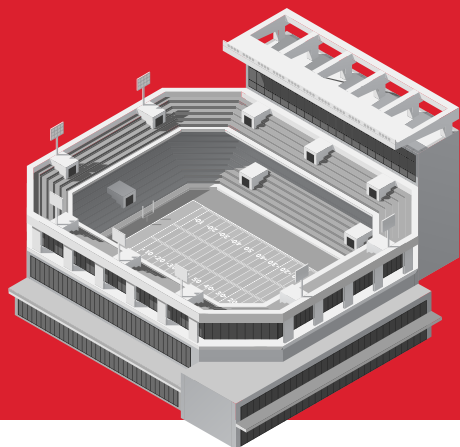


HONEYWELL UOP UPCYCLE PLASTICS RECYCLING

A critical solution for recycling more plastic waste

In North America Advanced Recycling Has the Potential to Annually Remove 14 MILLION TONS¹ OF PLASTIC FROM THE ENVIRONMENT OR



70 FOOTBALL STADIUMS FULL OF PLASTIC²

INNOVATIVE SOLUTIONS NEEDED TO ADDRESS MORE PLASTIC WASTE

- Increasing demand for new plastic products increases **urgency for new recycling technologies**.
- Today plastic waste is mechanically recycled, incinerated or landfilled.
 - **Mechanical recycling processes only a fraction of current plastic waste volumes** resulting in lower-quality plastic.
 - Even with increased mechanical recycling, **the majority of the plastic waste needs other solutions**.
- **Plastic waste unsuitable for mechanical recycling can be processed by the Honeywell UOP UpCycle Process** to enable production of virgin quality new plastics, incentivizing increased collection efforts, resulting in process volumes far beyond those currently achieved for mechanical recycling, and contributing toward ~90% of plastics to be recycled.^{3,4}
- Waste plastics processed through advanced recycling technologies, such as UpCycle, **may amount to between 5 and 15 million tons in 2030**.⁵

ENVIRONMENTAL BENEFITS BEYOND REDUCING WASTE

- Advanced recycling can reduce **reliance on fossil feeds for plastics production** because plastic waste, instead of fossil feeds, is the primary feedstock.
- Advanced recycling can provide an alternate destination for plastics from landfills, where plastics can leak into the environment, leach microplastics into soil and ground-water, and take up to 1,000 years to decompose, **avoiding potential adverse long-term global impacts to ecosystems, food supply, and human health**.⁶
- UpCycle is advanced recycling by pyrolysis at moderate conditions. **Unlike combustion or incineration, UpCycle does not consume oxygen or burn plastic for energy**.

NEW OPPORTUNITIES TO REDUCE CLIMATE IMPACT

- Using plastic waste to produce new plastic feedstocks can **reduce greenhouse gas emissions**.
- **Honeywell UpCycle can reduce CO₂ equivalent (CO₂e) emissions by 57% relative to virgin plastics, and 77% relative to conventional waste handling**, based on a plant in Spain.^{7,8}
- CO₂e reductions via the UpCycle process are among the largest improvements of all pyrolysis technology offerings.^{7,8,9,10}

UpCycle, when combined with mechanical and other chemical recycling approaches and improved collection & sorting, could result in

