



ALTA 2024

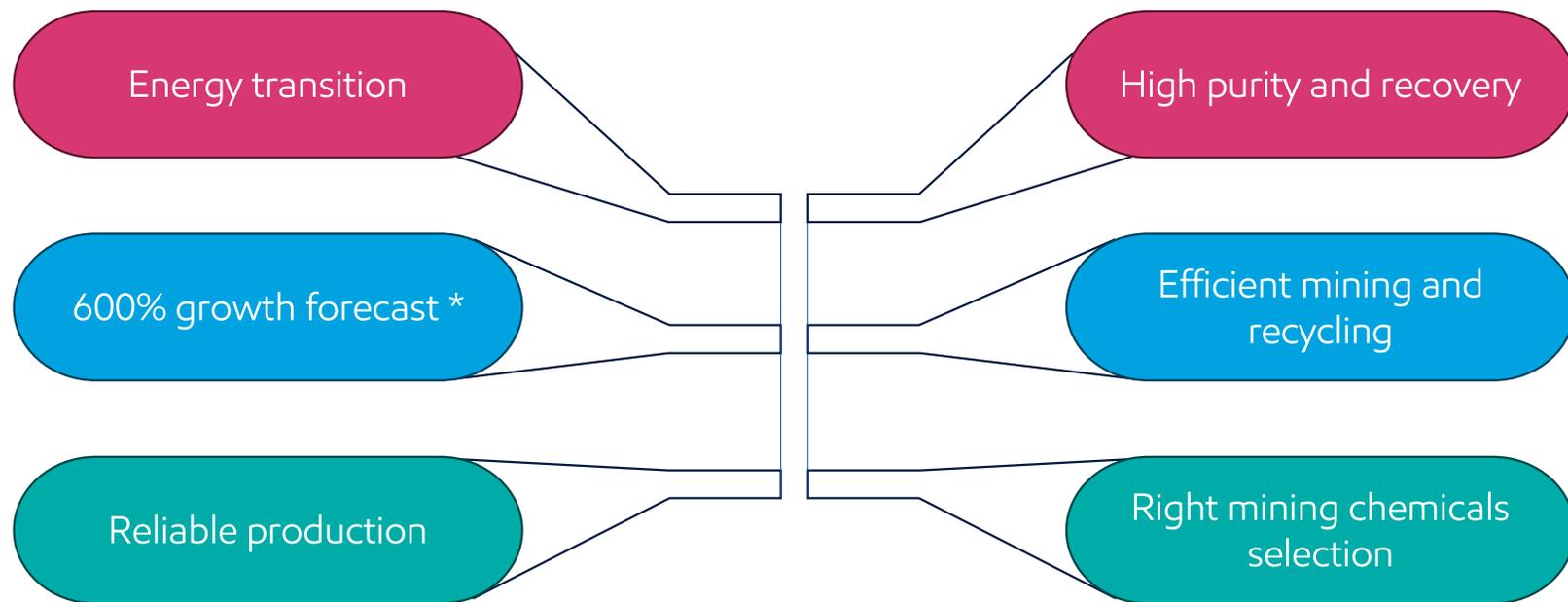
Diluent Selection and Its Impact on Performance

