Gasification and Pyrolysis: Polluting, Expensive, and Risky

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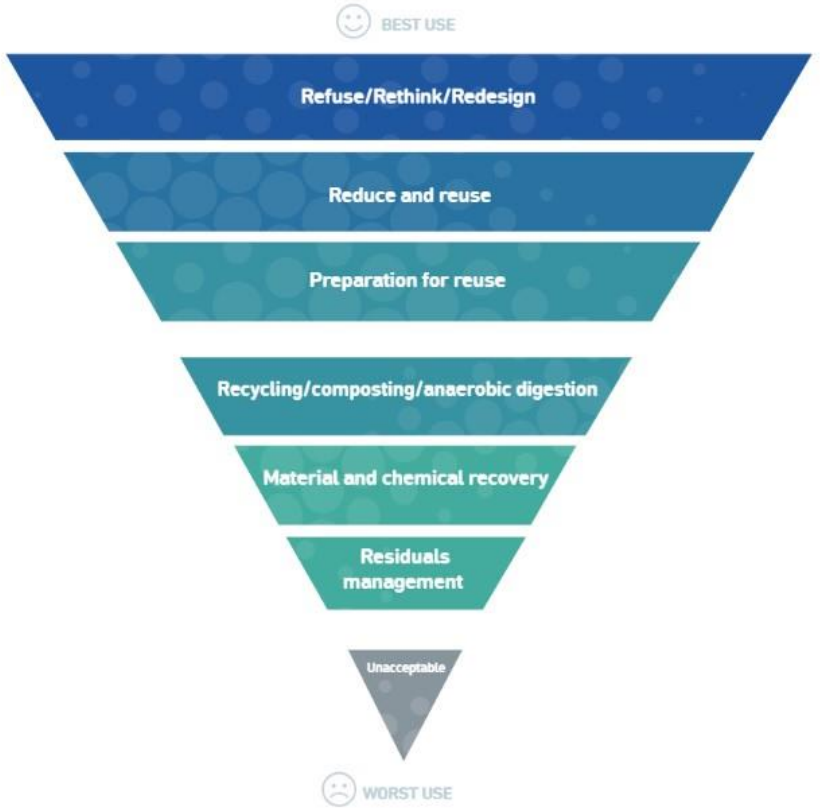

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Agenda:

- Gasification and Pyrolysis Overview
  - Outputs and Emissions
- Gasification is NOT Renewable Energy
- Gasification Prevents Waste Reduction
- Gasification's History of Failures
- We Already Have Real Solutions to Our Waste Problem

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Gasification and Pyrolysis Overview

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What are Gasification and Pyrolysis?

- "High heat" processing of waste
  - Gasification = low oxygen
  - Pyrolysis = no oxygen
- Comparable to mass burn incineration, but broken into two parts:
  - PART ONE: Waste is heated in oxygen-poor environment to create synthetic fuel
  - PART TWO: That synthetic fuel is burned in an oxygen-rich environment

