

# Trash As Treasure

How can we systematically reduce risk?

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# Minimizing systematic risk

## Risk

- (noun) expose (someone or something valued) to danger, harm or loss

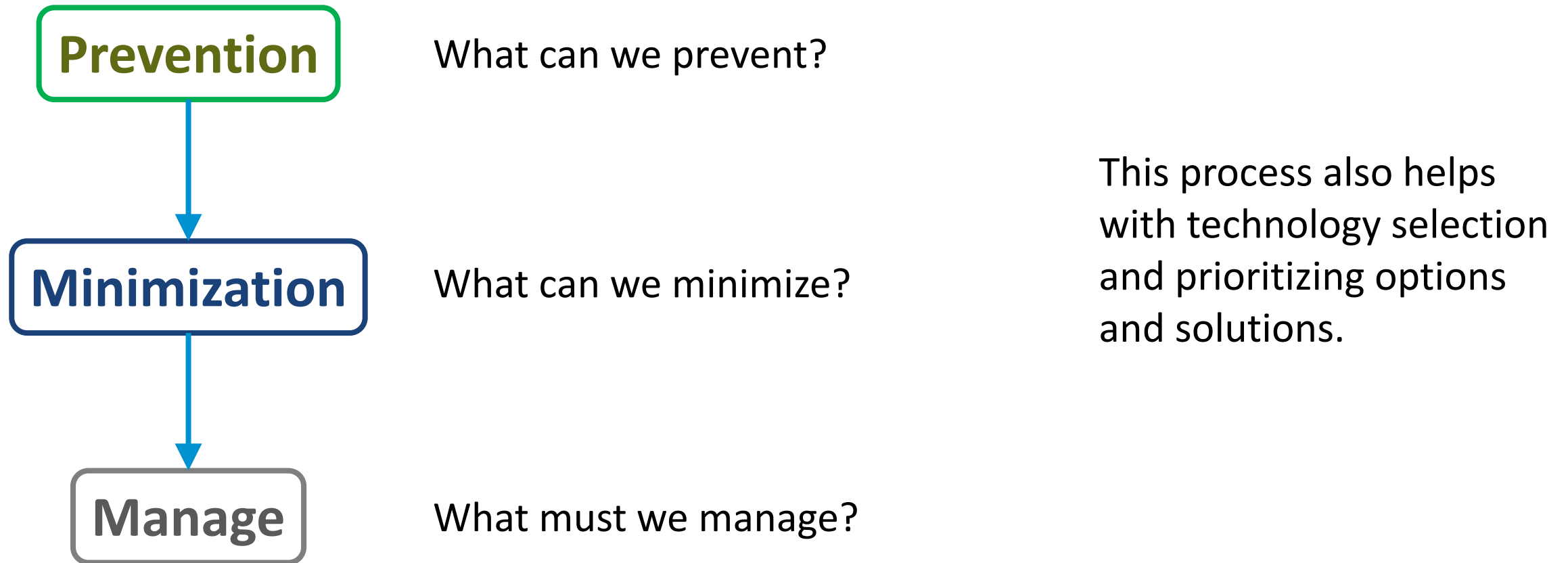
## Risk management

- (noun) the forecasting and evaluation of financial risks together with the identification of procedures to avoid or ***minimize*** their impact.

# What are some strategies to reduce risk?

- What outcomes do you need to achieve?
  - Aligning your organization to the negative externality to be minimized
- Define the problem, including the *time frame*. 30-days or 30-years of risk?
  - Prioritization of decision-making
- How do we reduce variance to minimize harm?
  - Process control / optimization is one strategy

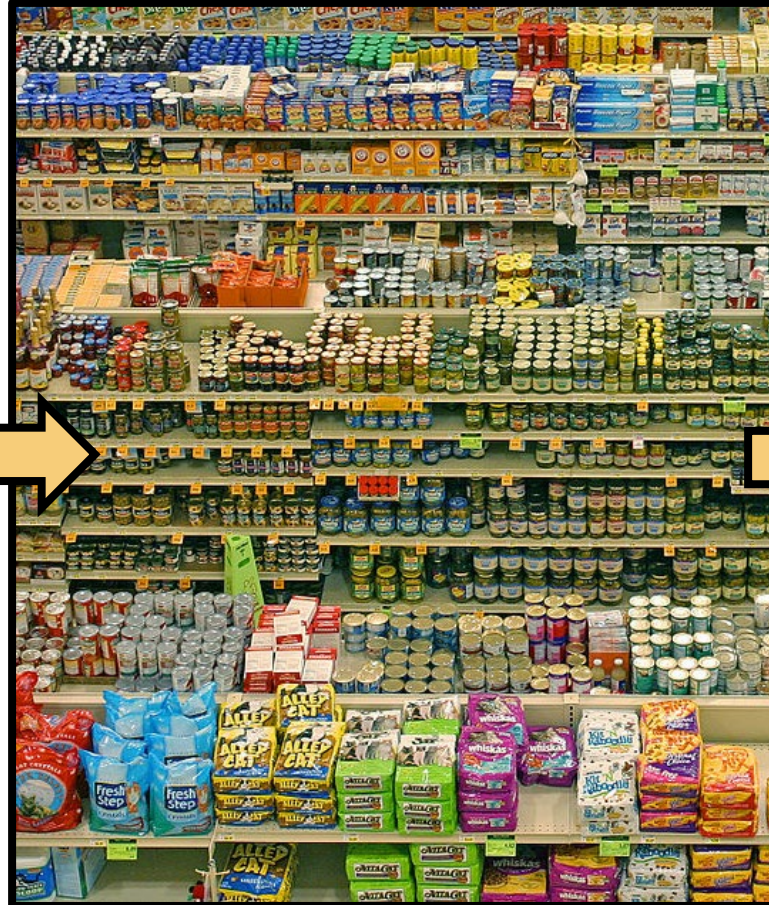
# Generically, the three questions for persistent risks are:



