



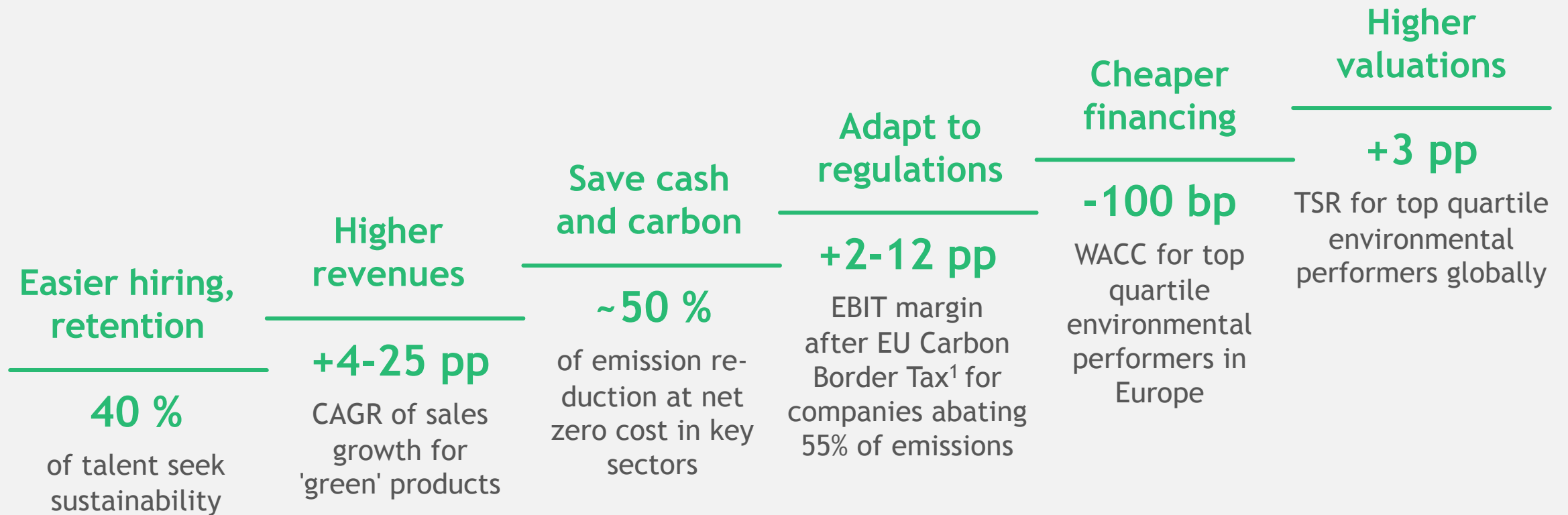
ESG: AN IMPERATIVE AND AN ADVANTAGE

BCG

\$100 - \$150 Trillion in
spending over the next 30
years to achieve Net Zero

*The biggest economic
transition in our lifetimes*

The world has shifted in the last five years: ESG leaders can now gain competitive advantage