Sources: Blue Ridge Environmental Defense League at 3-5; Tangri at 2

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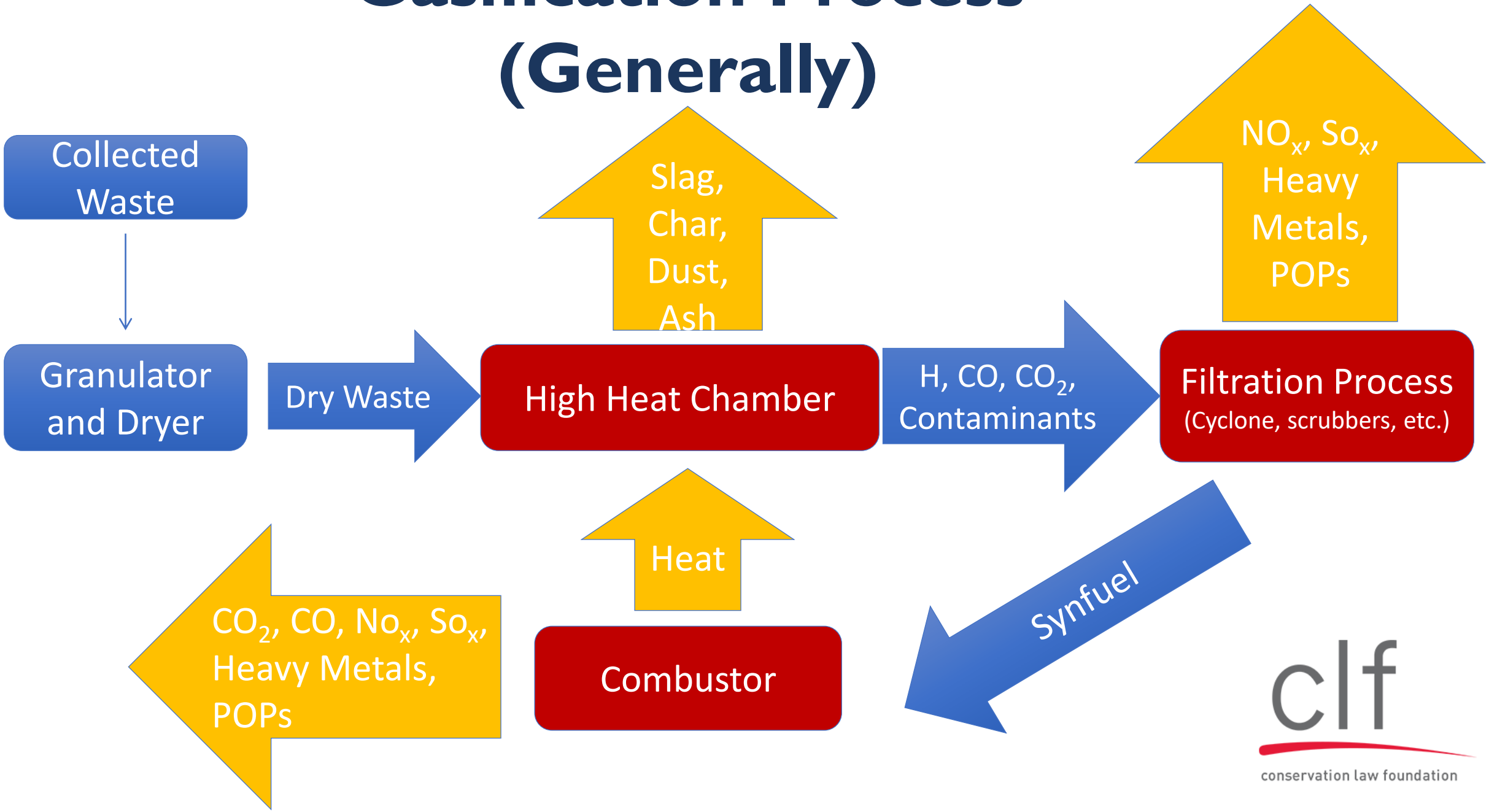
Gasification Process (Generally)



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Gasification Outputs: Heat Chamber

- Solids: slag, ash, char, and dust
  - Heavy metals like mercury and lead along with dioxins and furans
  - Landfilled or incinerated
- Toxic fuel mixture:
  - Hydrogen, carbon monoxide, carbon dioxide
  - Nitrogen oxides, sulfur oxides
  - Heavy metals: lead, mercury, cadmium, arsenic
  - POPs: dioxins, furans, PCBs

Sources: Azouly at 47-48; Blue Ridge Environmental Defense League at 3-9; Kaminska-Pietrzak at 7-11; Tangri at 9

