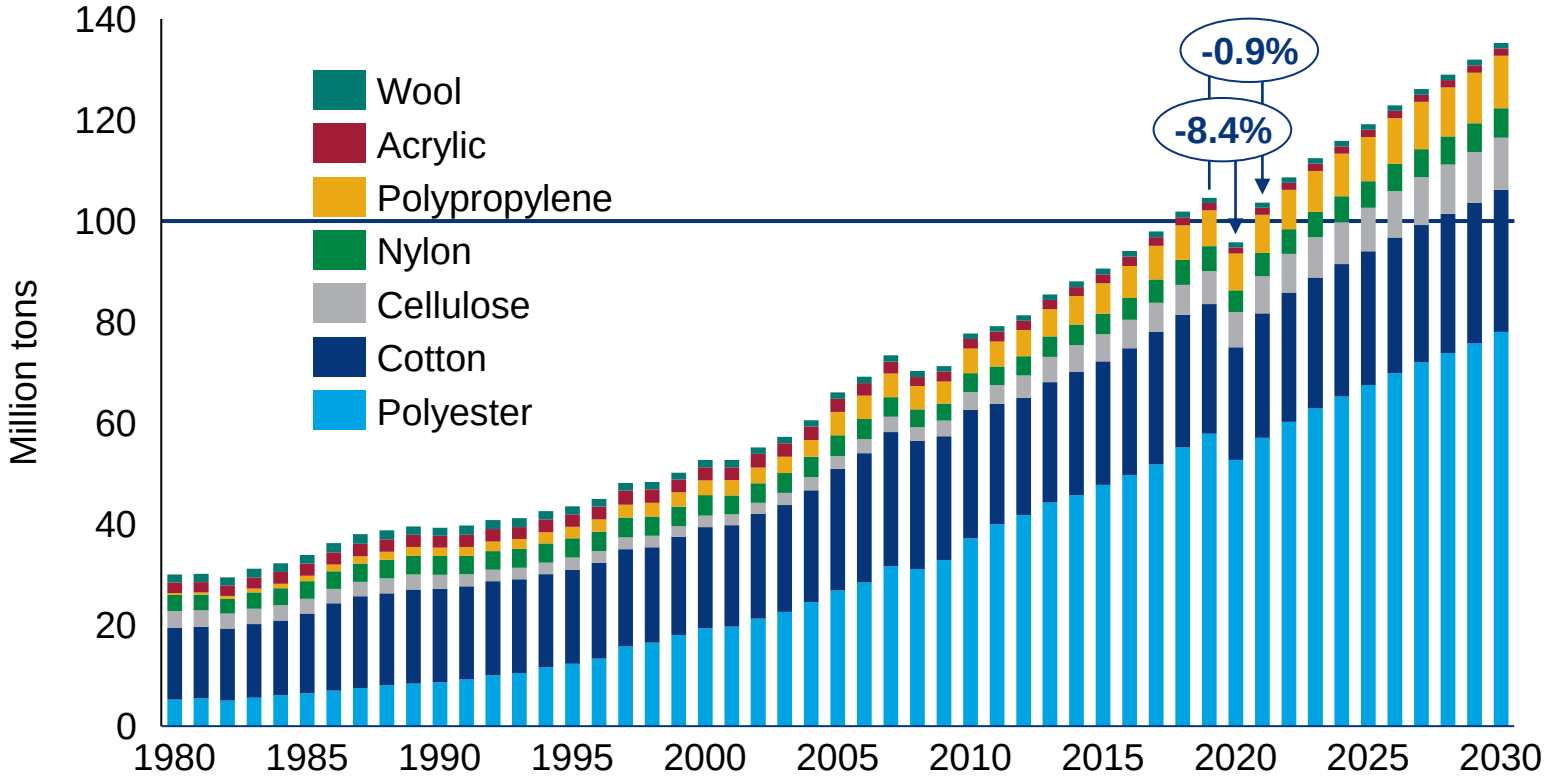
Fibres world in the age of uncertainty

Alexei Sinitsa, Ph.D., Fibres consultant

Contents

1. World of fibres in a few numbers

Total Mill Consumption



Source: Wood Mackenzie Chemicals Fibres Strategic Planning Outlook H1 2022

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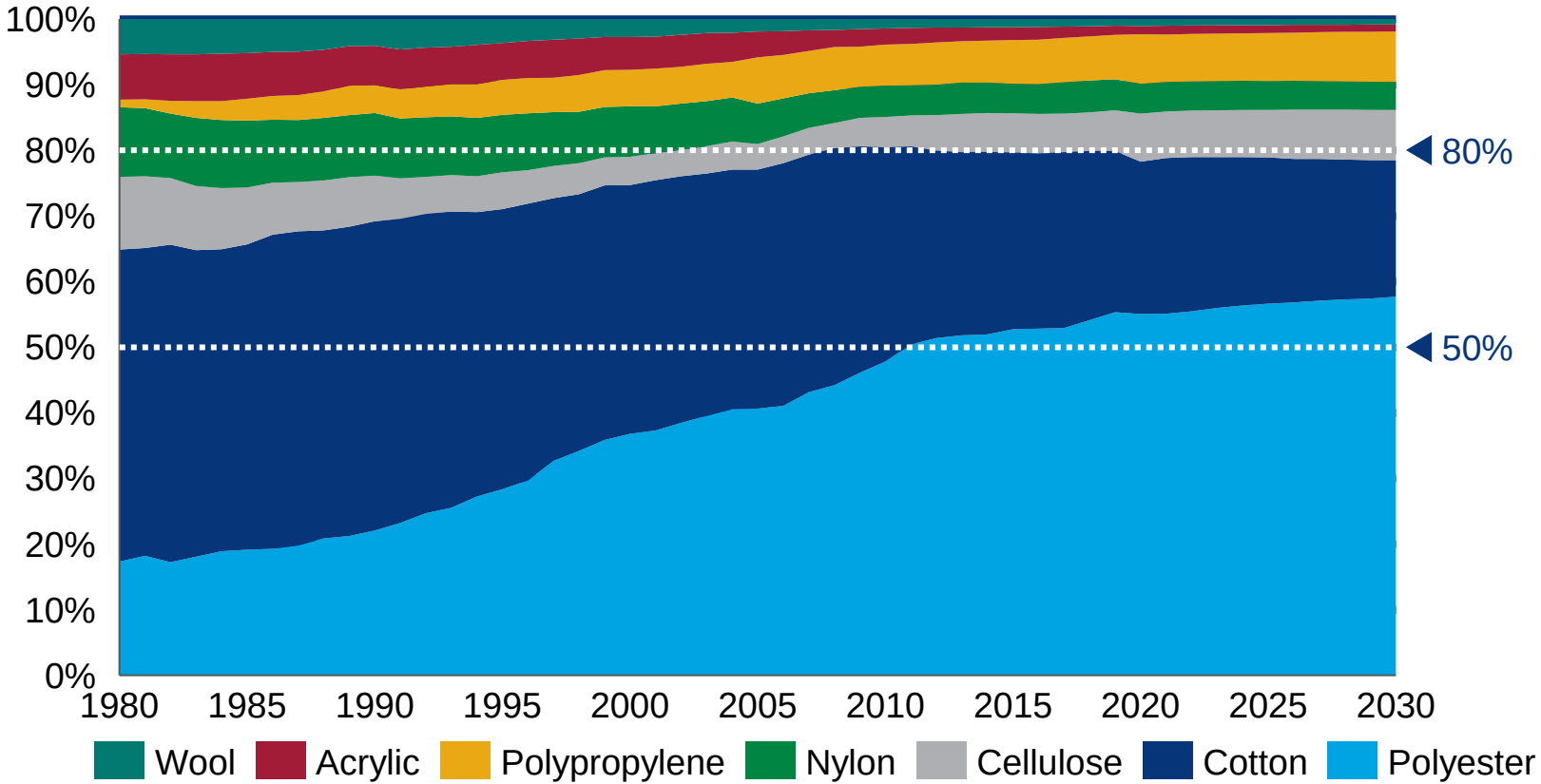
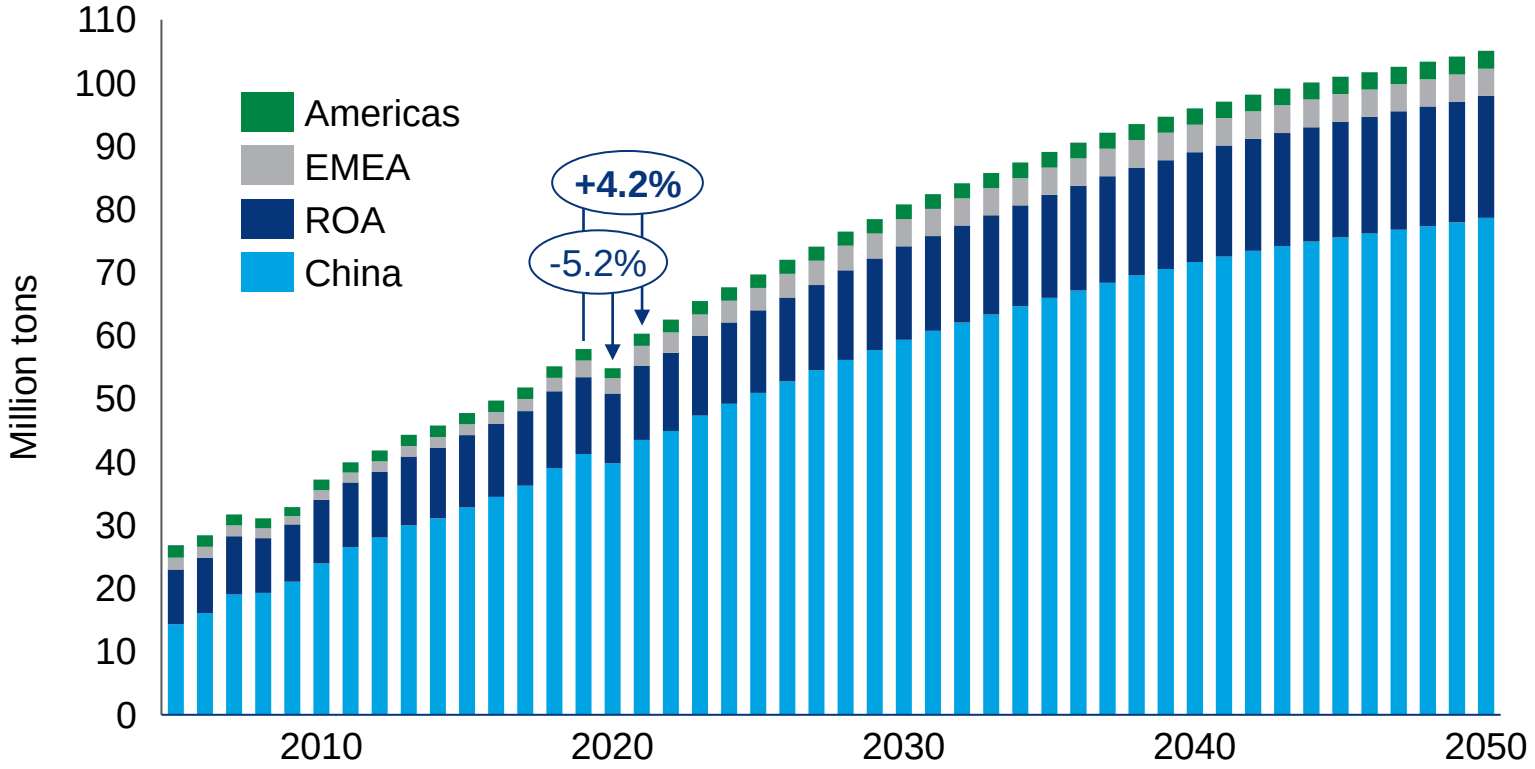