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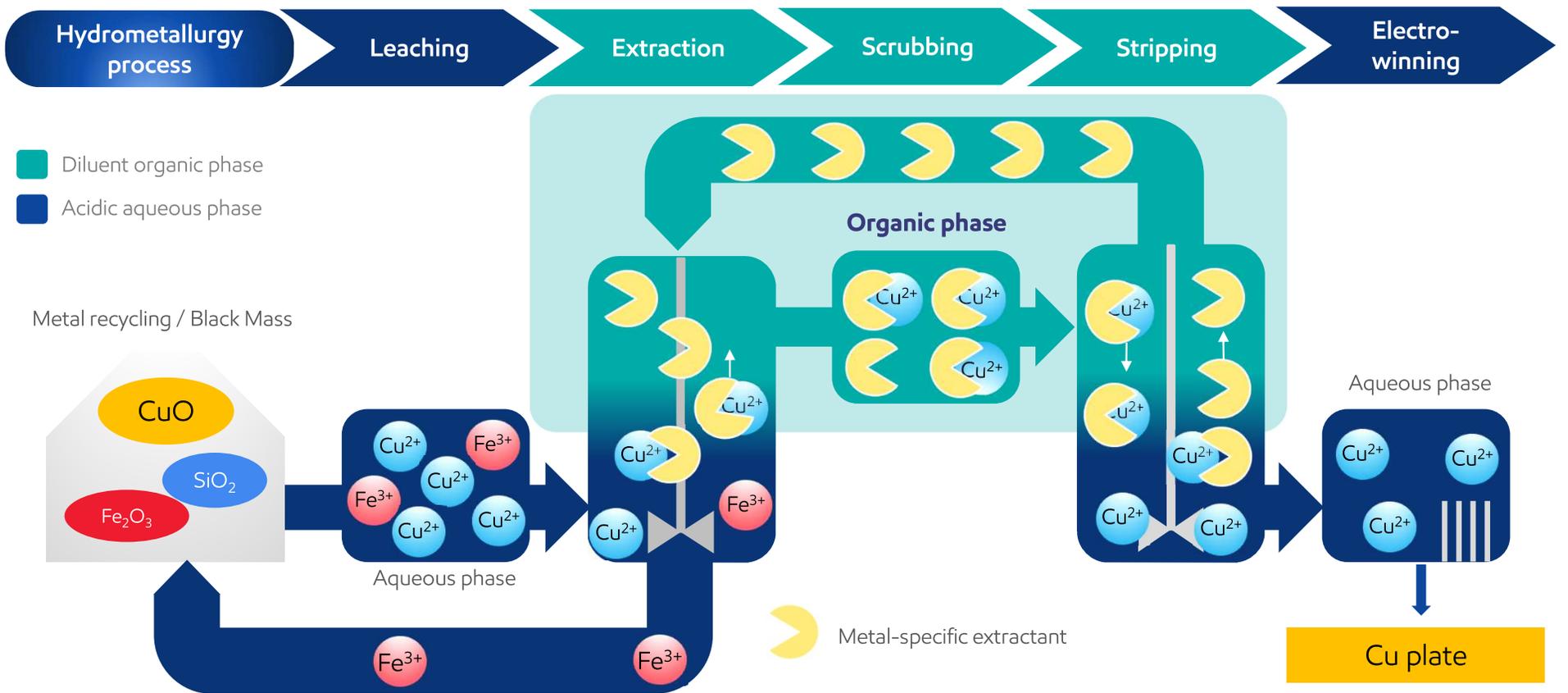
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Industry Challenges and Potential Solutions

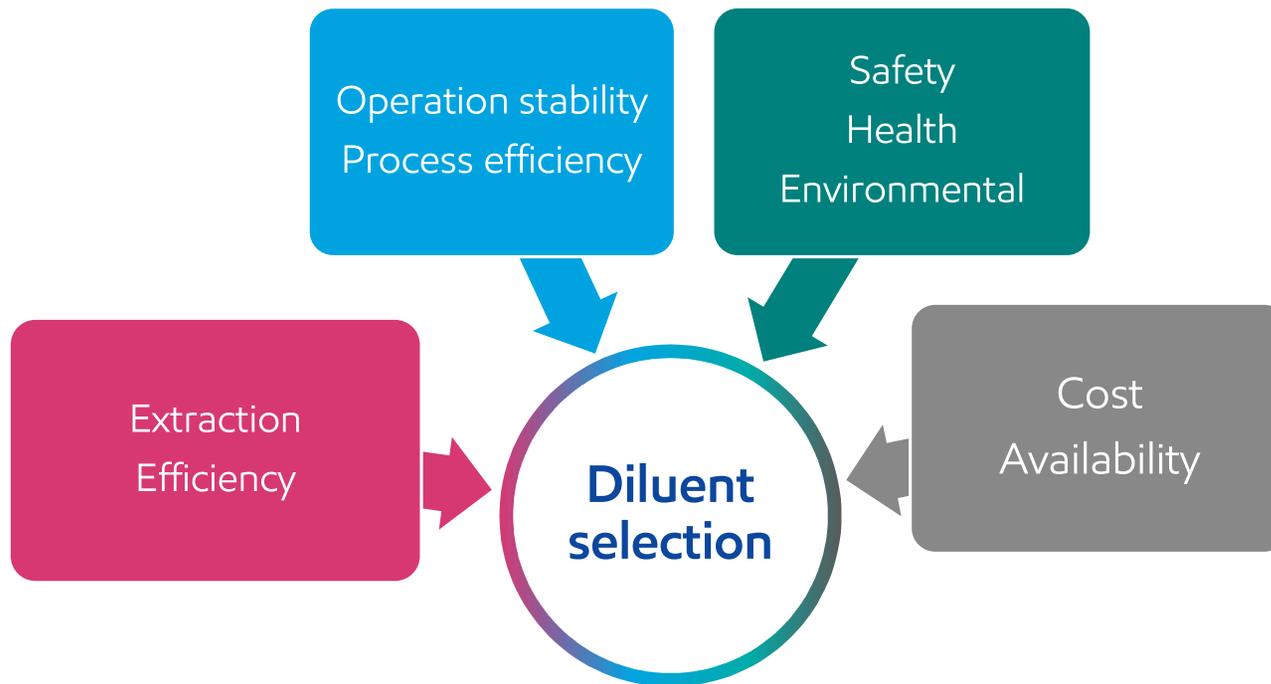


*By 2040, compared to 2020
Source: IEA (Link: <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary>)