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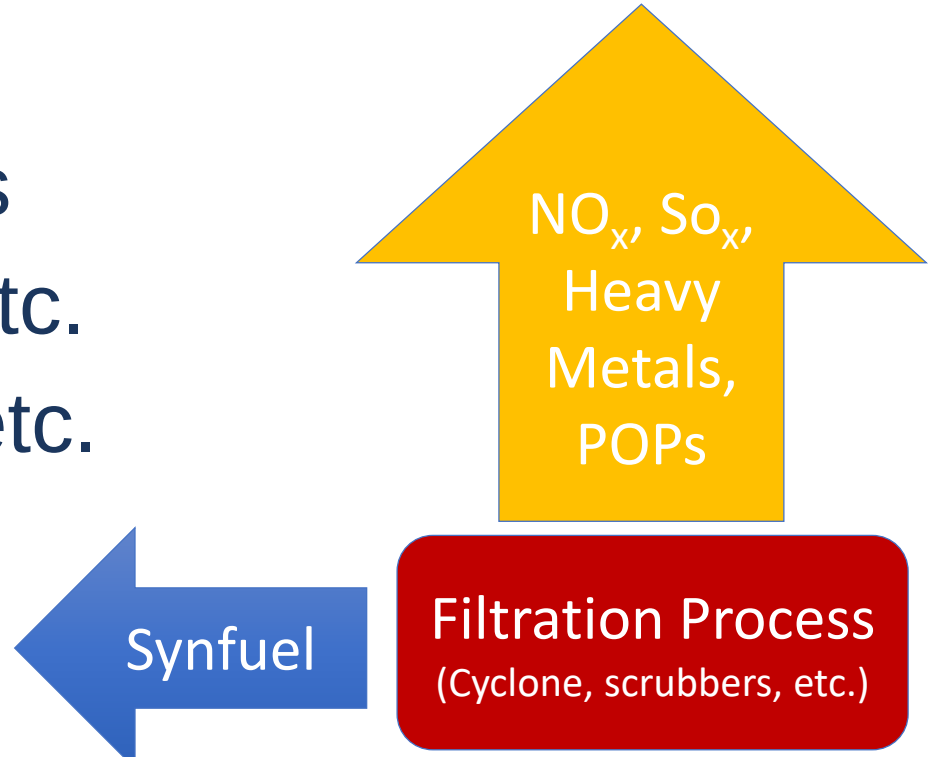
Gasification Outputs: Filtration

- "Contaminants":
  - Nitrogen oxides, sulfur dioxides
  - Heavy metals: mercury, lead, etc.
  - POPs: dioxins, furans, PCBs, etc.
- Synthetic Fuel:
  - H, CO, CO_2
  - Nitrogen oxides, sulfur dioxides
  - Heavy metals: mercury, lead, etc.
  - POPs: dioxins, furans, PCBs, etc.



Sources: Azouly at 47-48; Blue Ridge Environmental Defense League at 3-9; Kaminska-Pietrzak at 7-11; Tangri at 9

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Gasification Outputs: Combustion

- Heat
- Air emissions:
  - Carbon monoxide, carbon dioxide
  - Nitrogen oxides, sulfur dioxides
  - Heavy metals: lead, mercury, arsenic
  - POPs: dioxins, furans, PCBs, etc.
  - Particulate matter
  - Worse emissions profile than fracked gas, diesel, and gasoline

Sources: Azouly at 47-48; Blue Ridge Environmental Defense League at 3-9; Kaminska-Pietrzak at 7-11; Tangri at 9

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Gasification vs Mass Burn Incineration

GASIFICATION:

- Heat
- Ash and char
- Air pollutants:
  - Carbon Dioxide
  - Nitrogen Oxides
  - Sulfur Oxides
  - Mercury and Lead
  - Dioxins and Furans

MASS BURN:

- Heat
- Ash and char
- Air pollutants:
  - Carbon Dioxide
  - Nitrogen Oxides
  - Sulfur Oxides
  - Mercury and Lead
  - Dioxins and Furans

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Gasification Does NOT Generate Renewable Energy

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Gasification and Carbon Emissions

- “Thermal conversion” of materials that contain stored carbon releases that carbon to the atmosphere
- Plastics = fossil fuels
- Burning plastics = burning fossil fuels