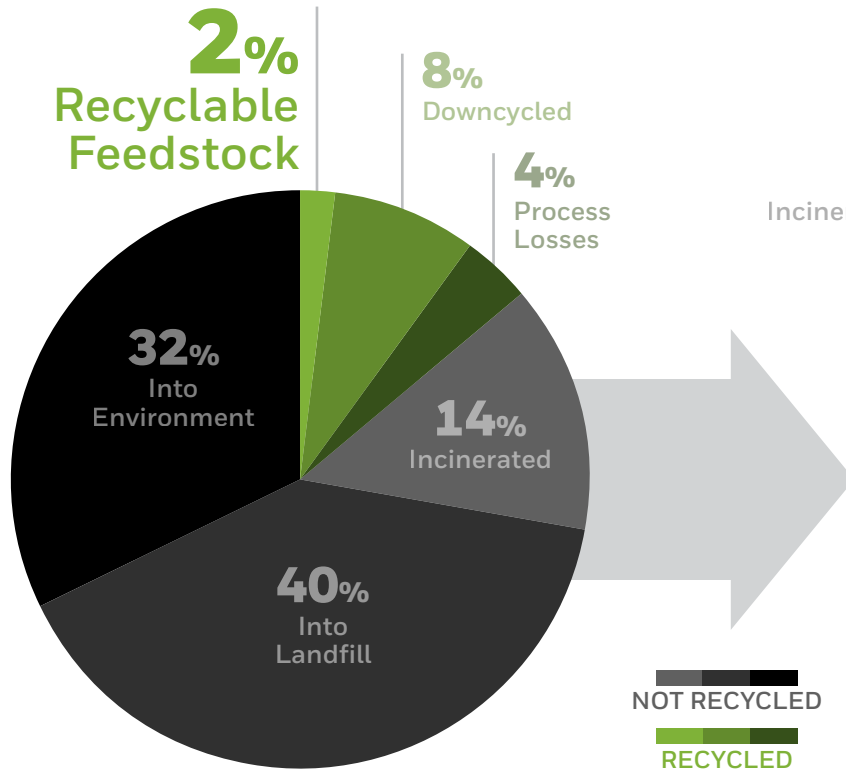
90%

of waste plastics being recycled.^{3,4}

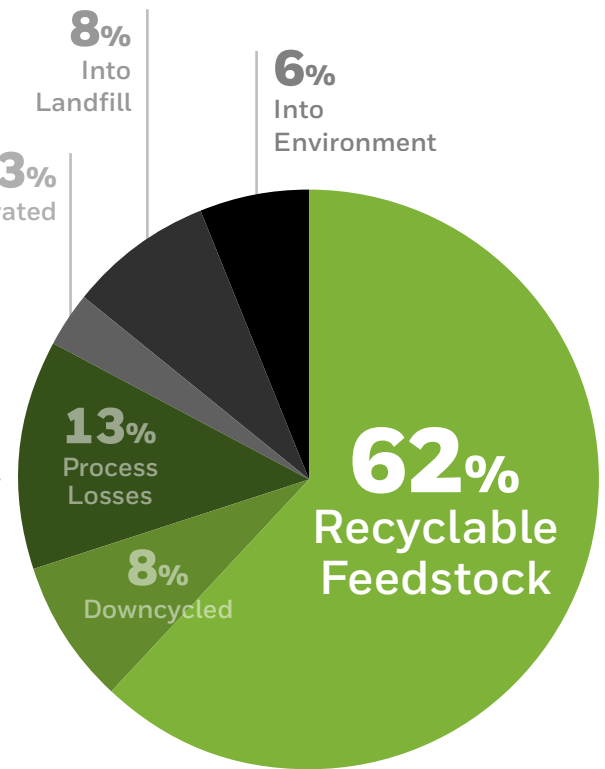
¹ According to a chemical recycling study by AMI in September 2020. Includes commodity polymers from post-consumer waste applications.
² According to Honeywell UOP estimation, assuming an average stadium volume of 100 million cubic feet, and a plastic density of 70 kilograms per cubic meter.
³ Assuming collection and sorting improves to recover most waste plastic, and chemical recycling, including Honeywell UOP UpCycle process, is widely deployed.
⁴ Honeywell UOP analysis of US EPA Advancing Sustainable Materials Management: Facts and Figures 2018 and IHSMarkit 2019 world polymer consumption data.
⁵ According to a chemical recycling study published by AMI in September 2020. The actual utilization rate will depend on a number of factors, such as favorable legislation, status of sorting infrastructure, outcome of Life Cycle Assessments (LCAs) etc.
⁶ UN Environment Program Report – Plastic planet: How tiny plastic particles are polluting our soil - <https://tinyurl.com/chtbx76d>
⁷ The degree of CO₂e reduction depends on several factors, such as the ratio of incineration and landfilling. For example, in USA, where incineration is less prevalent than in Spain, the analogous CO₂e emissions reductions are 99% relative to production of the same amount of virgin plastics from fossil sources, and 37% relative to conventional modes of waste handling.
⁸ Honeywell Life Cycle Analysis, September 2021. The LCA results are calculated by Honeywell UOP in accordance with international standards for life cycle assessment, ISO 14040:2006 and ISO 14044:2006. The LCA is pending critical review.
⁹ Plastic Energy LCA report: LIFE CYCLE ASSESSMENT OF PLASTIC ENERGY TECHNOLOGY FOR THE CHEMICAL RECYCLING OF MIXED PLASTIC WASTE
¹⁰ BASF LCA report: Evaluation of pyrolysis with LCA – 3 case studies

