Project 001
MSW-based SAF
(Alternative Jet Fuel Supply Chain Tropical Region Analysis)

Motivation and Objectives

- More than 1 million Mg of municipal solid waste (MSW) are disposed in landfills annually across the State of Hawaii, after recycling and diversions to a waste-to-energy power plant.
- At least two landfills in the State of Hawai'i are expected to reach their capacities within the next decade.
- Exporting MSW for disposal has been considered in the past.
- Utilization of MSW for the production of sustainable aviation fuel (SAF) via gasification and Fischer-Tropsch (FT) synthesis, an ASTM-approved pathway, should be considered to minimize waste going to landfill, reduce energy imports, and improve energy resiliency.
- This study investigates the greenhouse gas (GHG) emissions associated with different waste management options.

Methods and Materials

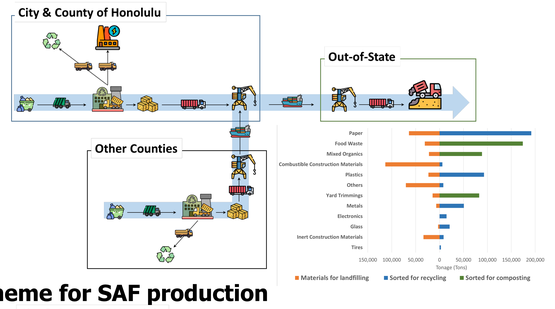
- Three waste management options are considered:
  - Option 1: Continuing disposal of MSW at local landfills
  - Option 2: Shipping MSW to out-of-state landfills
  - Option 3: Utilizing MSW for the production of sustainable aviation fuel (SAF) via gasification and FT synthesis
- Option 1: MSW in each county is transported to landfill by trucks
- Option 2: MSW in other counties (Hawai'i, Maui, Kaua'i) is transported to ports by trucks, transloaded for ocean transport, shipped to O'ahu. MSW in O'ahu is transported to port by trucks. MSW is transloaded for ocean transport to Portland port, transloaded to trucks, and transported to Columbia Ridge landfill for disposal.
- Option 3: MSW in other counties (Hawai'i, Maui, Kaua'i) is transported to ports by trucks, transloaded to ocean transport, shipped to O'ahu, transloaded to trucks, and transported to biorefinery. MSW in O'ahu is transported to the biorefinery by trucks. SAF is delivered by trucks to Daniel K. Inouye International Airport (HNL).
- GHG evaluation done using EPA Waste Reduction Model (WARM) v16 and openLCA v2.0.4 software.

Landfill option	LF-1	LF-2	LF-3	LF-4	LF-5	LF-6
Landfill location	Local	Local	Out-of-state	Out-of-state	Out-of-state	Out-of-state
LFG recovery and flaring	**Yes**	No	**Yes**	No	**Yes**	No
LFG recovery for electric generation	No	**Yes**	No	**Yes**	No	**Yes**
Recycling	No	No	No	No	**Yes**	**Yes**

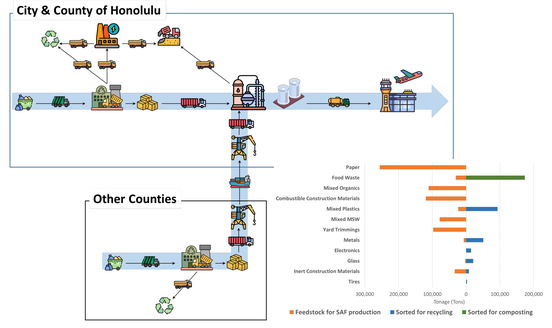
Summary

- Municipal solid waste management in the State of Hawai'i is challenging because there is only one incineration plant on the island of O'ahu, while at least two landfills (O'ahu and Kaua'i) are expected to reach their capacities within the next decade.
- GHG emissions associated with three different waste management options and scenarios were investigated.
- Preliminary results indicate that waste recycling can significantly reduce GHG emissions.
- In the best SAF scenario, GHG emission is 32.75 gCO_2e/MJ SAF produced.
- Theoretical SAF potential from MSW can account for 4-5% of commercial jet fuel consumption in Hawai'i based on 2024 data.