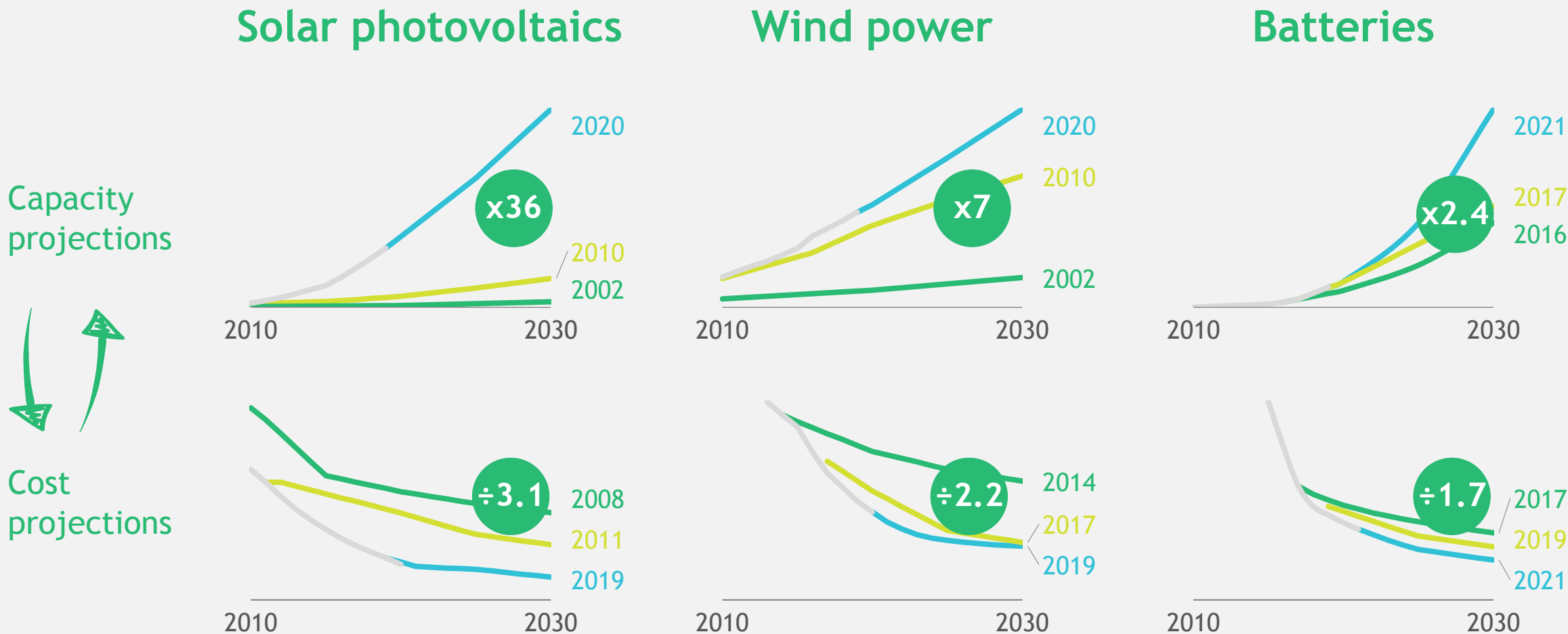


1. Based on a €75/tCO₂ carbon price assumption for 2030
Source: EU announcements; BCG analysis

Full decarbonization has low impact on end prices

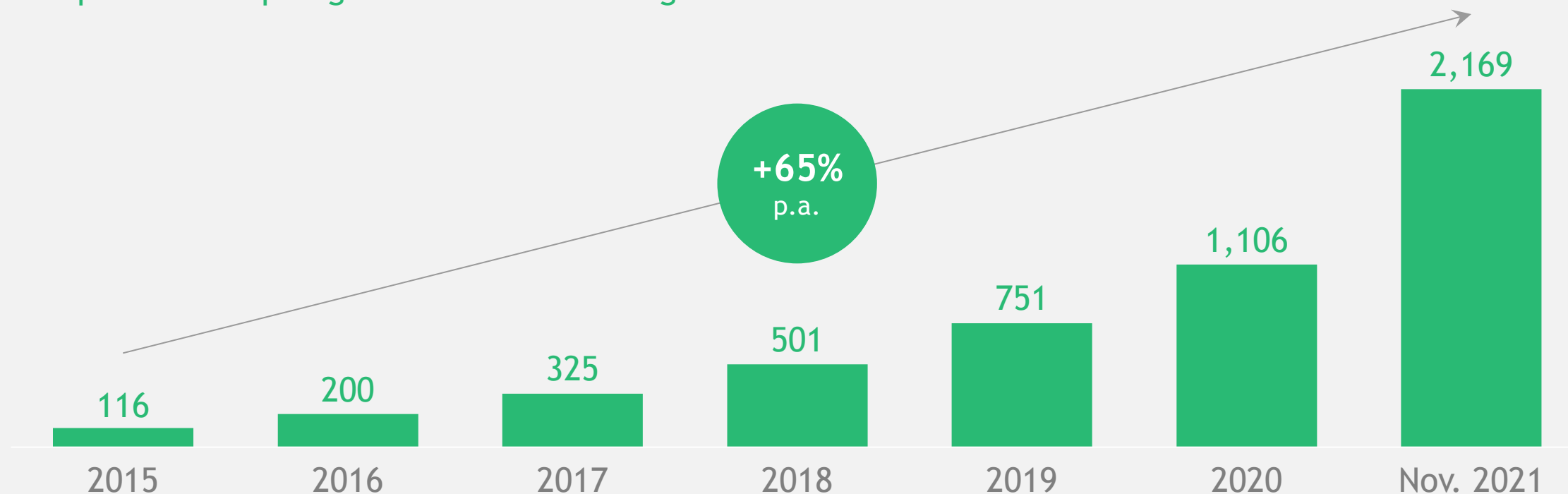


We underestimate the pace of progress



Corporate commitments are growing rapidly

Companies with pledged science-based targets¹