Source: Wood Mackenzie Chemicals Fibres Strategic Planning Outlook H1 2022

Polyester fiber production - where



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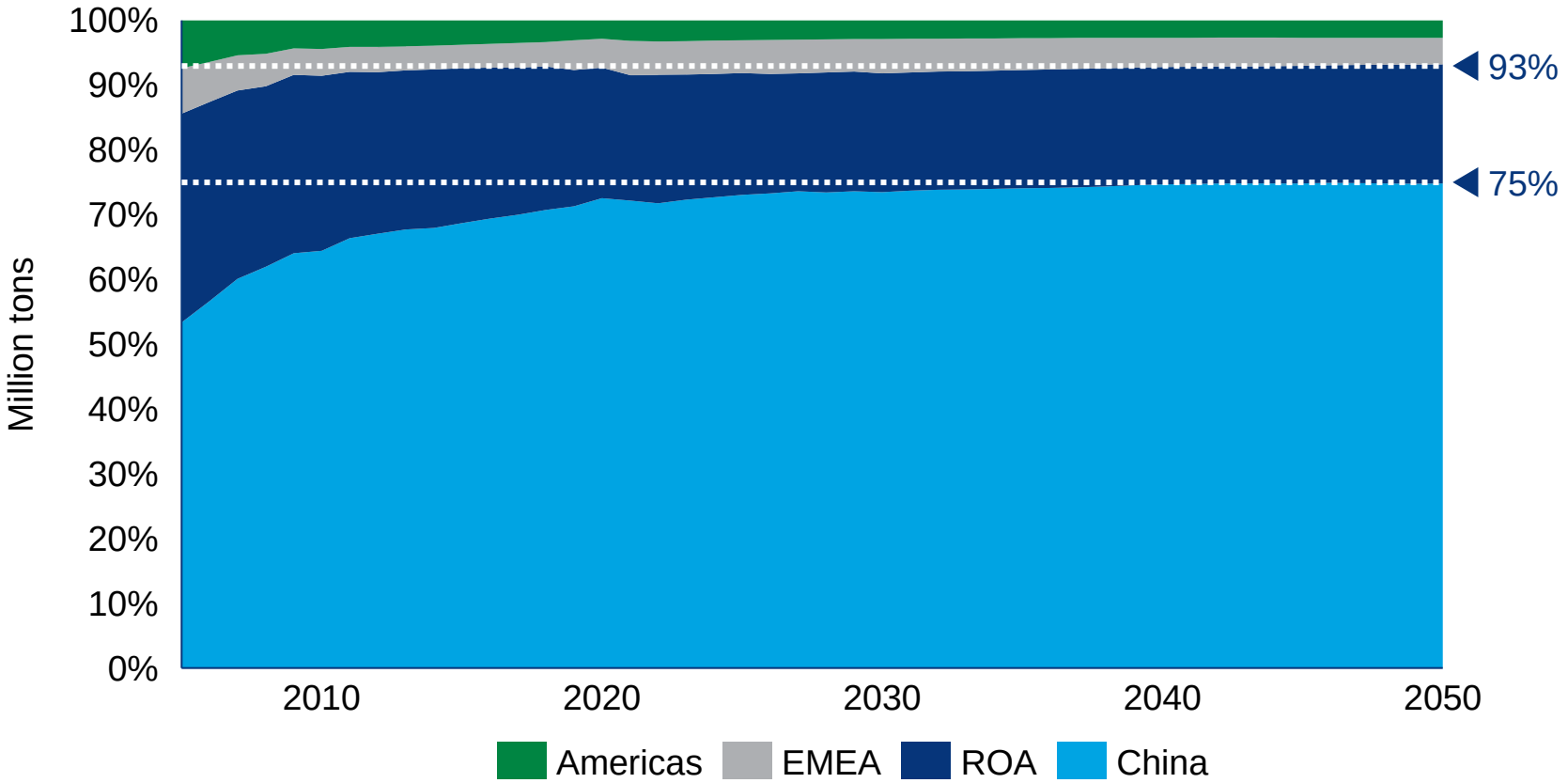
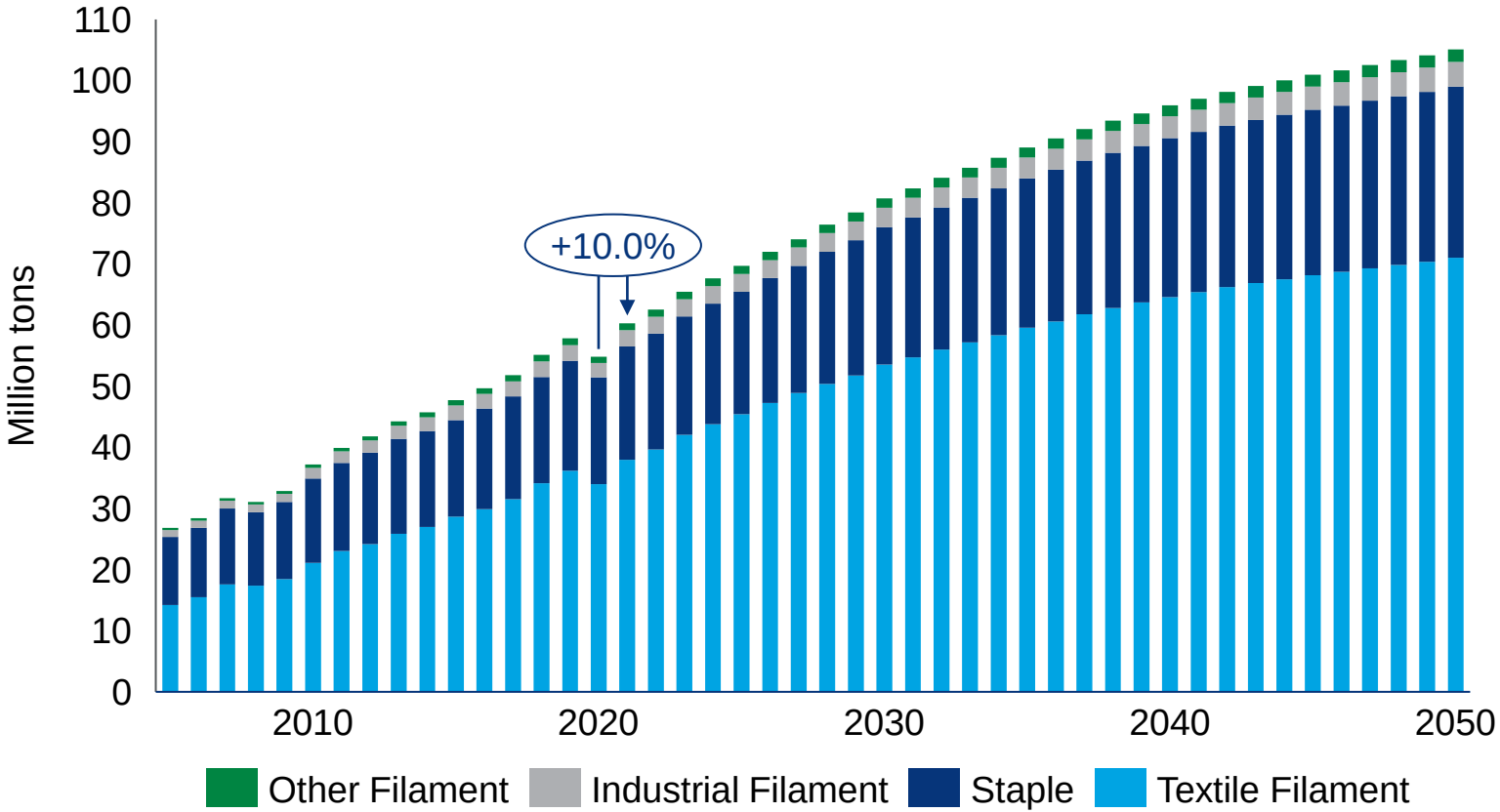


