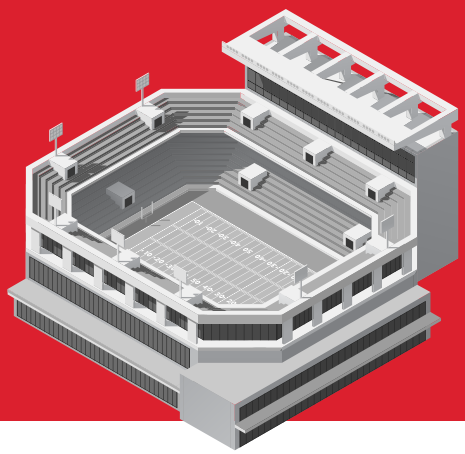
HONEYWELL UOP UPCYCLE PLASTICS RECYCLING

A critical solution for recycling more plastic waste

In North America Advanced Recycling Has the Potential to Annually Remove

14 MILLION TONS[1] OF PLASTIC FROM THE ENVIRONMENT OR



70 FOOTBALL STADIUMS FULL OF PLASTIC[2]

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 CO_2 equivalent (CO_2e) emissions by 57%** relative to virgin plastics, and **77% relative to conventional waste handling**, based on a plant in Spain.[7,8]
- CO_2e 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/chbxx76d
7 The degree of CO_2e 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 CO_2e emissions reductions are 9% 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 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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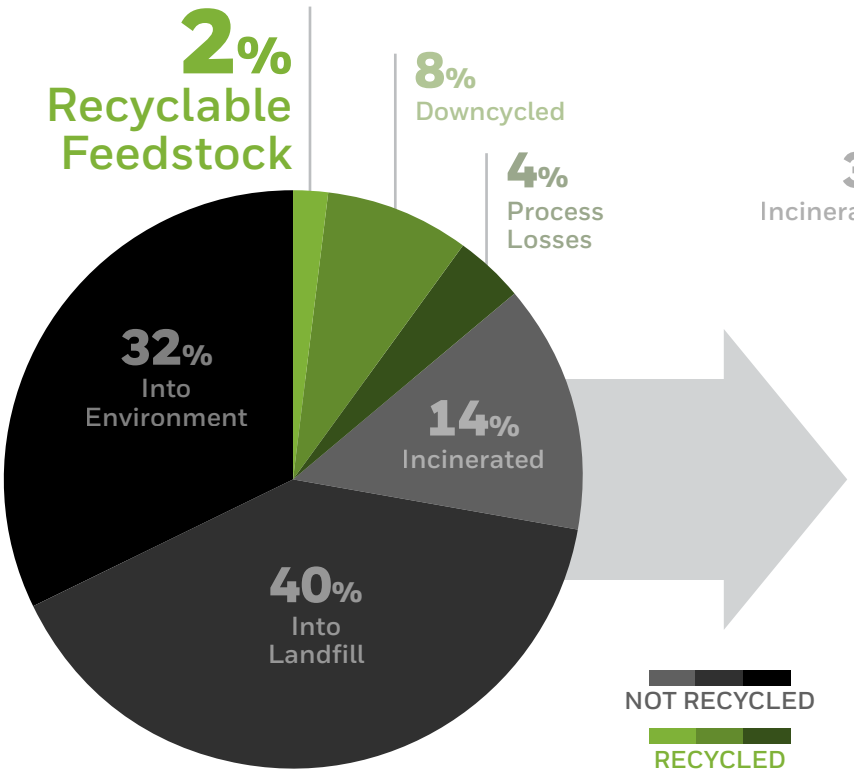
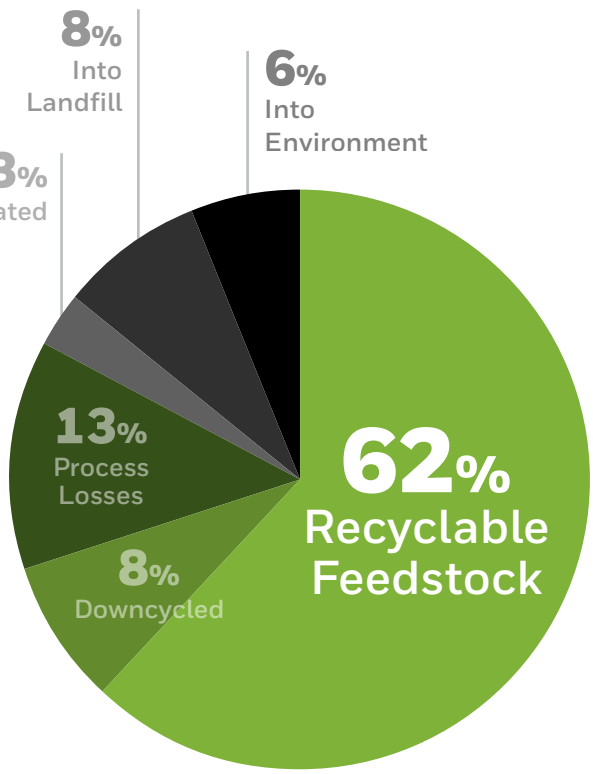
CURRENT PLASTIC RECYCLING TODAY[11]



