Chemical Recycling 2.0: Monomer Recovery

Global plastic consumption continues to rise, while traditional recycling methods struggle to keep pace. Mechanical recycling—though widely adopted—degrades material quality with each cycle, limiting reuse in high-performance applications such as medical-grade and food-contact packaging. True circularity demands more than waste management: it requires **molecular reinvention**, returning plastics to their original chemical building blocks.

A leading petrochemical and materials company partnered with Fortis & Peak to move beyond conventional recycling and unlock value at the molecular scale—powered by **TECHNEXIS™** and the **3D&S execution framework**.

Near-Virgin Material Quality

Recovered feedstock matching virgin polymer specifications

Expanded Waste Streams

Processing mixed and contaminated plastics previously unrecyclable

Reduced Virgin Naphtha Dependence

Lower exposure to volatile fossil-based feedstock pricing

New Circular Revenue

Monetizing waste streams as high-value industrial assets

Fortis & Peak
Shaping What's Next

The Strategic Challenge

The organization had recycling capabilities—but lacked the infrastructure and technology to recover value at the molecular scale. Five compounding challenges defined the gap between conventional recycling and true chemical circularity.

Polymer Quality Degradation

Mechanical recycling progressively degrades polymer chains across cycles, reducing material performance and limiting end-use applications.

Mixed & Contaminated Waste

Inability to process mixed or contaminated plastic waste streams locked out large volumes of potentially recoverable material.

Volatile Feedstock Dependence

Heavy reliance on virgin naphtha exposed operations to commodity price swings and supply chain instability.

Regulatory Compliance Gaps

Existing recycled materials could not meet strict food-contact and medical-grade regulatory standards, limiting market access.

Underdeveloped Infrastructure

Advanced chemical recycling infrastructure was nascent, with critical gaps in collection, sorting, and processing capacity.

> The organization could recycle—but not recover value at molecular scale. That distinction defines the entire transformation.

Transformation Powered by 3D&S + TECHNEXIS™

Fortis & Peak deployed its proprietary **3D&S methodology**—Define, Design, Deliver, Sustain—as the execution framework, with **TECHNEXIS™** serving as the underlying chemical engineering platform. Each phase targeted a specific layer of the transformation, from waste diagnostics to industrial-scale circular production.

1

DEFINE

Mapped the full plastic lifecycle using TECHNEXIS™. Analyzed waste streams, quantified value loss from downcycling, assessed material composition, and evaluated exposure to virgin feedstock price volatility.

2

DESIGN

Engineered an Advanced Chemical Recycling model: pyrolysis and depolymerization processes, breakdown into original monomers, integration into new polymer production, and a "Circular Hub" operating model.

3

DELIVER

Deployed chemical recycling units, integrated with existing petrochemical systems, optimized process efficiency and material yield, and established waste stream sourcing partnerships at industrial scale.

4

SUSTAIN

Enabled continuous optimization of recovery rates, real-time tracking of cost and yield metrics, expansion of recycling capacity, and capability building in advanced recycling technologies.

Transformation Architecture & Core Platforms

TECHNEXIS™ — The Circular Engineering Engine

TECHNEXIS™ is the technical backbone of the entire transformation. It designs and integrates advanced recycling technologies, enables molecular-level material recovery and reuse, and aligns recycling processes with existing industrial production systems. From material analysis through chemical process design to full integration and optimization, TECHNEXIS™ operates across every layer of the circular value chain.

- Molecular-level material analysis and characterization
- Chemical process design: pyrolysis and depolymerization
- Integration with petrochemical production infrastructure
- Continuous yield and quality optimization

From Linear to Circular: The Architecture Shift

The transformation replaces a linear, value-destroying model with a closed-loop molecular recovery system. Where the traditional model ends at landfill or low-grade recycling, the chemical recycling model returns materials to their original building blocks for reuse as virgin-quality feedstock.

Traditional Model

Plastic → Use → Waste → Landfill

Chemical Recycling

Plastic → Depolymerization → Monomers → New Polymers

Measurable Impact & Strategic Positioning

The Chemical Recycling 2.0 program delivered measurable outcomes across material quality, operational economics, regulatory compliance, and revenue generation—establishing a replicable model for next-generation circular chemical ecosystems.

Near-Virgin Polymer Quality

Production of recycled polymers meeting virgin-grade specifications, enabling use in food-contact and medical-grade applications previously inaccessible to recycled materials.

Expanded Waste Utilization

Mixed and contaminated plastic waste streams—previously diverted to landfill—are now viable feedstock inputs, dramatically expanding the recoverable material base.

Reduced Fossil Feedstock Dependence

Decreased reliance on virgin naphtha reduces exposure to commodity price volatility and strengthens long-term supply chain resilience.

New Circular Revenue Streams

Waste materials converted into high-value industrial assets, creating new revenue streams and enhancing compliance with evolving sustainability and regulatory standards.

> True circularity is not achieved by recycling materials—it is achieved by reconstructing them at the molecular level to preserve their full value.

Fortis & Peak is the creator of **TECHNEXIS™** and owner of the **3D&S methodology**—transforming waste into high-value industrial assets and enabling next-generation circular economy systems.

www.fortisandpeak.com · info@fortisandpeak.com

Fortis & Peak
Shaping What's Next