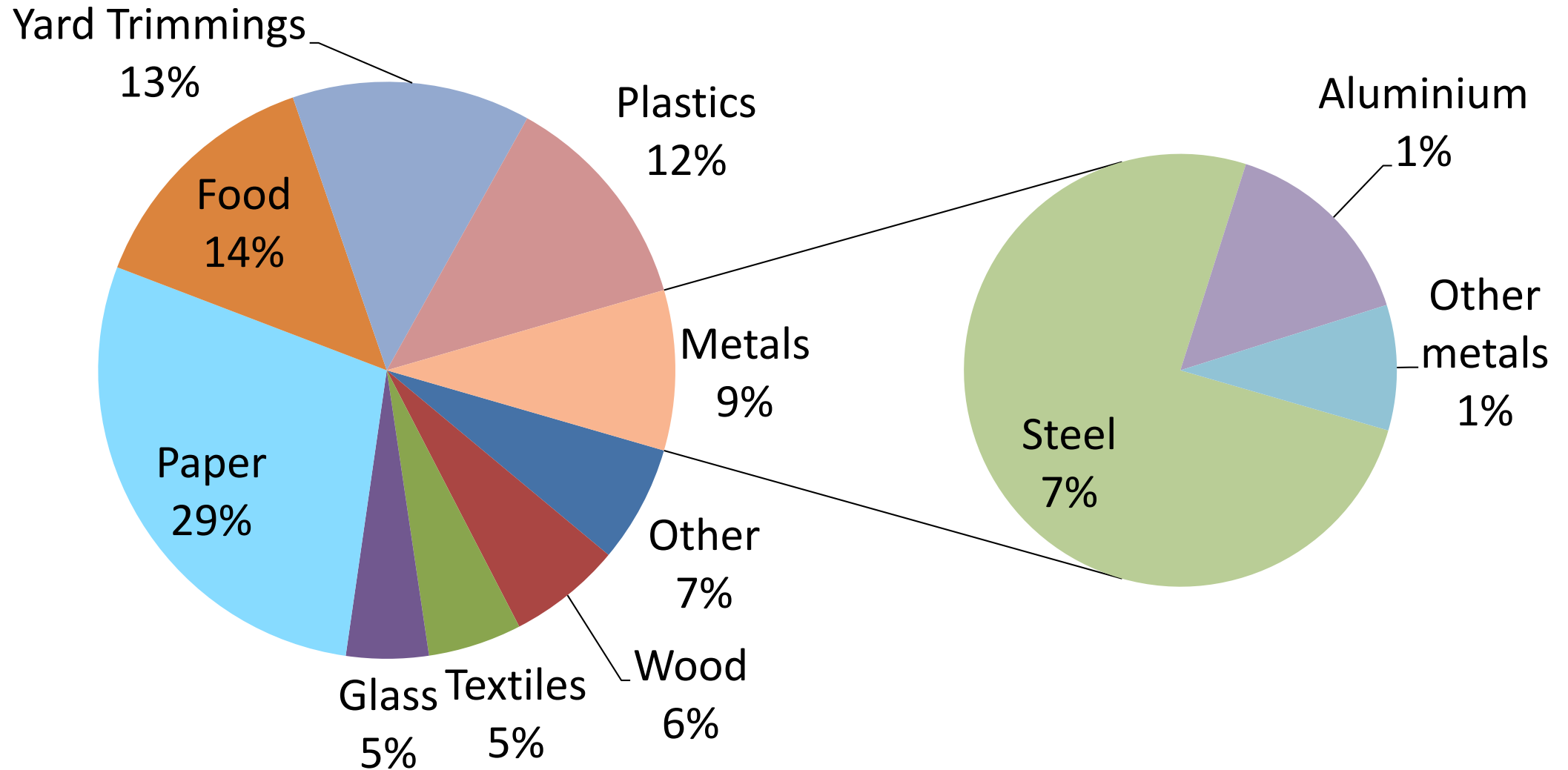


# Which actions today is creating new risks 100 years from now?

95% of everything we buy is thrown away at some point

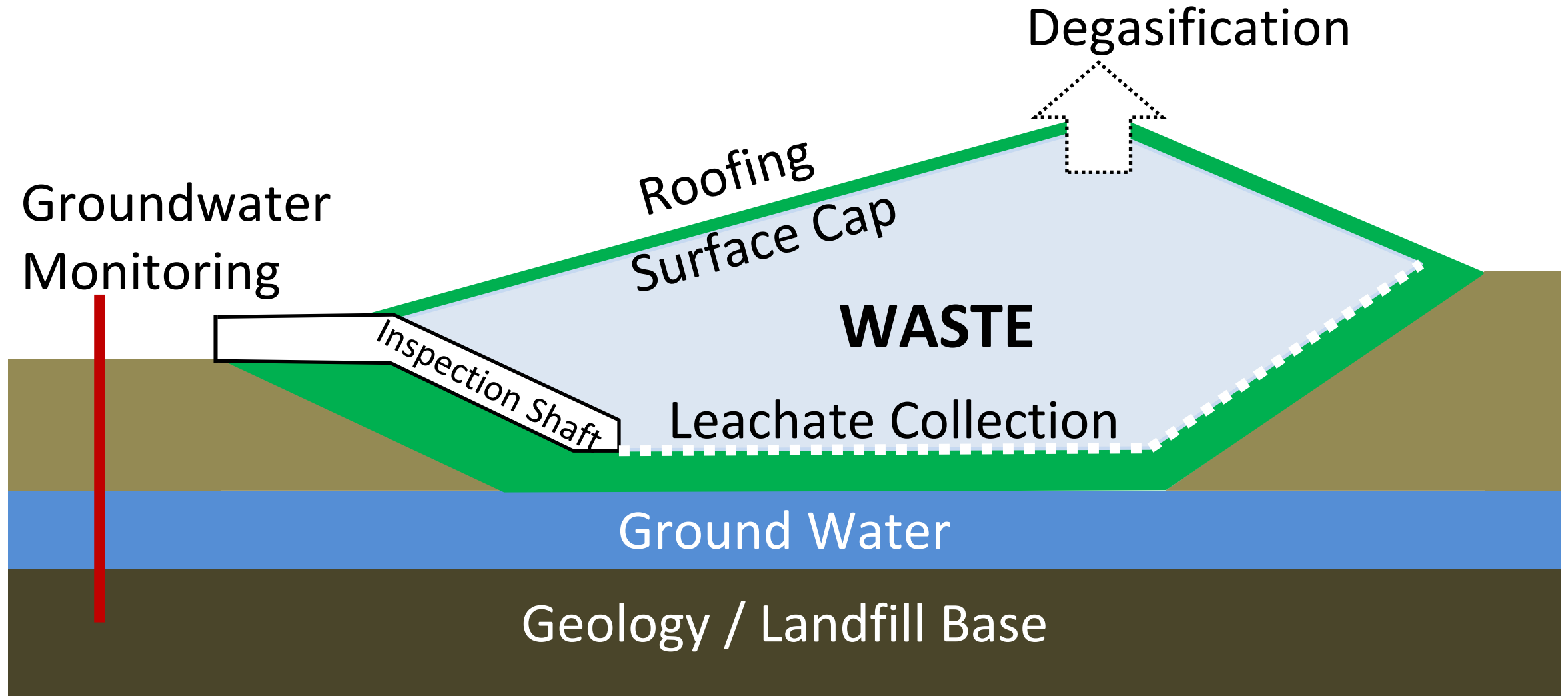


# Composition of Waste in the USA





# Landfill: An uncontrolled anaerobic digester

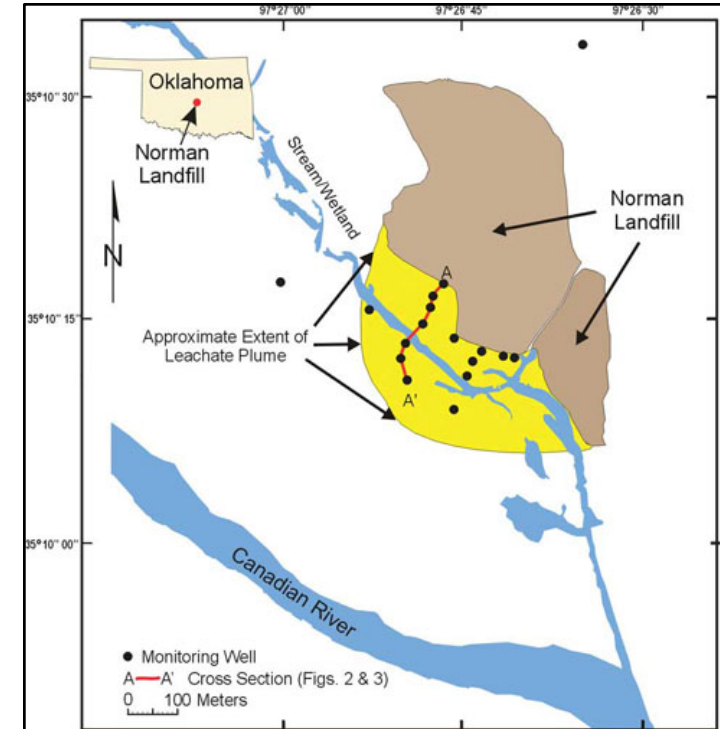


# Example side effects

8000 landfill fires in the USA alone



Leachate leaks



\$2 million per year in King County (Where Seattle is located)  
to maintain closed landfills



# How long does a landfill last for?



Oldest known *Midden*  
~140,000 years old

