Comparative Greenhouse Gas Emissions Analysis:

Briefing Report

An Integrated Materials Recovery Facility (MRF) with Conversion Technologies will achieve a net reduction in cumulative greenhouse gas emissions as compared to landfilling post-recycled residuals from a mixed-waste MRF.

BASELINE SCENARIO - LANDFILL

1,000 tpd

1,636,540 tons
Net generated greenhouse gas emissions

ALTERNATIVE SCENARIO - INTEGRATED MRF WITH CONVERSION TECHNOLOGIES

1,000 tpd

-666,022 tons
Net avoided greenhouse gas emissions

County of Los Angeles
Department of Public Works

January 2016

Background

"Conversion technology" refers to a wide array of technologies capable of recovering renewable energy, green fuels, and other useful products from post-recycled or residual solid waste through non-combustion thermal, chemical, or biological processes. Conversion technologies are critical to reducing our reliance on landfills, since it is not economically feasible to reduce, reuse, or recycle the entire waste stream. The successful development of conversion technologies is vital to achieving the landfill diversion targets identified in the County of Los Angeles' Roadmap to a Sustainable Waste Management Future. In addition, conversion technology facilities would also reduce greenhouse gas (GHG) emissions and offset other environmental impacts from current solid waste management practices, while creating green-collar jobs.

Analysis

A Comparative Analysis was commissioned by the County of Los Angeles Department of Public Works to compare the net GHG emissions of two scenarios. The first scenario is the transport and disposal of 1,000 tons per day (tpd) of residuals from a mixed waste Materials Recovery Facility (MRF) to a modern sanitary landfill (Baseline Scenario). The second scenario proposes to process the same residuals at an Integrated MRF with Conversion Technologies (Alternative Scenario). The Baseline Scenario results in a net increase of approximately 1.64 million metric tons of carbon dioxide equivalent (MTCO2E), while the Alternative Scenario results in net avoided GHG emissions of (0.67) million MTCO2E. Therefore, shifting from the Baseline Scenario to the Alternative Scenario would result in a total GHG reduction of approximately 2.31 million MTCO2E. The study parameters were strictly focused on analysis of GHG emissions and other air pollutants and do not consider other environmental, social or economic parameters.

In both scenarios, cumulative GHG emissions were analyzed for handling 1,000 tpd of post-recycled residuals (i.e., after recycling efforts)

BASELINE SCENARIO

Mixed Waste MRF Residuals to Landfill

from a mixed waste MRF over a period of 25 years. For the Baseline Scenario, GHG emissions were modeled for an additional 100-year period after the landfill ceased to accept waste to account for GHG emissions generated by the decomposition of the waste disposed at the landfill.

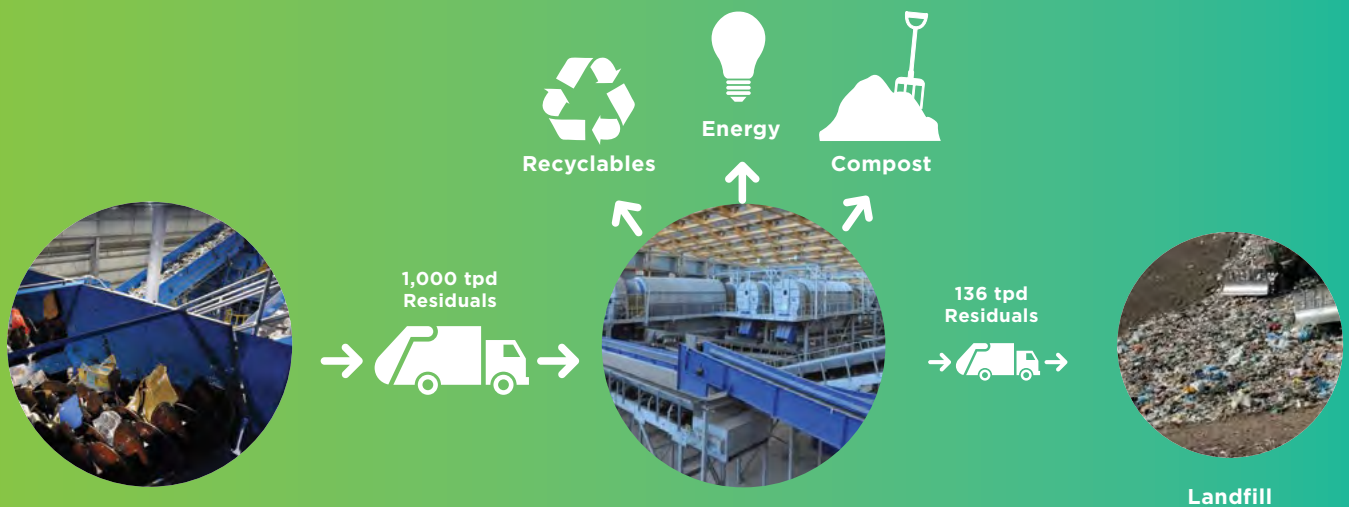
The models used in the analysis to estimate GHG emissions from transportation and landfill operations are developed by air districts throughout California and consider future truck fleets with better emissions controls such as alternative fuels. The Baseline Scenario also assumes a soil cover (or cap) for the refuse and landfill gas (LFG)-to-energy (when enough gas is generated) which is common of landfills in Southern California.