Note: ~\$24T revenues (~30% global GDP) covered with science-based targets

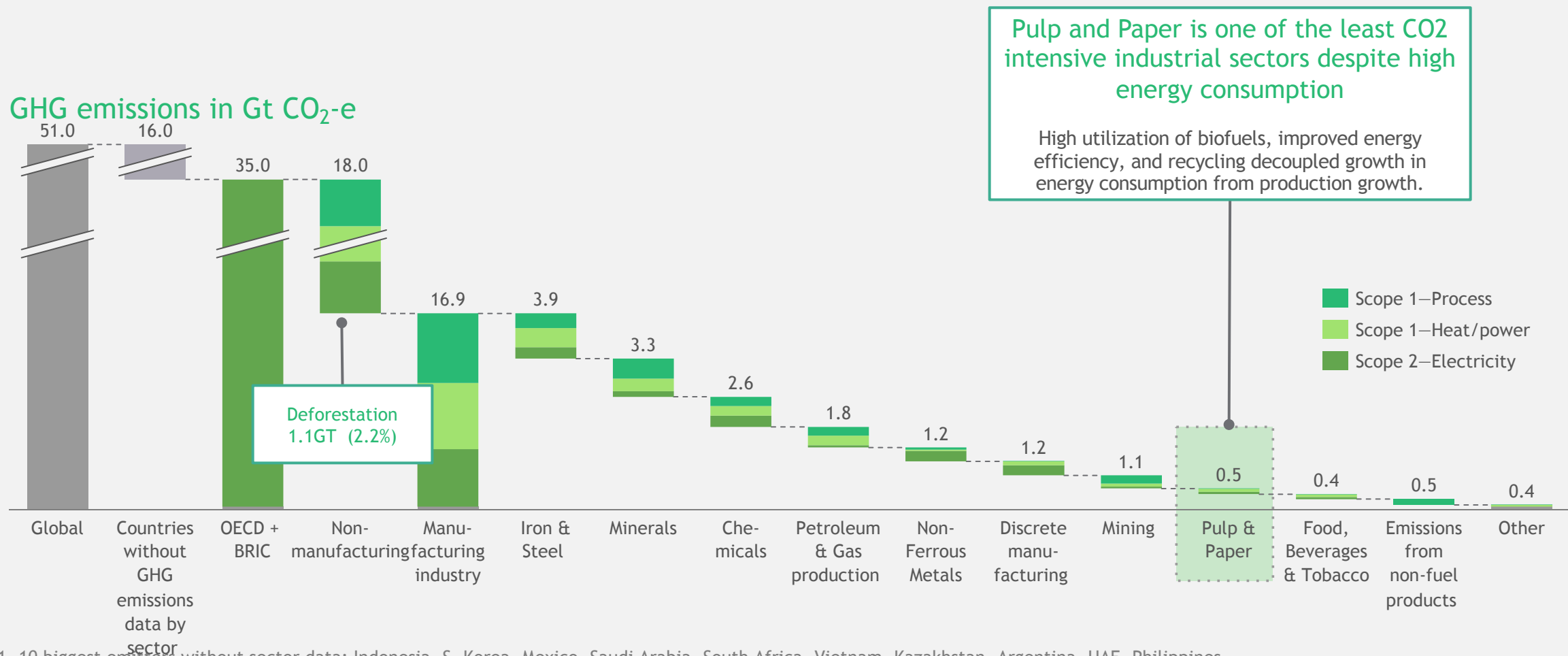
1. Data as of 19 November 2021; cumulative view, includes companies committed and with targets set.

Source: Net Zero Tracker; Science-Based-Targets initiative (SBTi)

BCG's ESG business transformation approach...