# 1991: German consensus that Landfills are bad

## **Regulatory Compliance**

- Germany 1991: Ordinance on the Avoidance and Recovery of Packaging Waste
- Required producers to take back the packaging associated with their products after consumption and ensure that a specified percentage of it is recycled each year.

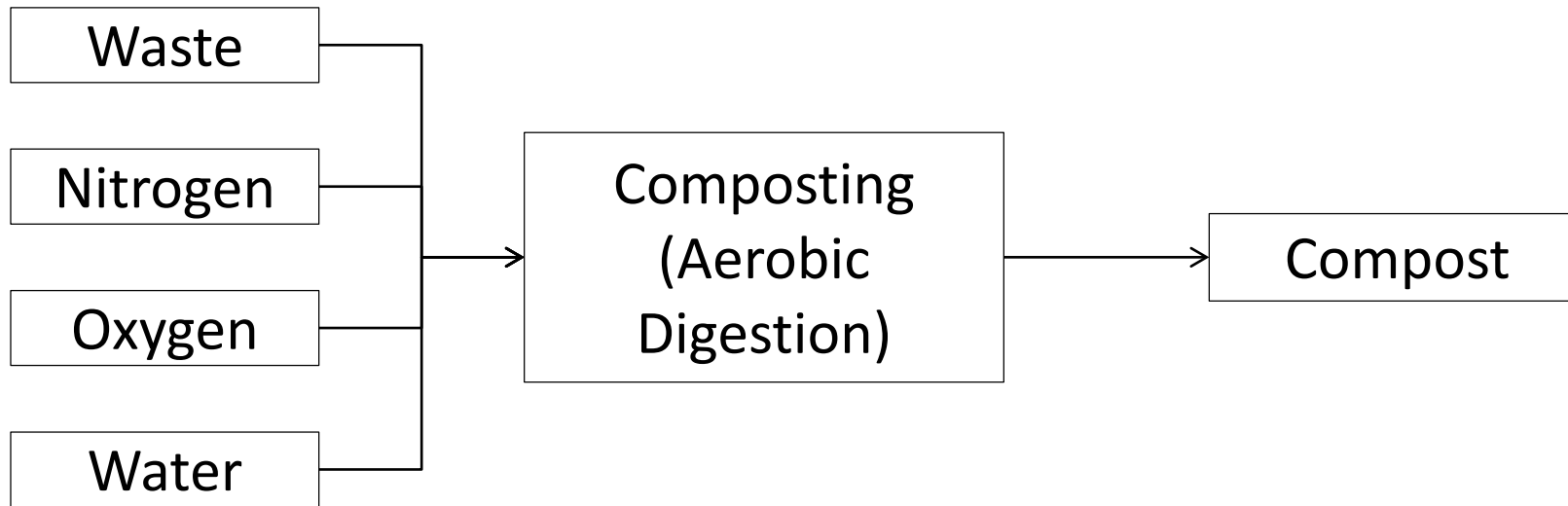
## **Business Response:**

- Creation of the Green Dot program that operates in parallel to the normal waste collection.
- Companies pay a fee to affix the label; product is collected and recycled separate from the waste stream