Sources: Tellus Institute, *Materials Management Options*, at 9-11; U.S. EPA at 76

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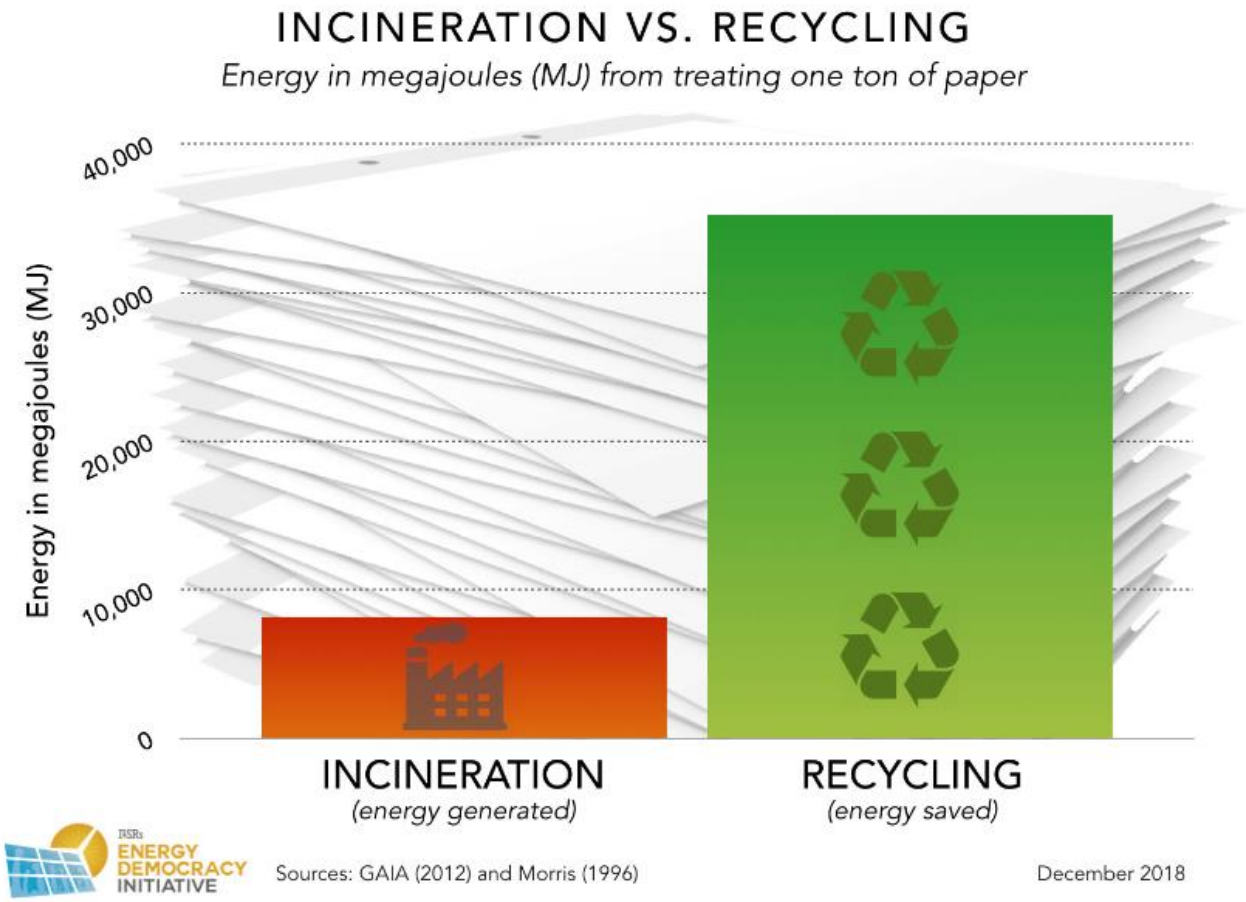
Gasification vs Zero Waste