FPPP industry accounts for ~3% global GHG emission

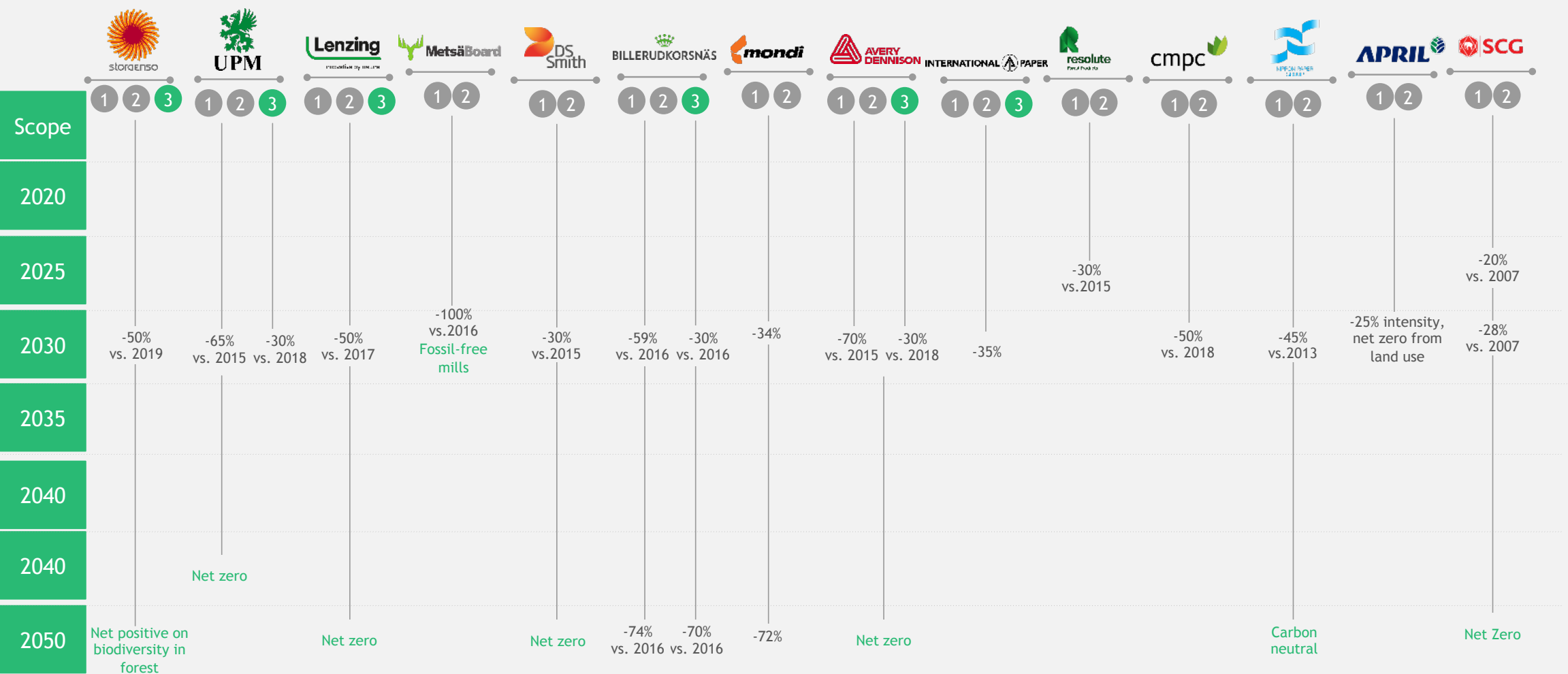


1. 10 biggest emitters without sector data: Indonesia, S. Korea, Mexico, Saudi Arabia, South Africa, Vietnam, Kazakhstan, Argentina, UAE, Philippines

2. Excl. Mexico and South Korea 3. Includes manufacturing of machinery

Source: UNFCCC data on GHG emissions 2017; IEA report 2019: CO₂ Emissions from fuel combustion; Climate Watch, the World Resources Institute (2020) BCG Analysis