Source: Wood Mackenzie Chemicals Fibres Strategic Planning Outlook H1 2022

Polyester fiber production - what



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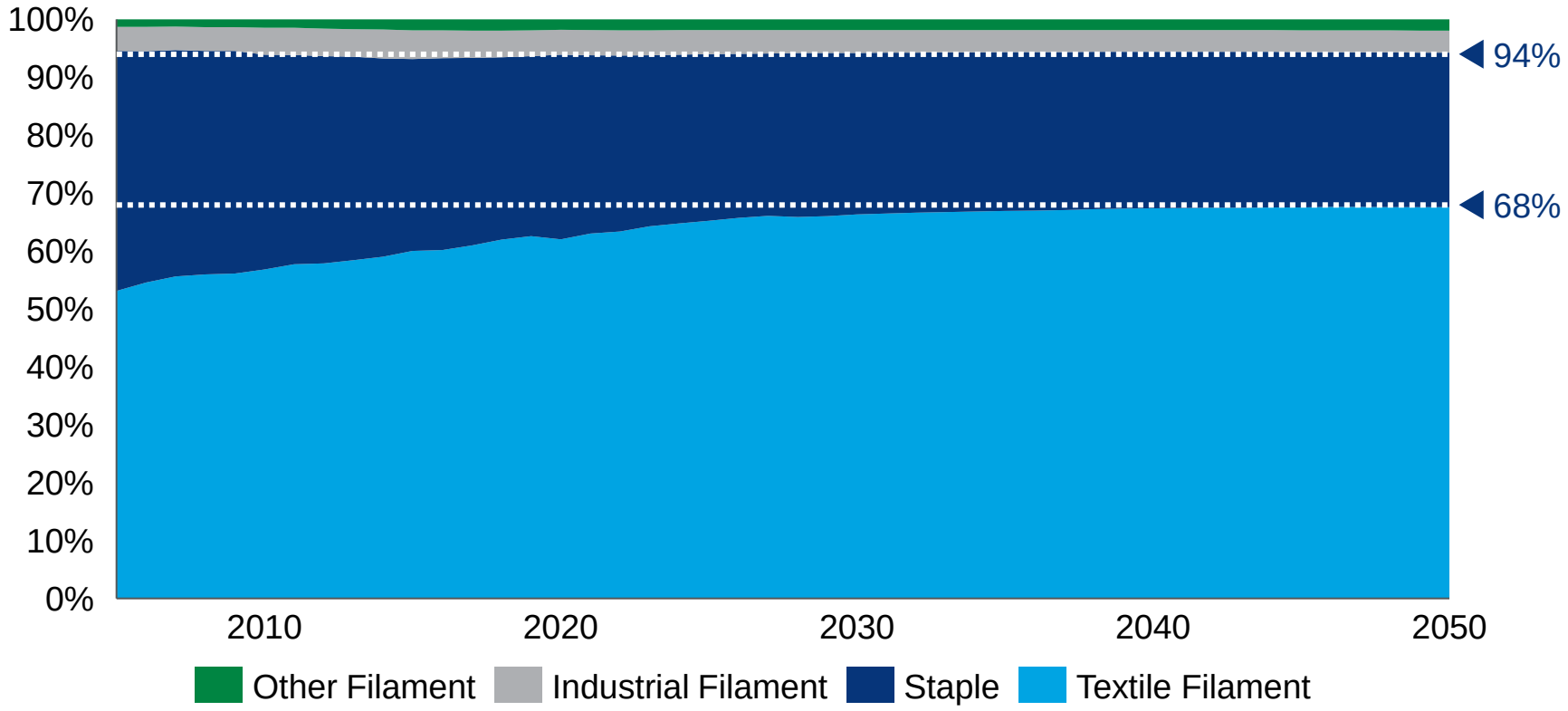
Polyester fiber production - what



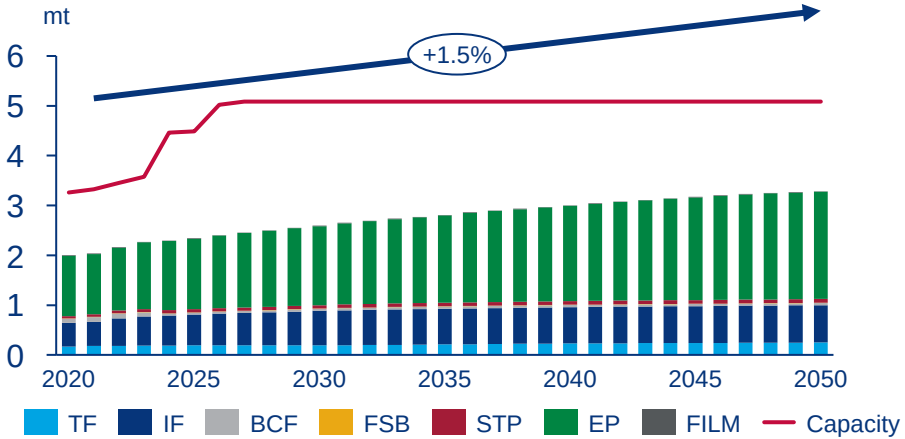
Source: Wood Mackenzie Chemicals Fibres Strategic Planning Outlook H1 2022

Global PA66 supply/demand balance

IF and EP are the main drivers. Most of the growth will happen in China

Global demand for PA66 by application

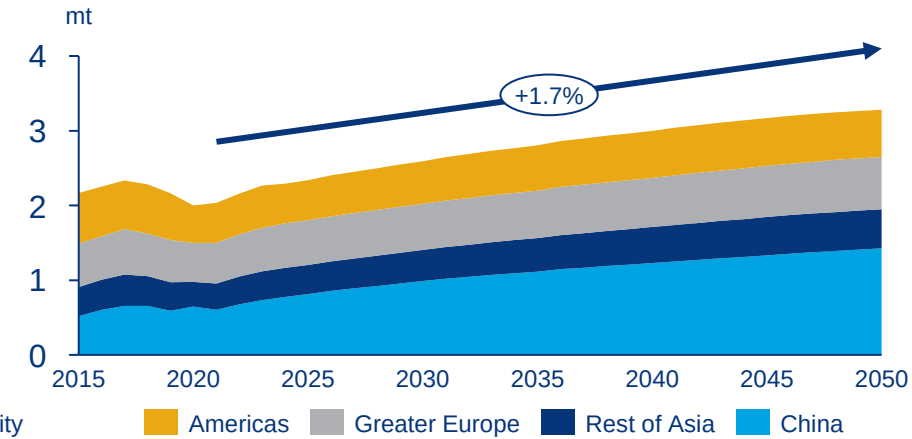
In 2022 global demand for PA66 polymer is expected to reach 2,165 kt. The major demand elements are engineering plastics (EP) (58%) and industrial filament (26%). The main growth also comes from EP and IF.



