

endeavour novara

**A WORLD WITH ZERO
POLLUTION FROM
TEXTILE DYEING AND
FINISHING**

About Alchemie Technology

- We are transforming textile manufacturing with advanced digital clean-tech solutions.
- Based in Cambridge, UK, we are an award-winning technology company harnessing technology to deliver a sustainability breakthrough in textile dyeing and finishing
- Our mission is to transform textile manufacturing by enabling:
 - A breakthrough in sustainability
 - Transformational cost savings
 - Factories of the future with digital manufacturing



Climate-KIC is supported by the EIT, a body of the European Union 



Dyeing and finishing is polluting, inflexible and costly



- **Water:** 20% of global water pollution is from textile dyeing/finishing [1]
- **Energy:** 3% of global CO₂ emissions [2] and rapidly increasing textile dyeing/finishing is forecast to generate 10% world's CO₂ emissions by 2050. The value of eliminating these emissions in today is estimated to be ~ \$105BN [3]
- **Cost:** Inflexible traditional production is energy intensive and leads to excessive inventory and supply chain waste with significant energy costs and product discounting in market [4]

[1] World Bank Report / UNEP <https://news.un.org/en/story/2019/03/1035161>

[2] Quantis report 2019 (35% of carbon footprint of the textile industry is dyeing/finishing)

[3] UN Global Compact target by 2020 = US\$100/tCO₂e x 35BN x 3% = \$105BN

[4] 30-50% retail discounting (various fashion retail sources)

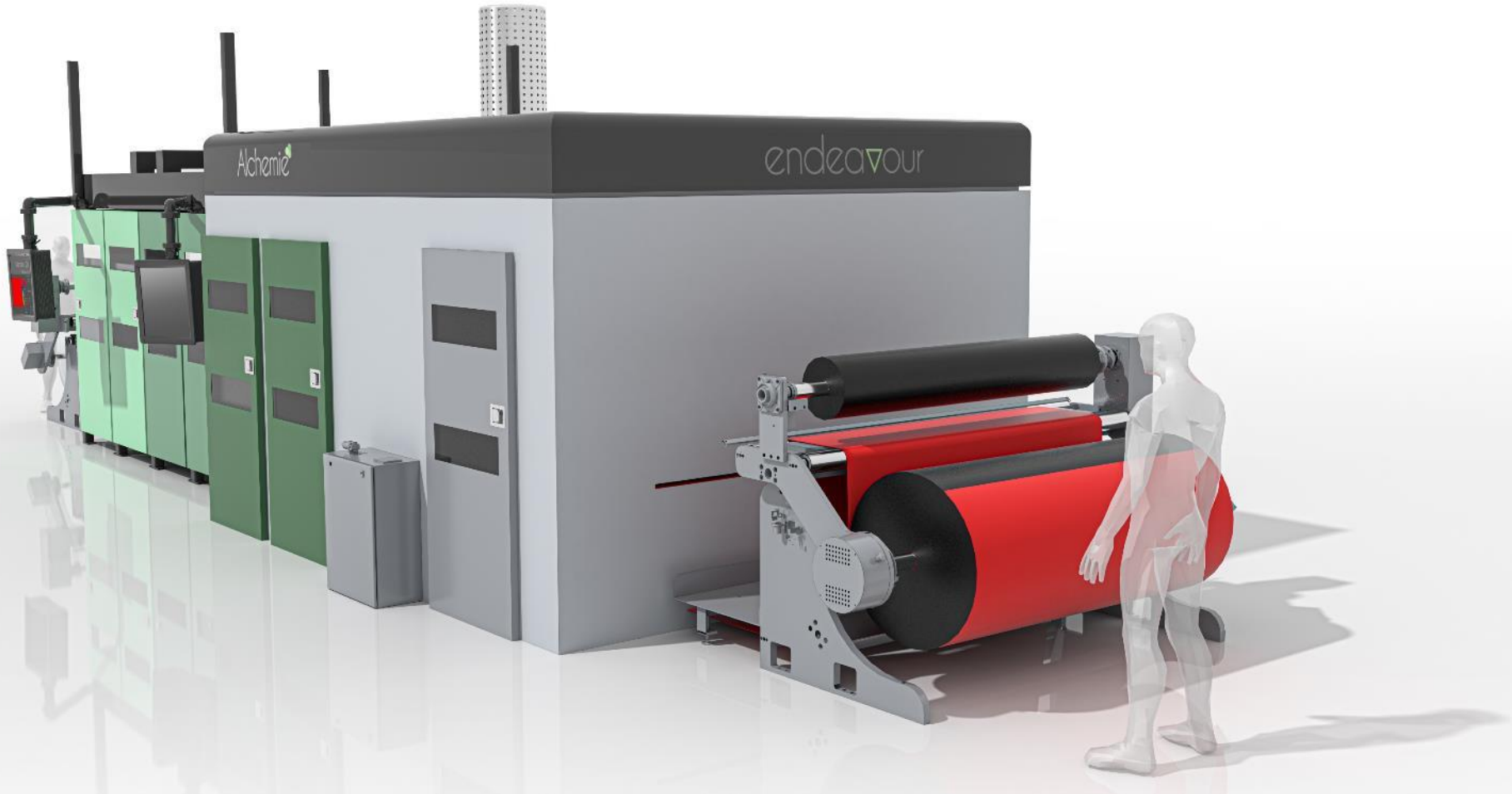
endeavour novara

**ENDEAVOUR
WATERLESS SMART DYEING**

endeavour

INTRODUCING ENDEAVOUR

Waterless Smart Dyeing

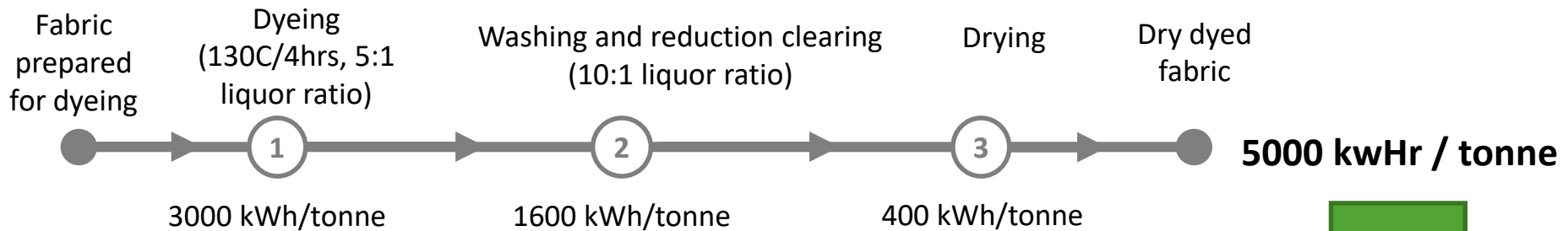


Endeavour – explaining the process

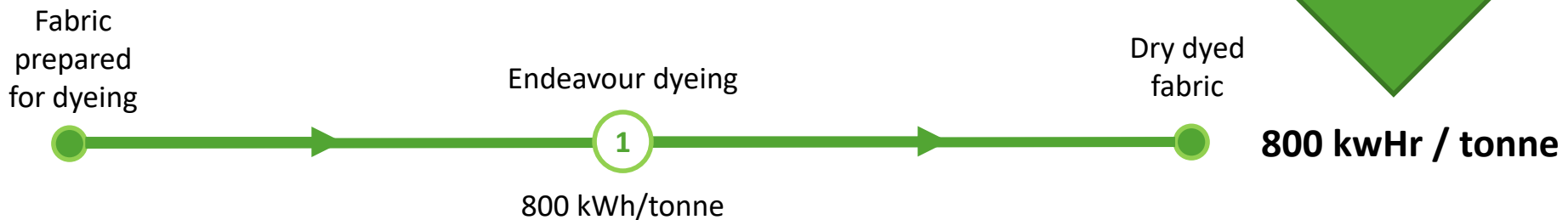


Sustainability breakthrough: >85% energy reduction

Traditional jet dyeing:

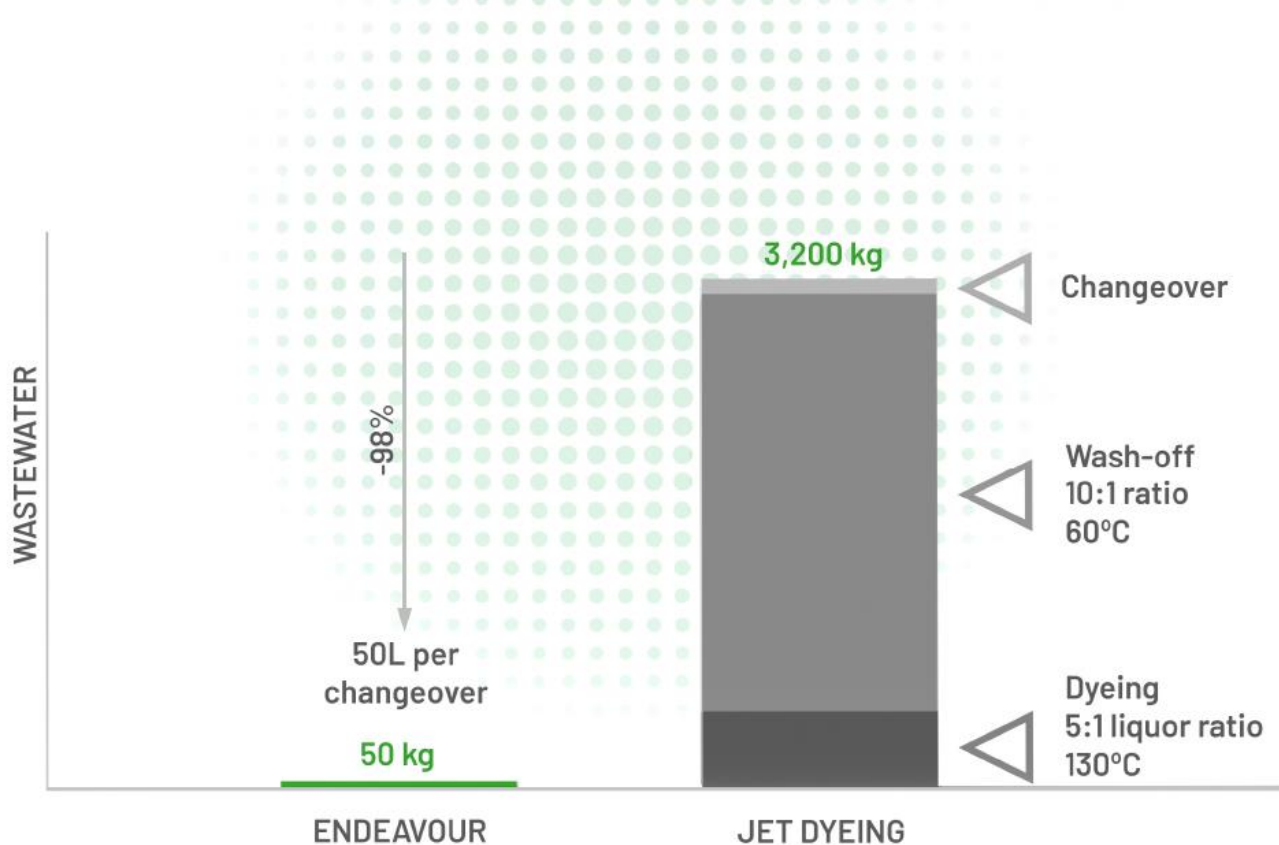


Alchemie Endeavour™:

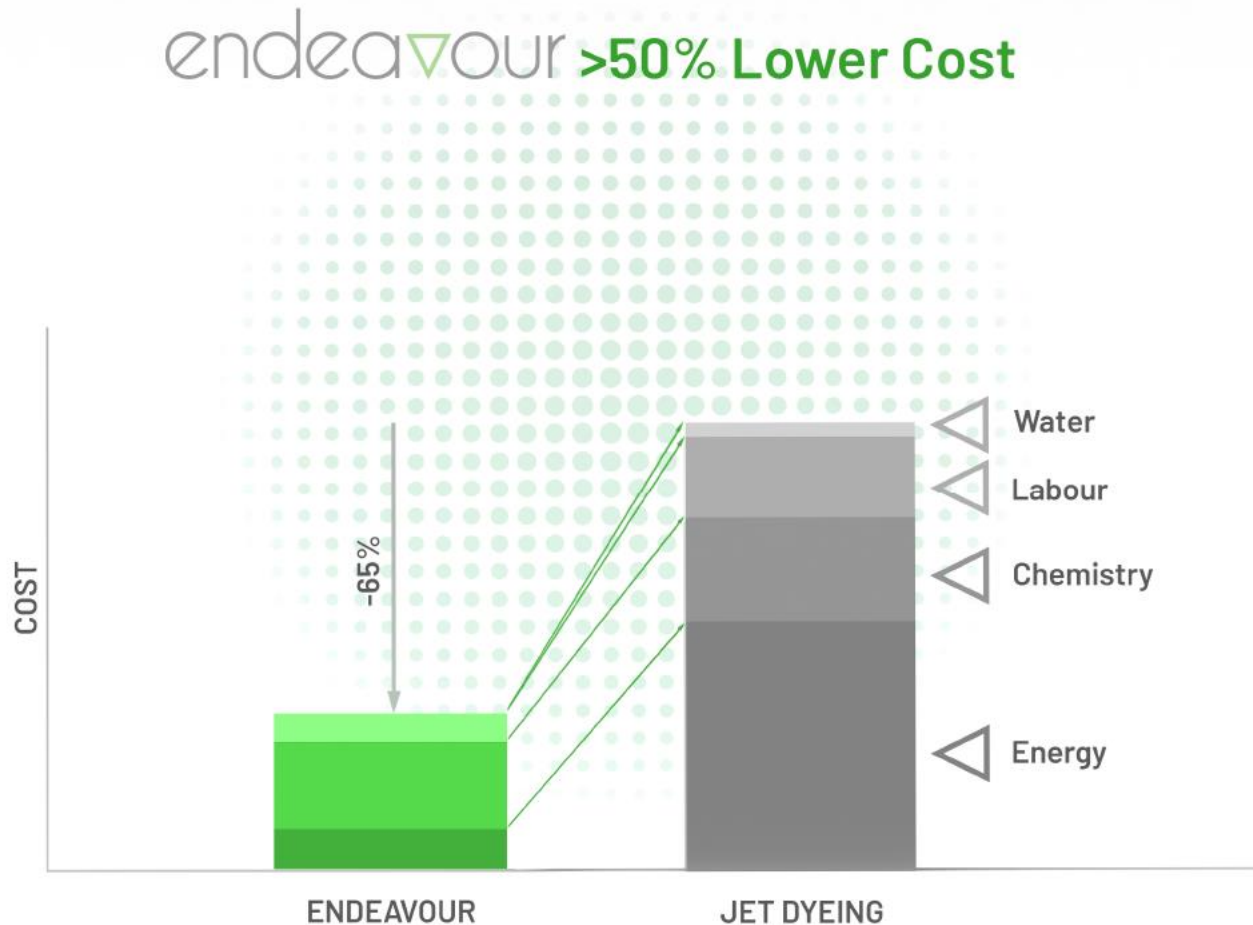


Sustainability breakthrough: wastewater elimination

endeavour **>95% Less Wastewater**



Significant operational cost savings



Exceptional return on capital investment

	Annual capacity / m2	Jet dyeing cost per meter / \$	Estimated annual savings / \$	Capital payback / months
Endeavour HF (15 m/min)	5.5M	0.5	\$1.4M	12
Endeavour HT (50 m/min)	18.4M	0.5	\$4.5M	8

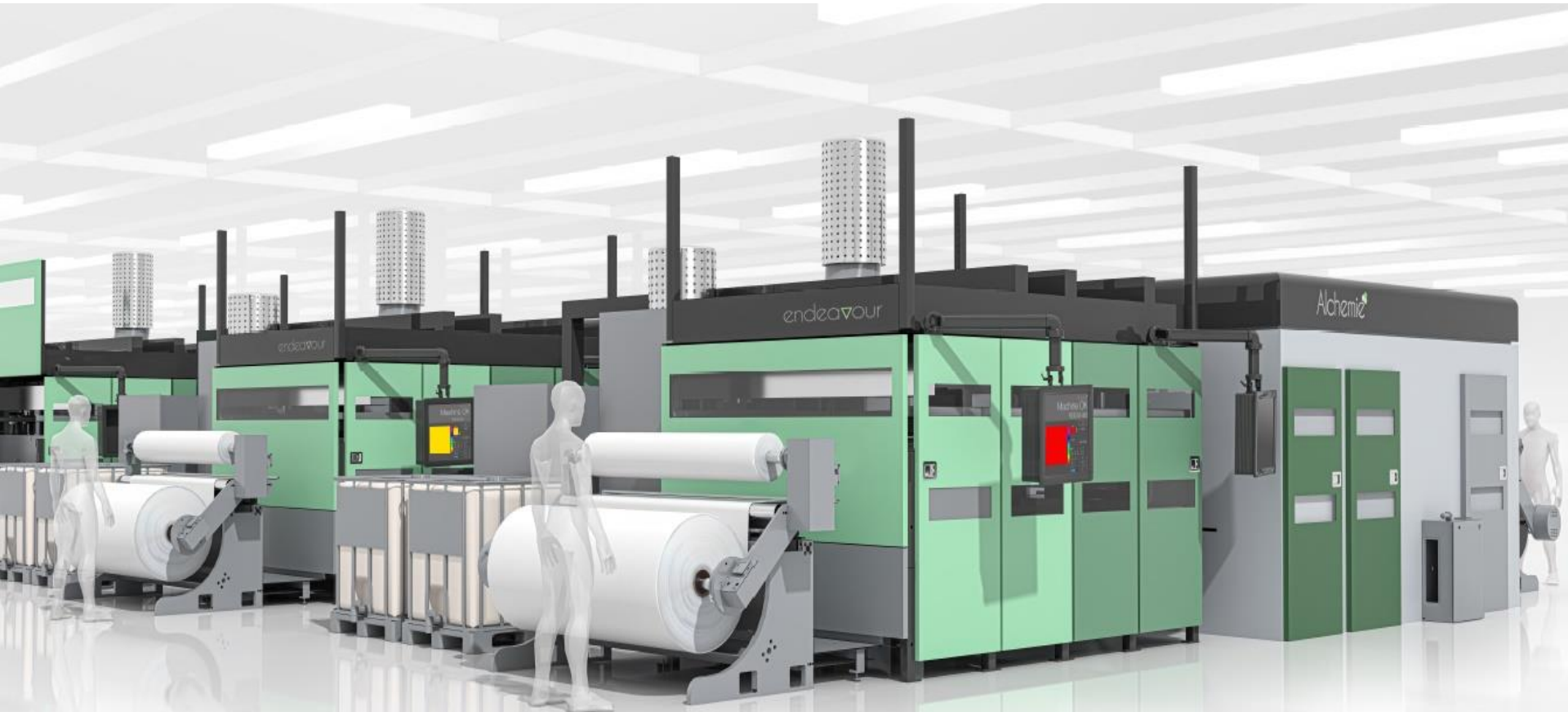
- The Endeavour process delivers significant operational cost savings
- 50% cost saving per meter vs jet dyeing based on:
 - -85% energy
 - -30% materials
 - -70% labour
- Investment per line: ~\$1.5M (Endeavour HF) ~\$3M (Endeavour HT)
- Capital payback < 12 months