FPPP companies increasingly committing to net zero



Source: Company website, company reports



MAKE THE CORE SUSTAINABLE

Scope 1 & 2

Key elements

Emissions inventory and baseline scenario analysis

Ambition level and target setting incl. alignment

Technology scouting, cost & feasibility assessment of measures

Program management, technical implementation, and communication strategy

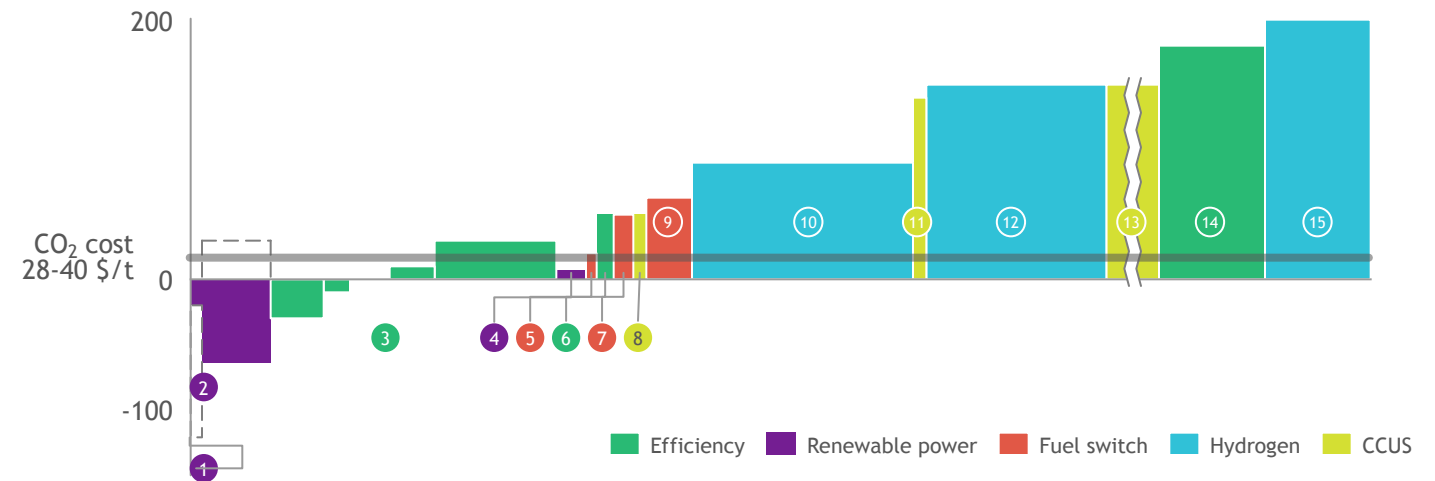
Outcomes

Optimal emissions abatement path, incl. time plan, CAPEX/OPEX, partnership and innovation strategy

Basis for public reporting and disclosure

Abatement curve helps to ID most cost-efficient and feasible path

Exemplary abatement costs for individual factory (\$/t CO₂e)



Potential measures

- | | | | | | | |
|----------|---|---|----|---|----|--|
| Scope II | 1 | Renewable power: On-site solar PV for share of power consumption | 6 | Efficiency: Progressive crude distillation | 11 | CCUS: Carbon recycling for use in methanol production |
| | 2 | Renewable power: Green power PPAs for share of power consumption | 7 | Fuel switch: Power-to-heat for share of process steam/heat | 12 | Hydrogen prod.: Blue H ₂ (flue)—captured from flue gas (CCS) |
| | 3 | Efficiency: Levers identified by client (shown here illustratively) | 8 | CCUS: Carbon recycling for use in building material aggregates | 13 | CCUS: Carbon-capture-and storage/recycling for remaining emissions |
| | 4 | Renewable power: Certified green power | 9 | Fuel switch: Solid biomass for share of process steam/heat | 14 | Efficiency: Other initiatives |
| | 5 | Efficiency: CO ₂ -optimization of supply chain | 10 | Hydrogen prod.: Blue H ₂ (tail)—captured CO ₂ from tail gas (CCS) | 15 | Hydrogen production: Green H ₂ —electrolysis-based production |



