrap was generally landfilled.

1965 to 1975- The problems with landfill disposal of nearly everything begin to show. Dumps are nearing capacity. Regulation of disposable industrial waste just starts to take hold. First Earth Day in 1970 brings awareness that we need to change. Forward thinking manufacturers are trying to develop sustainable programs reusing waste in house or finding buyers. Overall price still determining factor.

The Evolution of Materials Handling in Manufacturing

1976 – RCRA enacted – Resource Conservation and Recovery Act regulating the proper disposal, tracking, classification of waste materials passed. Large scale manufacturing waste starts a huge change from dumping and forgetting to proper tracking. Due to increased financial burden this created – plants look at ways to divert any possible waste away from disposal sites.

1980's through early 1990's - Recycling rates increase dramatically – driven by the consumer market and when reasonably possible business. Many hard to sort or exotic materials still primarily landfilled. High volume automotive manufacturing helps drive many industries to look for cost cutting opportunities which starts a trend toward more efficient material use.

From 1985 to 1995 there is an overall increase in recycled tonnage from 10% to over 25% of total solid waste. The easily process able materials programs and vendors boom with the influx of material. Manufacturers find the availability of sustainable input material is high

1995 to 2010 – The pace slows however we still add another 10% to the total of recycled tonnage – the increase in Waste to Energy through burring takes off. All the easy to recycle material is being done. While manufacturers continue better sorting and recycling programs technology driven composite materials makes recycling harder and harder. The reliance on oversees shipping to facilitate less desirable materials grows as manufacturers strive to keep making gains.

The Evolution of Materials Handling in Manufacturing

2010 –2015 – Overseas markets dry up and manufacturers are striving to find homes for there once “recyclable” scrap. Shareholders and cost factors creep in . The overall trend to lower landfill volumes increases competition driving landfill prices lower. This creates a market where in many locations throwing away trash is the most cost effective solution. Landfill technology grows to capture the methane gas generated and use for energy generation. Landfills take a higher mix of industrial manufacturing waste compared to residential waste than every before. Due to fantastic residential recycling programs. The composition of engineered plastics and composite materials used in advanced manufacturing are too difficult to reprocess often.

The availability of clean and easily recyclable material is higher everyday. So processing facilities tighten their standards of acceptance. The increased quality standards push many manufactures to disposal options.

Labor impacts of material handling programs damper internal plant efforts. With every increasing call for lean manufacturing attempts are made at cutting scrap in most every industry.

Overall manufacturing recycling levels off as the resources necessary to increase sustainability outweigh the cost benefits to many business’s.

