

# Gasification as a Potential Technology Solution in the Integrated Approach to a Sustainable Circular Economy for Plastics in the US: Case Study

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**Background/Objectives.** The United States (US) has growing volumes of single-use plastics that are a valuable scrap hydrocarbon resource and yet, they continue to be landfilled. It is apparent from the continuously increasing annual plastic production, low recycling rates, land use concerns, and energy recovery statistics that development and implementation of technologies to recycle or upcycle plastic waste is the need of the hour. The current practice of landfilling is linked to ecological and environmental damages from greenhouse gas (GHG) emissions and toxic leachates while the most common mechanical recycling techniques currently being implemented are challenging for mixed plastic waste handling. Chemical recycling methods such as gasification are lucrative alternatives to combustion or incineration for resource recovery from mixed plastic waste. Several companies are engaging at the pilot and demonstration scales indicating the increasing interest in waste gasification over the last decade. The project (sponsored by USEA for U.S. DOE) goals are to establish a foundational perspective on the potential for plastic waste co-gasification, to identify areas where additional work can enable commercial-scale implementation, and to generate interest in a better end-of-life prospect for mixed plastic waste.

**Approach/Activities.** This study provides a high-level assessment of the current state of the art in co-gasification technologies, areas of anticipated technology development, and an assessment of the potential market in the US. The study consists of a literature review and analysis to provide the current state of research and data in focus areas such as:

- Plastic gasification and landfill resource potential
- Issues in plastics gasification and potential solutions such as co-gasification with mixed feedstock (e.g., coal, biomass)
- Market potential for product synthesis gas
- Technical and non-technical (infrastructure, policy) gaps for commercial readiness
- Test facilities and useful platforms for technology acceleration

**Results/Lessons Learned.** Co-gasification offers potential synergy to support plastic waste management while debottlenecking critical operational and feedstock handling issues with better yields of versatile and valuable product gas in the US. There is potential for the CO<sub>2</sub> produced during this process to be captured and utilized and/or securely sequestered deep underground to allow the integrated system to achieve net negative emissions in operations. While gasification of feedstock such as coal has been a commercial technology for nearly two centuries, co-gasification technologies with mixed feedstock are currently at a pilot scale technology readiness level. The need for an evaluation of all the components involved in different chemical recycling technologies is identified for co-optimizing the engineering needs and economics to support the growing market demand for synthesis gas. Alignment of supportive market systems, innovative subsidies, and policy drivers are proposed to help overcome technical and economic risks for technology acceleration by incentivizing efficiency and reliability improvements in gasification technologies as well as the use of recycled plastics in the economy.