endeavour

Designed for e-commerce digital supply chains



Integrated digital manufacturing solutions



- Rapid automated changeover of colors
- Ultra-low minimum order quantities
- Fully connected digital manufacturing solutions for Industry 4.0

Efficient workflow with ColourHit™ digital colour matching



Input target colour sample or Pantone®

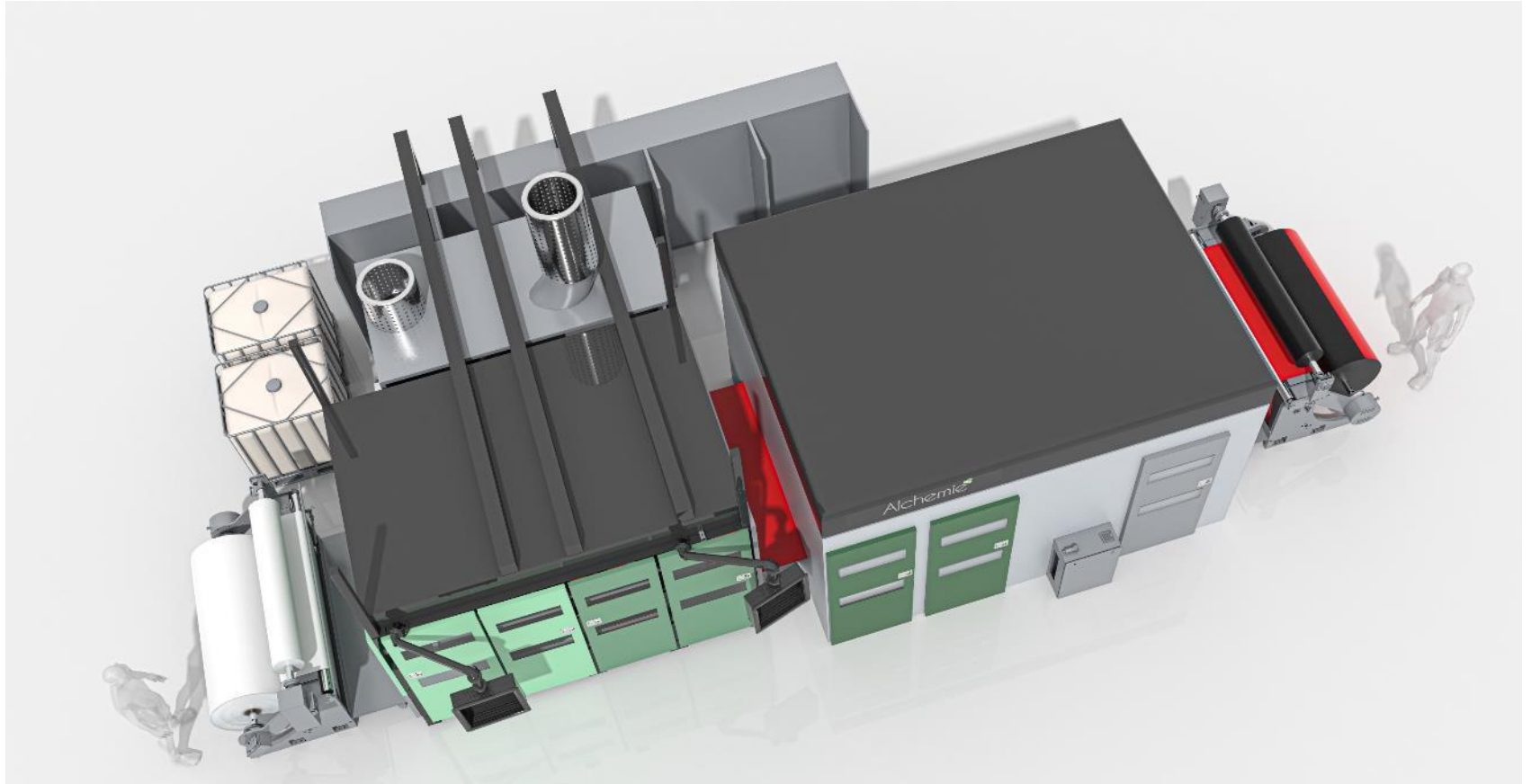
Select approved Endeavour liquid dye

Laboratory ColourHit™ samples

Measure and compare to target

Store match in ColorHit™ database

Endeavour™ settings in ColourHit™ database



MORE
PROFITABLE
PRODUCTION



DYE ON
DEMAND

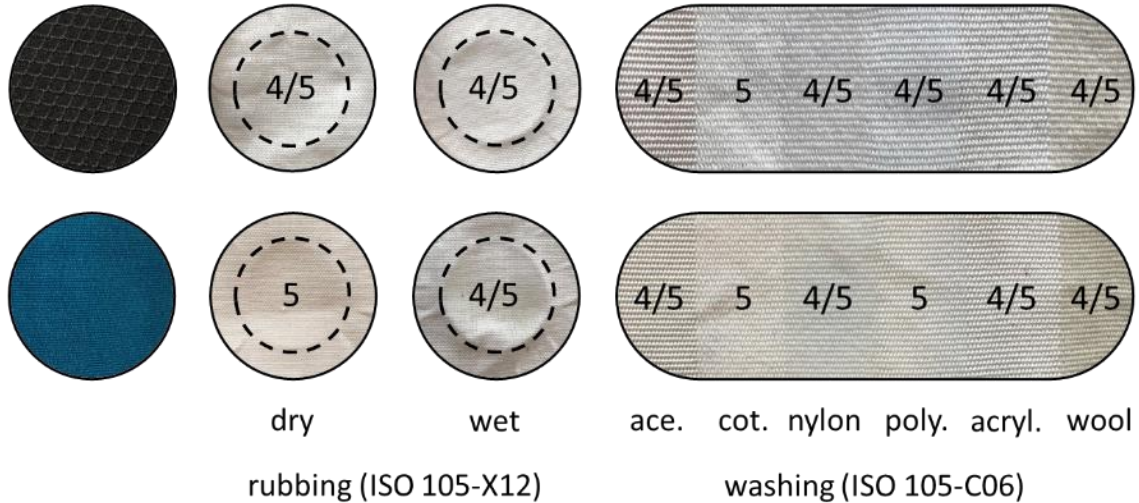


WASTE
WATER
ELIMINATION



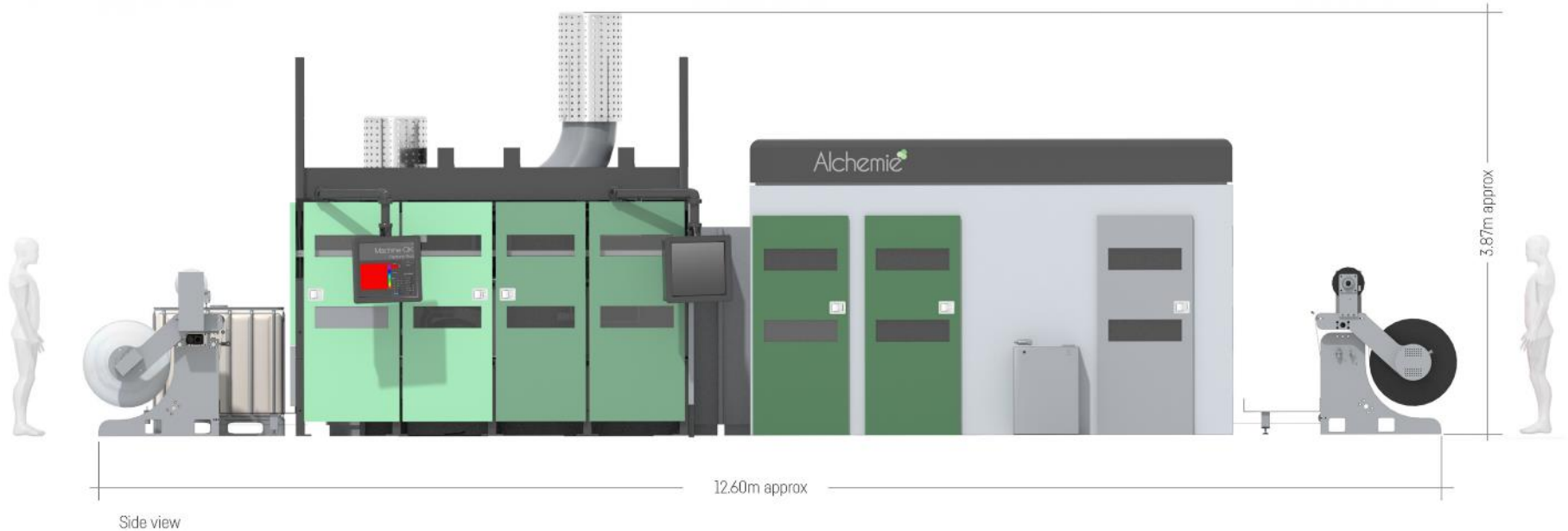
REDUCED
ENERGY

Excellent fabric quality



- Colour consistency $\Delta E < 0.5$
- Colour fastness $> 4/5$ wash and dry/wet rub
- Excellent hand-feel