The Evolution of Materials Handling in Manufacturing

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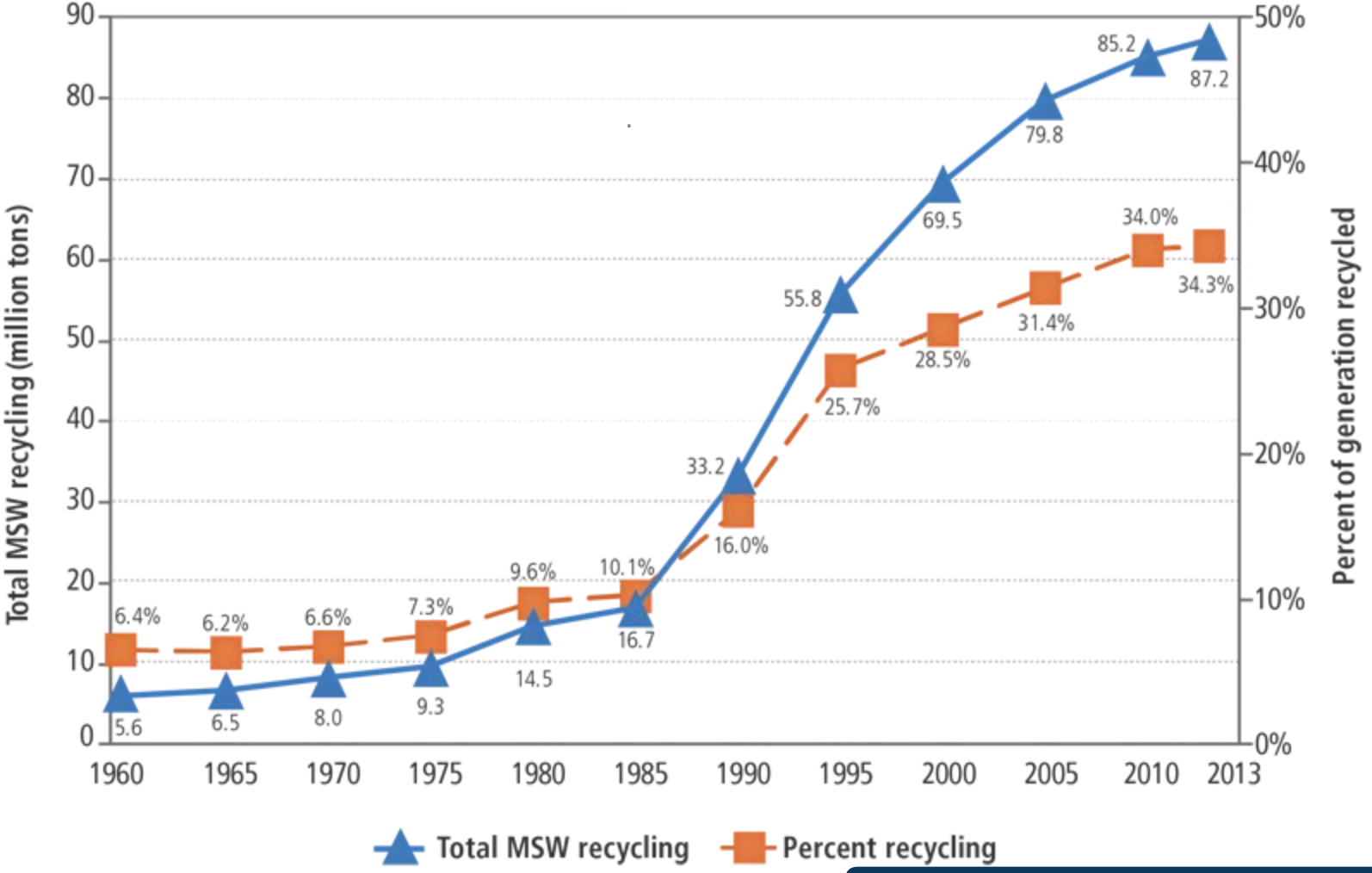
2016- TODAY

While some manufacturers excel at sustainable materials management others struggle.

Product manufacturing and engineering specifications greatly effect the ability to increase your diversion percentages.

Marketing of sustainable waste practices becomes a financial driver for industry and consumer demands. Making the investments necessary more palatable to manufactures.

The Evolution of Materials Handling in Manufacturing



Required Steps for Adopting In Plant Sustainable Waste Practices

- Gather Baseline Data (Waste Audit with averages)
- Determine the recyclability of your scrap or waste materials through sample accumulation and vendor selection.
- Set material, percentage or weight/volume goals
- Determine market sources for material either rebated or cost incurred
- Present and gain support of upper management AND line supervisors
- Implement a structured process for material handling
- Include verification of proper process being followed (Random collection audits)
- Ongoing tracking of net weights / volumes of recyclable materials
- Set Continuous Improvement Goals.
- Explore (either directly or through third party consultant) alternative sources ongoing, new sources.
- Open a dialogue with material providers to develop input materials for manufacturing with goods that allow post processing.

Common Challenges encountered…

Challenge	Description	Solutions . Comments
 Money and Cost of Implementation	The starting of a successful program oftentimes requires capital investment OR a temporary willingness to spend more on labor / containers / shipping	Long term financing, vendor cost share with transparency. Marketing budgeting.
 Mis-alignment of departmental goals	Expectations of management, reporting, and competing priorities hold back so many initiatives	Early team decision making on implementation and effect of new program. Upper management directives.
 TIME – Short staffing etc	EHS departmental staffing (one?) Extra time for sorting? Movement of material.	Proper expectations of timing, training and adjustment period. Increased budgeting.
 Mandatory compliance to third party specifications	Increasing technologies and specification requirements from engineering staff are having effects on the ability to recycle.	Discussion with customers and vendors to eliminate use of exotic materials OR alternative material exploration etc…

Common Challenges encountered…

Budgeting timelines and market conditions effecting implementation.