MAKE THE CORE SUSTAINABLE

Scope 3

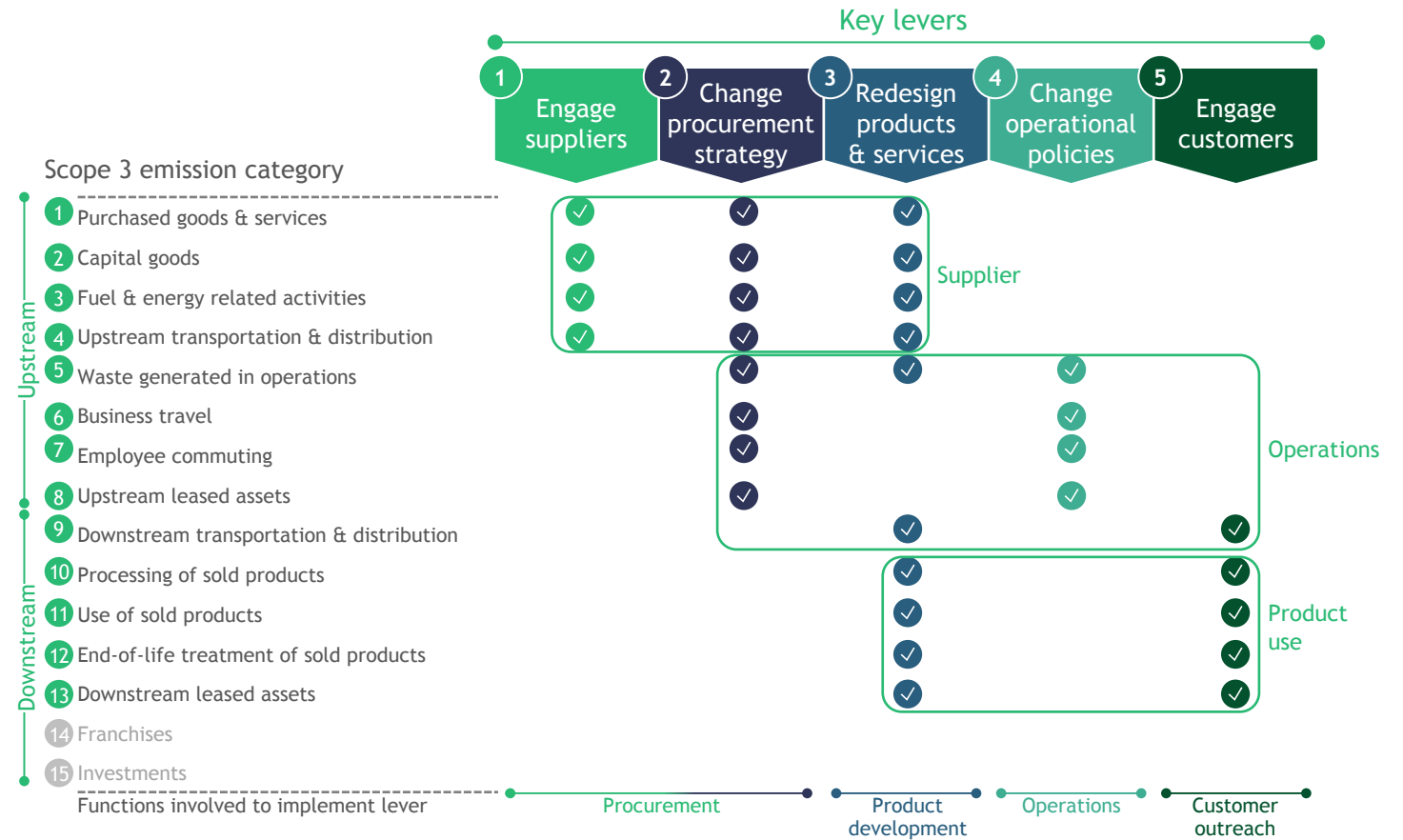
Key elements

Value chain emission inventory and baseline
 Identification of value chain CO₂ reduction potential
 (suppliers, product design, customer engagement,...)
 Scope 3 abatement cost curve and matrix
 Supply chain engagement initiatives and steering model

Outcomes

Transparency on value chain/scope 3 emissions
 Abatement cost curve of CO₂ reduction potentials
 Program design to address value chain emissions

Scope 3 emissions reduction measures



Source: GHG protocol; Science Based Targets; BCG Analysis

New Revenue: Forestation attractive and cost-effective compared to other nature-based offsetting levers