Production lines – available for delivery



- Roll-to-roll direct to fabric digital dyeing solution
- Polyester / dispersed dye, cotton/polycotton – pigments, nylon/acid dye
- 1.8 m wide
- 50 - 500 gsm substrates
- ColourHit digital colour matching

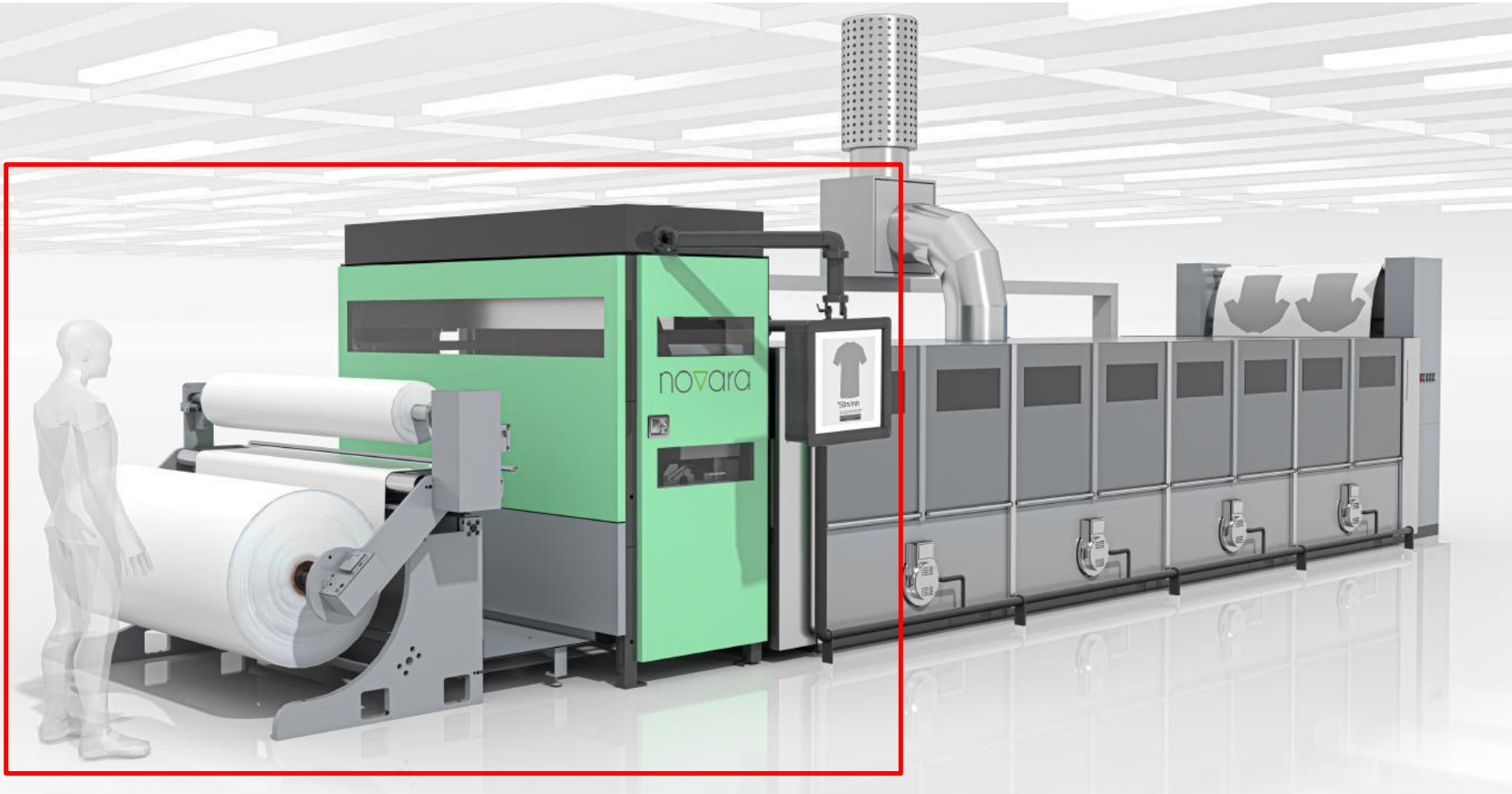
endeavour novara

NOVARA DIGITAL PRECISION FINISHING

noV_oara

INTRODUCING NOVARA

Digital Precision Finishing



Novara – Key Benefits



DIGITAL ON-
DEMAND
PRODUCTION



SUSTAINABLE
FINISHING
PROCESSES



NEW PRODUCT
INNOVATION

A digital textile finishing processes



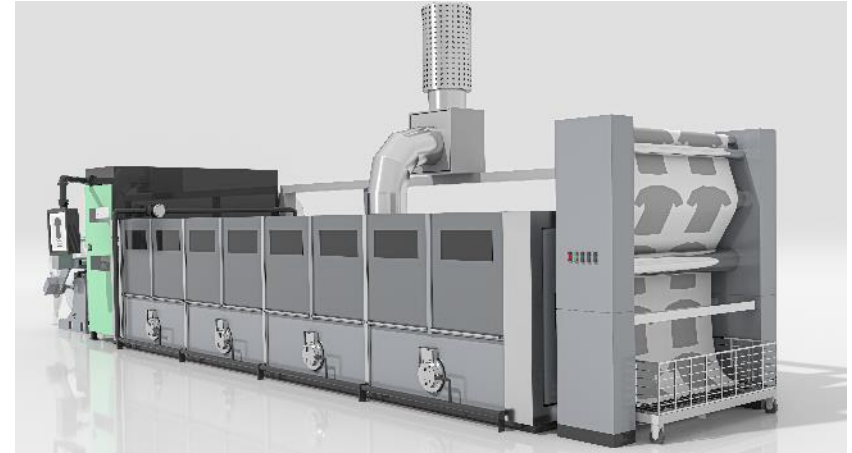
COST
REDUCTION > 30%



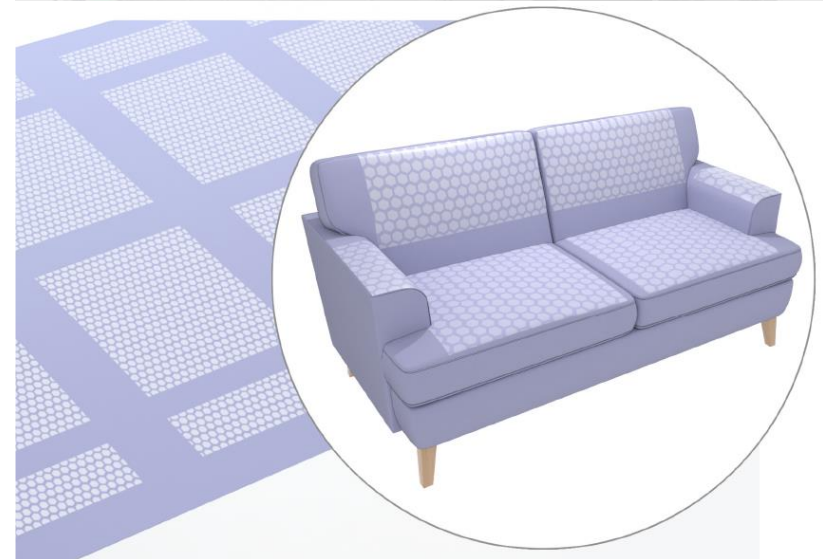
CHEMISTRY
SAVINGS > 25%



ENERGY
REDUCTION > 85%



- Finish to side and/or shape:
 - Higher concentration than pad finishing
 - Reduced waste
 - Lower energy for drying/curing
 - Designed for recycling
- Significant savings:
 - Cost
 - Chemistry
 - Energy



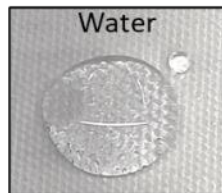
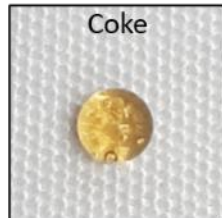
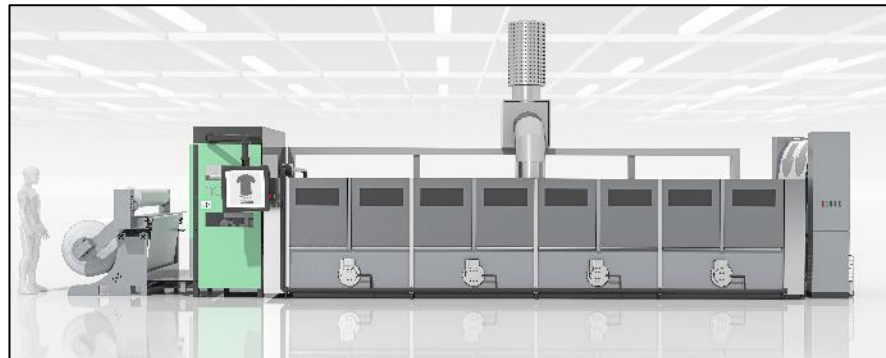
Case study: Single-sided water and oil repellent

Single-sided water and oil repellent coating:

- Coating applied: Approved C6 DWR
- Speed: 27 m/min.
- Chemistry add-on: 12 gsm.
- Performance: hydrostatic head test: 21 cm H₂O (ISO 811:2018).