- Source reduction, recycling, and composting conserve more energy than high heat processes can generate and provide significant reductions in greenhouse gas emissions



Sources: Donahue at 11; U.S. EPA at 116-19

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Gasification Wastes Energy

- Gasification and pyrolysis consume as much as 87 times more energy than can be generated by burning the synthetic fuel they produce
- The laws of thermodynamics are inviolable

Source: Rollinson

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Gasification is Expensive

- High energy consumption
- High capital costs:
  - Industry estimates range from $7,500 to $11,500 per kW generation capacity
  - A gasifier with a 15 MW output could cost as much as $172.5 **million**
  - More than 2x the capital costs of wind and solar
- **High costs mean high tip fees**

Source: Tangri at 7

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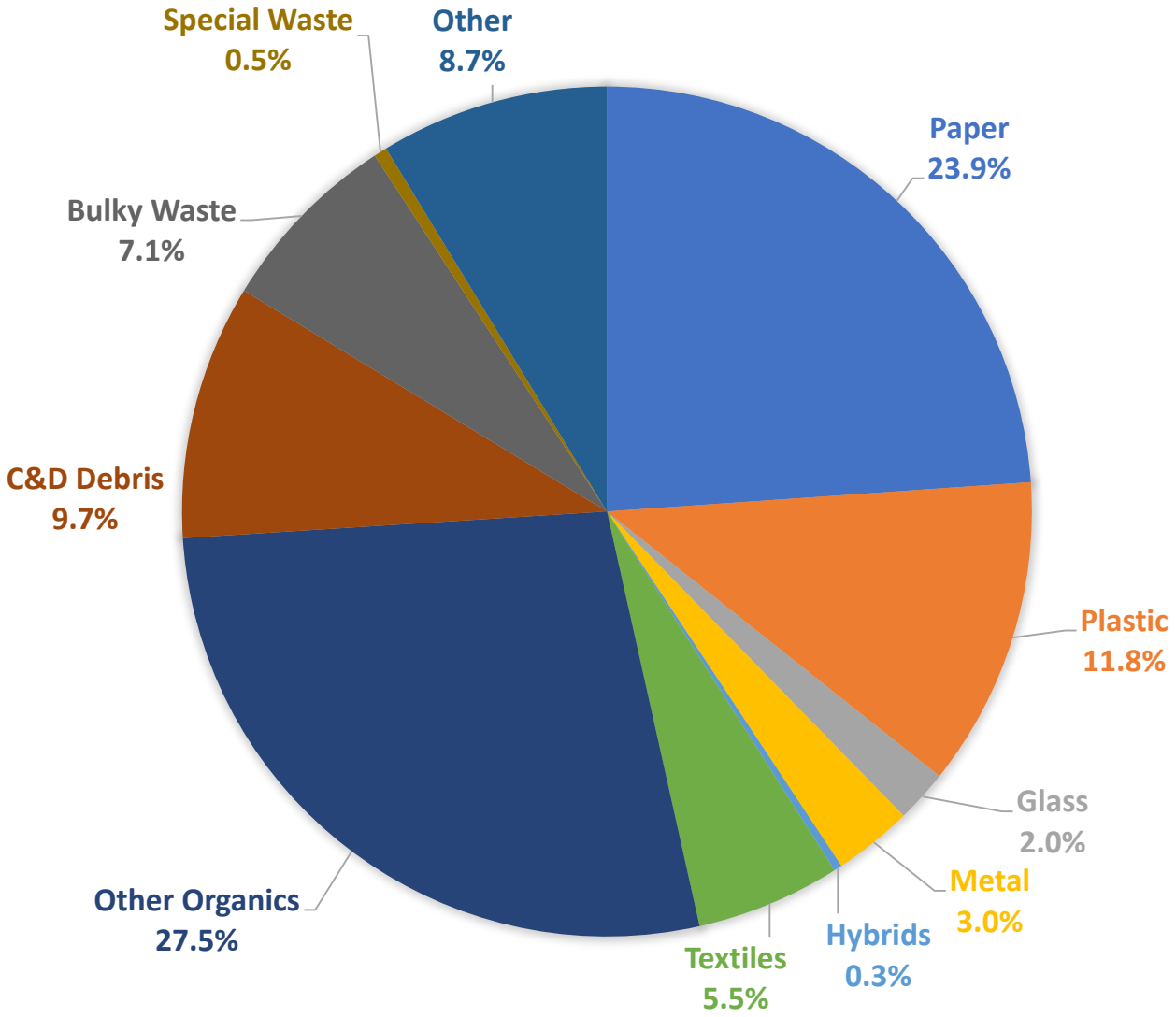
Gasifying Waste is Challenging