Sustainability programs are often seen by management and controllers on an isolated basis.

We see decisions being made based on current conditions without taking into account overall market volatility for value.

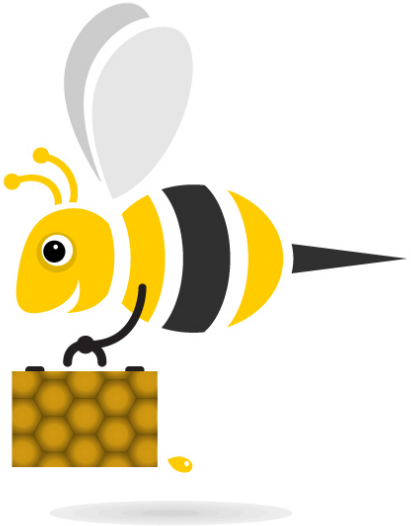
Since the ROI for implementation is sometimes past the common budgeting year other plant projects take priority.

We often see non-ideal material management MAINTAINED in order to limit exposure to cost. Basically a “good enough” attitude takes hold and Change is Hard……

Common Challenges encountered…

There is ONE very common recurring lynchpin challenge to successful materials management that requires continuous improvement. Any guesses?

Employee Behavior



Most implementation and failures of sustainable materials management can be traced back to employee behavior.

Worker bee mentality with production quotas etc

Modern LEAN MANUFACTURING plants both try to operate efficiently material wise as well as labor wise.

So when errors, backups, problems occur the first thing to go is non-essential (in order to meet CUSTOMER DEMAND) process's.

BEST PRACTICE: Writing scrap material and recycling process into the process of manufacturing each good has proven helpful. Sustainability cannot be an afterthought it must be an essential job function your are held to just like any other product quality standard.

Recyclable Waste Streams and Ongoing Commodity Values

Well established recycling streams have become a commodity and values fluctuate with market conditions. The large variability in value makes budgeting and projections very difficult for manufacturers. What once was well worth the effort for sorting and in plant aggregation of recyclables may become more cost than benefit from a purely financial side. The opposite can also be true.

Developing a longer term view of the materials management in plant means realizing the inconsistency in material value.

Product	Value	Notes
Cardboard	Market Dependent Varies $50-$100/ton.	For maximum value GOOD BALES required, direct to mill trailers. Less than weight loads or processing challenges greatly decrease value
Office Paper Mixed	Usually Nothing but sometimes up to $10/Ton	Gaylord or bales preferable
Metal (Scrap Steel, aluminum copper)	Highly market variable. In past worth upwards $400/ton. Now depending on quality may break even.	Bulk transport common
Plastics	$0-$400 / Ton. SO MANY plastics huge differences in value.	Source separation and cleanliness is very important. Composite plastics are hard, additives etc. Compaction or densification can help with logistics.
All In One Recycling	COST Program – Vendor sorts and charges for service	Cost continue to rise. Contamination rates are high.
Pallets	Good pallets value between .25 and $4 on average	Bulk pickup or staged trailers
Scrap Wood	Service cost – no value usually charged tipping fees	Usually mulched

Proper Densification of Recyclables contributes to sustainable materials management while Reducing environmental impact

For those manufactures without a current method of densification a capital investment (either directly or indirectly) is required for long term success.

		
Vertical Balers: Least Expensive. $5,000-$15,000 Many sizes 36”-72” wide typical	**Horizontal Balers:** Most Expensive $15,000-$200,000 Customized sizes generally larger	**Compactors:** Medium Priced $5,000-$50,000 2yd-8yd (40yd receiver box)
Requires manual loading and bale preparation. Fit’s almost anywhere. Medium grade compaction rates average.	With conveyor and eye systems hands off. Auto-Tie available. Lowest labor, highest compaction rates.	Lowest labor impact – generally higher service cost. Contamination rates generally higher.

