Sustainability Assessments of Waste Management Strategies

2025 Winter Conference

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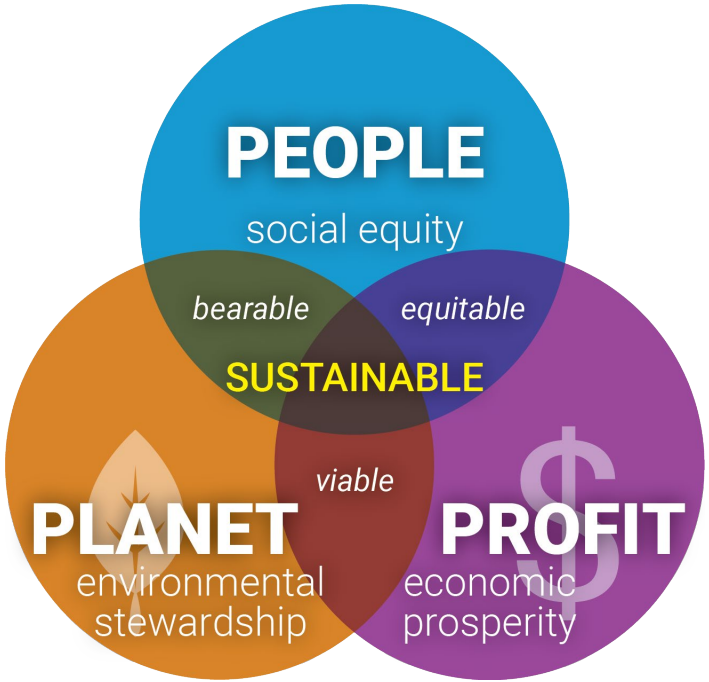
February 25, 2025

Finding the Right Balance

- People, Planet and Profit
  - Reveal hidden costs
  - Engage a diverse group of stakeholders
  - Seek to find viable and equitable solutions



Waste Management Stakeholders

Waste Generators

Residents

Industry

Commercial

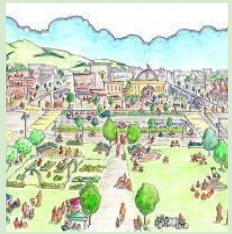
Private Waste Management Service Providers