CAGR %	TF	IF	BCF	FSB	STP	EP	Film	Total
2022-2027	1.3	3.2	-15.5	2.1	1.8	3.4	0.0	2.5

Global demand for PA66 by region

Demand in China represents 31% of global demand. Greater Europe, Americas and Rest of Asia follow with, 26%, 25% and 17% respectively. The main growth comes from China, while America is forecast to be flat.



CAGR %	Americas	Europe	ROA	China
2022-2027	0.2	1.5	1.4	5.6

Source: Wood Mackenzie

Intermediates PA66 update

How many of the planned ADN expansions in China will actually materialise?

Wood Mackenzie CHEMICALS

Project capacity, PA66 – site

Capacity expressed in:

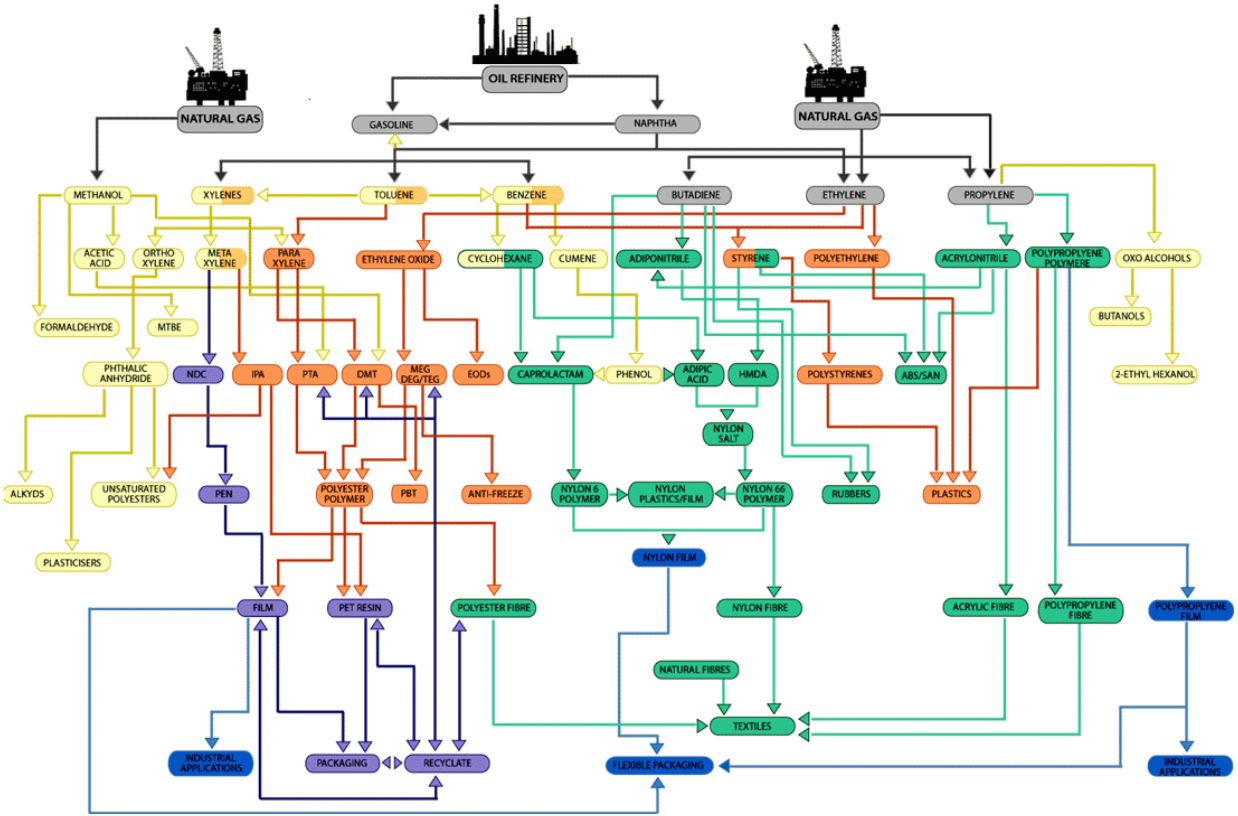
Project capacity by site

Product	Country	State/Province	City	Asset Name	Feedstock	2022	2023	2024	2025	2026	2027	2028	2029	2030
Adiponitrile	China	Shanghai	Shanghai City	Invista, Shanghai City	Butadiene	300	400	400	400	400	400	400	400	400
Adiponitrile	China	Shandong	Zibo	Tianchen Qixiang, Zibo, Zibo	Butadiene		150	300	300	300	300	300	300	300
Adiponitrile	China	Sichuan	Chongqing	Huafon, Chongqing #2	Adipic Acid	50	50	50	50	50	50	50	50	50
Adiponitrile	China	Henan	Pingdingshan	Shenma CF, Pingdingshan	Butadiene		50	50	50	50	50	50	50	50
Adiponitrile	China	Henan		Xiaguang Polymer Materials, Unspecified	Butadiene				100	100	100	100	100	100
Adiponitrile	China	Shanxi	Yangquan	Yangmei, Yangquan	Butadiene	1	1	1	1	1	1	1	1	1
Adiponitrile	China	Anhui	Anqing	Shuguang Chemicals, Anqing	Butadiene				100	100	100	100	100	100
Adiponitrile	China	Jiangsu	Nanjing	Nanjing Chengzi Clean, Nanjing	Butadiene	3	3	3	3	3	3	3	3	3
Adiponitrile	China	Sichuan	Chongqing	Huafon, Chongqing #3	Adipic Acid		100	100	100	100	100	100	100	100
Adiponitrile	China	Sichuan	Chongqing	Huafon, Chongqing #4	Adipic Acid				100	100	100	100	100	100