	Maturity	Cost	Quality			
	Tech. maturity/ 2020 prevalence	Breakeven cost per t _{CO2} utilization ¹	Perman- ence	Harm- lessness	Indepen- dence	Addition- ality
 Reforestation & afforestation (forest)		\$10 - 40				
 Soil sequestration (soil)		\$20 - 90				
 Bioenergy with carbon capture and storage (BECCS)		\$60 - 160				
 Direct air carbon capture with storage (DACCS)		\$30 - 100 ²				
 Enhanced Weathering (EW)		<\$200				
 Ocean fertilization		Not calculated				

 High
  Low

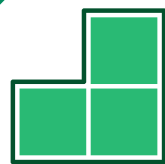
1. The breakeven cost in 2015 US\$ per tonne of CO₂ adjusted for revenues, by-products, and any CO₂ credits or fees. A breakeven cost of zero represents the point at which the pathway is economically viable without governmental CO₂ pricing. 2. Currently there is huge uncertainty on DACCS economics, with estimates in the literature ranging from 100 to 1000 \$/tCO₂, according to the different designs proposed and the purity level of the captured CO₂/year. Source: Hepburn et al. The technological and economic prospects for CO₂ utilization and removal. Nature 575, 87-97 (7 Nov 2019); Fuss et al. Negative emissions - Part 2: Cost, potentials, and side effects. Environmental Research Letters, Volume 13, Number 6 (22 May 2018); Keith et al. A Process for Capturing CO₂ from the Atmosphere. Joule Volume 2, Issue 8, 1573-1594 (15 August 2018); Realmonde et al. An inter-model assessment of the role of direct air capture in deep mitigation pathways. Nat Commun 10, 3277 (22 July 2019); Expert interviews; BCG Analysis

indigo



Indigo's Terraton:

A global effort to remove 1 trillion tons of carbon dioxide from the atmosphere and use it to enrich our agricultural soils



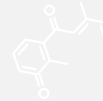
Build the most economical, scalable and immediate mechanism for carbon sequestration harnessing the collective action of farmers globally



Create a powerful consumer-led movement of influential brands through the Climate Positive Certification



Transform the lives of farmers and their communities by compensating them fairly for regenerative practices



Stora Enso | "We are the renewable materials company"

Stora Enso betting on 4 product lines with many potential uses



Biocomposites
Wood-fibre biocomposite that can replace plastic



Bio-based chemicals
Such as crude tall oil, turpentine and xylose sugars.



Bio-based materials
Renewable and biodegradable materials, such as MFC



Lignin
Refined lignin can replace petro-based phenols

Increase focus on lignin innovation for various application



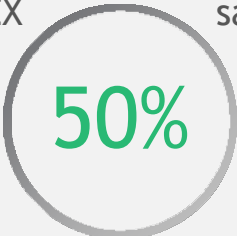
Lignode for batteries
Lignin-based carbon for battery in electronics, automotive, and energy storage systems



Estimated CAPEX



Estimated sales



EBITDA margin

Apart from Lignode, several development for lignin are done in parallel



NeoLigno®
Bio-based, renewable binder made from lignin with promising initial tests



NeoFiber®
a renewable carbon fiber made from cellulose and lignin, used in numerous composite applications.

Stora Enso is working with Cordenka, on developing cellulose-lignin precursors for larger scale carbon fiber production.

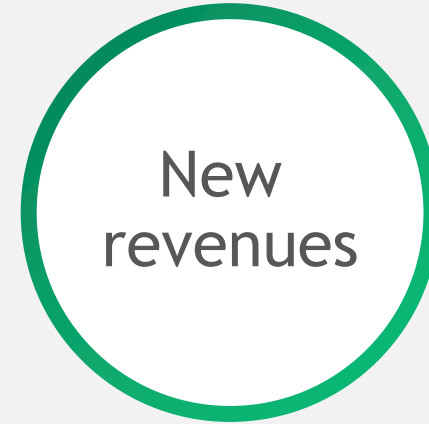
Source: Annual reports; Company websites; Press search; BCG analysis

Opportunities in forestry, building products & packaging



Reduce cost &
carbon together

Scope 3 measurement /
management



Carbon credits/ certification
(quality story)

Sustainable packaging,
building products

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