Technology Reconnect



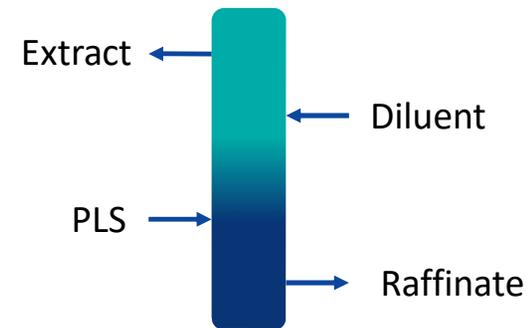
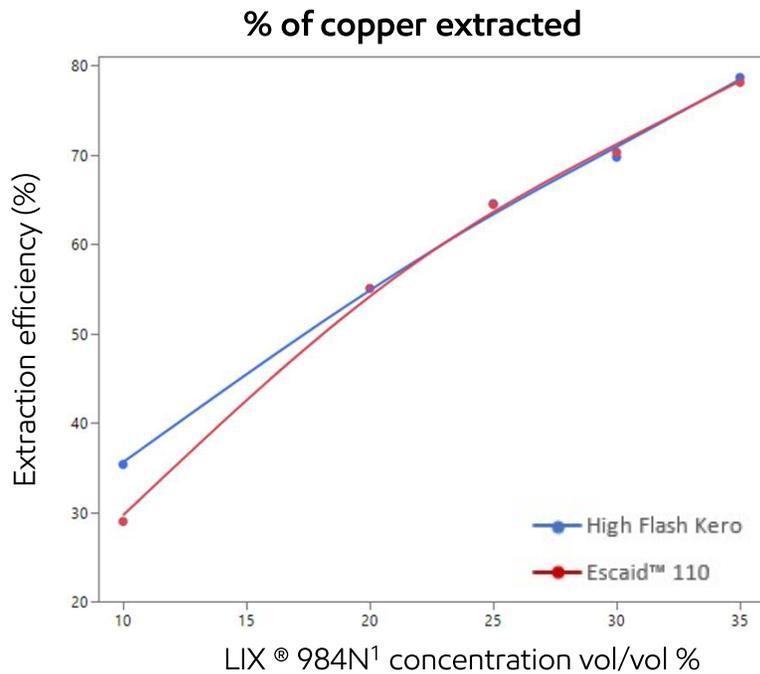
Diluent Selection Considerations



Diluent selection comprises of balancing the effects to reach an **optimum compromise**.

Extraction Efficiency

Efficiency



Lab scale extraction performed with copper nitrate solution.
pH compensated with sulfuric acid.

Pregnant leach solution (PLS) :
[Cu] 15.2 g/l – pH: 2.11

Equivalent extraction efficiency on 1 stage for aromatized & dearomatized diluent

¹LIX® is a brand of an extractant produced by BASF

Data generated by or on behalf of ExxonMobil.