Haulers

Disposal Facilities

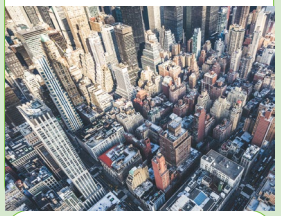
Advocacy Organizations

Local Community



Local Government

Cities



Counties

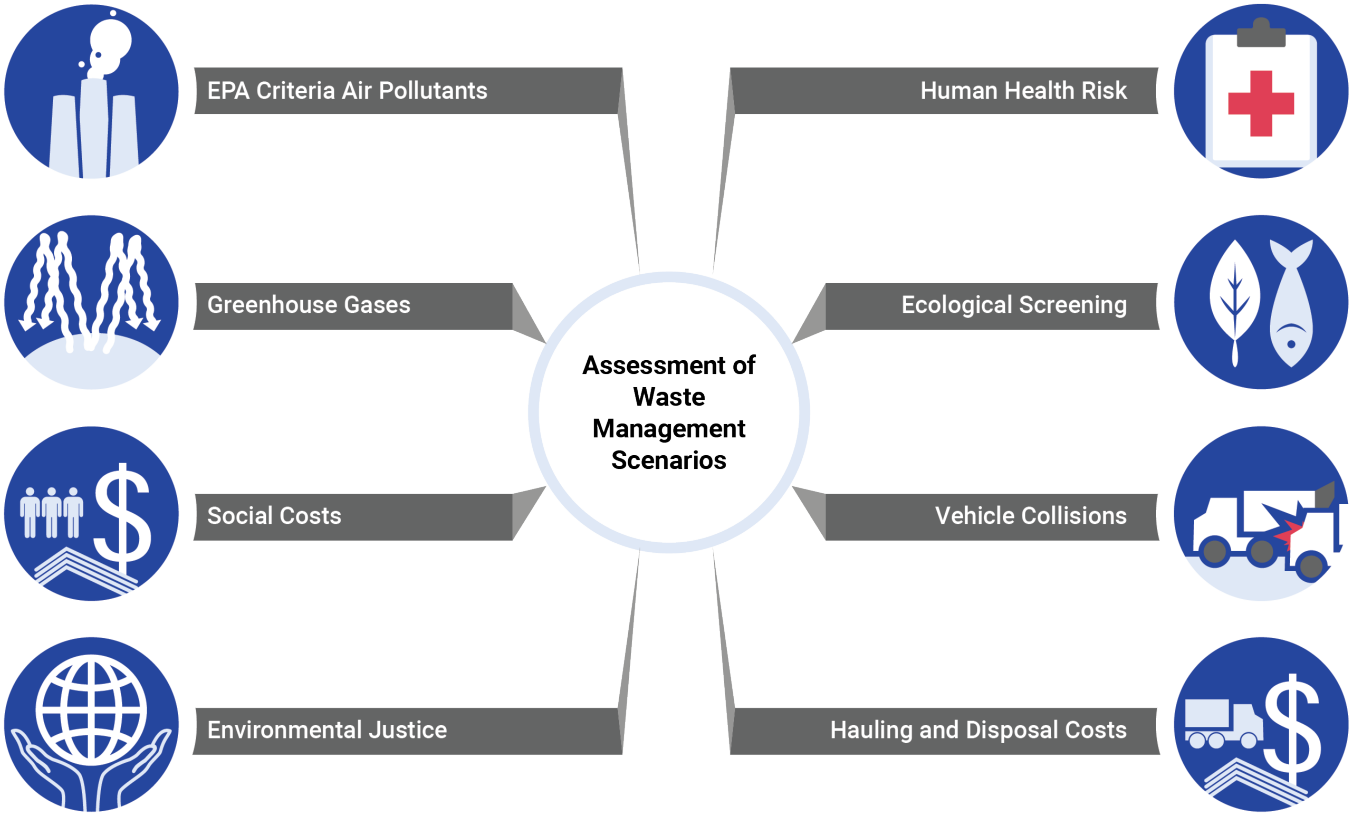
Regulatory Authorities

Federal

State

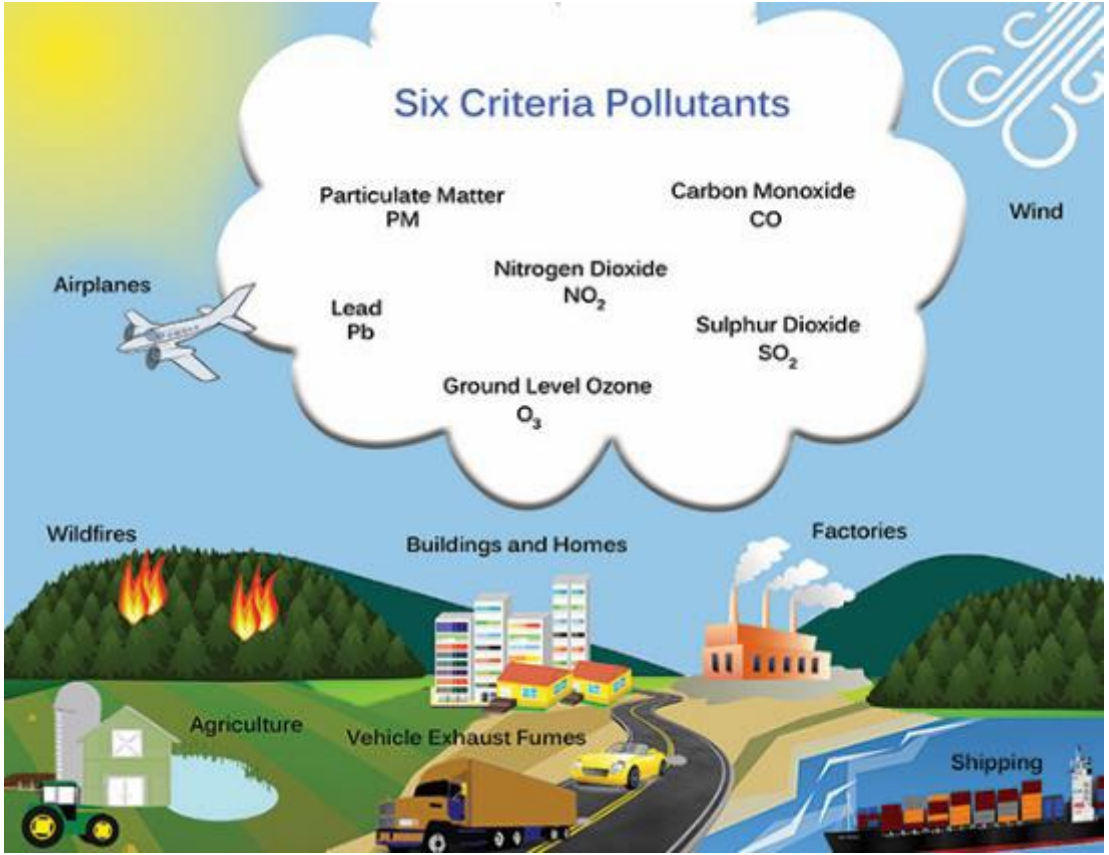
Local

Criteria Selection



People/Planet

- **Local Air Quality**
  - EPA established national ambient air quality standards
  - Attributed to a variety of adverse health effects



Planet

- Greenhouse Gases (GHGs)
- Sources of GHGs
  - Combustion of waste
  - Anaerobic digestion of landfilled waste
    - Surface emissions of methane
  - Tailpipe emissions

People

- Annual expected collisions

Collision Type	per 100m VMT (2017)	
	Trailer	Packer
K - Killed	1.53	1.16
A - Incapacitating	3.24	4.58
B - Non-Incapacitating	12.75	18.04
C - Possible/Other	27.41	38.77
O - Property Damage	111.80	138.20

