Carpet Fiber Recycling
Novel Process

North Coast Fibers
May 2016
Agenda

• Introduction to North Coast Fibers (NCF)
• NCF technology for recycling carpet
• Advantages of the NCF technology
• Representative product samples
• Next steps for commercialization
North Coast Fibers, LLC

North Coast Fibers was formed in 2016 in a partnership between Flooring Transport and Broadview Group

• Flooring Transport, LLC — owned by George Morris
  • 14 years in carpet recycling
  • Currently secures 10 Million Pounds per Year (PPY) and can increase this to more than 24 Million PPY
  • 60,000 SF facility in Canton, Ohio

• Broadview Group International, LLC — J.Bork, S.Paspek, A.Schroeder, J.Fischer
  • Engineering and technology company with 15 years experience developing new recycling technologies
  • More than 20 patents, many related to carpet recycling
  • 100,000 SF facility in Elyria, OH containing pilot and commercial carpet recycling system
North Coast Fibers, LLC

• North Coast Fibers, LLC (NCF) has been established to commercialize the new BGI carpet recycling technologies

• Current 1500 PPH carpet recycling system producing bale quantities of Recycled PET, PP and Nylon fibers (samples available for testing)
  • Can leave the PP in the fiber or separate the PP backing fibers from the face fiber
  • 2% - 8% residual ash in recovered fibers
  • 2% - 4% PP backing fibers in recovered fibers
  • PP backing fiber from Nylon/PET carpet has 4%-6% non-PP fibers

• New 6000 PPH carpet recycling system to be located in Flooring Transport facility in Canton, Ohio
North Coast Fibers Approach for Recycling Post-Consumer Carpet

Collection Points → Collector/Sorting Facility → NCF Technologies

- Mixed Fiber (PET w/ PP, Nylon w/ PP)
- CaCO3 / Adhesive (Fiber Free)
- PP (PP Face Fiber, PP Backing Fiber)
- Nylon, PET (Pure Face Fiber)

Flow:

- Pellets – Compounding, Injection Molding
- Pellets – Compounding, Injection Molding, Sheet
- Non-woven mats – insulation, sound deadening, underlayment
- Filler, carpet backing, other products

Waste to Landfill (< 10%)
Current Carpet Recycling Efforts

Current technologies do not meet the market demands for economical post-consumer carpet recycling

Main processes used for Post Consumer and Post Industrial fiber separation from the carpet are:

- **Shearing** - is labor intensive, recovers less than 50% of face fibers, and throws more than 70% of carpet to landfill.

- **Fiber Opening and Hammer mills** - are expensive, high energy and have high maintenance costs. They can not produce a face fiber product with low percent PP contamination.

- **Wet, Chemical and Thermo-processing** - have high capital cost and high operating costs.
North Coast Fiber Carpet Recycling Technology

NCF’s new technologies address the need for high quality recycled fibers at low cost

• Lower Conversion costs
• Lower Capital cost
• Recovered fiber quality approaches the most expensive current recycling methods
• Higher product yields
• PET as well as Polypropylene and Nylon carpet can be economically recycled and turned into valuable industrial feedstocks
• Technology is scalable from 1,000 PPH to 15,000PPH
Capital and Conversion cost comparisons

The NCF recycle technology has significant cost advantages relative to a hammer mill system.

Capital Cost Comparison
6000 PPH Feed
Mixed fiber product with 4% ash

Processing Cost Comparison
6000 PPH Feed
Mixed fiber product with 4% ash
NCF Technologies – Key Process Differences

• Ash is removed during the carpet disassembling process and is removed by gravity rather than requiring additional downstream ash removal systems; saves capital, energy, and maintenance costs.
• The internals can be varied to adjust amount of fiber opening that occurs during carpet disassembling.
• Low wear on internals and screens.
• Low heat build up (minimal wasted energy)
• Inter-stage cooling is not required to prevent PP melting
North Coast Fibers - Process Results

PET & PP Fiber from PCC

< 3% Ash

Fiber
Non Woven Product
PET Fiber from PCC
4% Ash, 2% Polypropylene
North Coast Fibers - Process Results

Polypropylene Backing Fibers from PET Carpet

<3% Ash, <5% PET face fiber
North Coast Fibers - Process Results

Polypropylene Fiber from PCC

< 3% Ash

Fiber

Pellets
NCF Commercial Carpet Recycling
Elyria, Ohio

Capacity – 1500 -2000 PPH Feed
Processing Area – 2,600 SF
Utilities – 150 HP (Connected)
NCF Commercial Carpet Recycling
Canton, Ohio

Capacity – 6000 PPH Feed
Processing Area – 7,400 SF, 60,000 SF available
Utilities – 775 HP (connected)
North Coast Fibers – Next Steps

• Continue to produce Mixed Fiber and PP baled product for Non-woven industry and PP compounding in Elyria, OH
• Install 6000 PPH system in Canton facility and expand production of Mixed Fiber and PP products.
• Expand Canton operation to produce a low PP face fiber products
• Add a line for recycling artificial turf
• Partner and/or License the technology both domestically and internationally
Who should be interested in NCF Technology?

- **Carpet Collectors** - who want to move downstream in their operations
- **Current Carpet recyclers** - who want to upgrade their facility, reduce production costs, increase product quality or add capacity
- **Carpet Manufacturers** - that want to recycle their Post Industrial Wastes
- **Downstream users of fiber** - that want to add up-stream value
- **Investors** - that are looking for a cost effective method for recycling carpet and other fiber products
Next Steps

• With a completed Non-Disclosure Agreement, we can provide:
  • Detailed operating costs with Projected Cash Flow
  • Detailed equipment specifications and costs
  • Visit current NCF operation in Elyria, Ohio
  • Test representative material through the Elyria facility

• We can also provide initial consulting for a system to meet specific needs, initial cost estimates, preliminary and final engineering, construction facilitation, start-up support, and end-use market connections.

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