- Gasification and pyrolysis were originally designed to burn homogenous fuel sources like wood and coal
- Municipal solid waste is anything but homogenous

Sources: Rhode Island Solid Waste Characterization Study at 13; Rollinson; Tangri at 5-6

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Gasification Prevents Waste Reduction

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Gasifiers Demand Fuel

- Gasification and pyrolysis facilities depend on carbon-rich feedstock such as:
  - Organic waste
  - Paper
  - Plastic
- These facilities therefore compete with preferred strategies like source reduction, composting, anaerobic digestion, and recycling

Source: Blue Ridge Environmental Defense Fund at 10-12

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Gasifiers Demand Fuel

You can’t feed the beast and reduce waste at the same time

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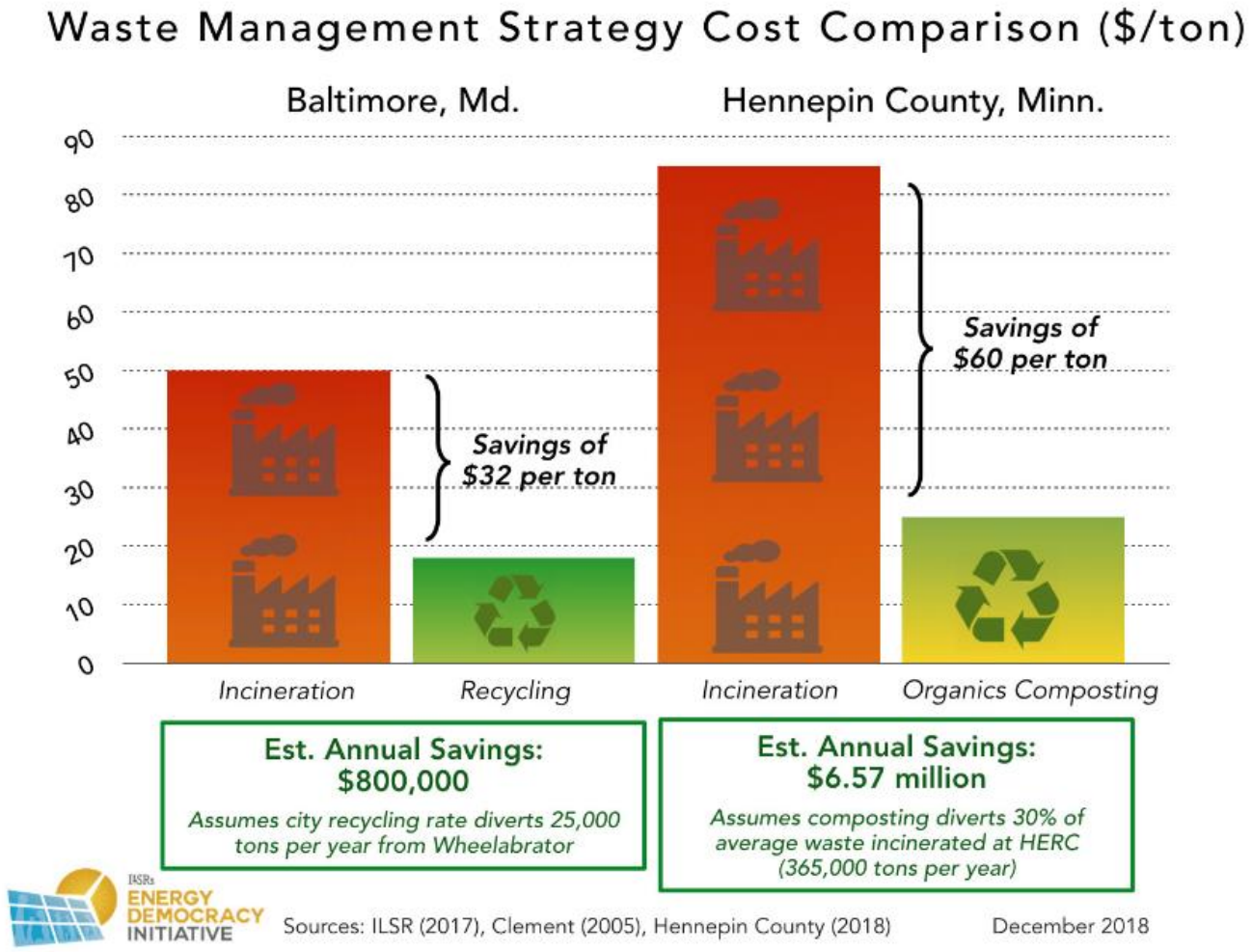
Gasification vs Zero Waste