Hidden Cost and Lack of Transparency is prevalent

In general there are two sides to the coin in regards to attitudes on recyclables going out the door.

ONE - I don’t care what happens to it once it leaves here and you tell me it is recycled.

Or

TWO - Tracking and accountability of your recyclables.

Hidden Cost and Lack of Transparency is prevalent

Many business's got comfortable with feeling good about recycling. Times were good for many years and the value of mixed recyclables was high enough to offset NON RECYCLEABLES mixed in. While paying under market rates for plastics, metal and fiber allowed processers to cover the sins of clients in regards to improper handling or treatment of recyclables.

Even now we see items for recycling end up in the landfill due to a variety of reasons.

-Current market pricing is TOO LOW and the generator is unaware or unwilling to share in the cost for processing. --Let's not rock the boat philosophy—
-The margin the recycling provider is making on more premium products allows them to be less stringent on quality of goods. Up to the point of NO REBATES being provided however assuming any risk.
-Generators "lack of will" to take responsibility for the quality standards of recycling going out the door.

Hidden Cost and Lack of Transparency is prevalent

Tracking and Accountability of your recyclables creates transparency AND requires the generator to take ownership for the implications of in house procedures.

This is the difference between SAYING you are recycling and ACTUALLY recycling. Allowing you to properly understand the reality of your environmental impact.

HIDDEN TRANSPORTATION COST:

If you are not being charged transportation directly YOU are being charged transportation indirectly. Either through lower rebates, material weight discrepancies. These are REAL cost that must be accounted for in the sustainability program you participate in. Time will catch up to you as almost all recycling processors are for FOR PROFIT.

Exploring intelligent recycling options challenges and success's

Recycling Options	Details
In-Plant Reprocessing	Best solution, using scrap in house for direct reuse in your products
Intercompany Reprocessing	Transporting of scrap material to another facility within your organization
Beneficial Reuse	When your scrap products can be used without additional processing in another product
Direct Recycling	Sending material for DIRECT reprocessing of the goods for in their process
In Direct Recycling and Reprocessing	Most common, sending good to an aggregator / broker for sale or processing for sale.
Paid Processing	Where the cost involved in recouping useable material is greater than the benefit.
Waste To Energy	Burn what's left. OR Burn it all?

Exploring intelligent recycling options challenges and success's

- Metal
- Fiber (Cardboard and Paper)
- Wood
- Pure Plastics
- Drums (Metal and Plastic)
- Lightbulbs
- Battery's
- Electronics

- Liquid's
- Paints
- Composite Plastics
- Composite Parts
- Organics (depends on location)
- Composite Fibers
- Rubber
- Contaminated Materials

Brainstorming

Let’s talk about some materials you have trouble with….

When recycling has a NEGATIVE NET IMPACT.

Many manufacturers have a goal of sending nothing to landfill. On the surface this seams like a noble ambition.

This concept is routed in the belief that if you can recycle it you should do it. It is better for the environment, our planet, and our people.

There was rampant waste in the past and it still exist today. That doesn't mean we have to go to the other extreme to fulfill the goal of sustainable manufacturing.

Simply put there are some materials that when recycled have a greater negative impact on the environment than landfill or burner disposal options.

When recycling has a NEGATIVE NET IMPACT.

Bucknell University economist **Thomas Kinnaman** explored the impacts of different recycling materials, below are some highlights from his interview with Here and Now In October of 2015.

Positive full life cycle materials for recycling include; aluminum cans, tin cans, fiber(paper)

"…. Glass bottles, plastic bottles, other forms of plastic – a lot of us want to recycle those things. I think the environment and the economy would rather that we didn't."

The densification issue for transport impact on bottles is generally higher. Also the environmental impact of making new is comparatively less.

Modern landfills are reducing the environmental impact through methane collection, treatment, liners etc and when weighed against the process of recycling certain materials are favorable.

Finding the path to Zero Landfill Waste

This doesn't mean we shouldn't recycle, it means we need to understand THE PROCESS of recycling in order to effect the impact your methods have and make informed choices.