Source: Wood Mackenzie Chemicals Polyamide Global Supply Demand Report

2. Petrochemistry, fibres and the war

Raw Materials Overview - Original

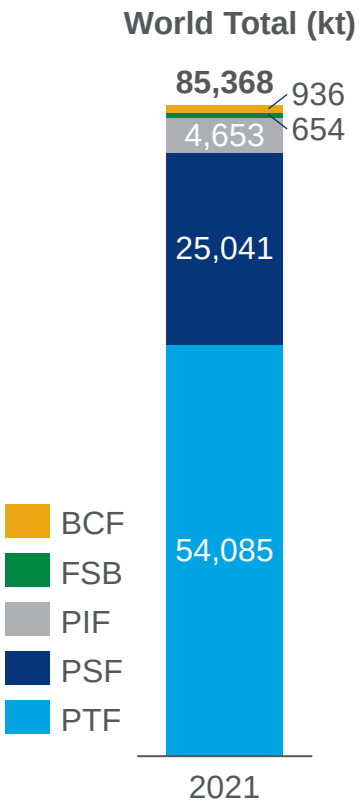


The Drivers For European Fibre Manufacturing

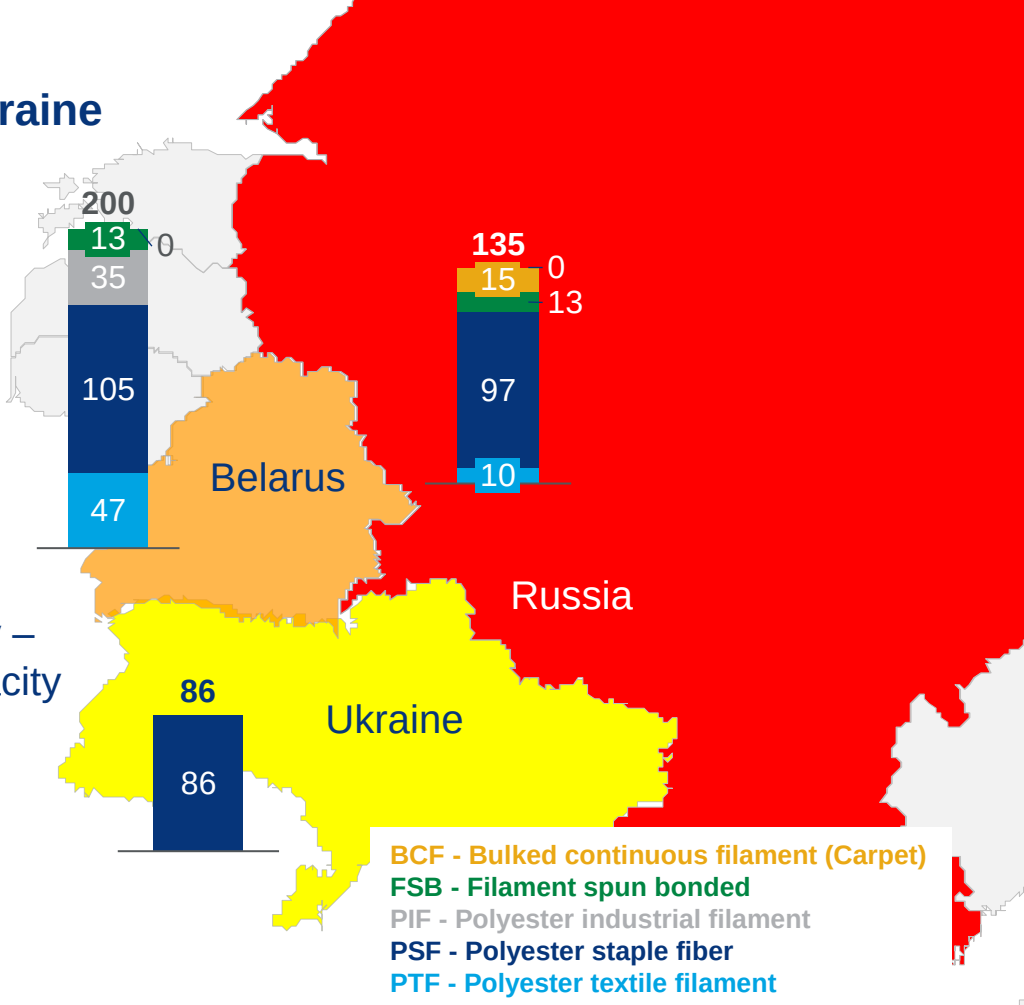
Headwinds

Tailwinds

Polyester Fibers in Russia, Belarus, Ukraine



Regional Capacity –
0.5% of global capacity



Source: Wood Mackenzie Chemicals – Fibres Long Term Strategic Planning Outlook

Polyester Fibers in Russia, Belarus, Ukraine

2021: 216 kt of PET fibers exports to Russia

- China – 70 kt
- Belarus – 62 kt
- S. Korea – 25 kt
- India – 24 kt

March 2022 vs 2021:

- China - down 60%
- Belarus - ?
- S. Korea – down 95%
- India - ?

Source: Wood Mackenzie Chemicals – Fibres Long Term Strategic Planning Outlook

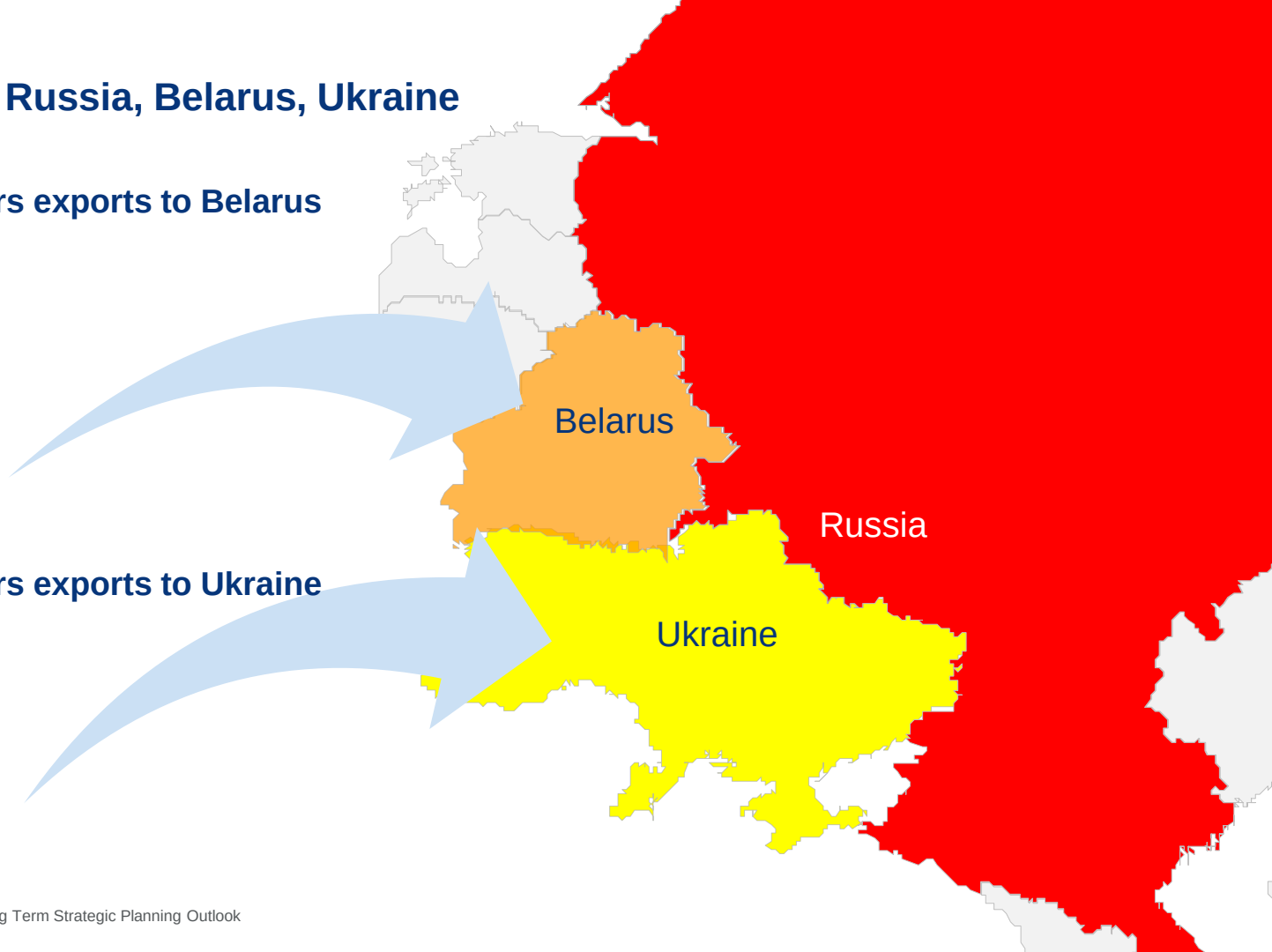
Polyester Fibers in Russia, Belarus, Ukraine

2021: 39 kt of PET fibers exports to Belarus

- China – 9 kt
- Russia – 6 kt
- Denmark – 6 kt
- S. Korea – 5 kt
- Ukraine – 4 kt

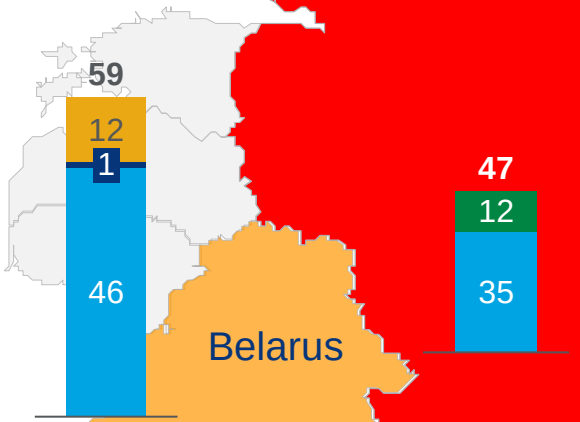
2021: 25 kt of PET fibers exports to Ukraine

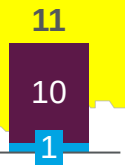
- China – 5 kt
- Belarus – 2 kt
- S. Korea – 5 kt
- India – 2 kt