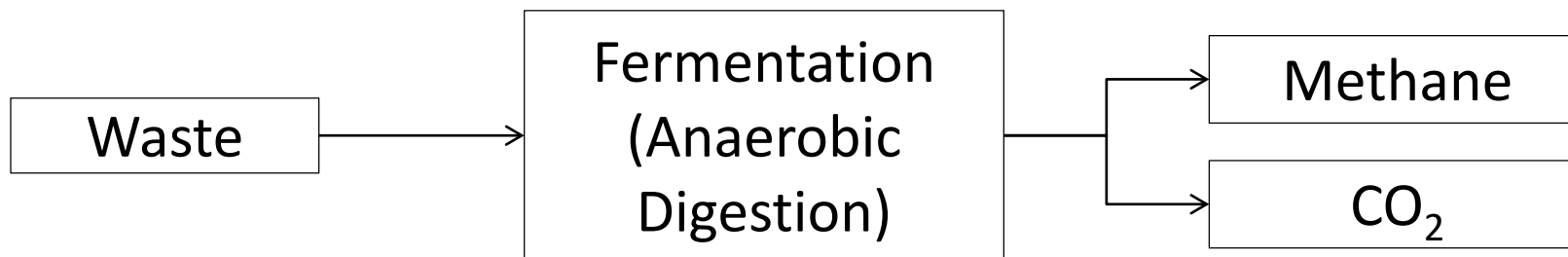


# Managing Food Waste

## Diagram of Composting



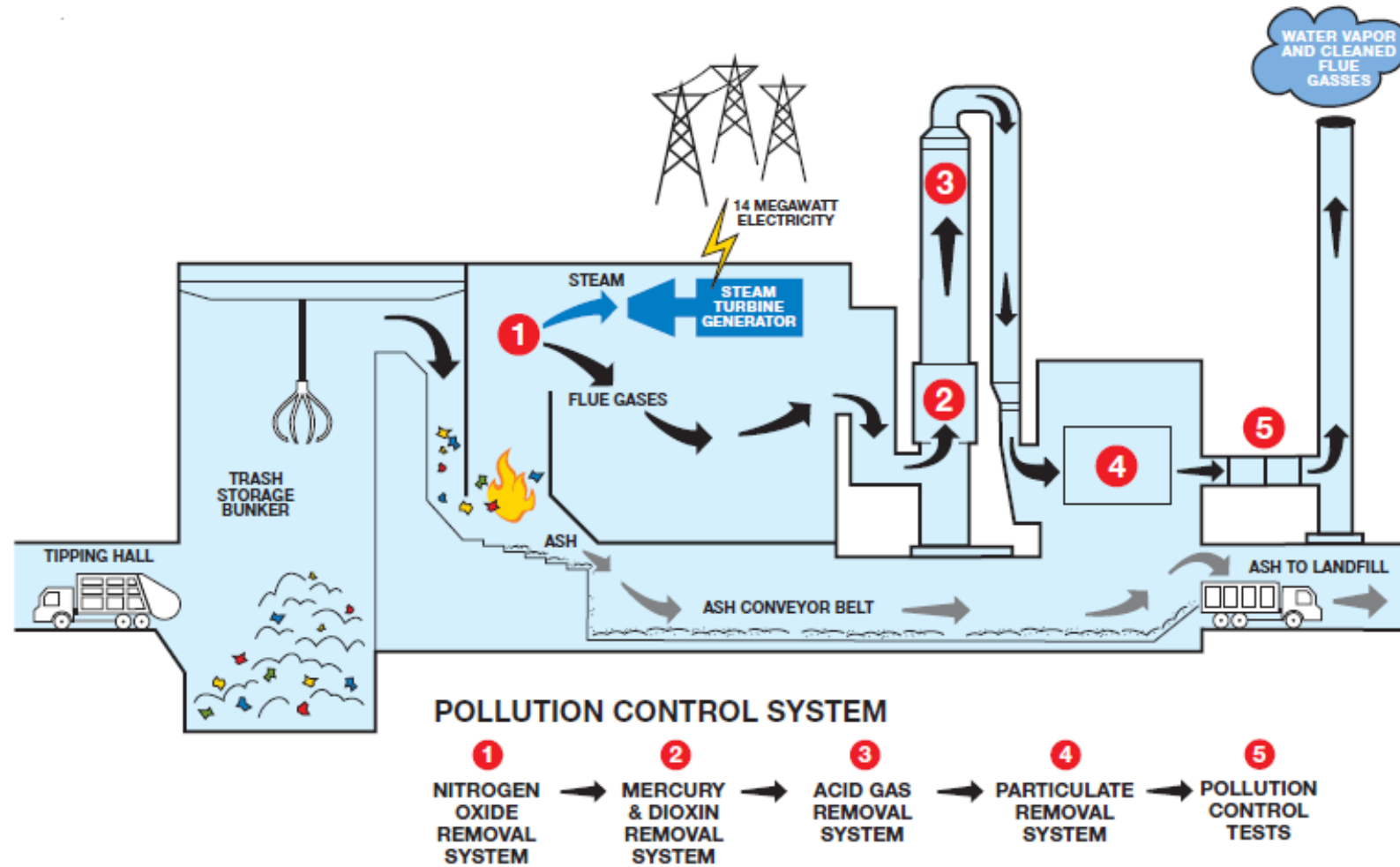
## Diagram of Fermentation



## Recycling – Energy savings as compared to virgin materials

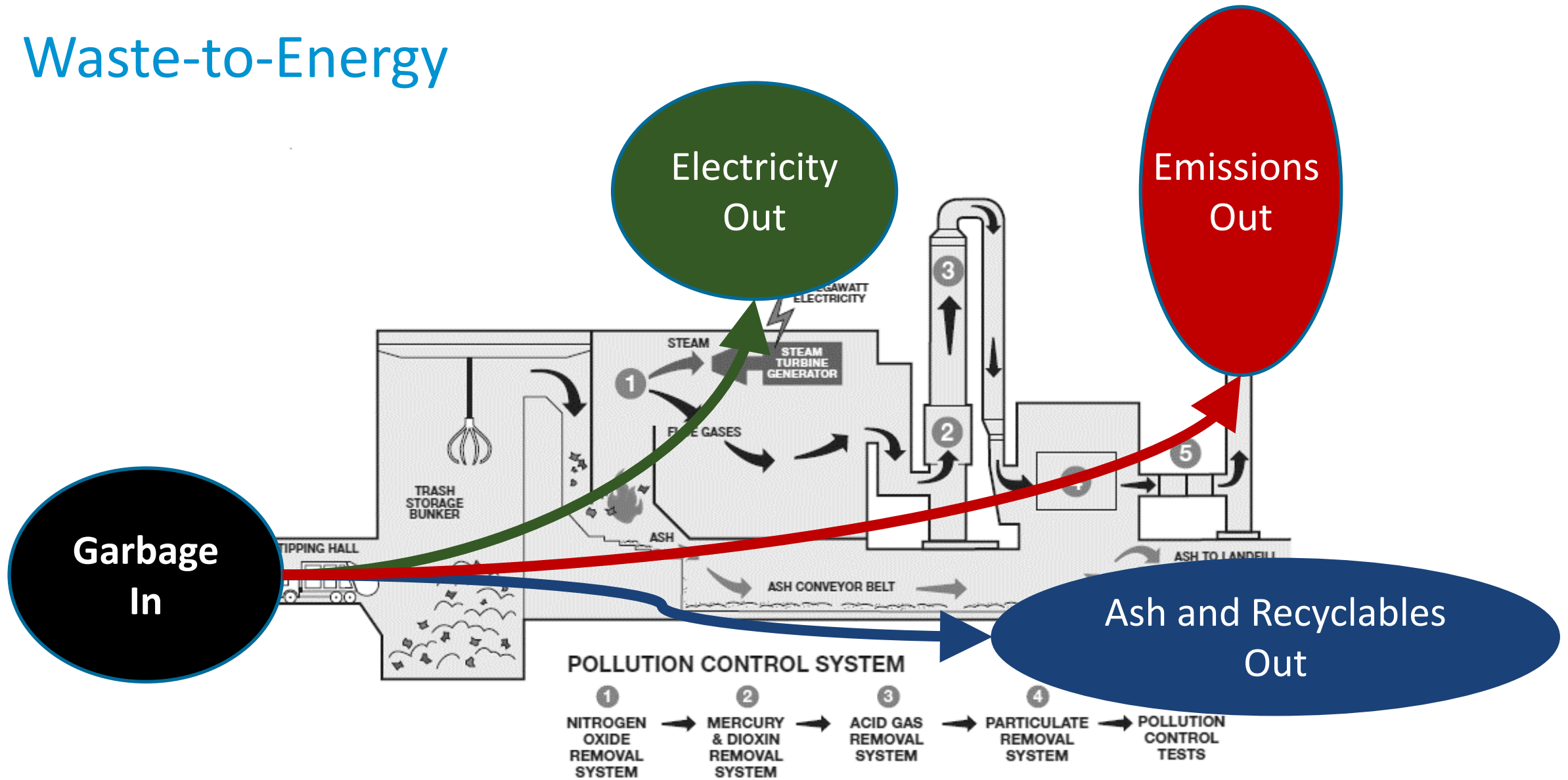
Reduction of:	Aluminum	Steel	Glass	Paper	Plastics
Energy Use	95%	60%	20%	50%	60%
Air Pollution	95%	85%	20%	74%	-
Water Pollution	97%	76%	-	35%	-
Water Use	-	49%	50%	58%	-
Maximum of times material can be recycled	Many	Many	Many	5-7	1-2