Benefits compared to padding process:

- Cost reduction >30%.
- Energy reduction >83%.
- Chemistry reduction >24%.

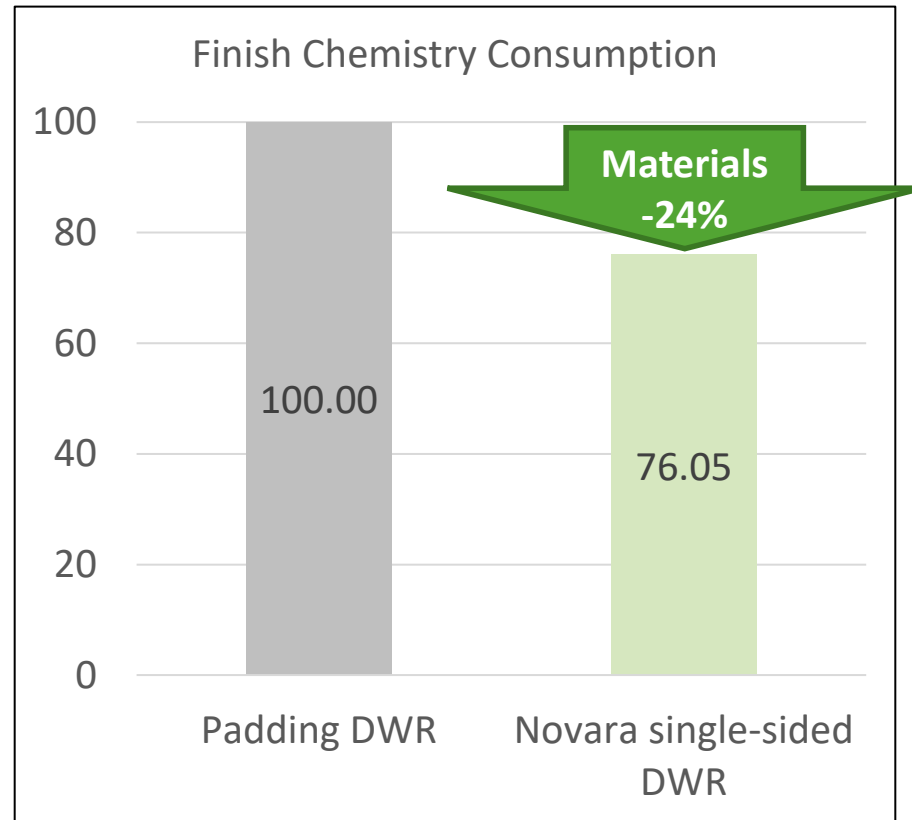
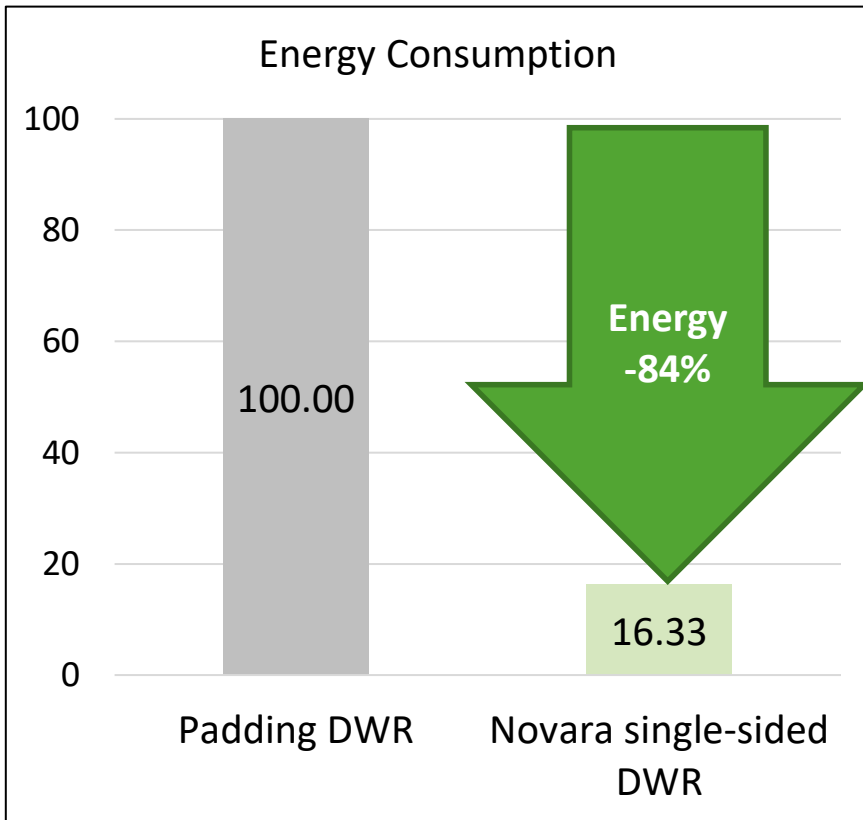


Case study: 2D water repellent patterning



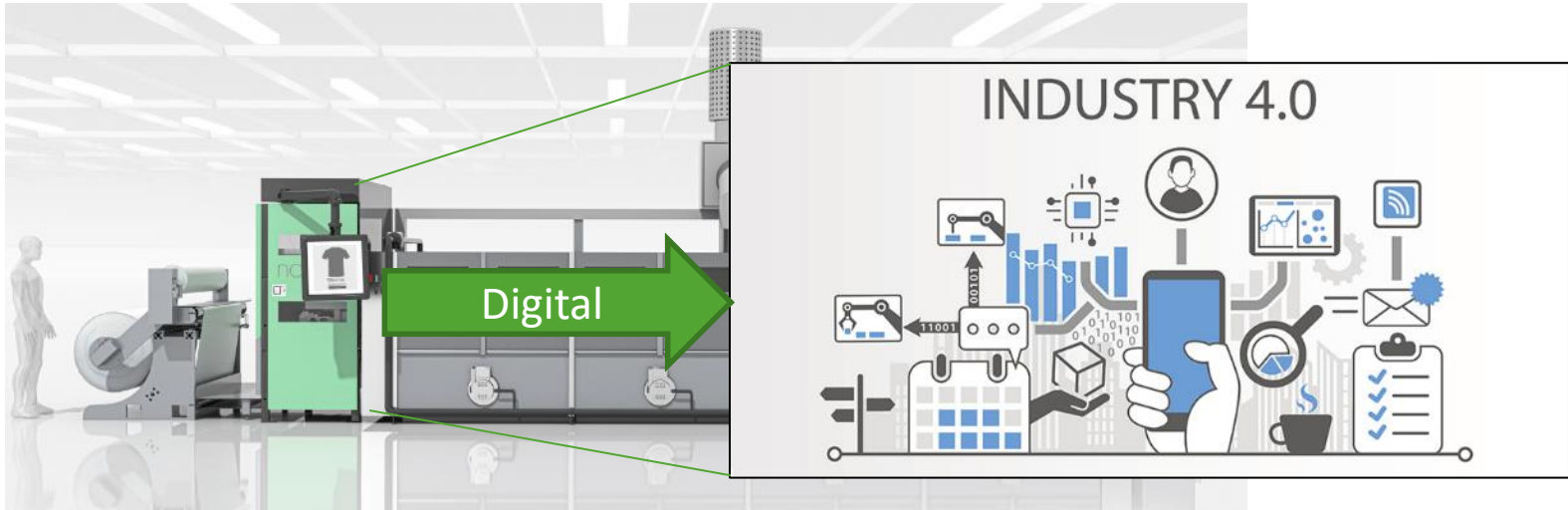
Selective finishing of water repellent coating

Sustainability breakthrough – energy and materials



Case study: Single-sided water and oil repellent finish

Digital on-demand production



- Software-defined 2D patterning textile finishing application under full digital control
 - Instant pattern changes
 - Near-instant chemistry changeovers in < 15 mins
- Finish on-demand:
 - Reduced inventory, make to order, economic short runs
- Ready for integration with enterprise resource planning (ERP) / Industry 4.0 solutions

