This achievement was mainly accomplished by *Jiangsu Guowang High-Technique Fiber Co. Ltd., China *Beijing Institute of Fashion Technology, China



Samarkand, Uzbekistan September 8-10, 2024

ITMF Sustainability & Innovation Award, 2024 Nominated by China National Textile and Apparel Council (CNTAC)

Low-Carbon & Sustainable Innovation in the PET Fiber Industry

Speaker: Rui WANG



Textile Industry and Environment



- Environmental conservation has definitely become a major challenge faced by almost all industries, especially the manufacturing industry.
- According to data from the United Nations Environment Programme (UNEP), 10% of the total industrial carbon emissions is from the textile and apparel industry, It is only below the oil industry. With population growth, the textile industry might be on the way to becoming the top carbon emitting industry.
- Low carbon, Green mode, and Sustainability will definitely be the key point for the future textile industry.

Carbon Emissions from Fiber & Textile Industry



Fiber production¹, Yarn production², Fabric production³, Dyeing & finishing⁴, Garment manufacturing⁵, Distribution & sales⁶, Usage⁷, and Final disposal⁸. (life cycle assessment analysis (8 stages) on textile and apparel industry conducted by The Federation of Indian Chambers of Commerce and Industry (FICCI))

Notably, in carbon emissions, the fiber production stage is at third or fourth, accounting for 12%. Obviously, the carbon emission is mainly from the production of synthetic fibers.



Chemical Fiber Industry in China



China holds the largest market share in the production of chemical fibers, accounting for about 70 % of global total chemical fiber production.

In 2023, 68.72 million tons of chemical fibers was produced. Among these, synthetic fibers account for 63.93 million tons, especially, PET fibers is 57.02 million tons (~85% of global annual production). (According to statistics from the Chemical Fiber Association of China)





Apparel Industry Chain in China



- In the global apparel industry chain, China accounts for more than 50% of the upstream processes, including 57% of fiber, 64% of yarn, 60% of fabric production. Additionally, 44% of dyeing/finishing and 35% of apparel cutting/assembly are completed in China. (Released by UNEP in 2020)
- China is the largest producer of fabrics. So, the fiber/textile industry in China has an urgent need to transition to a low carbon mode. That is also the manufacturer's responsibility.



The Need for Transition to Low-Carbon Mode



- The Circular Economy is gradually developing as a basic path to solve resource and environmental constraints and creating new economic growth points.
- This is driven by the "Dual Carbon" vision, proposed by the Chinese Government in 2020. Carbon emissions will reach the peak by 2030, and carbon neutrality is to be achieved by 2060. All industries in China are actively engaged in technological innovation.
- We need to establish a sustainable and modern fiber industry characterized by High-end, Intelligent, and Green. (from Guidance on the High Quality Development of the Chemical Fiber Industry in China, Issued by the Ministry of Industry and Information Technology & National Development and Reform Commission in 2022)

Guowang High-Tech & BIFT



Jiangsu Guowang High-Tech Fiber Company, affiliated to Shenghong Group, is specializing in the

research and production of functional polyester fiber. (including functional PET filament, bio-based PTT fiber, high-quality recycled eco-friendly PET filament, full-dull PET fiber, and composite elastic polyester fibers, etc.)

Beijing Institute of Fashion Technology (formerly Beijing Institute of Textile Technology, Beijing Institute of Chemical Fiber Technology) has unique advantages in the fields of innovative fashion design, functional fiber materials for textile and high-performance garments, apparel culture and art design, etc.

Guowang High-Tech and BIFT have been cooperating for many years, seeking the development of green and low-carbon technology for the polyester fiber industry. Guowang High-Tech has advantages in the production of all kinds of PET fibers, and BIFT has advantages in theoretical research on functional fiber materials and fabrics.





Carbon Recycling: Convert CO₂ to PET Fiber, achieving innovation on industrial technologies for sustainable low-carbon PET fiber.



■ More specifically, CO₂ captured from industrial emissions was purified to food-grade level, then chemically converted to high purity ethylene glycol. Direct esterification (with PTA) → Polycondensation → Melt direct spinning continuous technology is adopted to establish a production line for low-carbon PET fiber.

Technological Innovation



In this project, we have developed three key industrial technologies.

- ¹ The capture and purification of CO₂(ensure the conversion efficiency of the chemical reaction)
- ² Chemical reaction to obtain high purity EG, and then fiber grade PET (the ethylene glycol based carbon dioxide needs to undergo multiple steps of purification)
- ³ Melt direct spinning technology to produce low-carbon PET fiber (compared to pellet spinning, further reducing the energy consumption)



Quantified Benefits



- Next, I will show you the benefits and advantages of this project through our data. At present, the production of 1,000 kg of polyester fiber requires 335 kg of high-purity ethylene glycol, and approximately consumes 840 kg of carbon dioxide
- Additionally, benefiting from the melt direct spinning technology, energy consumption is reduced by 37.4%, equivalent to reduction in carbon dioxide emissions of around 100 kg. Therefore, this route can significantly reduce the environmental impact, reducing CO₂ emissions by 936 kg.



Present: convert CO₂ (120,000 t/a) to EG (48000 t/a)

Expected: convert CO₂ (300,000 t/a) to EG (120,000 t/a) or more



- The project demonstrates social responsibility and benefits in both energysaving and emission - reduction.
- It serves as a leading and demonstrative role in the sustainable development of the textile industry.
- Also, it will promote the establishment of sustainable supply chains and cobuilding of low-carbon textile lifecycle systems with textile and apparel partners.
- Finally, it can push forward the formulation of industry standards and accelerates the low-carbon transformation and sustainable development in the textile industry.

Conclusion----New Textile Road



Low carbon mode and sustainable innovation will be the NEW TEXTILE ROAD, and also the powerful driving force for technological upgrading and progress.

Let's work together, to reduce carbon emissions, to recycle the emitted carbon, and to build a better world.



Thank you very much