Source: Wood Mackenzie Chemicals – Fibres Long Term Strategic Planning Outlook

Nylon Fibers in Russia, Belarus, Ukraine





Belarus

Russia

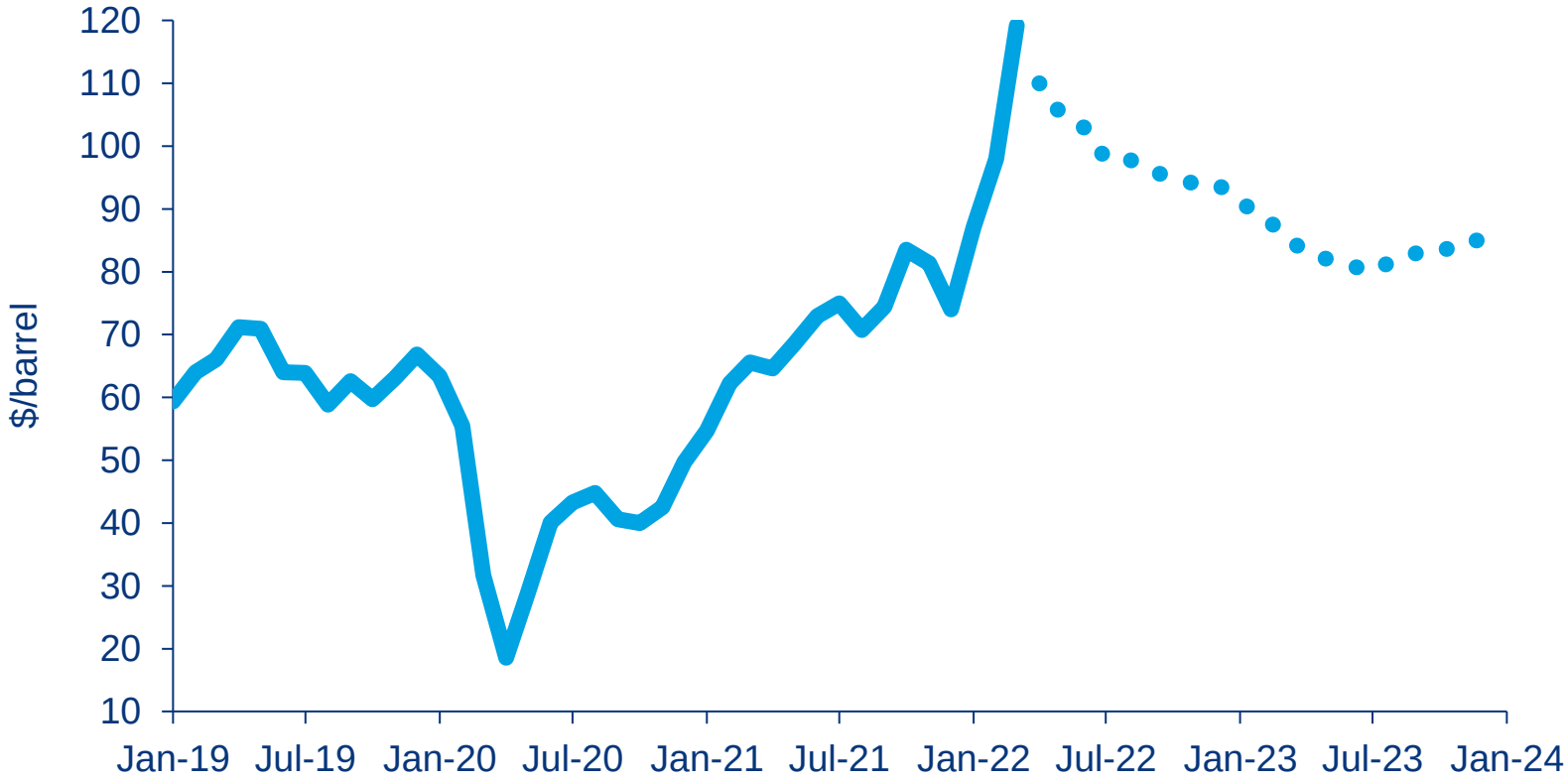
Ukraine

Regional Capacity –
1.3% of global nylon fibres capacity
1.5% of global PA6 fibres capacity

NIF PA66 – Nylon Industrial Filament (mothballed)
BCF - Bulked continuous filament (Carpet)
NTF – Nylon Textile Filament
NSF - Nylon staple fiber
NIF PA6 – Nylon Industrial FIlament

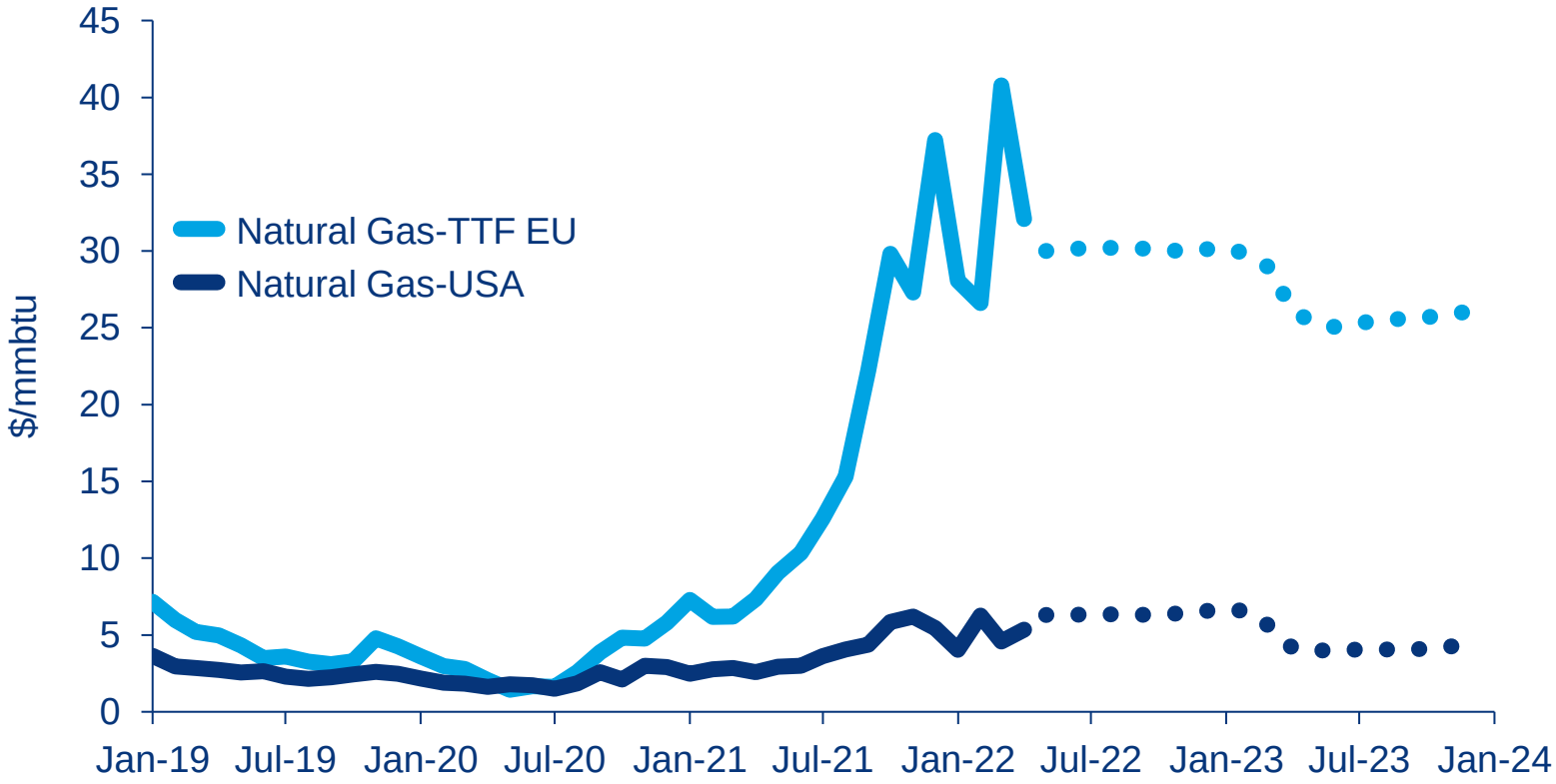
Source: Wood Mackenzie Chemicals – Fibres Long Term Strategic Planning Outlook