➢ **Scheme for out-of-state landfill**



➢ **Scheme for SAF production**



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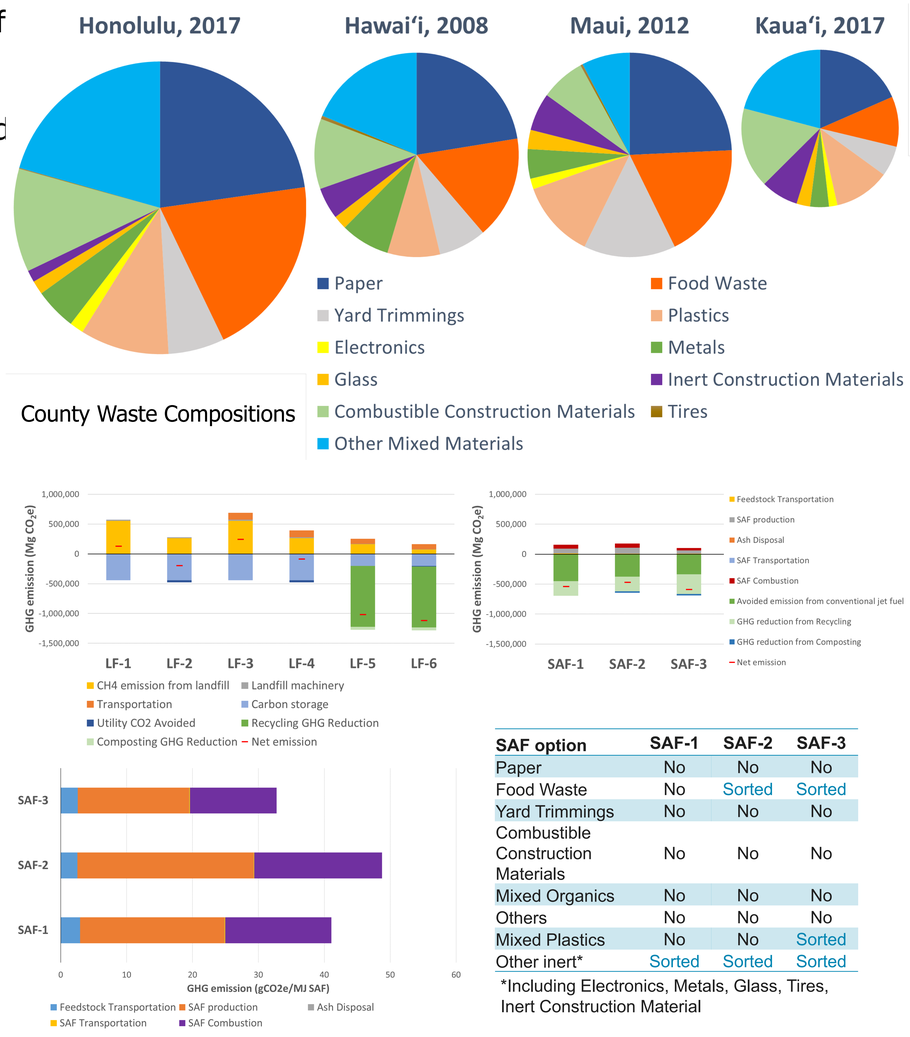
Results and Discussion



SAF option	SAF-1	SAF-2	SAF-3
Paper	No	No	No
Food Waste	No	Sorted	Sorted
Yard Trimmings	No	No	No
Combustible Construction Materials	No	No	No
Mixed Organics	No	No	No
Others	No	No	No
Mixed Plastics	No	No	Sorted
Other inert*	Sorted	Sorted	Sorted

*Including Electronics, Metals, Glass, Tires, Inert Construction Material

Conclusions and Next Steps

- Waste recycling can significantly reduce GHG emissions from landfill.
- Theoretical SAF potential from MSW is 25-30 million gallons annually, which is 4-5% of commercial jet fuel consumption in Hawai'i based on 2024 data.
- Fuel conversion (gasification and Fischer-Tropsch synthesis) accounts for a majority of GHG emissions from SAF production.
- A techno-economic analysis is being conducted to investigate the cost associated with each waste management options.

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