- High heat waste treatment is significantly more expensive than zero waste alternatives like recycling and composting

Source: Donahue at 15

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Gasification vs Zero Waste

- High heat waste treatment generates fewer jobs than recycling and composting

- Composting: 4-15x as many jobs per ton processed

- Recycling: 12-20x as many jobs per ton processed

Sources: Donahue at 15; Tellus Institute, *More Jobs, Less Pollution*, at 34-35

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Gasification's History of Failures

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Landscape of Failures

- Scotgen—Dargavel, Scotland: Closed 2013
  - Consistently exceeded emissions limits for dioxins and other pollutants
  - Generated significantly less energy than expected
  - Operating permit revoked by Scottish Environmental Protection Agency

Source: Tangri at 11

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Landscape of Failures

- Plasco—Ottawa, Canada: Closed 2015
  - Plasma gasification demonstration project failed to comply with emissions limits, including limits for sulfur dioxide
  - Facility only processed 7% of the waste total for which it was projected
  - Plasco filed for bankruptcy in 2015

Source: Tangri at 11

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Landscape of Failures

- Caithness Heat and Power—Scotland: Closed 2009
  - Biomass gasification plant planned to provide heat to 200 local homes
  - Closed after one year of operations due to technological failures and financial problems
  - Resulted in £11.5 million loss to Highland Council

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Landscape of Failures

- Thermoselect—Karlsruhe, Germany: Closed 2002
  - Regularly exceeded air emissions limits for dioxins, nitrogen oxides, particulate matter, and hydrogen chlorides
  - Generated no electricity some years
  - During five years of operation, processed only 1/5 of its contracted waste
  - Facility owner lost the equivalent of $500 million

Source: Tangri at 13

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Landscape of Failures

- Brightstar—Wollongong, Australia: Closed 2004
  - Significant exceedances of emissions limits for arsenic, sulfur dioxides, carbon monoxide, dioxins, hydrogen chloride, and heavy metals
  - Parent company lost the equivalent of $134 million on the facility

Source: Tangri at 13

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We Have Real Solutions to Our Waste Problem