Product innovation opportunities

- Combine incompatible chemistries on the same substrate:
 - 2D patterns
 - One or two-sided application
- Deliver high-value finishes for technical applications:
 - Medical
 - Outdoor wear
 - Premium sportswear
 - Military
- We have demonstrated:
 - Waterproof (DWR)
 - Stain resistant
 - Fire-retardant (FR)
 - Wicking
 - Anti-viral
 - Advanced: self-cooling, stealth, conducting

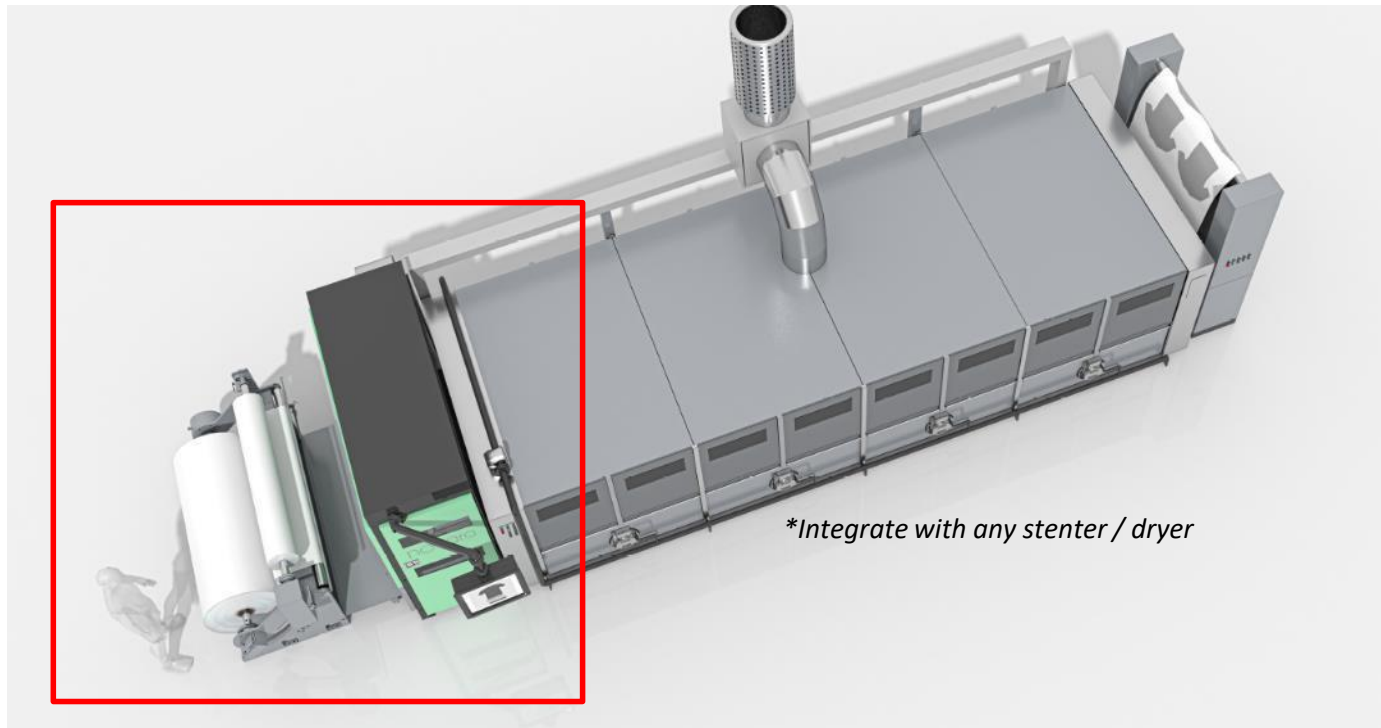


Exceptional return on capital investment

Finish cost per meter (\$)	Estimated annual savings / \$	Capital payback /months
0.25	700,000	12
0.5	1,400,000	6
1	2,800,000	3

- The Novara process delivers significant operational cost savings
- Annual capacity ~ 9 million linear meters / year
- 30% cost saving per meter vs padding based on:
 - 85% energy reduction
 - 25% materials reduction
- Investment per line \$0.5-1M
- Capital payback < 12 months

Production equipment – available for delivery



- Roll-to-roll direct to fabric digital finishing solution*
- Non-contact
- 1.8 m wide
- Digital 2D Patterning
- One or two-sided finish application

About Alchemie

Textile dyeing and finishing processes are some of the most polluting manufacturing processes on the planet and are responsible for over 3% of global CO₂ emissions and over 20% of global water pollution.

To address this urgent issue, we have developed breakthrough digital dyeing and finishing technologies that deliver a dramatic reduction in energy consumption and eliminate contaminated wastewater emissions.

Our mission is to transform the textile industry with clean-tech digital manufacturing solutions that eliminate the environmental impact of these polluting processes.

The key benefits of our digital approach to textile dyeing and finishing are:

- Digital manufacturing agility: designed for e-commerce supply chains
- Reduction of energy consumption by > 85%
- Elimination of wastewater emissions
- Significant cost reductions of > 50%

We are delivering next-generation textile production processes that will be radically more efficient, less costly and more sustainable with our advanced digital manufacturing technologies.



APPENDIX

Endeavour and Novara Process Data

PANTONE®
15-5519 TCX
Turquoise

PANTONE®
15-5519 TCX
Turquoise

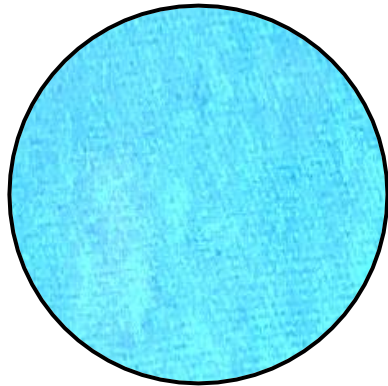
PANTONE®
15-5519 TCX
Turquoise

PANTONE®
15-5519 TCX
Turquoise

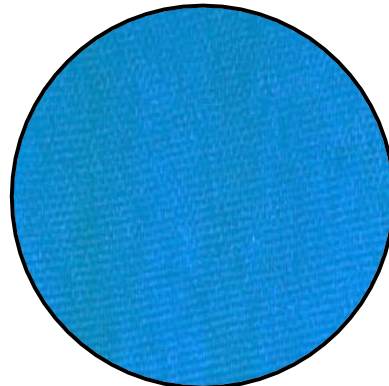
COLOURHIT™
COLOUR MATCHING



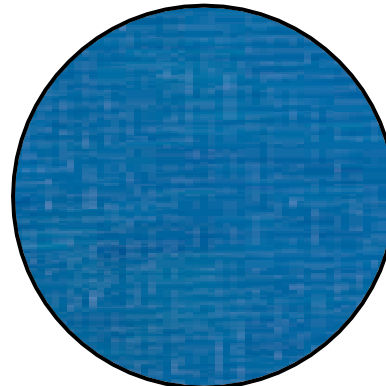
Digital shade control



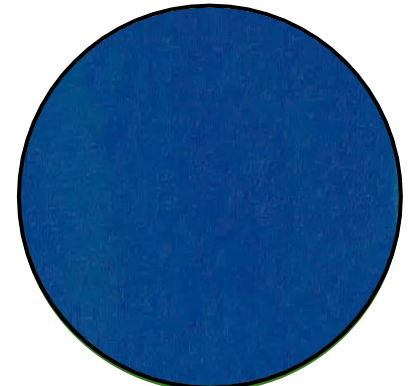
0.375%



0.75%



1.5%



3.0%

- We can control the colour shade using our digital application technology
- This enables precise shade matching with no trial runs – colours can be accurately dialled into the process based on process intelligence