Energy prices – Brent Oil



Source: Wood Mackenzie Chemicals

Energy prices – EU Natural Gas



Source: Wood Mackenzie Chemicals

3. Questions that will not go away

What else to think about…

Circularity

- Like-to-like recycling
- Bottle wars
- Carbon neutrality

Maintaining competence

Inflation

Energy prices

Extended producer responsibility

4. Wood Mackenzie Fibres Practice at your service

Wood Mackenzie Background

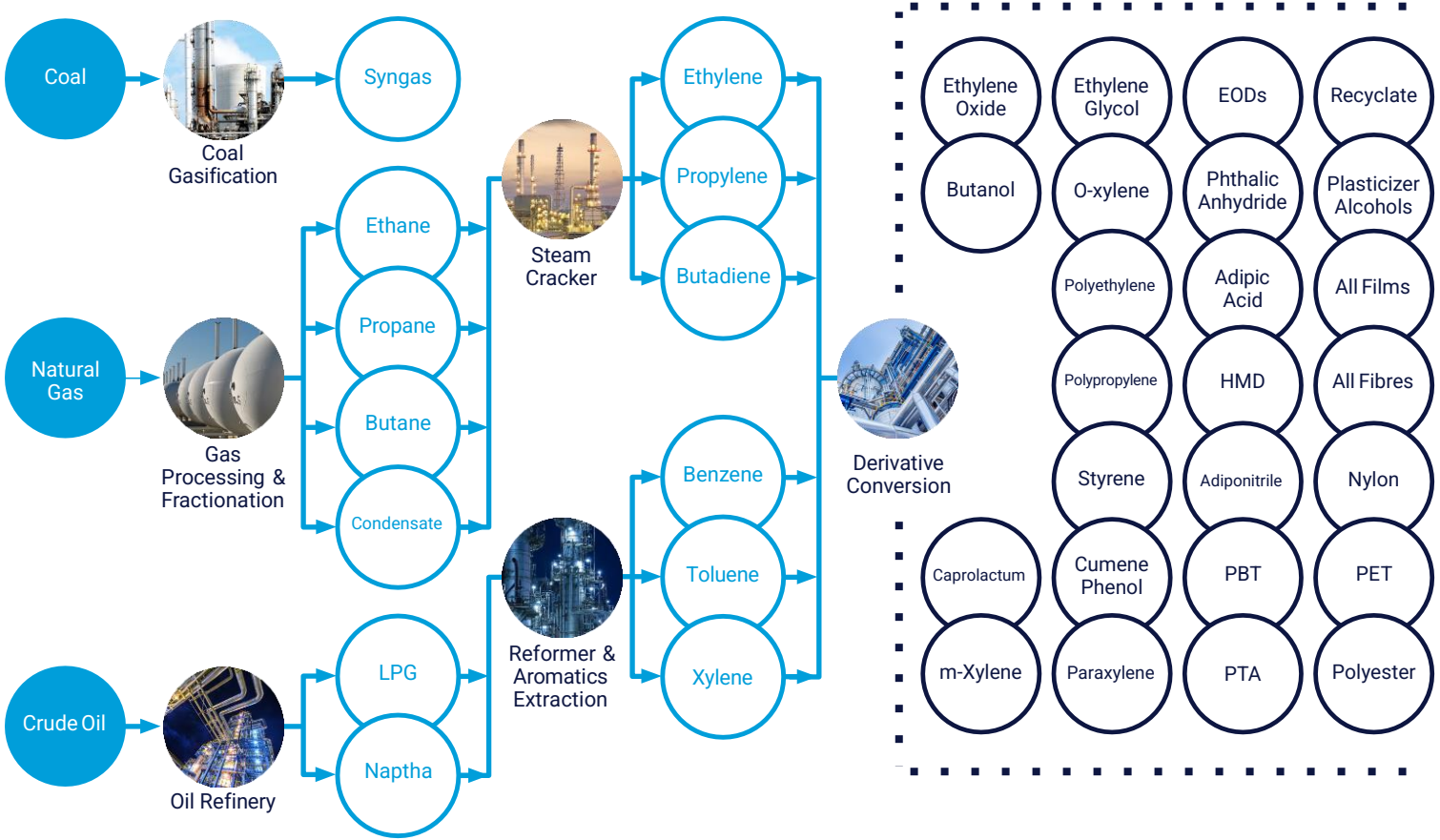
- Verisk Analytics (NASDAQ:VRSK)
  - Data analytics provider
    - Insurance
    - Energy and Specialized Markets
    - Financial Services
- Bought Wood Mackenzie in 2015
  - Leading Global Research and Consultancy Business
    - Chemicals
    - Energy
    - Metals & Mining
  - Bought PCI Group in 2015
    - Provider of analysis and data on
      - Fibers
      - Chemicals
      - Polymers
      - Films
- Rebranded to Wood Mackenzie Chemicals August 2018

Build your competitive advantage on a perspective that **spans the value chain**

Use our independent, expert analysis across the entire value chain to make better commercial decisions.

Unsurpassed experience, methodologies and insights

across the entire energy to petrochemical value chain



Fibres at Wood Mackenzie Chemicals

Short term services

Fibres Report

- Monthly
- Price discovery and market analysis, with commentary on recent events

Technical Fibres Report

- Monthly
- Price discovery and market analysis
- Concentration on technical fibres - Tyres

Long term services

Strategic Planning / Investment Outlooks

- Semi-annually
- Global capacity, production, and demand, textile mill consumption

Specialized services

Global Reports

- Spandex
- Nylon Tyrecord
- HMLS Tyrecord
- Airbag
- Single-client studies

5. The MAP to the textiles future

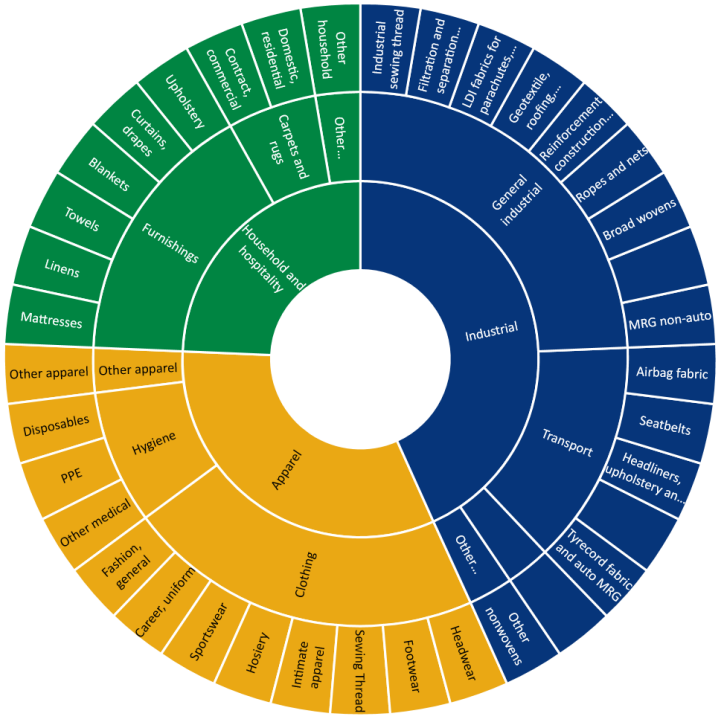
Textiles and apparel applications and materials

Clothing is acknowledged as a basic physiological need. Today, fibres extend to almost all agricultural, industrial and service sectors, to fashion and into the future of space exploration.

- **Textiles and apparel** are the latest demand sectors in our **Materials Applications Platform** (MAP).
- Wood Mackenzie's fibre capacity, production, mill consumption and final demand outlook underpins the textile and apparel MAP forecasts.
- The MAP platform enables the modeling of different sustainability scenarios on fibre and virgin polymer demand across countries and regions.

Fibre Types	
Natural fibres	Cotton
	Wool
Man-Made Fibres	Polyester
	Nylon
	Acrylic
	Cellulosic
	Polypropylene

MAP textile and apparel taxonomy

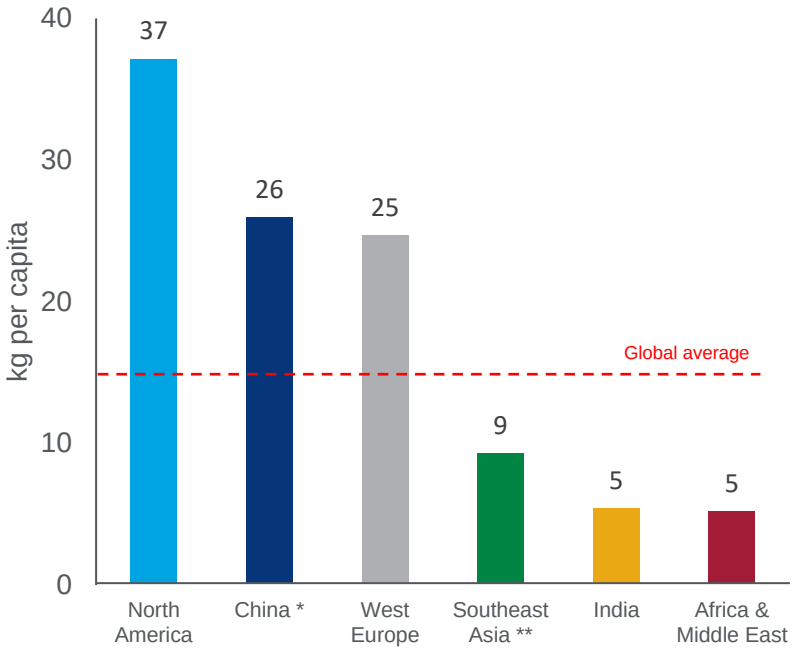


Source: Wood Mackenzie Chemicals

Annual fibre volumes – upside potential

Disparities in current regional per capita demand could lead to higher absolute fibre demand if aspirational consumption offsets environmental sensibilities