# Waste-to-Energy





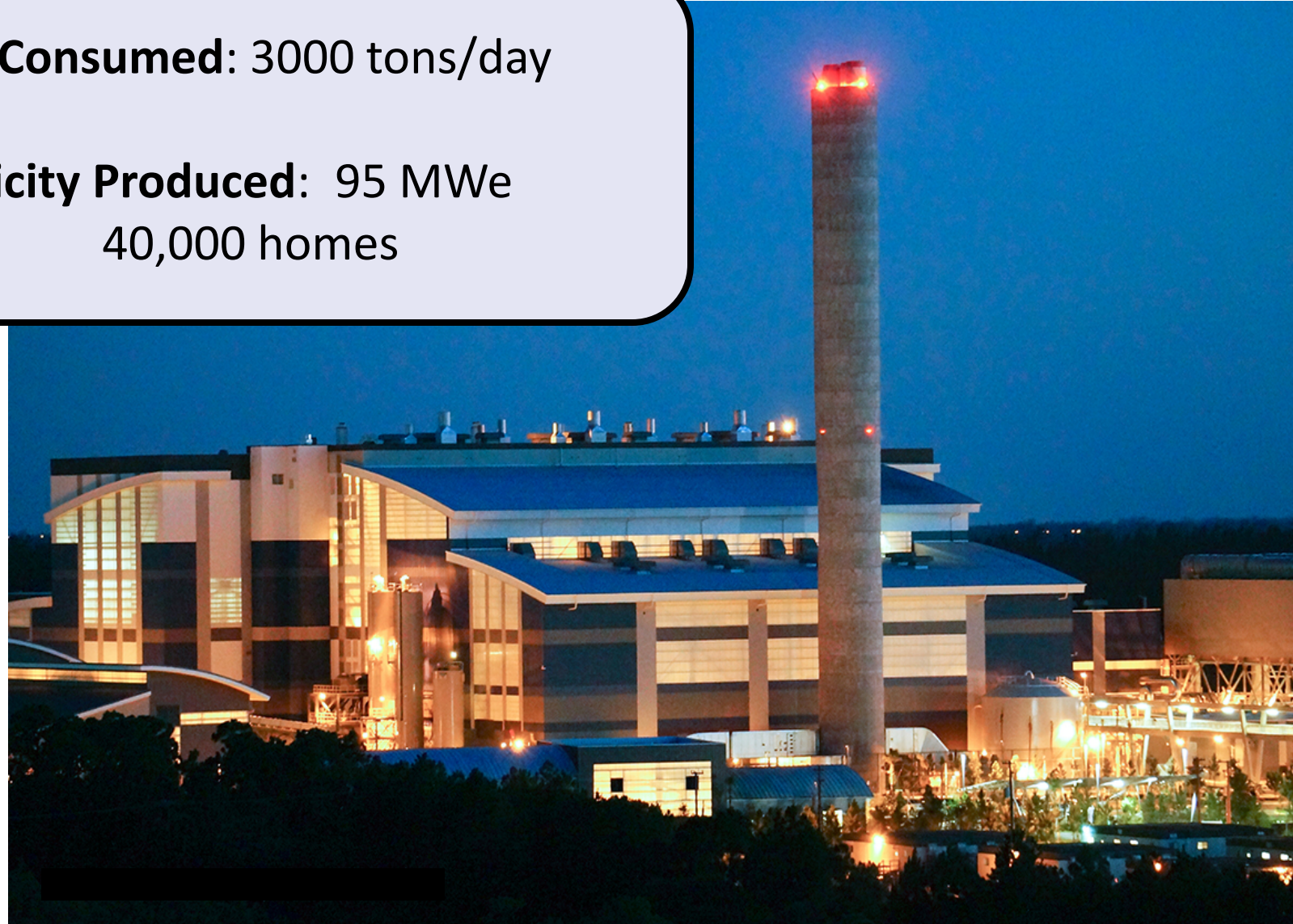
# Waste-to-Energy



# 2015 Project in the USA

**MSW Consumed:** 3000 tons/day

**Electricity Produced:** 95 MWe  
40,000 homes



# USA Project Permit vs. Actual Emissions

Pollutant	Emissions Permit	Actual Emissions Test**
NOx	<50 PPM	< 35 PPM
Carbon Monoxide	<100 PPM	< 30 PPM
SOx	<24 PPM	< 21 PPM
Unburned Hydrocarbons	< 7 PPM	< 3 PPM
Particulate Matter	12 MG/DSCM	< 3 MG/DSCM

\* All Data Shown For Typical Concentration (Parts Per Million Volume) Except Where Noted

\*\* Actual emission test conducted during compliance test three 4 hr. test per unit – 9 total test with range showing high and low measurement under stable full load testing

# USA Project Permit vs. Actual Emissions

Pollutant	Emissions Permit	Actual Emissions Test**	
NOx	<50 PPM	< 35 PPM	
Carbon Monoxide	<100 PPM	< 30 PPM	Less than 40 cars
SOx	<24 PPM	< 21 PPM	
Unburned Hydrocarbons	< 7 PPM	< 3 PPM	Less than 3 cars
Particulate Matter	12 MG/DSCM	< 3 MG/DSCM	

\* All Data Shown For Typical Concentration (Parts Per Million Volume) Except Where Noted

\*\* Actual emission test conducted during compliance test three 4 hr. test per unit – 9 total test with range showing high and low measurement under stable full load testing



# From CDM Smith, Inc.- Paul Hauck, PE

## Pasco County Ash Reuse - First in Florida to Receive FDEP Authorization for Beneficial Reuse



### **FDEP approved beneficial reuse in December 2014 for three applications**

1. Bottom ash as road base
2. Bottom ash as aggregate in asphalt
3. Bottom ash as aggregate in concrete





From CDM Smith, Inc.- Paul Hauck, PE

## High Tech Magnets for Optimized Recovery of Ferrous and Non-ferrous Metals

# High Strength Drum Magnet for Ferrous Metals



## Samples of Non-ferrous Metals Recovered by Eddy Current Separator

Aluminum, brass, bronze,  
copper... even gold and silver!