ColourHit™ colour matching method



Input target colour
sample or Pantone®



Select approved
Endeavour liquid dye



Laboratory ColourHit™
samples – shade
variation



Measure and compare
samples to target
colour



Store colour match in
ColorHit™ database

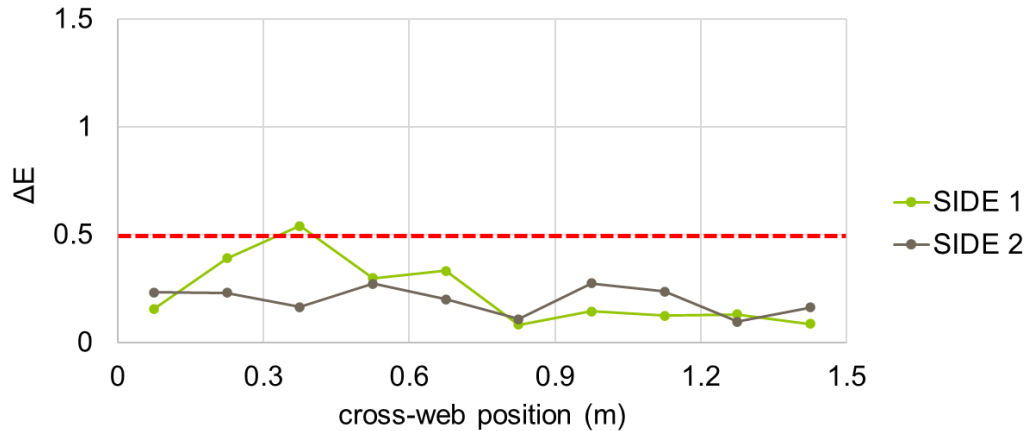


Endeavour™ settings
generated by
ColourHit™ database

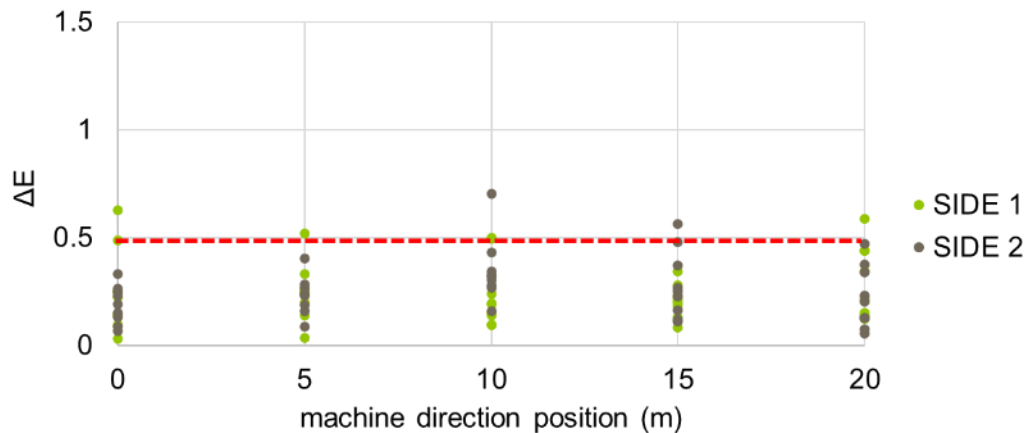


Excellent colour consistency

Cross-web direction colour consistency (ΔE)

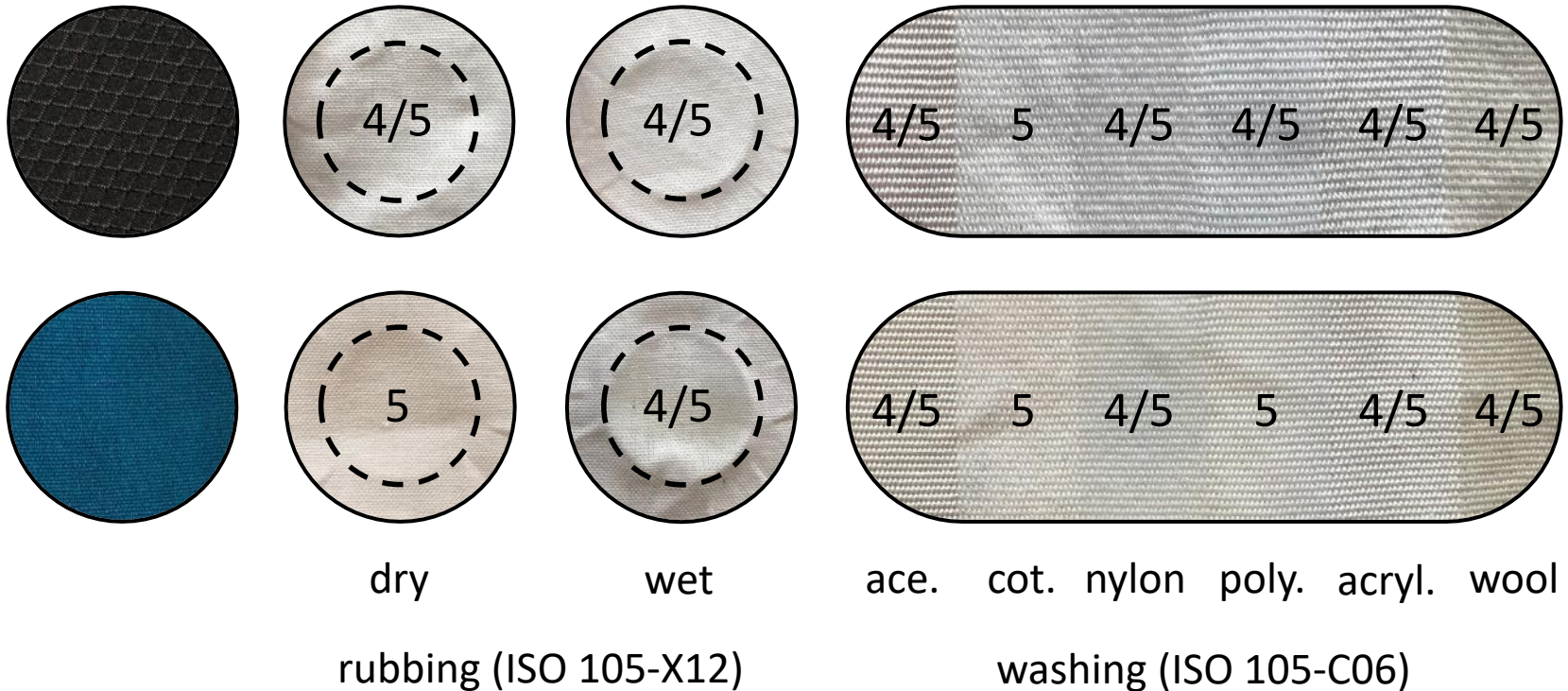


Machine direction colour consistency (ΔE)