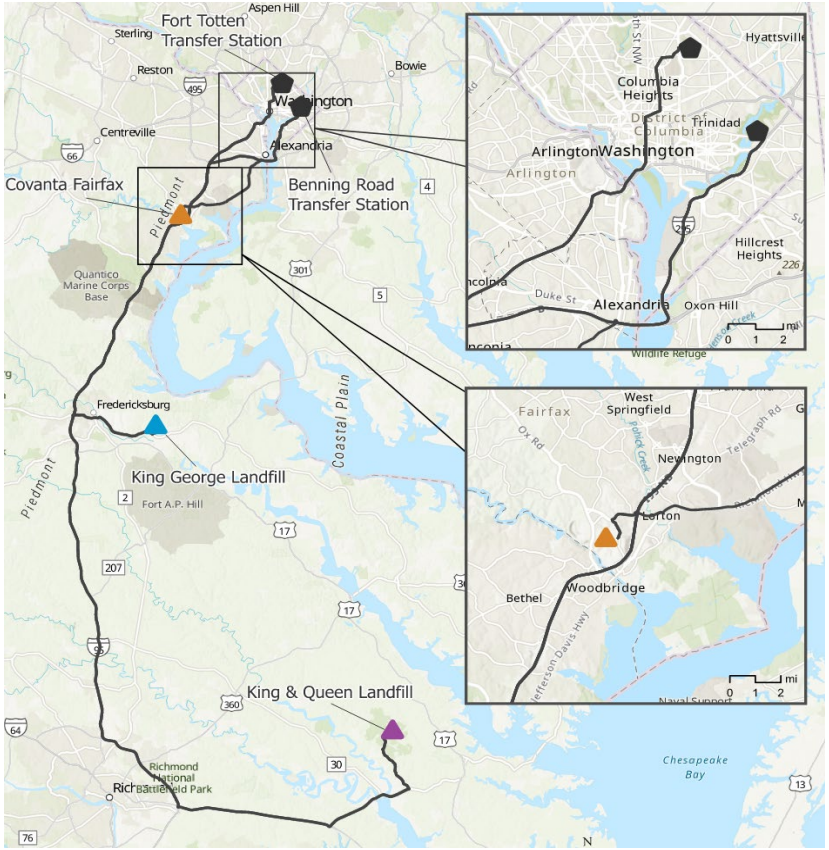
Scenarios

Disposal Scenarios

- Covanta Fairfax Waste-to-Energy
- King George Landfill
- King & Queen Landfill

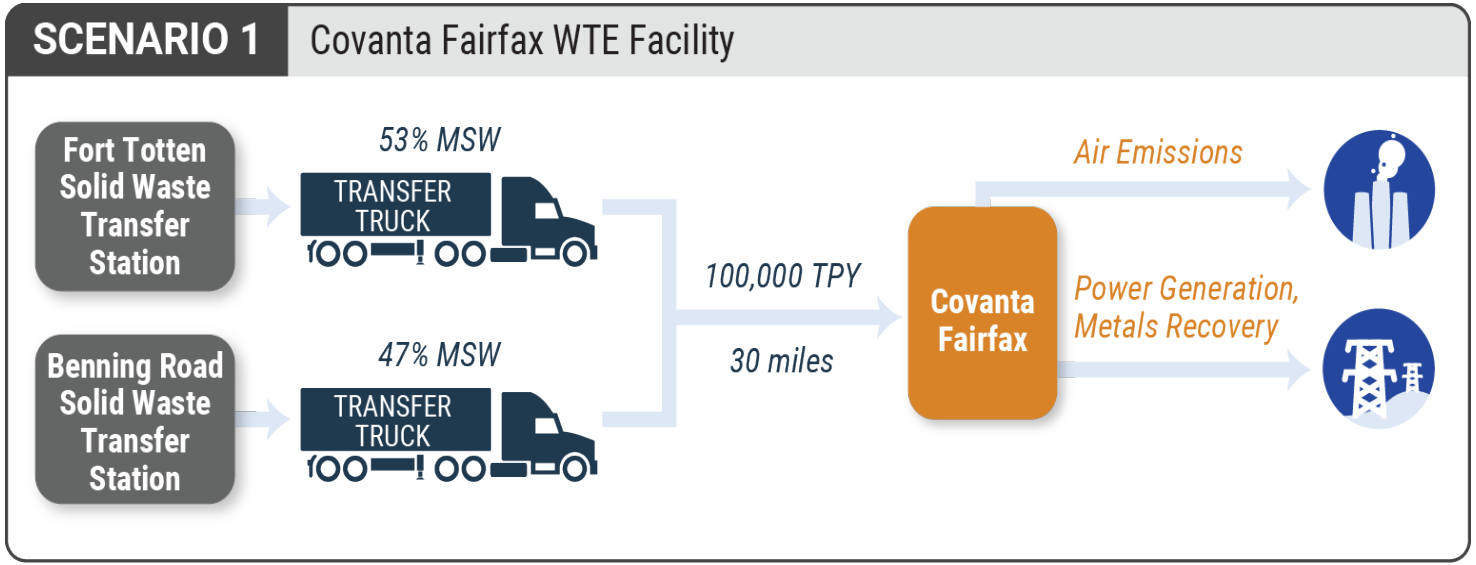
Waste-to-Energy

Landfilling



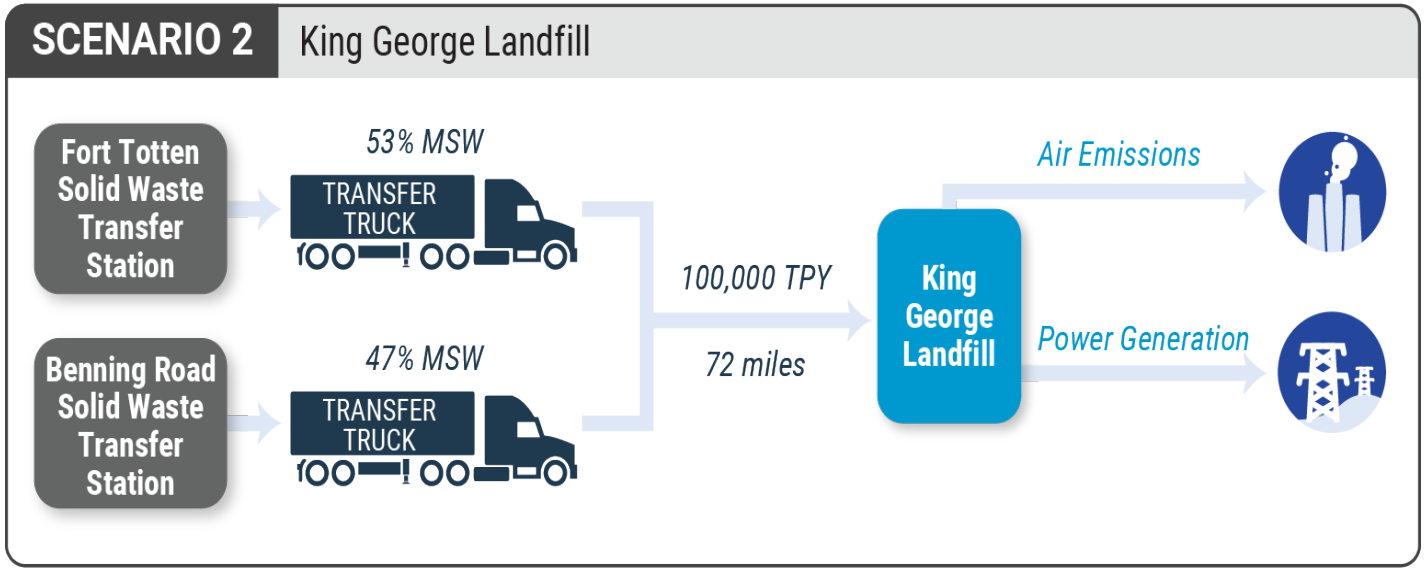
Scenario 1 – Covanta Fairfax Waste-to-Energy

- Current practice
- Municipal solid waste (MSW) is hauled 30 miles to Lorton, Virginia



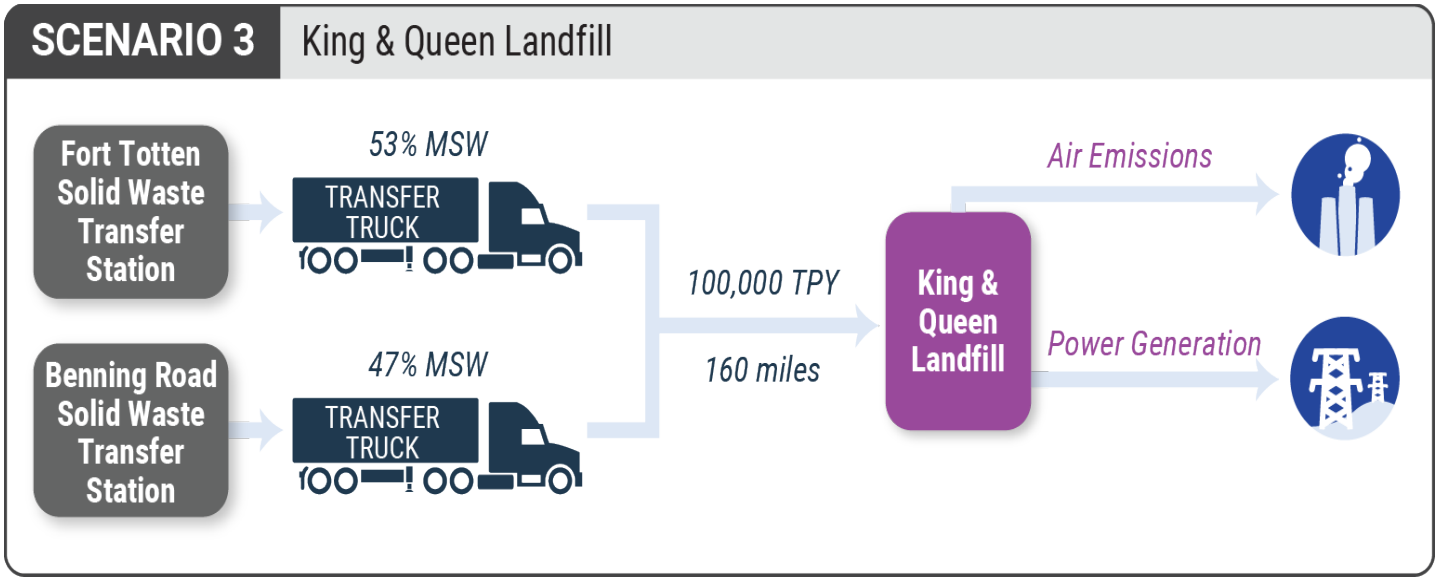
Scenario 2 – King George Landfill

- King George Landfill is owned and operated by Waste Management
- Waste is hauled 72 miles to King George, Virginia



Scenario 3 – King & Queen Landfill

- King & Queen Landfill is owned and operated by Republic Services
- Waste is hauled 160 miles to Little Plymouth, Virginia



Methodology

Steps to Calculate Emissions

Data Gathering

- Waste characterization
- Projected Annual Tonnage
- Landfill Gas Management
- Community Demographics
- Hauling distances and types of transport