Diluent Losses

Cost

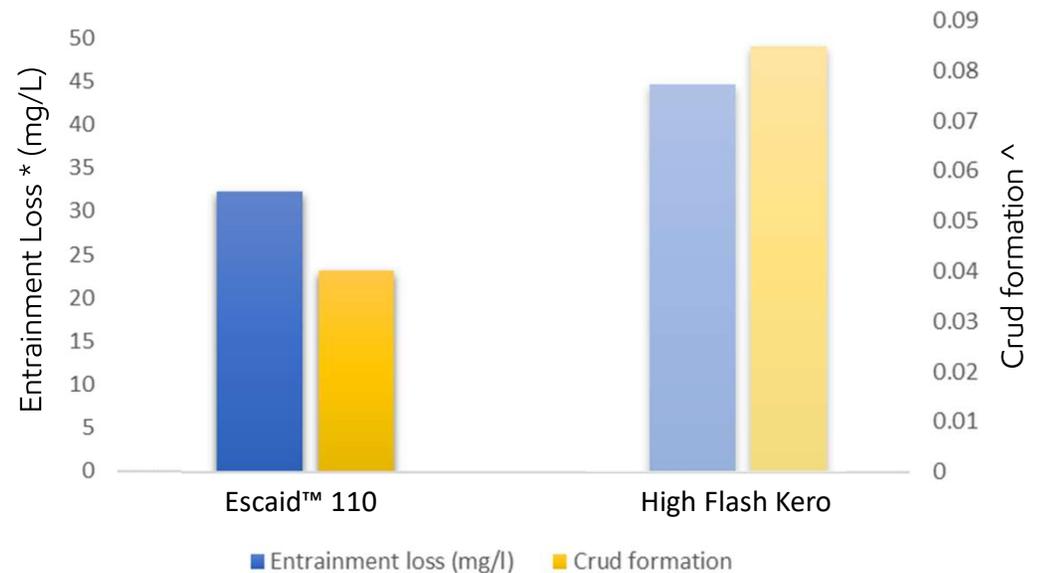
Process

- Escaid™ 110 fluid shows **lower entrainment losses** and **lower crud formation** vs. high flash kerosene



Lower diluent / extractant consumption

Potential for lower operating cost



* Entrainment loss refers to trace organic fluid (15% LIX 984 N PLS 5 with pH=1.83) in aqueous phase measured via molecular absorption spectrophotometry following contact with the organic phase (O/A=1) and subsequent extraction with cyclohexane

^ Crud formation refers to ratio of total volume sludge / total volume organic

Lower diluent losses when comparing Escaid™ 110 fluid against high flash kerosene

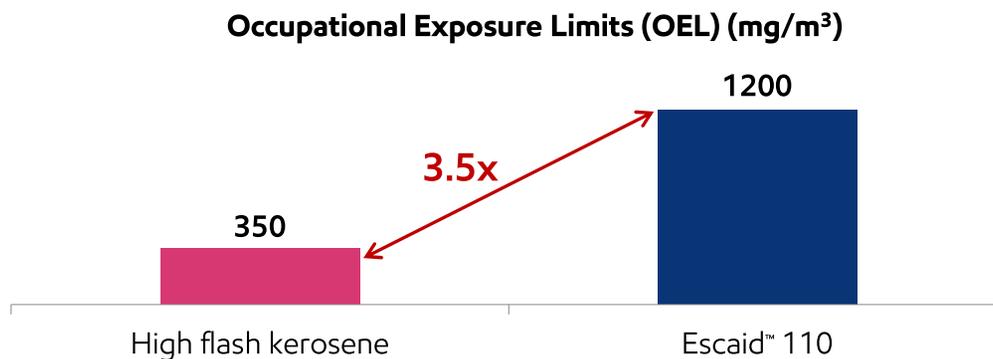
Data generated by or on behalf of ExxonMobil.

Potential for lower health and environment risk

SHE

Property	Escaid™ 110 fluid (typical)	High flash kerosene (typical)
Aromatics (wt%) [UV/GC]	0.001	23
GHS hazard categories (environment)	-	Aquatic Chronic 3
Aquatic toxicity - Rainbow Trout	LL ₀ > 1000 mg/l	LL ₅₀ = 41.4 mg/l

Source: Data from tests performed by or on behalf of ExxonMobil. All data are typical. Typical values may vary over time



Potential benefits:

Not classified for environment (GHS)

- No aquatic toxicity classification
- Readily biodegradable (OECD 301F)

Lower risk of workers' overexposure

- Escaid™ 110 fluid has a higher OEL compared to high flash kerosene
- Lower health hazard (inhalation)
- Greater margin for safe use

Regional presence, global reach

Availability

Harmonized and globally available products enable rapid scale up and consistency of quality across regions.



Battery Recycling Opportunity

2 Million

Ton by 2030*

Global Annual Li-ion Batteries Available for Recycling

+90%
Recovery

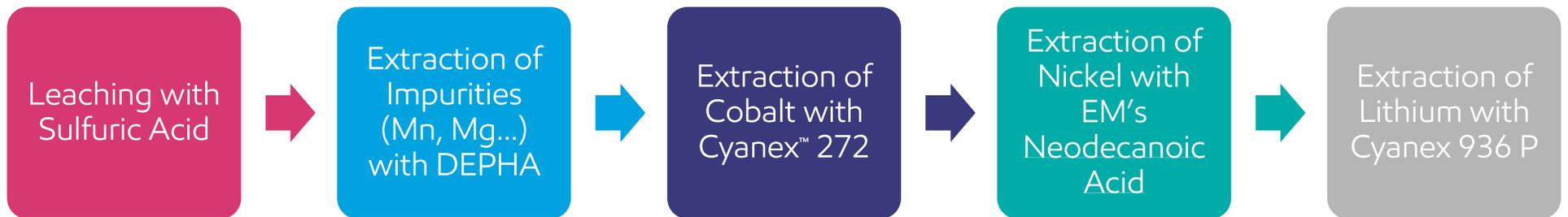
+95%
Purity

Enabled by Hydrometallurgy
and Solvent Extraction[^] (SX)

*Source: BNEF- Lithium-Ion Battery Recycling.