ADVANCED PLASTIC RECYCLING IN THE FUTURE[11]

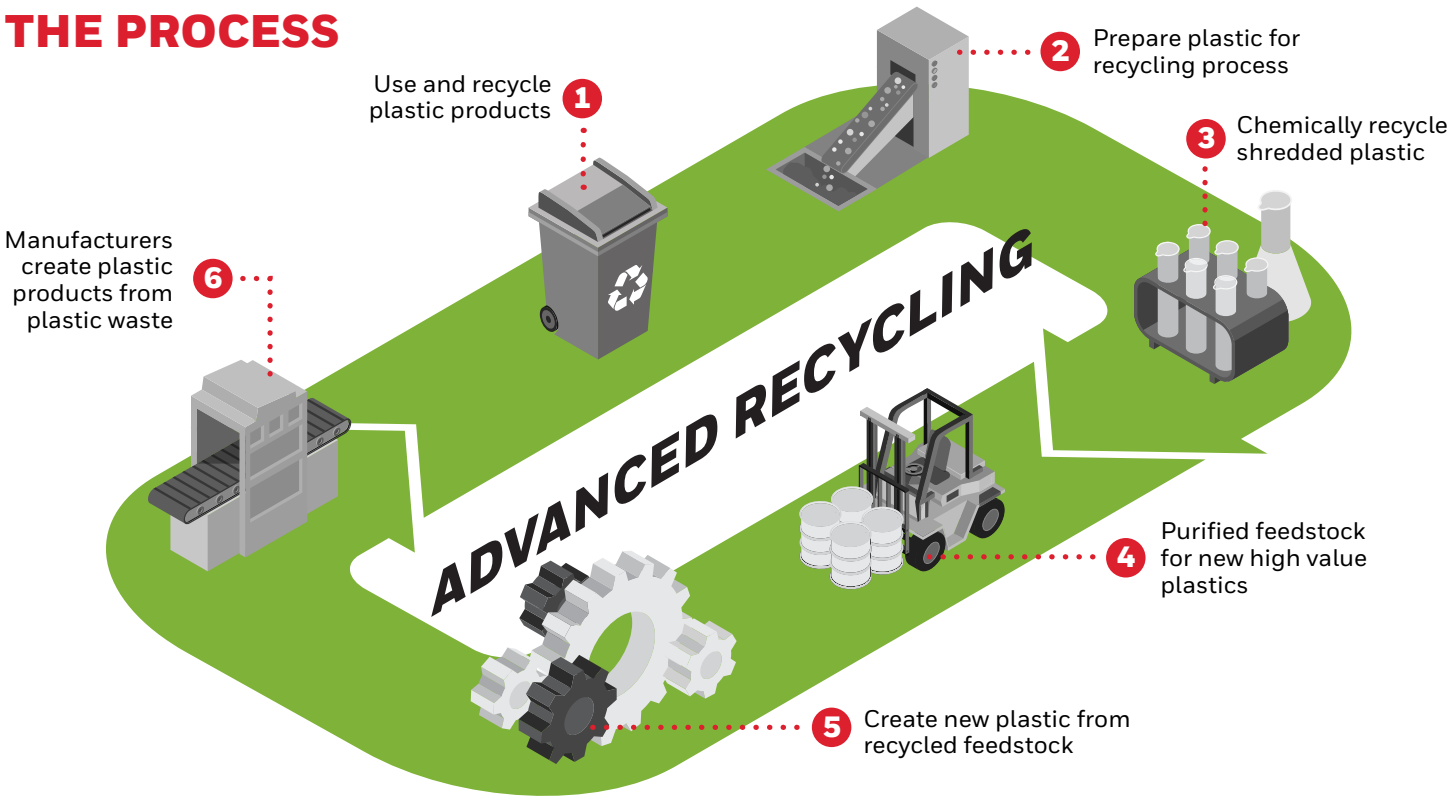


NOT RECYCLED

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 UOP estimates of the potential impact of improved collection and sorting and wide implementation of all recycling methods, mechanical and chemical.

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