Modeling

Emissions from waste

Emissions from waste:

Emissions from hauling

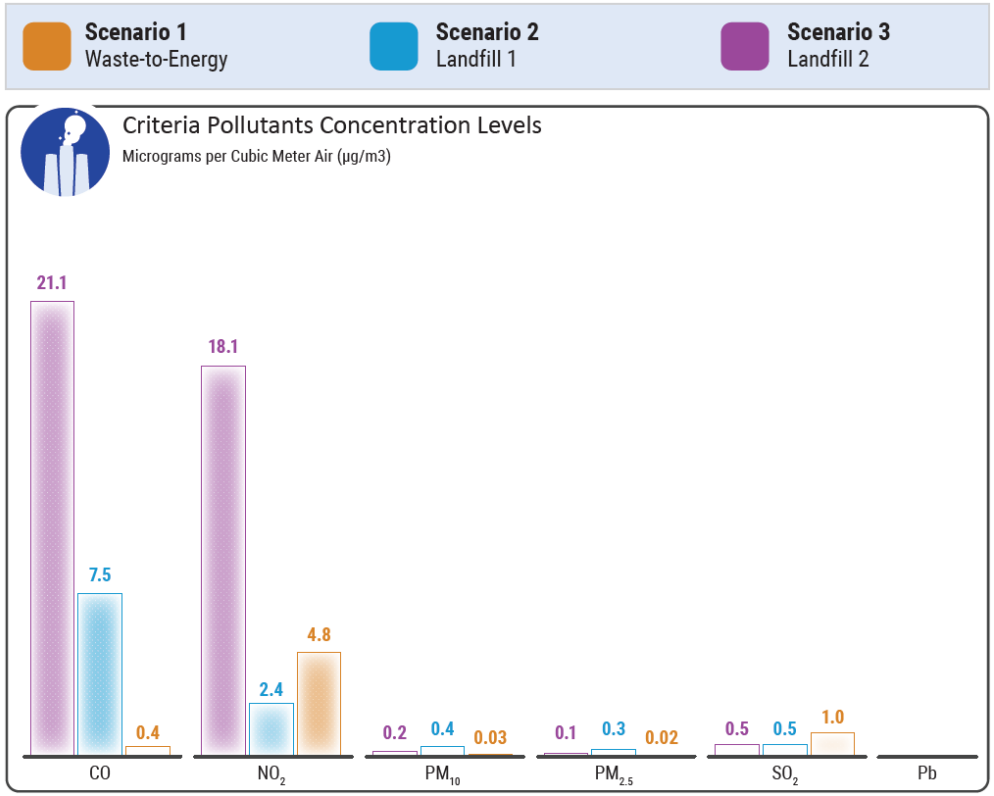
Post Processing

- Biogenic CO2
- Global Warming Potentials

Results

Case Study Results

Study Results – Local Air Quality



Study Results – Human Health Risk

Scenario 1
Waste-to-Energy

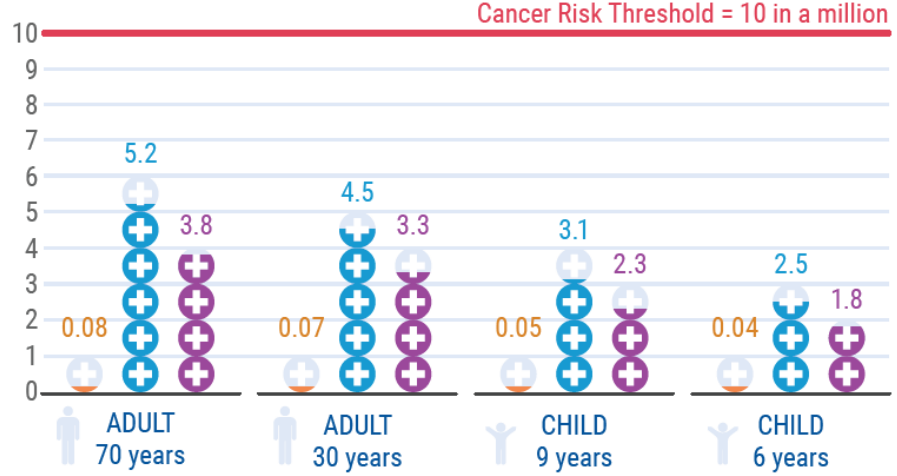
Scenario 2
Landfill 1

Scenario 3
Landfill 2

Health Risk Assessment

Out of 1 Million People

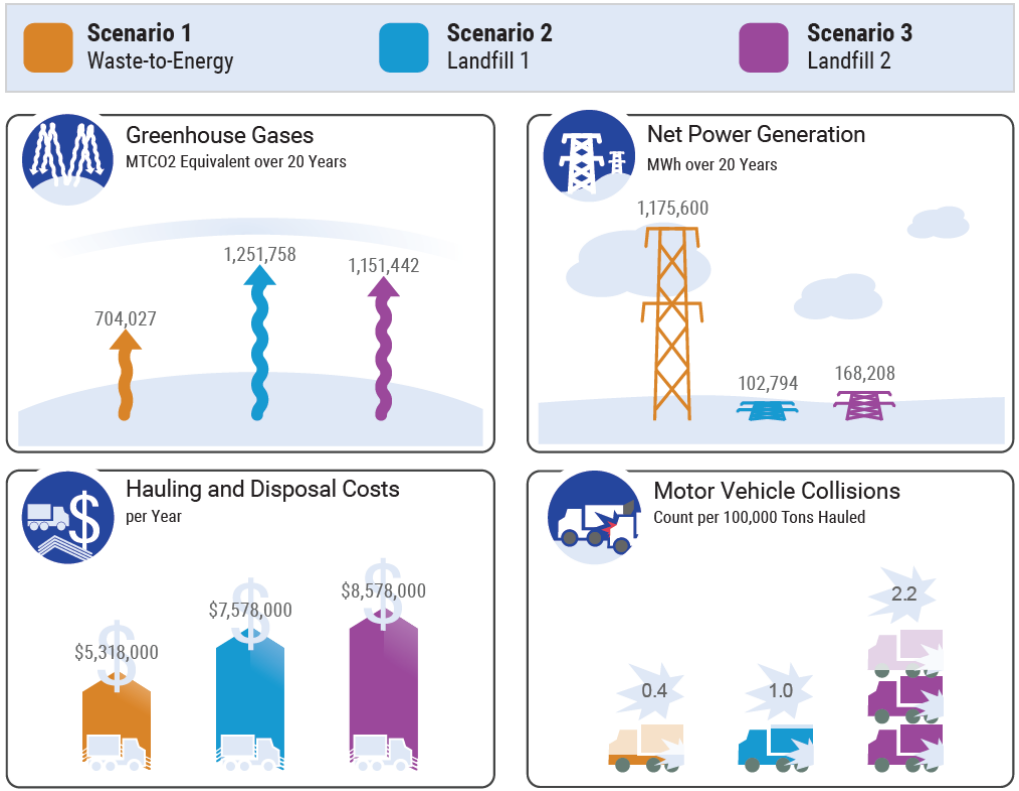
Cancer Risk from Inhalation of HAPs*



** Values are shown as the number of cancer cases per million people.*

Note: Maximum cancer risks are shown for each scenario assuming residential risk at all modeled grid locations. This is a conservative assumption – see text for uncertainty discussion.

Study Results – GHG, Power, Costs & Collisions



Study Results – Environmental Justice

Environmental Justice (EJ)

Relative Rankings

– 1 2 3 *Best to Worst*

	Waste-to-Energy		Landfill 1		Landfill 2	
	Facility	Hauling Route	Facility	Hauling Route	Facility	Hauling Route
EJ communities *(low income & minorities)*	3	2	2	3	1	3
Lower median household income	1	1	2	1	3	1
Minority population	3	3	2	3	1	3
Households living in poverty	1	2	3	2	2	2
Population without health insurance	2	3	3	3	1	3
Need for public assistance	1	2	2	2	3	3
Proximity to facilities with environmental conditions	3	–	3	–	1	–
1% annual change flood hazard risk	1	1	1	2	1	3
Subtotal Scores	15	14	18	16	13	18
Total Score	29		34		31	