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CURRENT PLASTIC RECYCLING TODAY¹¹



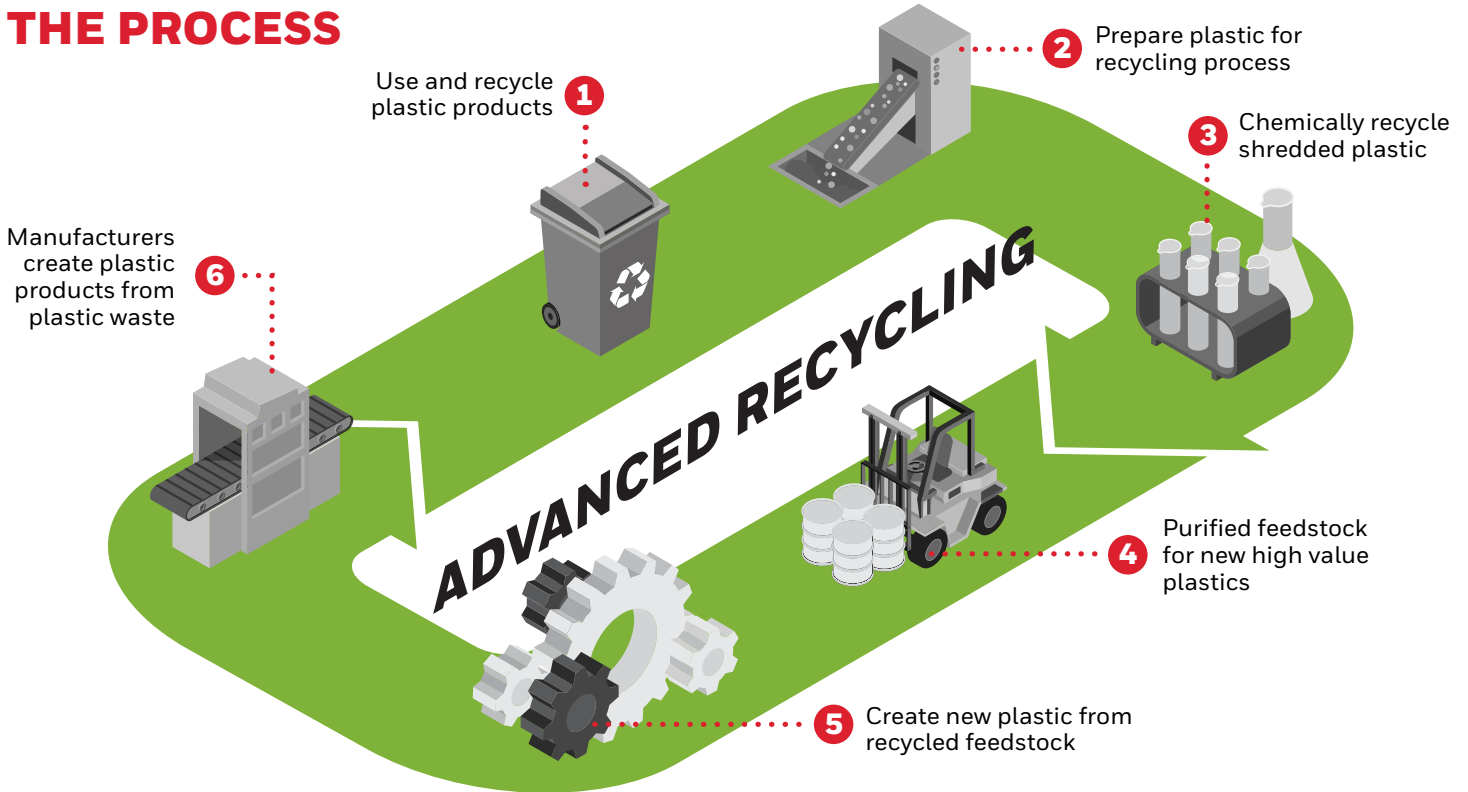
ADVANCED PLASTIC RECYCLING IN THE FUTURE¹¹



NOT RECYCLED
RECYCLED

For illustrative purposes only

THE PROCESS



For illustrative purposes only

¹¹ *Today* figure based on Ellen MacArthur Foundation publication: The New Plastics Economy: Rethinking the Future of Plastics & Catalysing Action. Tomorrow figures based on Honeywell UDP estimates of the potential impact of improved collection and sorting and wide implementation of all recycling methods, mechanical and chemical.