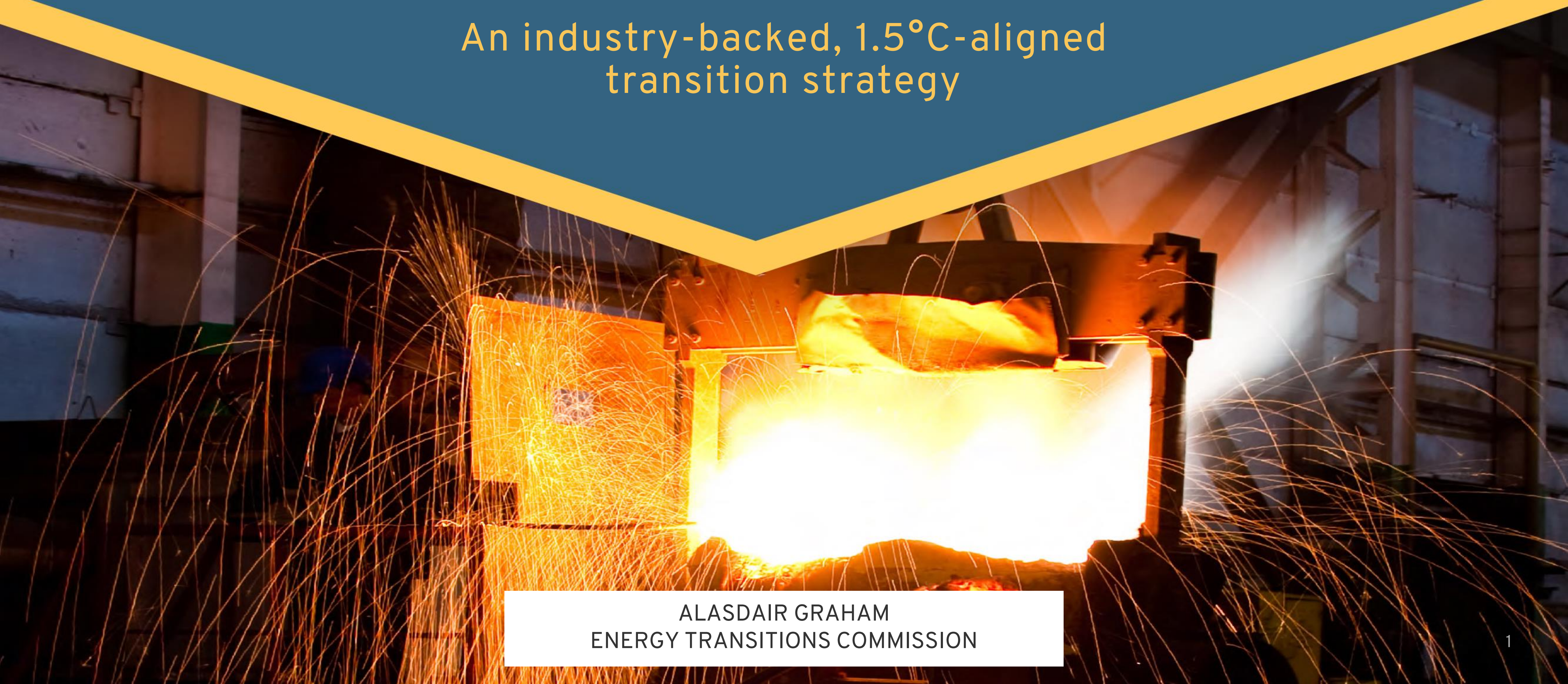
MAKING NET-ZERO STEEL POSSIBLE

An industry-backed, 1.5°C-aligned transition strategy



ALASDAIR GRAHAM
ENERGY TRANSITIONS COMMISSION

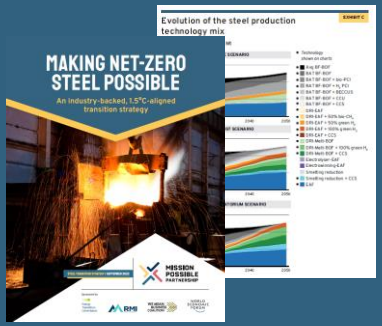
THE STEEL SECTOR TRANSITION STRATEGY AND ITS OBJECTIVES

WHAT THE SECTOR TRANSITION STRATEGY DOES...