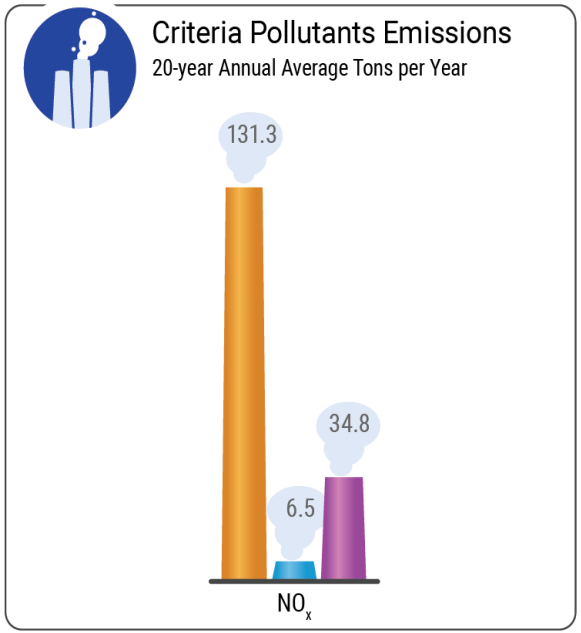
Key Topics

Criteria Air Pollutants Tons vs. Concentration

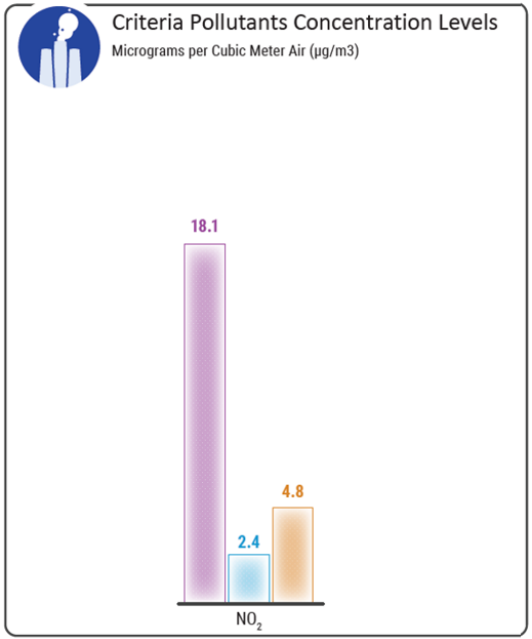
Scenario 1
Waste-to-Energy

Scenario 2
Landfill 1

Scenario 3
Landfill 2

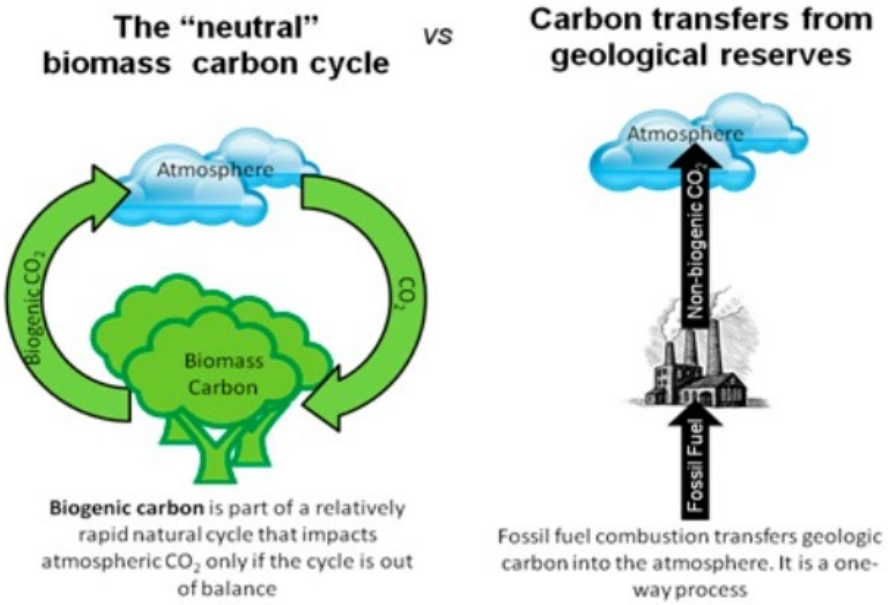


VS

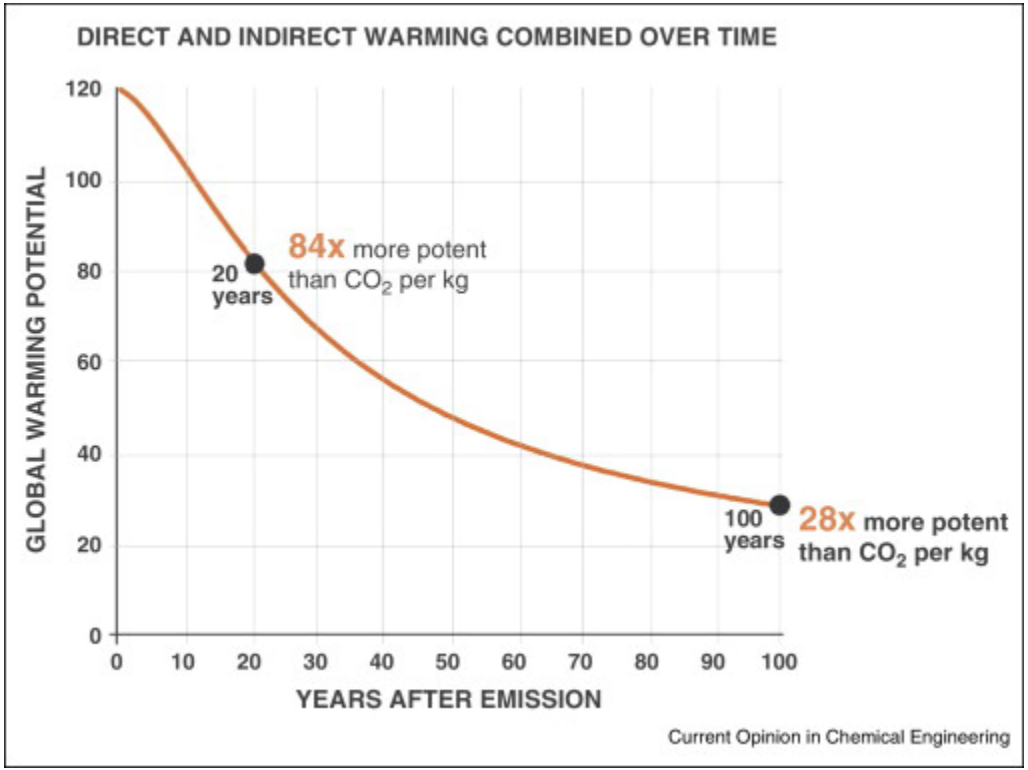


Exclusion of Biogenic CO2

- Biogenic CO2 is part of the carbon cycle
- Fossil fuels add carbon to the carbon cycle
- Exclusions are made for WTE and landfills biogenic emissions
- We included biogenic from tree productions due to climate change urgency

