PROSPECT & CHALLENGES OF BIO-BASED SYNTHETIC FIBRE

TARUN NARANG
Chief Marketing Officer
RECRON MALAYSIA

CREATING VALUE THROUGH COLLABORATION

20-21 AUGUST 2018
KUALA LUMPUR CONVENTION CENTRE, MALAYSIA
This presentation contains forward-looking statements which may be identified by their use of words like “plans,” “expects,” “will,” “anticipates,” “believes,” “intends,” “projects,” “estimates” or other words of similar meaning. All statements that address expectations or projections about the future, including, but not limited to, statements about the strategy for growth, product development, market position, expenditures, and financial results, are forward-looking statements.

Forward-looking statements are based on certain assumptions and expectations of future events. The companies referred to in this presentation cannot guarantee that these assumptions and expectations are accurate or will be realised. The actual results, performance or achievements, could thus differ materially from those projected in any such forward-looking statements. These companies assume no responsibility to publicly amend, modify or revise any forward looking statements, on the basis of any subsequent developments, information or events, or otherwise.
Content

- Introduction – RIL / Recron (Malaysia)
- What are Biosynthetics
- Polyester
- Biosynthetics - Options
- Challenges
- Conclusion
Introduction

Largest Indian Private Sector Company
Reliance Industries – India’s Largest Private Sector Company

- Most profitable company in India in FY2017-18: net profit of ~US$ 5.6 billion for the year
  - Revenue of ~ US $ 66 billion, EBITDA of ~US$ 11 billion
- India’s first private sector company to feature in Fortune 500 – consecutively since 2004.
- A market leader across energy and materials value chain (E&P, R&M, Petchem) and in consumer businesses (Telecom and Retail)

### Energy Value Chain

#### Refining and Marketing
- Largest, most complex single site refinery with 1.24 mb/d capacity
- Consistently outperforming regional margins
- ~61% volumes placed in international markets

#### Petrochemicals
- Ranked Top 10 globally in key products
- Largest producer of polyester fibre/yarn globally
- Production: ~31 MMT

#### Exploration and Production
- Significant expertise in deep-water operations

### Consumer-centric Businesses

#### Reliance Retail
- India’s largest retailer by revenues
- Presence across 750 cities
- Over 13.80 MM sq.ft. space
- Number of stores: 3,679

#### Reliance Jio
- Pan-India next generation digital platform to provide high-speed broadband network, digital content, applications and services
- Jio – India’s MOST Innovative Company*, Globally 17th
- Only player with pan-India sub 1 GHz spectrum
- Commenced Jio services in September 2016
- 125 Million subscribers as of 30th June 2018

Sources: *FAST Magazine

Growth is life
RIL Petrochemicals - Unique model of growth

Vertical Integration as model of growth

1970
- Textiles

1980s
- Polyester
- Polymers
- Fiber Intermediates

1990s
- Olefins and Aromatics
- Petroleum Refining
- Petroleum Retailing
- Chemicals

2000s
- Oil and Gas Production
- Oil and Gas Exploration

Post-2000
- Vertical Integration as model of growth
RIL Petrochemicals – Present in every walk of life

TEXTILES
INFRA
PACKAGING
AGRICULTURE
HEALTHCARE
AUTOMOTIVE
NEW AVENUES
RIL Petrochemicals Portfolio

Polymers
- PP – 2.9
- PE – 2.1
- PVC – 0.75
- Ethylene – 3.7
- Propylene – 2.9

Elastomers
- PBR – 0.13
- SBR – 0.15
- Butyl – 0.12
- Halo Butyl – 0.06

Aromatics
- PX – 4.6
- Benzene – 1.3
- LAB – 0.18

FIDs
- MEG – 1.8
- PTA – 4.9

Polyesters
- PFY – 1.5
- PSF – 0.8
- PET – 1.1

Product | Global Ranking
--- | ---
PFY & PSF | 1
PX | 2
PTA | 4
Polypropylene | 5
MEG | 6
PET | 7
Polyethylene | 14

- All units for capacity are in MMTA
Birth of Recron (Malaysia) Sdn. Bhd.  
(member Reliance group)

Incorporation – July 2007, a Pvt. Ltd. Co  
SPV to acquire assets of erstwhile Hualon Corp