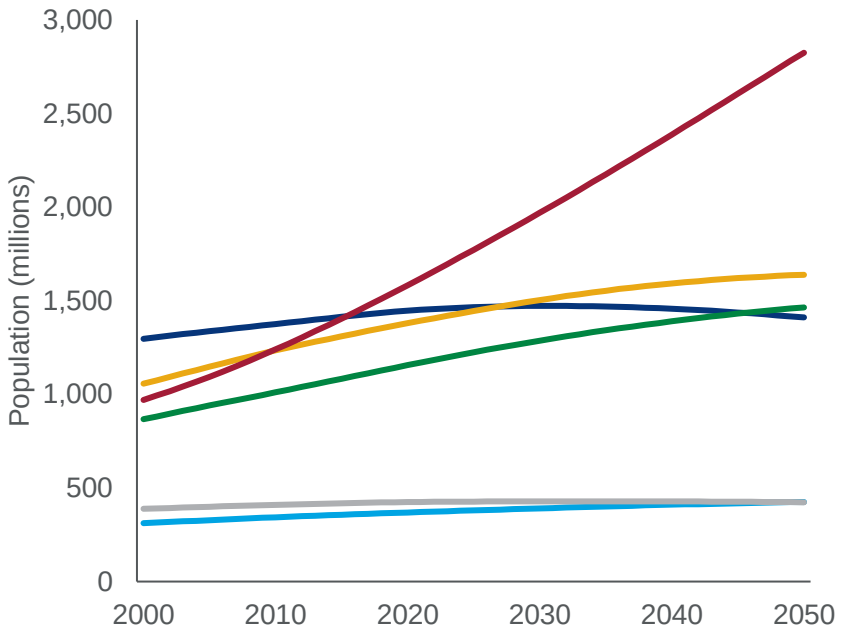
Per capita fibre demand 2021



* includes Hong Kong

** excludes India

Regional populations



Source: UN World Population Prospects 2019 edition

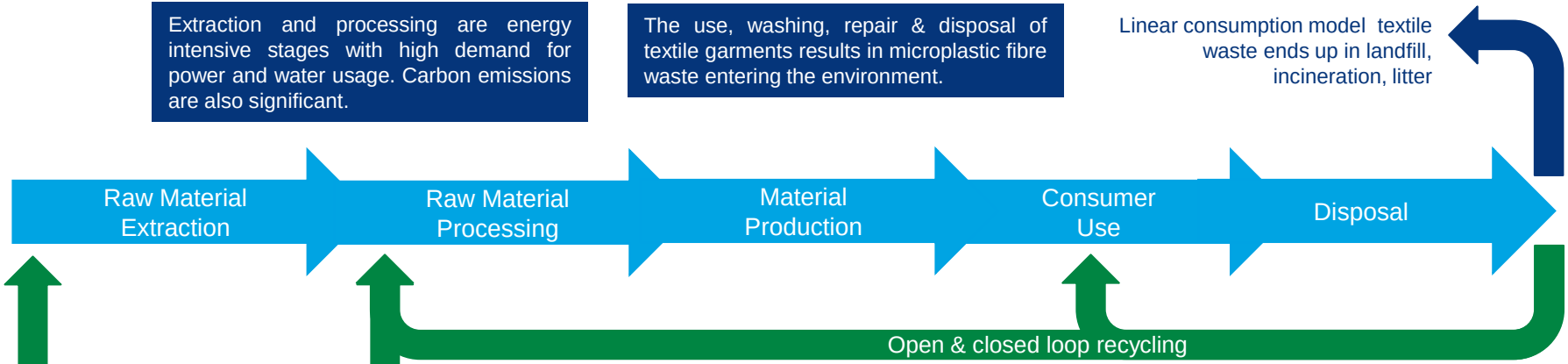
Environmental footprint

Comfort, fashion and performance have environmental costs at production, use and disposal – where do the 100 Mt + volume of fibres produced annually end up?

Extraction and processing are energy intensive stages with high demand for power and water usage. Carbon emissions are also significant.

The use, washing, repair & disposal of textile garments results in microplastic fibre waste entering the environment.

Linear consumption model textile waste ends up in landfill, incineration, litter



Use of bio-based feedstocks has the potential to reduced reliance on fossil-fuel based feedstock i.e. crude oil & natural gas. High costs limiting current supply but companies such as Avantium & Genomatica are active in this sector.

RPET usage reduces reliance on virgin polyester fibre.

Competition from the packaging industry poses a significant risk to secure a reliable supply of bottle flake RPET.

Mechanical recycling
Collection and separation remain major hurdles to reduce cost and processing waste. Mechanical recycling needs to address issues of performance and contamination.

Chemical recycling
Developing rapidly across all fibres, but volumes are still low while costs remain high.

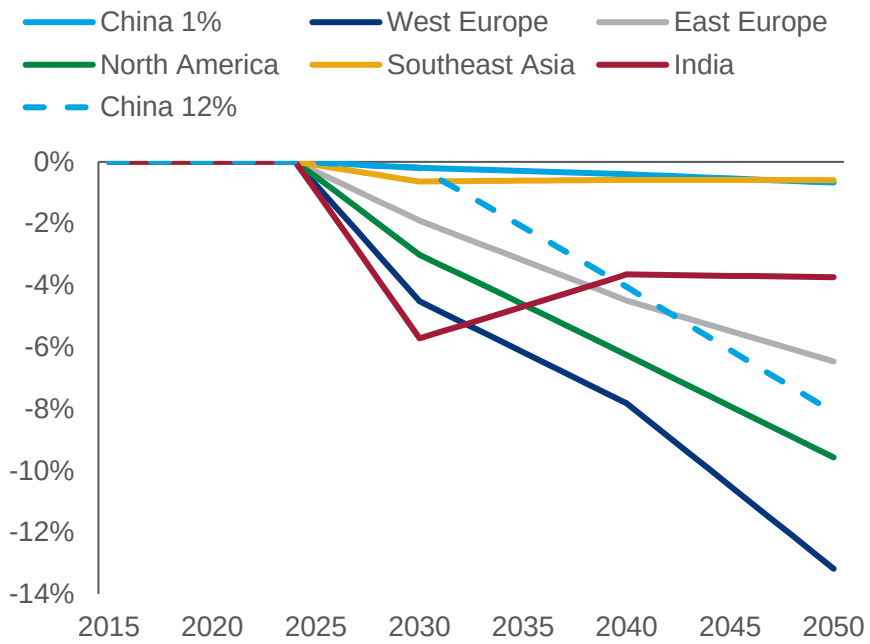
Reuse model
Reuse covers a large number of business models from repair to hand-me-downs to charity shops to e-commerce to rental that extend the life of a product beyond first use.

Potentially, this could lift demand for virgin fibre if this provides consumers with the opportunity to churn quickly through fashion choices and then offsetting the cost of first use with sales for second and further use.

Modelling textile and apparel reuse on demand for virgin fibres

Reuse of textiles and apparel is high up in the waste hierarchy – preventing waste and reducing resource use and emissions

Regional virgin fibre demand reduction, scenarios vs base case



- Current penetration rates of reuse in demand for textiles and apparel are highest in western countries and are set to increase further.
- In low income countries where reuse is driven currently by lack of resources, rates will decline, at least for a while, as incomes rise.
- Cultural factors and regulations around bio-contamination also affect penetration rates.
- The modelling set out on the chart opposite and in the next slides shows two scenarios for China:
  - » **1% penetration rate** by 2050 if current trends persist
  - » **12% penetration rate** if a step change takes place in both consumer attitudes and the necessary infrastructure and regulation

Source: Wood Mackenzie Chemicals

Q&A

Wood Mackenzie
A Verisk Business

Alexei Sinitsa

Fibres consultant | Wood Mackenzie Chemicals

Biography

Dr Alexei Sinitsa joined Wood Mackenzie in 2018, following more than 20 years experience in the chemicals industry. His industrial career began with Rhône-Poulenc/Rhodia, spanning technical, commercial, executive and consulting roles in the nylon chain, including intermediates, polymers, fibres and downstream applications.

Alexei now leads the European fibres contribution to the Wood Mackenzie monthly Global Fibres Report covering nylon, polyester and other synthetic fibre businesses. He has significant experience across a range of international markets, focusing on West, Central and Eastern European markets in particular.

He graduated in Organic Chemistry with honours from Kiev University, and did his doctoral research with the Institute of Organic Chemistry, National Academy of Sciences of Ukraine.

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