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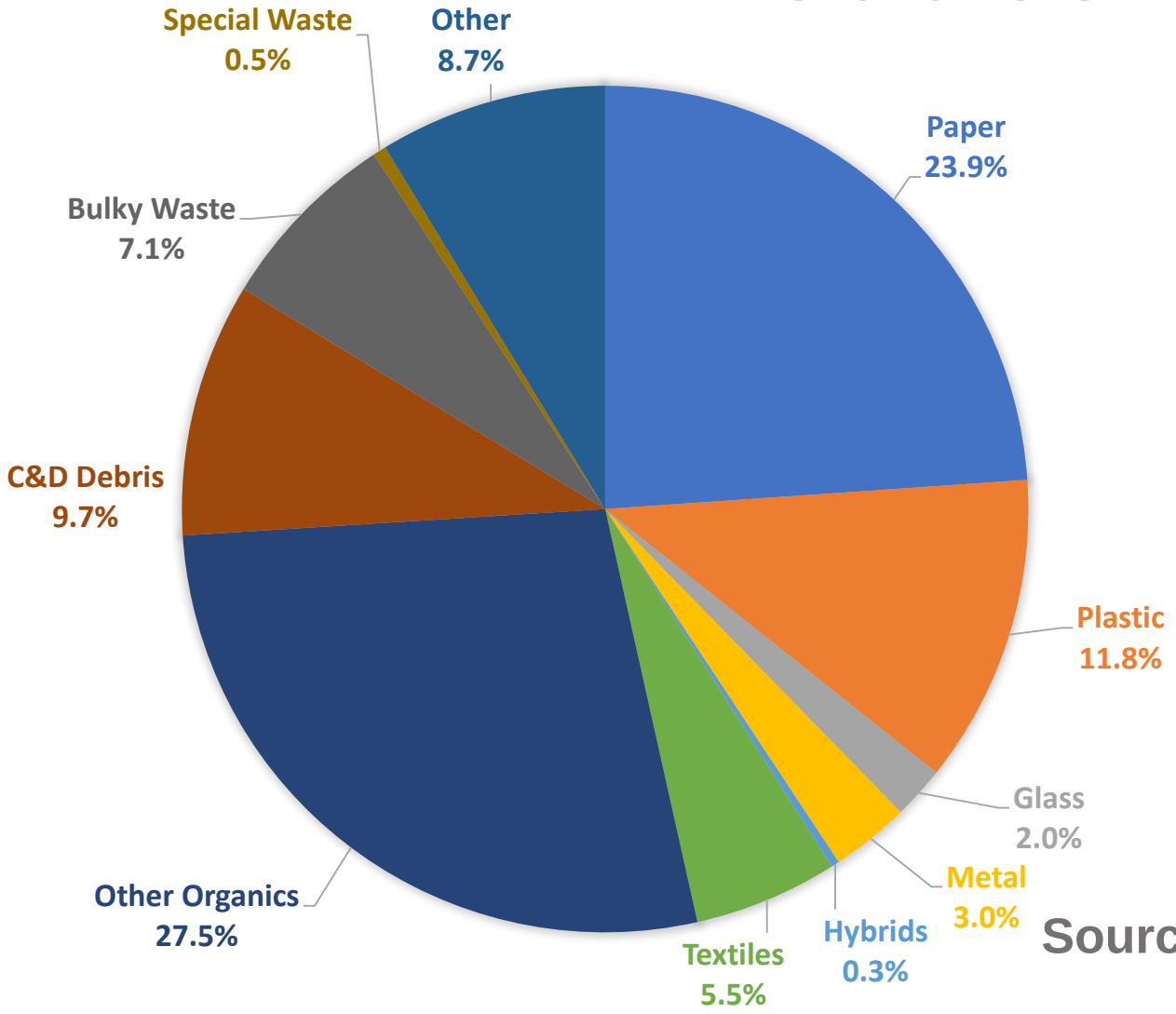
Refuse-Rethink-Redesign-Reduce-Reuse



- Source reduction
- Composting/anaerobic digestion
- Extended producer responsibility
- Better recycling

Source: Rhode Island Solid Waste Characterization Study at 13

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The Path Ahead

- Rhode Island can reduce emissions, save money, and protect communities through zero waste initiatives
- Gasification and pyrolysis are incompatible with a healthy, thriving Rhode Island

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Questions?

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