Operation Agreement  
w.e.f Dec 2007

Legal Transfer of assets  
w.e.f June 2008
Reliance Assets in Malaysia

- Kuala Lumpur, Head Office:
  - 200 employees

- Nilai:
  - 190 acres
  - 3000 employees

- Melaka:
  - 40 acres
  - 1300 employees

- Kuantan:
  - 148 acres
  - 300 employees
Recron (Malaysia) Sdn. Bhd.
(member Reliance group)

World’s Largest Integrated Polyester & Textile Complex
Vertical Integration – Processes

Polyester Polymer (530)

PET (150)
PSF (65)

POY (170)

FDY (100)

DTY (90)

HTY (6)

Outsource
Mico Polyester/ FD/ CD/ Nylon (6)

Fabric (375)
In Mn meter/Annum

Dyed Fabric (60)
In Mn meter/Annum

Continuous Upstream Production

Capacities in KT/Annum

PTA & MEG Feed
Recron Inherent Strengths

World Class Technology
- Zimmer (Germany), Tejin Seiki, Murata, Tsudokama & TMT (Japan)

Total Integrated Plants
- No value loss in manufacturing chain

Experienced work force

Proximity of major Raw material
- PTA – 325 Kms, MEG – 400 Kms

Easy Availability of power & gas

Access to RIL Manufacturing / R&D / Technology and Market competency

Access to Global Market
Recron Products

- Polyester Chips & PET Bottle Resin
- Polyester Staple Fiber
- Polyester Pre-Oriented yarn
- Polyester Full Draw Yarn
- Polyester Draw Textured & Air Textured yarn
- Polyester Fabrics, Nylon Fabrics & Mixed Woven Fabrics
- Circular Knitted Fabrics
Recron’s Unique Position in Malaysia

Contribution to Malaysian Economy

**Foreign Exchange Export (in US$Mn)**
- 2017 ~ US $780 Mn

**Domestic Purchase**
- Product & Services - >US$750 Mn p.a

**Largest Containerized Exports**
- 5000 containers movement/ Month

**Direct Employment**
- 4500

**Indirect Employment**
- 25000

---

**Corporate Supporting Organization**

**CREATING VALUE THROUGH COLLABORATION**
Recron Market

America ~ 2%
Europe ~ 5%
Middle East ~ 36%
- Turkey 32%
- UAE 4%
Africa ~ 5%
Asia ~ 50%
- Malaysia 38%
- Pakistan 10%
- Bangladesh 9%
- Vietnam 7%
- Japan 7%
- S. Korea 7%
- Thailand 5%
Australia ~ 0.2%
Others Market ~ 2%
Biosynthetics
Bio Based vs Petro Based

Our Industrial Biotech Process

- Corn
- Cane / Beets
- Non-food Biomass

Sugar → Building Block Chemicals

Conventional Oil-Based Process

- Pumping crude
- Deep sea
- Oil sands

Naptha
What are Biosynthetics?

A biosynthetic fibre consists of polymers made from renewable resources, either wholly or partly.

First Generation – Focussed on food resources such as corn, sugar cane, Starch.

Cellulose based feedstocks – Wood & pulp, Food, Solid waste

New Developments
Why Biosynthetics are important

50 years of oil remaining
- About 115 years of coal production & roughly 50 years of both oil and gas remaining
- To keep average global temperature rise below 2 degrees global target, ~ 65 to 80% of current known reserves to leave untouched. [University of Oxford]

Keeping global warming under 2°C, striving for 1.5°C
- Legally binding global climate deal.
- Made a notable commitment to implement actions on responsible policy engagement in their company. [Paris COP21]

Bio based products represent €57 billion in revenue
- Biobased products and biofuels represent approximately €57 billion in annual revenue and involve 300,000 jobs.
- Bio based share of all chemical sales will rise to 22% by 2020, with a compounded annual growth rate of close to 20%. [European Commission]

45 countries have developed national policy strategies
- Developed national policy strategies with significant impact on bioeconomy development [German Bioeconomy Council]

Source: aboutbiosynthetics.org/
Global - GDP & Fiber Growth

Fiber Consumption (MMT)
- Series 1
- Series 2

Global GDP ($ Tr)


Global Fiber Consumption Trend
- Synthetics
- Cotton
- Cellulose
- Wool

Global Fiber Consumption Trend (ICAC, Cotton World Statistics 2016)
Global Fiber Mix – Polyester