# Is incineration the same technology?

**Waste In**

**Waste-to-Energy**

- More economical to maintain a high-temperature fire
- Breaks down toxic chemicals.
- Self-sustaining fire.
- Better sorting of waste: Only want to burn plastics, wood and paper. All else should be removed.
- Materials recovery of metals and ash

**Goal:**  
Maximize Energy  
Conversion

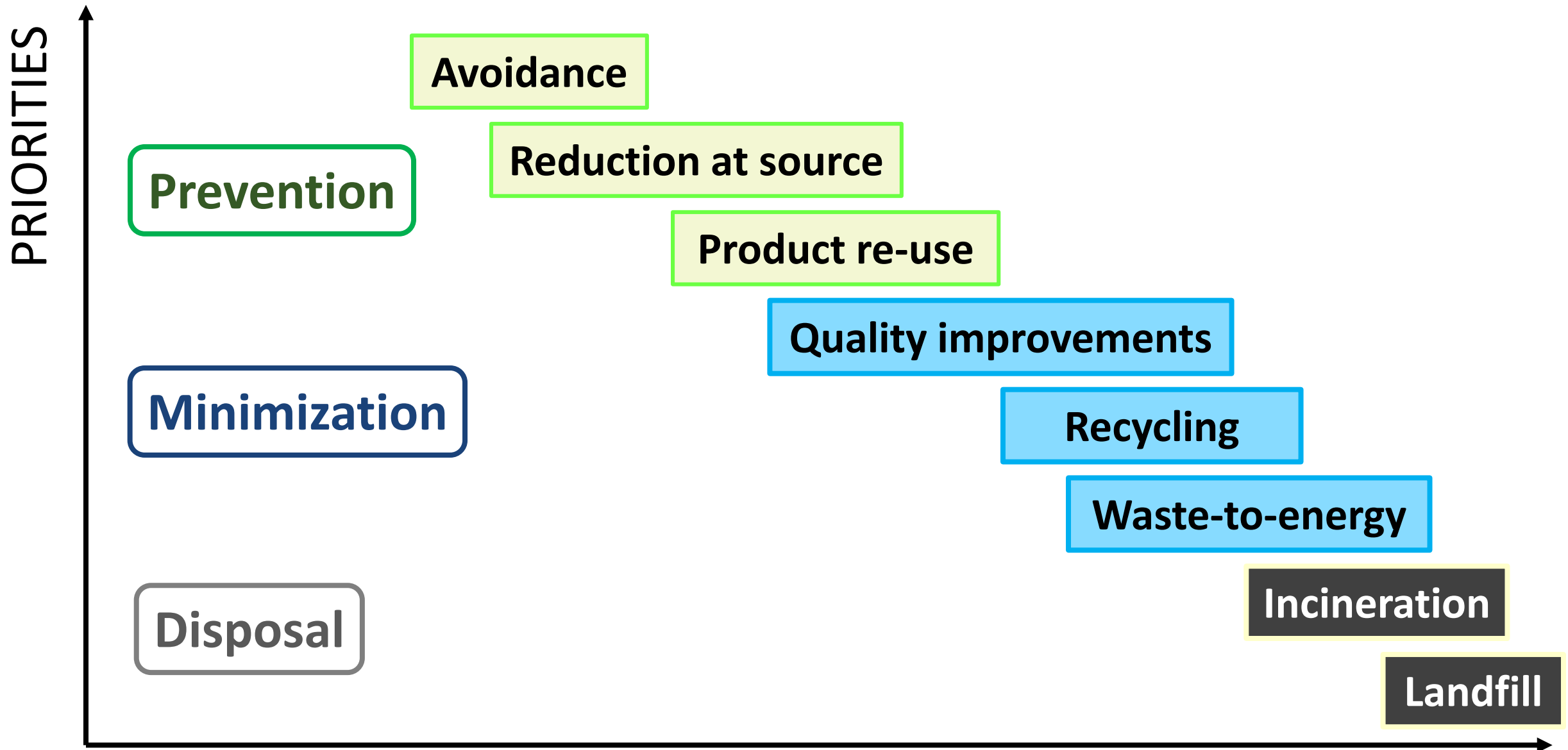
**Waste In**

**Incineration**

- More economical to maintain a low-temperature fire
- Toxins are not burned completely.
- Burn natural gas to maintain fire.
- No ability to recover recyclables from embers.
- No feedback into the economy