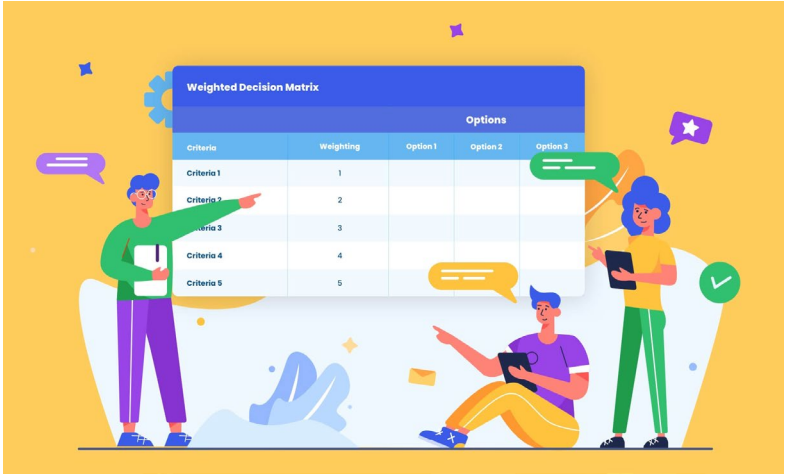


Methane Global Warming Potential



Select Criteria Weights

SUSTAINABILITY CRITERIA	CRITERIA WEIGHTS	SOLID WASTE MANAGEMENT OPTION	
		CRITERIA SCORE	WEIGHTED CRITERIA SCORE
Local Air Quality			
Greenhouse Gases			
Environmental Justice			
Hazardous Air Pollutants (Cancer Risk)			
Ecological Screening			
Vehicle Collisions			
Hauling and Disposal Costs			
	100%		
		OPTION SCORE	



Lessons Learned & Considerations

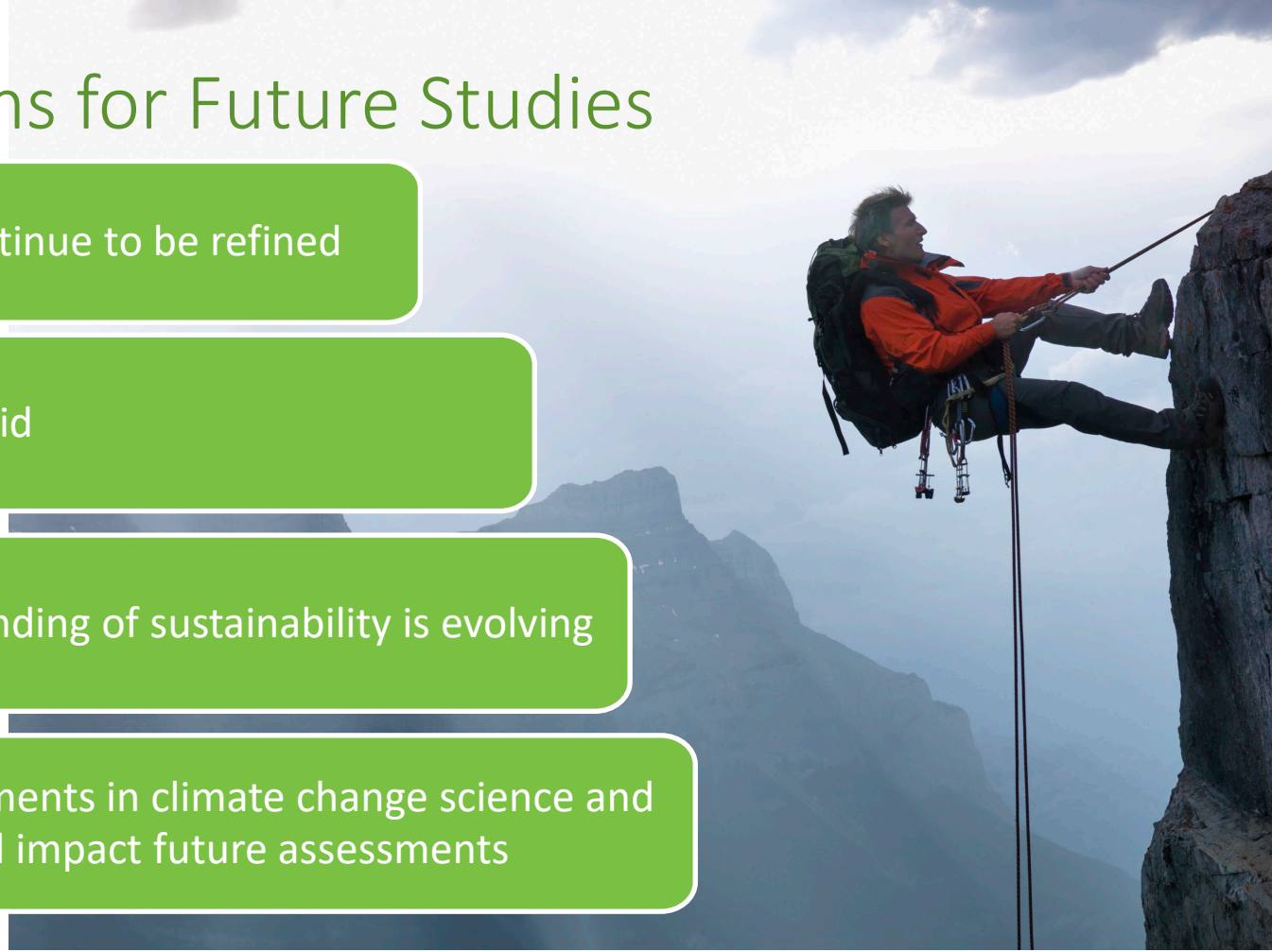
Lessons Learned

Finding the most sustainable scenario involves more than comparison of financial costs

There are no industry standards for weighting assessment criteria

Social and environmental factors require careful consideration of local and global impacts and collaboration with all stakeholders

Considerations for Future Studies



- Methodologies will continue to be refined
- Greening of the grid
- Our understanding of sustainability is evolving
- Advancements in climate change science and policy will impact future assessments

Discussion

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