ΔE (CIE76) <0.5

Excellent colourfastness without washing



- Wash and rub fastness > 4/5

Woven, non-woven and knitted polyesters



woven

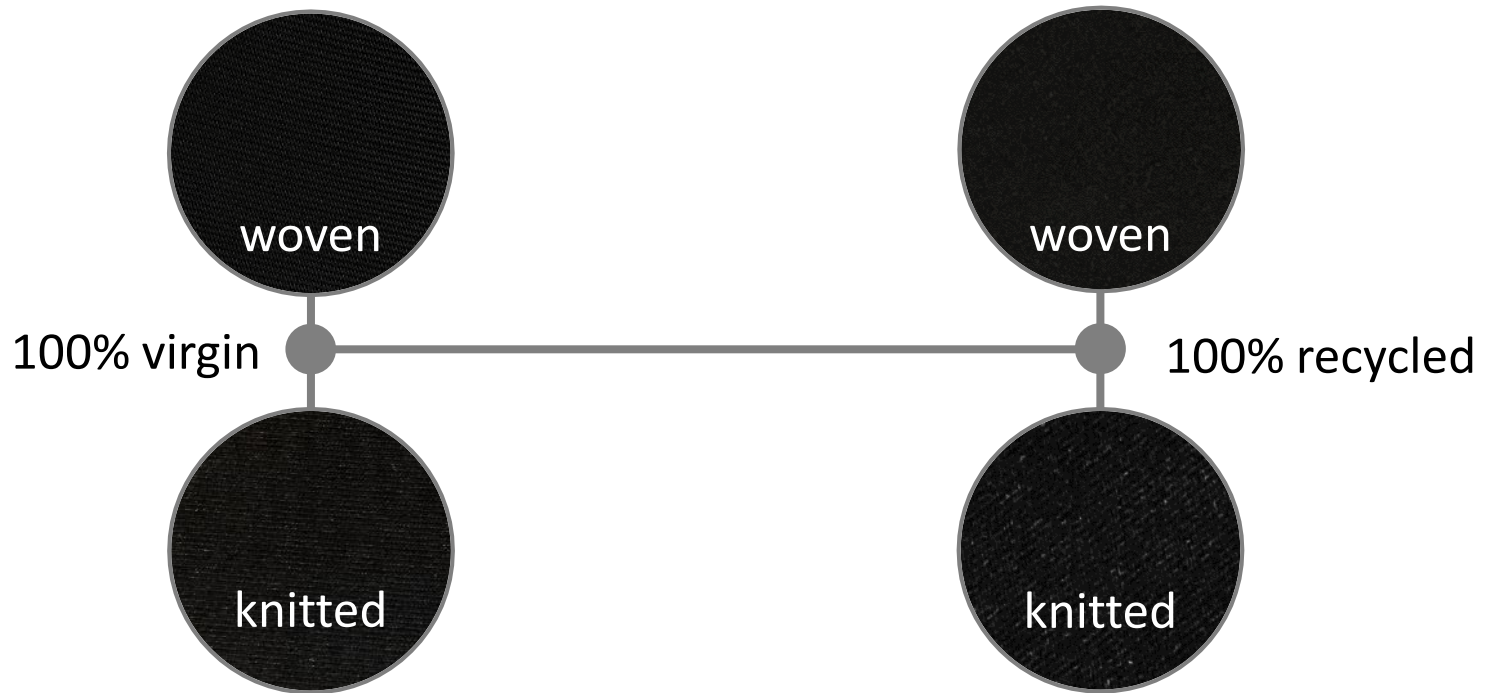


non-woven



knitted

Excellent performance with recycled polyester

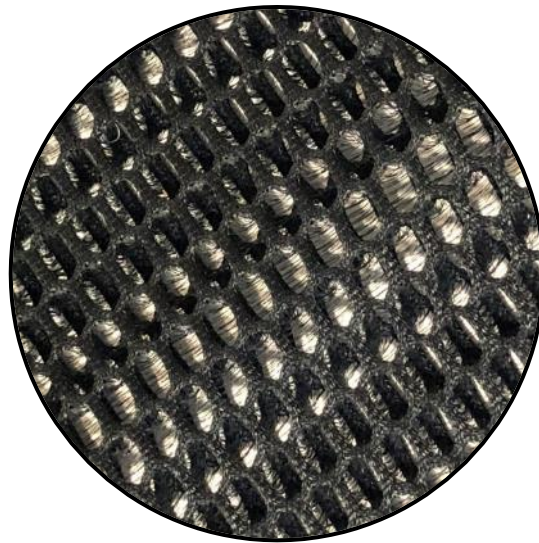


- Demonstrated technical equivalence recycled vs virgin polyester

Successfully dyed 4 mm spacer fabrics and tapes



3 mm spacer



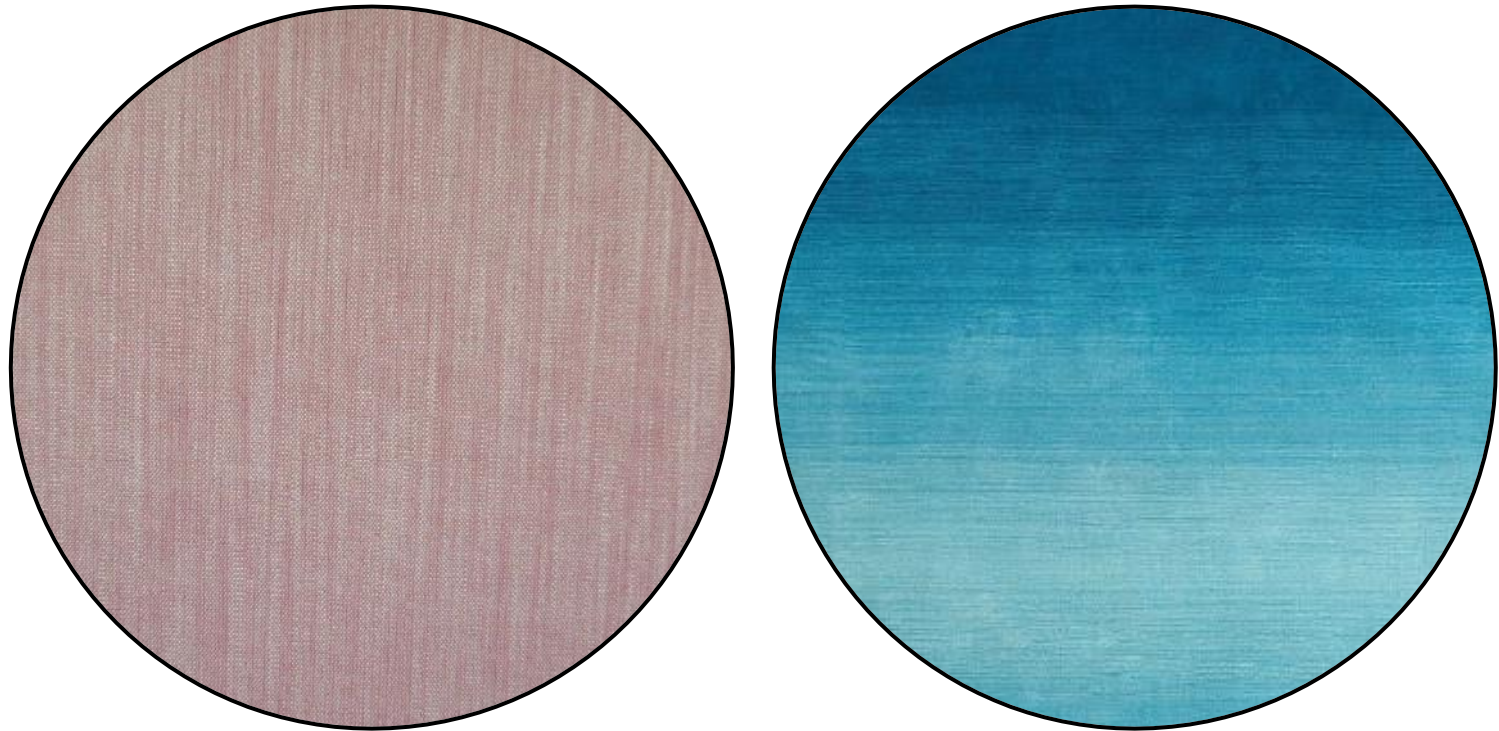
4 mm spacer



tapes

- Endeavour demonstrated on spacer fabrics up to 4 mm thickness
- Narrow-web tapes dyed successfully with widths as low as 15 mm

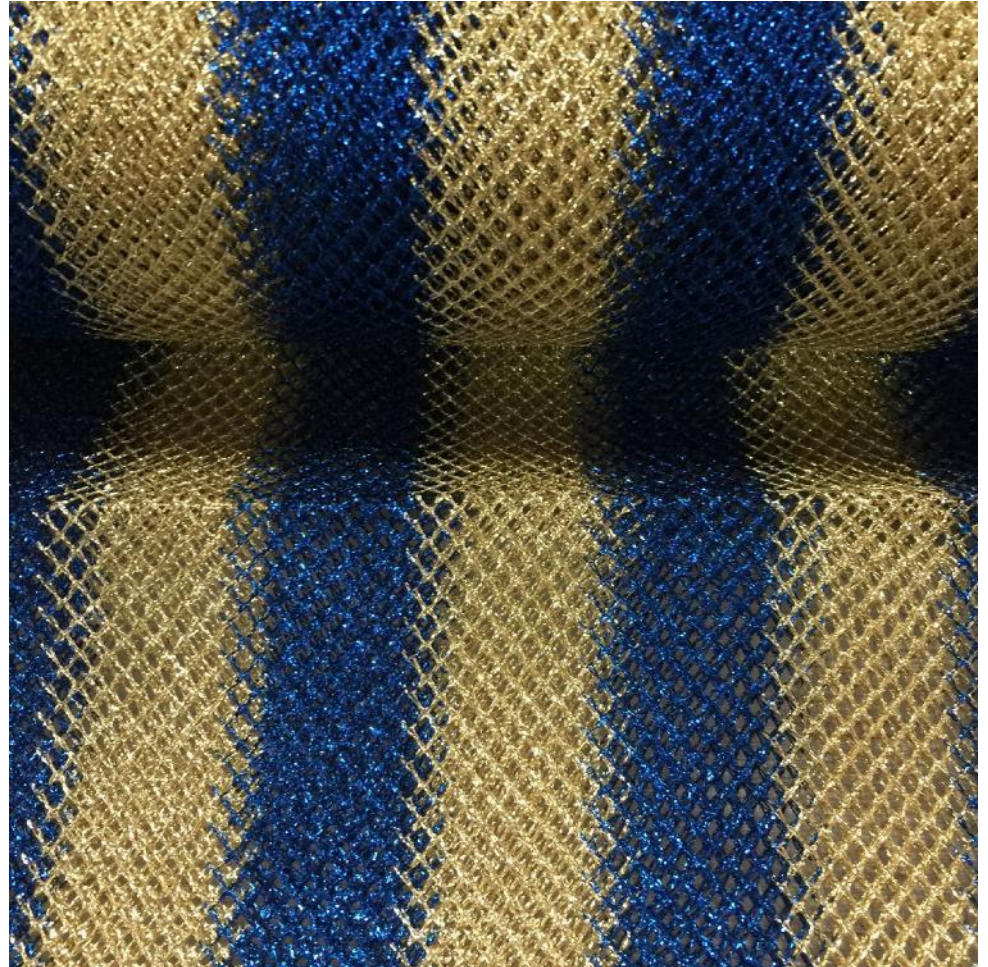
New visual effects



- We can deliver unique dye patterning and visual effects

Metallics

- Two-colour metallic effect stripes



Surface finishes

- We can deposit surface finishes:
 - Gloss
 - Matt
 - Satin



Single-sided water and oil repellent



material	polyester
basis weight	208 gsm
fabric code	ALC-05-003
front coating	Rucostar EEE6
rear coating	-
total coat weight	10 gsm dry add-on
sample ref.	TB01-042

Single-sided wear resistance



material	polyester
basis weight	208 gsm
fabric code	ALC-05-003
front coating	Dicrylan 7836
rear coating	-
total coat weight	10 gsm dry add-on
sample ref.	TB01-042

Single-sided flame retardance



material	polyester
basis weight	208 gsm
fabric code	ALC-05-003
front coating	-
rear coating	Flovan CGN
total coat weight	10 gsm dry add-on
sample ref.	TB01-042

Multi-functional two-sided coating



material	polyester
basis weight	208 gsm
fabric code	ALC-05-003
front coating	Rucostar EEE6 – DWR Dicrylan 7836 - Wear
rear coating	Flovan CGN – Fire retardant
total coat weight	30 gsm dry add-on
sample ref.	TB01-042

Antiviral: HeiQ Viroblock

Effect / Property	Testing standard	Test parameter	Test result
Domestic laundering	ISO 6330:2013	4G: 40°C, gentle setting (wool silk synthetics)	Excellent >99.9% after 15X washes
Quantitative antibacterial test (hydrophilic fabrics)	ISO 20743:2013		Excellent >99.9%



- Excellent results, no adjustment on recipe or application were needed, showing very good antimicrobial activity beyond 15 x 40°C washes (99.97%).
- Higher performance vs pad coating based on efficacy data
- We offer toll coating services using Novara:
<https://www.alchemietechnology.com/Viroblock/>