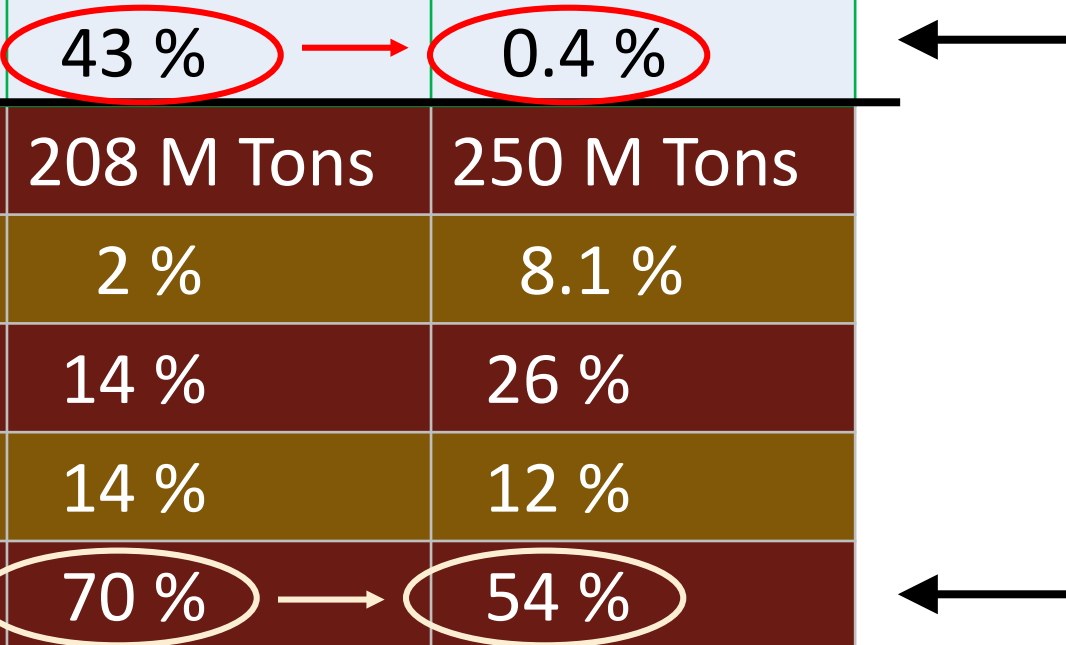
**Goal:**  
Volume Reduction

# Waste prioritization hierarchy

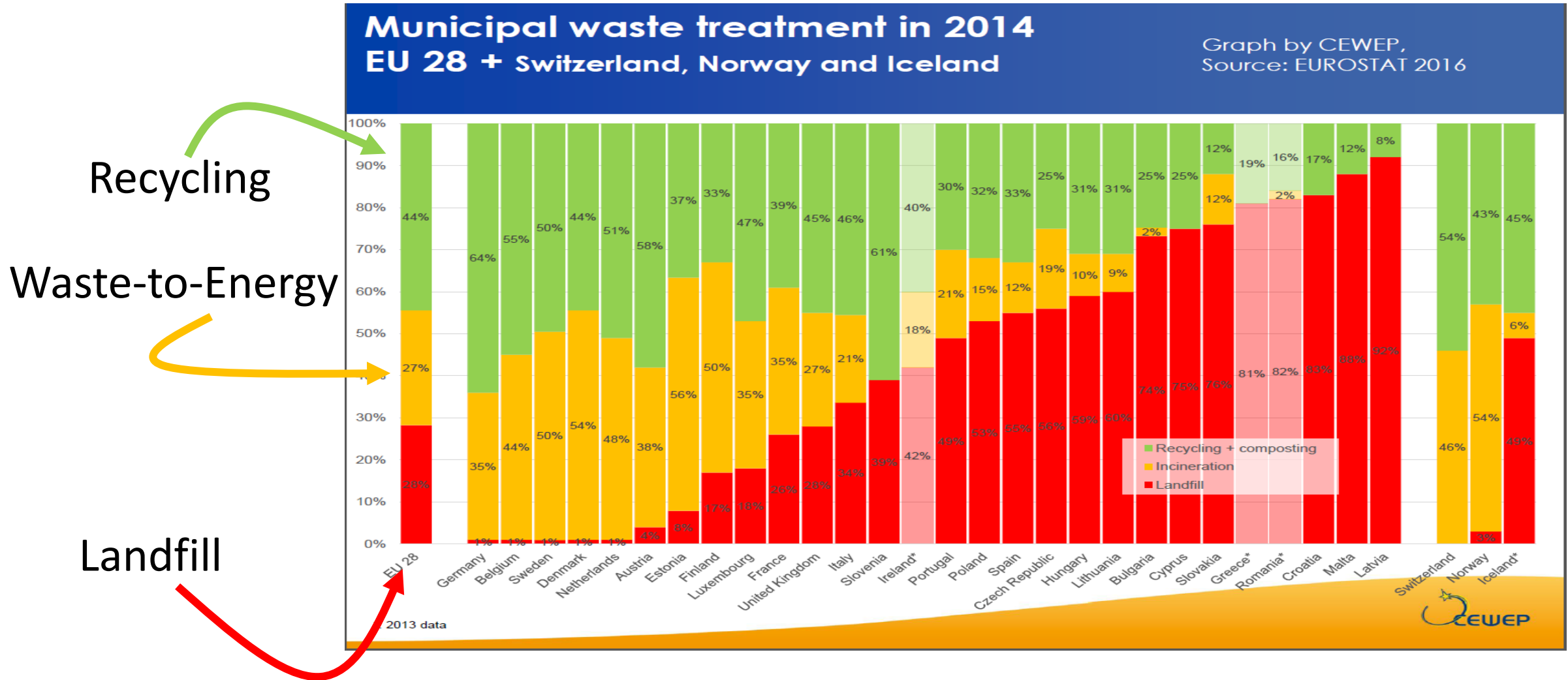


## Landfills as a negative externality

		1990's	2010
Germany	MSW Generation	50.9 M Tons	49.2 M Tons
	Composting	13 %	17 %
	Recycling	26 %	46 %
	Waste-to-Energy	18 %	37 %
	Landfill	43 %	0.4 %
USA	MSW Generation	208 M Tons	250 M Tons
	Composting	2 %	8.1 %
	Recycling	14 %	26 %
	Waste-to-Energy	14 %	12 %
	Landfill	70 %	54 %



# W2E has a positive correlation to Recycling





# Economic:

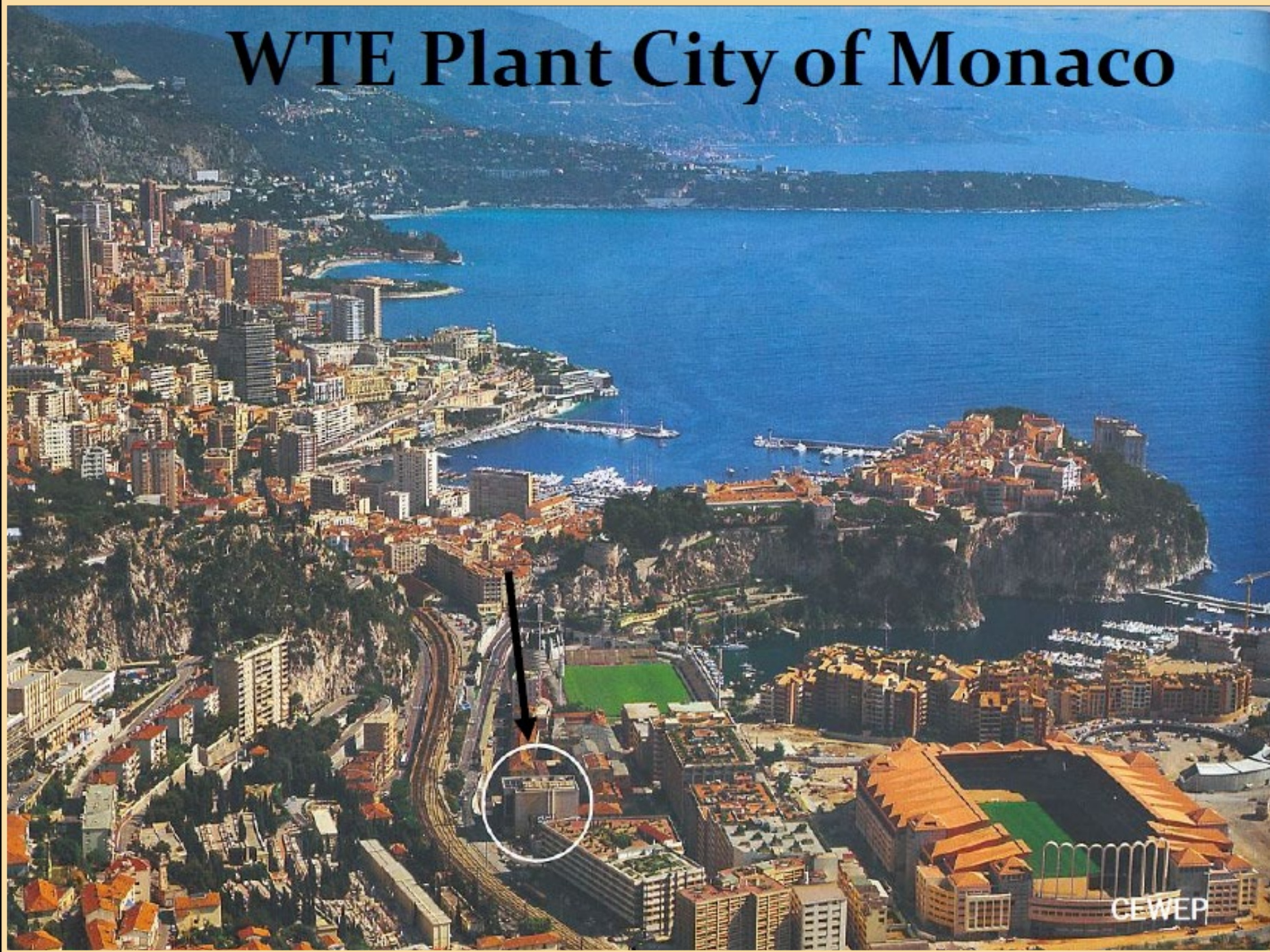
## Germany:

- Created 200,000 jobs to manage waste
- Extracts ~16 Golden Gate Bridges per year from W2E ash
- Generates €75 Billion contribution to GDP
- “Producer Pays” system