Knowing the factors that contribute to environmentally sustainable manufacturing and the impact of HOW you treat your materials in house gives us a basis for creating the steps necessary to get to Zero Landfill Waste or ZERO Waste.

Here is a simplified process.

Finding the path to Zero Landfill Waste

1) Gather your current state data: ACCURATELY through an internal and external waste audit. Interested in total volumes and weights generated and received.
   -Visual Inspection
   -Sorting and Weighing of materials
   -Volume measurements vs weight for current methods of disposal / recycling
   -Need a varied sampling – shifts, day, month, product line any variances

2) Compile the information into useable data PER MATERIAL STREAM.
   -How much of material X is generated
   -How much of material X is recycled
   -How much of material X is disposed of
   -How much of material X that leaves site is reported back from receiving site.

Finding the path to Zero Landfill Waste

3) CAPTURE the material that you know is recyclable BETTER
   - -This is why we need accurate data PER LINE in a plant or day or shift
   - -So we can focus on refining the process at each point of generation
   - -Use end site reporting in between full audits to track progress

4) Start with making targets for materials to recycle or reuse that are being generated.
   - - Biggest to smallest waste streams by volume (not weight) this helps later when looking at alternate disposal options.

5) Internal Meeting to discuss any possible reuse in plant or company of largest waste streams. Form committee to explore cost to implement. FOLLOW the chart regarding recycling options…. For every waste stream and Categorize.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Exploring intelligent recycling options challenges and success's

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Paid Processing	Where the cost involved in recouping useable material is greater than the benefit.
Waste To Energy	Landfill gas to Energy? Burning?

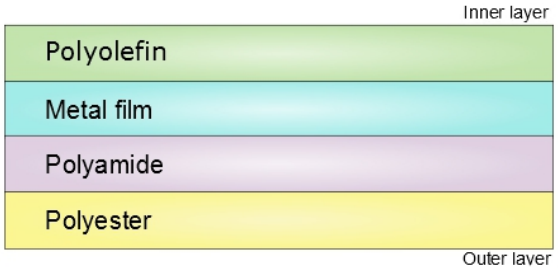
Exploring intelligent recycling options challenges and success's

Along the way you will find particular problem composite products or non-recyclable items in your waste stream. Working with ENGINEERING, VENDORS, PURCHASING can be critical in eliminating the raw inputs that prevent the end product from sustainability. Controlling your environment is critical.

Automotive Components

Wax coated paper water cups…

Packaging Design



Beneficial Reuse of Scrap Materials

Beneficial use of industrial materials is a key part of EPA's Sustainable Materials Management (SMM)

Manufacturing creates high volume waste streams and exploring the beneficial reuse through trade partners. Internal resources. Collaboration with others in your field. Exploring and reaching out to other manufactures to create the opportunity is often a necessary step.

Common Scrap Used in Beneficial Reuse

Iron and Steel Slag Building Products Food Waste

Sand (limited) Insulation Scrap Coal Ash (limited)

Wood Scraps Tires Paper Residuals (limited))

Exotic Recycling Opportunities - Difficult Materials…

Explore offering your scrap products FOR FREE, advertising donation of your scrap can often spur innovation and creative thinking.

No one want what you have. Create something out of it yourself. Maybe you can use reprocessed scrap that wouldn't meet specifications for a current customer but can be turned into a useable product – EXAMPLE – PS Foam