Under the Alternative Scenario, the post-recycled residuals from a mixed waste MRF are assumed to be further processed in an Integrated MRF with Conversion Technologies over the 25 year period, after which the facility is assumed to cease operating. The Integrated MRF with Conversion Technologies assumed in this study was modeled after a combination of proven technologies and actual commercial scale operating facilities in Europe and Asia. Facility components include mechanical pre-processing to recover additional recyclable material and to separate residuals into a wet fraction for anaerobic digestion and composting and a dry fraction for thermal gasification. In order to model emissions from a facility in California, the latest available statewide post-recycled MRF residual waste composition data (at the time of the analysis) from CalRecycle was assumed as the feedstock for the analysis. The Alternative Scenario also accounts for transport and disposal of the Integrated MRF with Conversion Technologies residuals to landfill, assuming a landfill with a cap and flare (due to residuals having very low organic content and thus low landfill gas generation from those residuals not sufficient for LFG-to-energy).

The net GHG emission result calculated in this study are based on non-biogenic emissions (i.e., fugitive methane emissions from landfills and emissions from combustion of fossil fuels). Biogenic emissions are not included in the calculation results, as these emissions naturally cycle through the atmosphere by processes such as photosynthesis, and are therefore carbon neutral and do not impact GHG emissions.

ALTERNATIVE SCENARIO

Mixed Waste MRF Residuals to Integrated MRF with Conversion Technologies



Results

The result, in net GHG emissions, for the Baseline Scenario was approximately 1.64 million MTCO2E over a 125 year period, which is comparable to 340,000 passenger vehicles driven for one year, while the Alternative Scenario resulted in net avoided GHG emissions of (0.67) million MTCO2E over a 25 year period, which is comparable to 140,000 fewer passenger vehicles driven for one year.

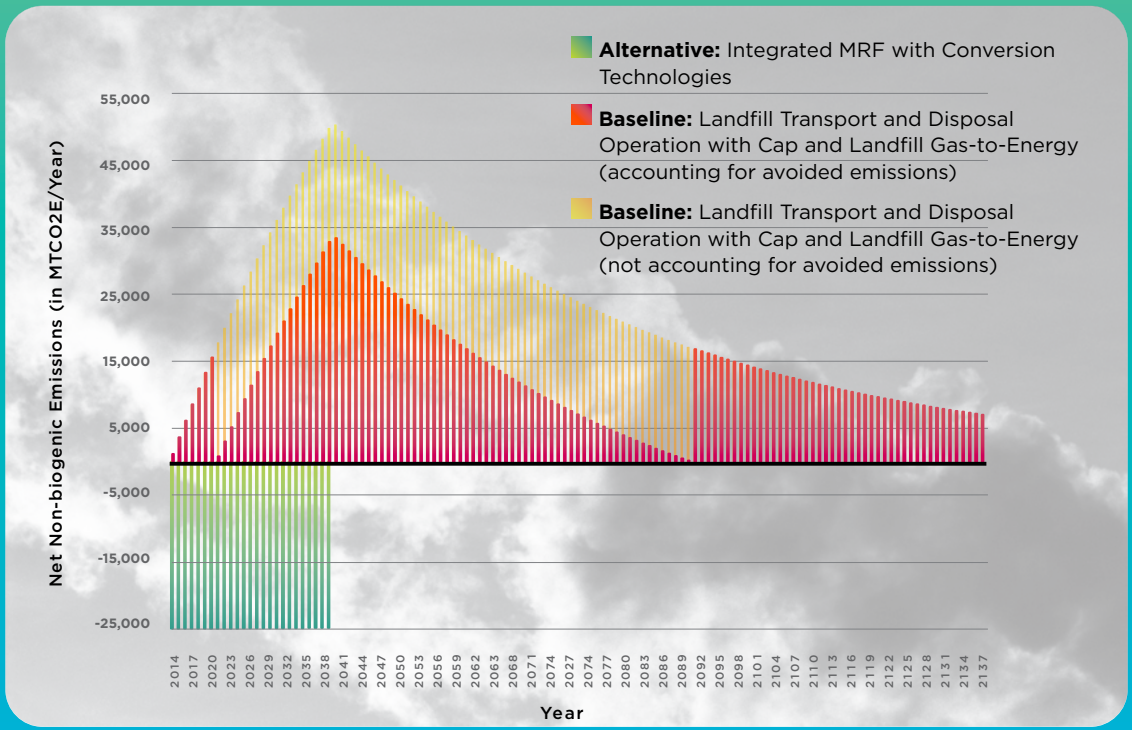
The two scenarios evaluated emissions from transportation, operation, and avoided emissions. The most significant difference between the two scenarios is that the avoided emissions are much greater for the Alternative Scenario. This is due to the renewable energy generated from anaerobic digestion and gasification, which would replace fossil fuels, as well as the additional integrated MRF recycling in the Alternative Scenario.

The avoided emissions in the Baseline Scenario are due to LFG-to-energy replacing the use of fossil fuels during the time period that enough landfill gas is generated to support a LFG-to-energy facility. The net annual non-biogenic GHG emissions (after accounting for avoided emissions) associated with the management of waste materials for the Baseline and Alternative Scenarios is graphically shown below.

Conclusion

The White Paper determines that an Integrated MRF with Conversion Technologies will achieve a net reduction in cumulative GHG emissions as compared to landfill transport and disposal. The net reduction is due to higher avoided emissions for renewable energy generation, replacing fossil fuels, and energy savings from additional recycling.

Net Non-Biogenic Emissions Over Time: Baseline vs. Alternative Scenario



County of Los Angeles Department of Public Works
900 South Fremont Avenue, Alhambra, CA 91803
www.CleanLA.com
www.SoCalConversion.com