Total Fiber Demand in 2016

- Polyester 48%
- Cotton 26%
- Olefin 10%
- Cellulosic 6%
- Nylon 5%
- Acrylic 2%
- Wool, Silk & Linen 2%
- Other Synthetic Fibers 1%

Total Fibers by Applications

- Apparel 51%
- Home Furnishings 25%
- Industrial 12%
- Non-Woven 12%

2016 Total Fiber Demand 95.5 Million Metric Tons
Need for Sustainable Polyester

**Working Against Polyester Fiber**
- Petrochemical Based - Carbon Footprint
- Non-Biodegradable
- Eco Visibility / Perceived Risks
- Marine Debris, Micro-Plastic and Microfiber Waste - impact on aquatic life

**Working In Favor of Polyester Fiber**
- Recycling of Consumer Drink Bottles
- Recycling of polyester fiber on the rise (post industrial, post consumer)
- Polymer Solution Dying during melt extrusion in fiber spinning
  - Reduced Dying Costs
  - Reduce Water Consumption & Waste Disposal

![Symbols for Reduce, Reuse, Recycle, Recover](apic2018.png)
Polyester – A Winning Material

Global Fibre production to reach 100 Million tons in 2018 (in line with GDP growth)

Polyester dominates and expected to grow @ 4-5% p.a, expected to be over 60 million MT by 2020.

R-Polyester: Currently at ~7% of Polyester production (3.5-4 Mn MT), will make up some of this growth.

Bio-Polymers – Currently very niche – predicted to contribute to overall growth in Polyester.
Emerging preferred fibre

Pull from Brands and retailers - Clothing, footwear & household

Shift from fossil based to biobased
  ✓ Biobased Polyester
  ✓ Biobased Polyamides

Production Scale up
How to make bio–based polyester?

“bio-base”

1st generation tech from food: corn, sugar cane

1.5 generation tech from Tapioca/malosses

2nd generation tech from wood chips, switchgrass, stalks, algae, city wastes

Syngas or Sugar → Ethanol

Ethylene → MEG → polyester

Bio-Fuels

Crude Oil → Oil Refinery

Corporate Supporting Organisation

CREATING VALUE THROUGH COLLABORATION
Bio-Based Polyester

Green Petrochemical Company

Produced **ethylene oxide** → Derivatives & glycols from renewable agricultural sources, molasses/sugar cane

Produces 3 derivatives of ethylene glycols:
- MEG
- DEG
- TEG

30% Bio-polyester Commercialized in Global Market
1. Biopolyester – PLA (Polylactic Acid)
   - Produced from 100% renewable resources
   - Currently produced from lactic acid by fermentation of natural sugars, other starch
   - Industry exploring use of cellulosic-based feedstock (straw, wood & biomass)

2. PEF (Poly ethylene terephthalate)
   - Monomer FDCA (Furan dicarboxylic acid) from bio source (wheat straws) reacted with MEG to form PEF.
   - Avantium Chemicals BV (Netherland) developed process for the new PEF illustrated as below:
3. Biobased PET (Polyethylene Terephthalate)
   • Partially biobased PET available commercially using biobased EG
   • Far Eastern New Century (FENC) along with Virent to convert Virent’s BioFormPX® to biopolyester & produce the first 100% biopolyester fabric & Shirt.
4. PHA (Polyhydroxylalkanoate)
   • Produced by bacterial fermentation of sugar or lipids.
   • Most sustainable – bio-based and biodegradable.

5. Other Biobased fibres / Future Development
   • Biobased Polyamides (Nylon) - Produced from castor oil which had almost 85% of ricinoleic acid
   • Synthetic Spider Silk - Made of protein (water-based solution in a spider’s silk glands)
   • Biobased alternative coatings and finishing for textiles
   • Biobased alternatives to synthetic leather

Technology Development, Process optimization underway to improve product performance
Challenges

- Sustainable Feedstock
  - Type of feedstock
  - Agricultural Techniques

- Feedstock Competition

- Economies of Scale and Economics of process

- End-of-Life

- Funding - Support from Government
Conclusion

- Fossil Economy → Bio Economy → World Economy - Opportunity & growing interest for development of Biosynthetics.

- Product performance, sustainability and customer awareness – Will drive the demand.

- Start ups, Scale up and Hubs – Today’s Buzzwords !!

- Sense of reality – Cost, complexity and timelines.
Thank you!!

Terima Kasih!!