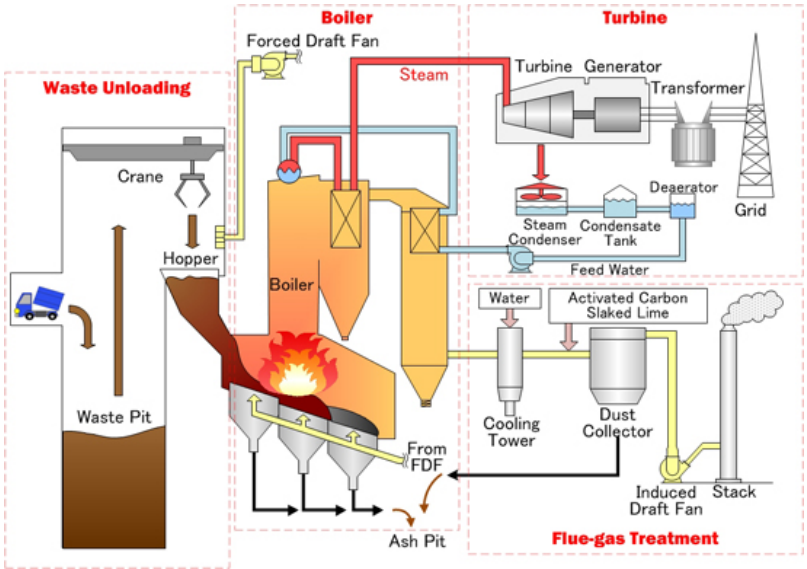
The world is a big place. Some countries or regions of the country have different technology or other options.

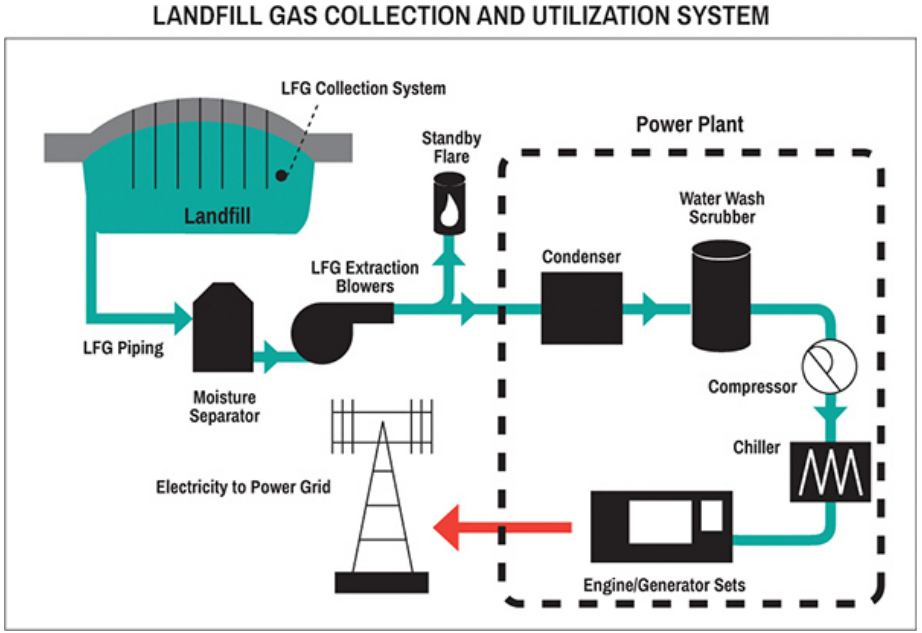
Usually there is a source.
TIME and MONEY are the most common difficulties to overcome.

Incineration vs Landfill Gas to Energy

Comparing the impacts on the environment

Burner





Incineration vs Landfill Gas to Energy

Comparing the impacts on the environment

When you get to the point of I've done all I can effect for now. Meaning you can't get to ZERO WASTE you are left with this choice.

This is partially a philosophical question and one that is more complex.

Is our company policy ZERO LANDFILL no matter what? OR

Is our company policy to be
"the most sustainable"
"lowest environmental footprint"
"most environmental responsible manufacturing process"

Incineration vs Landfill Gas to Energy

Comparing the impacts on the environment

Many factors to consider if your goal is to use the most environmentally friendly option.

- Distance to Landfill vs Distance to Burner
- Transportation Method Used in Both (collection equipment, natural gas, diesel)
- Capacity at both (wait times, diverted trash etc)
- Site design, technology, environmental standards adhered too (filters, gas collection, ash, leachate, etc)
- Indirect impacts of transportation (allocation of truck and driver resources for individual runs etc)
- Indirect impacts of diversion from landfill (for solidification or to achieve material mix to meet odor standards etc - sludge diverted because landfill lacks material. OR burner does not operate efficiently because of diverted material, not as long, or shuts down.
- Indirect impacts of site closure…..

Thank You

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