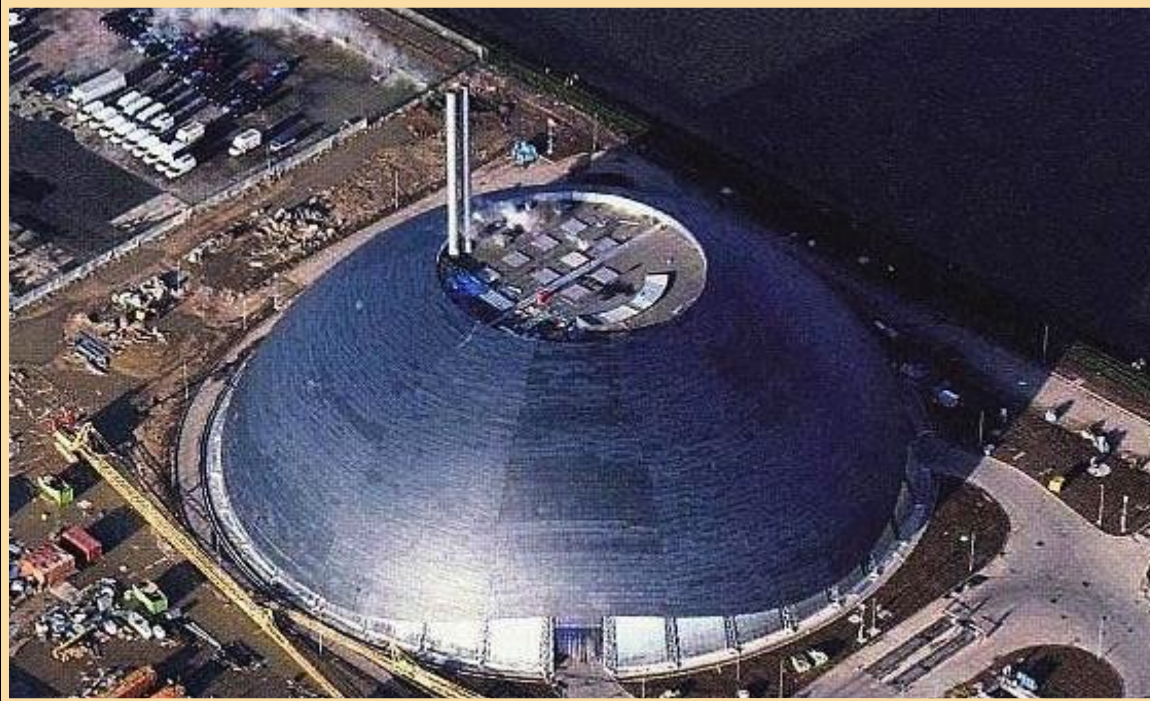
## USA Equivalent:

- “Bury” \$250-375 Billion in economic value in landfills every year (GDP Opportunity cost)
  - Includes several hundred Golden Gate Bridges of metals per year.
- Industry costs society \$50 Billion to maintain
- “Consumer Pays” system

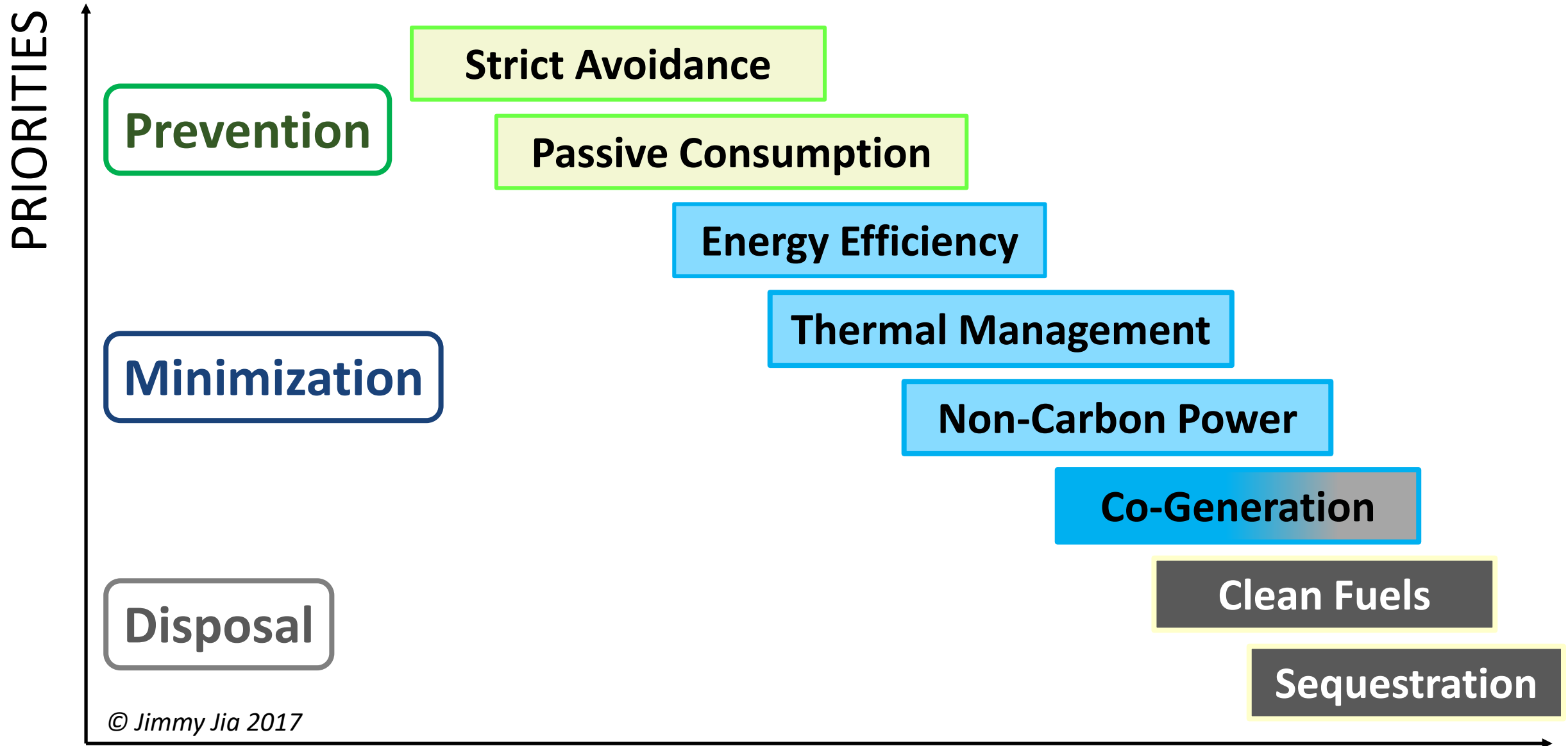
# WTE Plant City of Monaco







# Carbon Resource Prioritization



## In your list of risks,

- What are your ***critical functions*** where functionality outweighs all else?
- What strategies can you take to ***avoid*** the risk?
- For that which you cannot avoid, how can you ***minimize*** the risk?
- For those which are outside your control, how can you ***manage*** the risk?



# Summary on Prioritizations

- Risk and Innovation are along the same spectrum.
- Risks can be mitigated using process control and optimizations.
- Complex technology selection can be simplified by understanding what needs to happen *first*.
- Long-term risks can be mitigated using a prioritized decision framework

**Questions?**