[^]Source: Chagnesa A, Pospiech B, A brief review on hydrometallurgical technologies for recycling spent lithium-ion batteries. Journal of Chemical Technology and Biotechnology. 88: 1191-1199 (2013)

Flowsheet Example



Escaid™ 110 fluids can be a suitable diluent for all solvent extraction steps.

Escaid™ fluids

A product range to match various process requirements while delivering advantages over traditional kerosene alternatives.

Key properties <small>Methods</small>	Escaid™ 110 fluid	Escaid™ 115 S fluid	Escaid™ 120 fluid
Distillation range (°C) <small>ASTM D86</small>	207-240	222-241	235-265
Aromatics content (%wt) <small>UV Test Method</small>	<0.01	<0.05	<0.1
Viscosity at 25°C (cSt) <small>ASTM D445</small>	2.09	2.41	3.16
Flash point (°C) <small>ASTM D93</small>	82	93	103
Density at 15°C (kg/dm ³) <small>ISO 12185</small>	0.795	0.796	0.822
Occupational exposure limit (mg/m ³) <small>ExxonMobil data</small>	1200	1200	1200

Source: Data from tests performed by or on behalf of ExxonMobil. All data are typical. Typical values may vary over time.

Escaid™ fluids in summary

Escaid™ fluids are **high performance extraction diluents** that can provide value in solvent extraction (SX) and also battery recycling:

The wide portfolio of ExxonMobil solvents can support innovation and process development in the field of solvent extraction.

Escaid™ fluids are globally available to ensure worldwide support.



Interested in learning more?

Access the deck via the QR code



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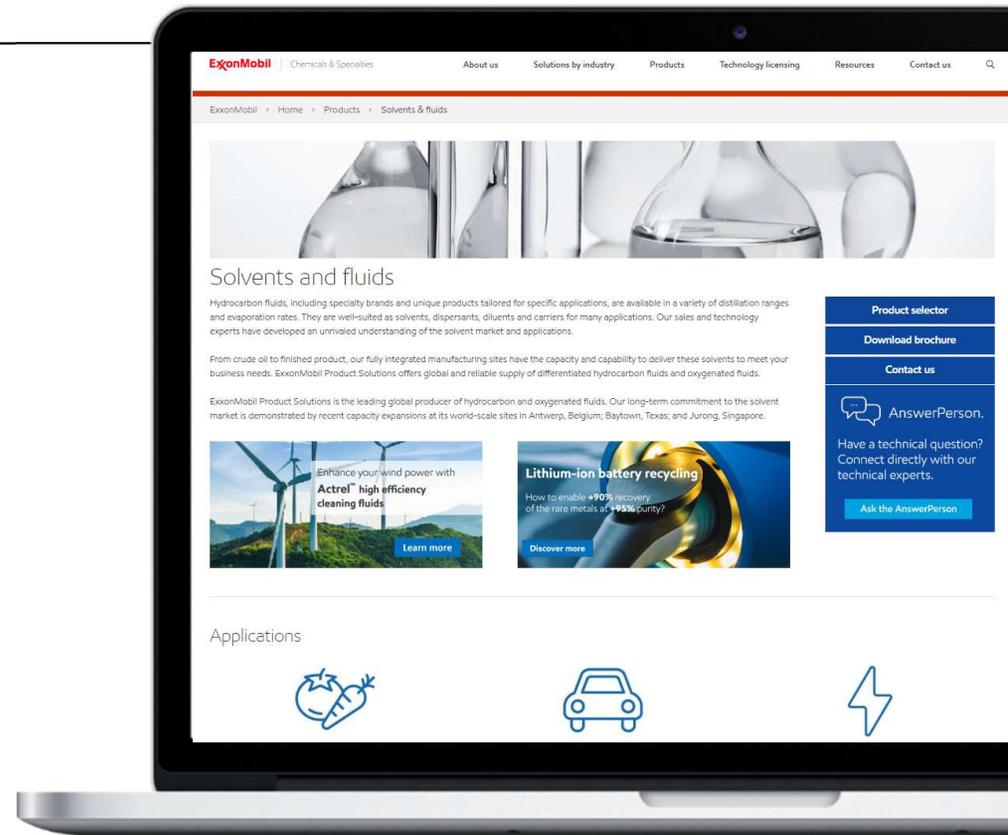
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