1. Define an open, industry-backed, ambitious net-zero pathway

2. Define what needs to happen over time to achieve that trajectory

3. Secure commitments to action in the 2020s from critical stakeholders in the value chain



...HOW THIS CONTRIBUTES TO OTHER EFFORTS

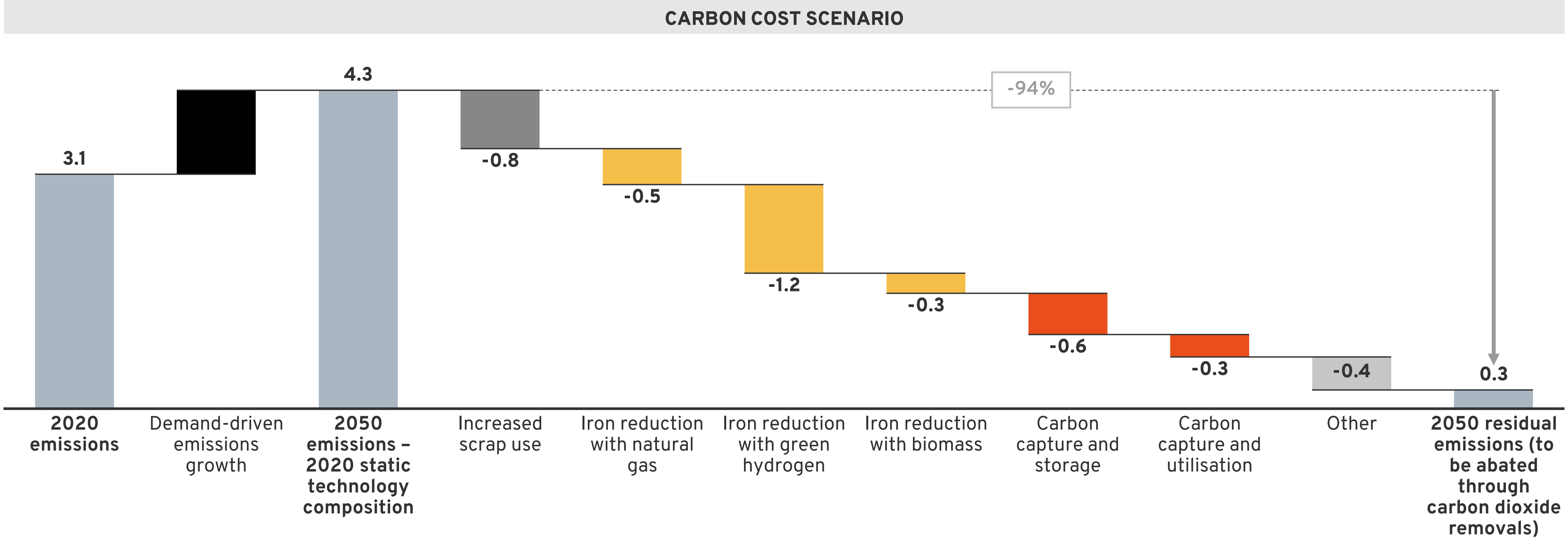
1. Provides a quantitative reference point that can underpin:
   - NDCs and mid-century strategies
   - SBTs
   - Portfolio alignment in finance sector

2. Informs actions in the 2020s of stakeholders who shape markets
   - Governments (individually & collectively via CEM, MI, LeadIT...)
   - Buyers of carbon-intensive materials and services
   - Financial institutions

3. Demonstrates that zero-carbon value chains can work, and encourage others to follow

KEY EMISSIONS REDUCTION LEVERS TO ACHIEVE NET ZERO IN THE STEEL INDUSTRY

Annual emissions (Scope 1 and Scope 2), in Gt CO_2

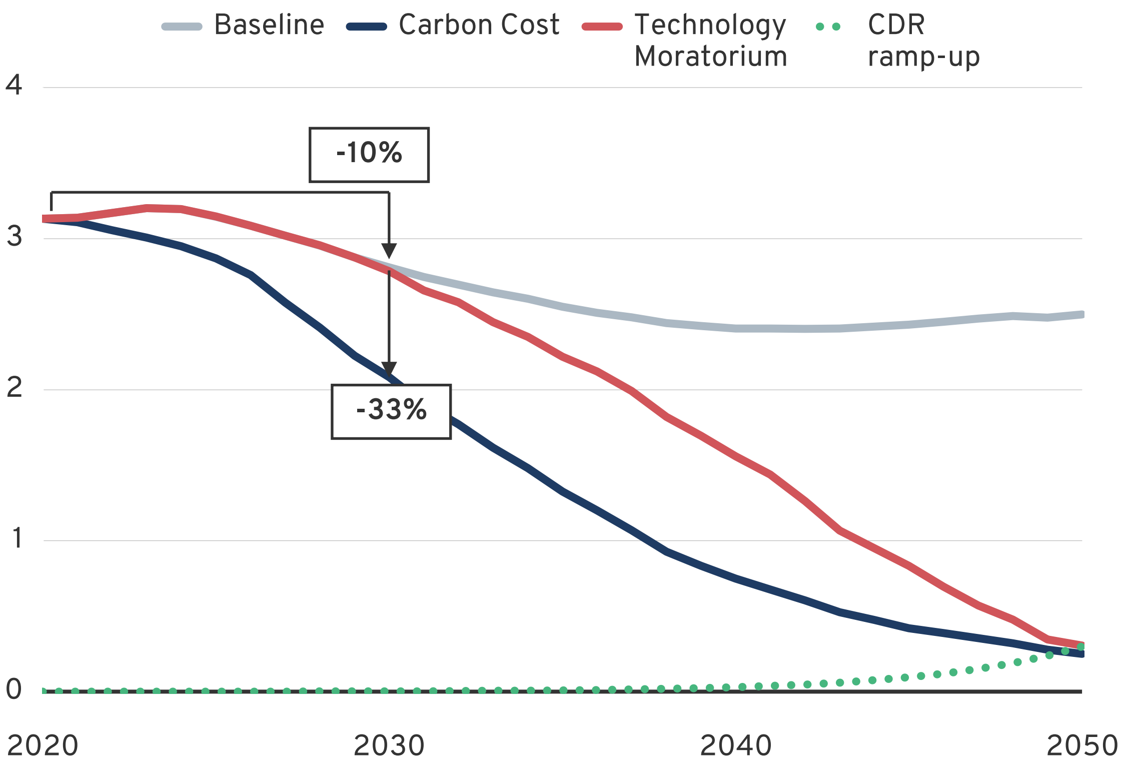


Note: The “2050 emissions – 2020 static technology composition” bars in both panels represent what annual emissions would be in 2050 if projected steel demand were met by the same technologies in the same proportions as in 2020. This is not the same as the Baseline scenario, in which some production technology changes occur even in the absence of concerted efforts to decarbonise the steel industry.

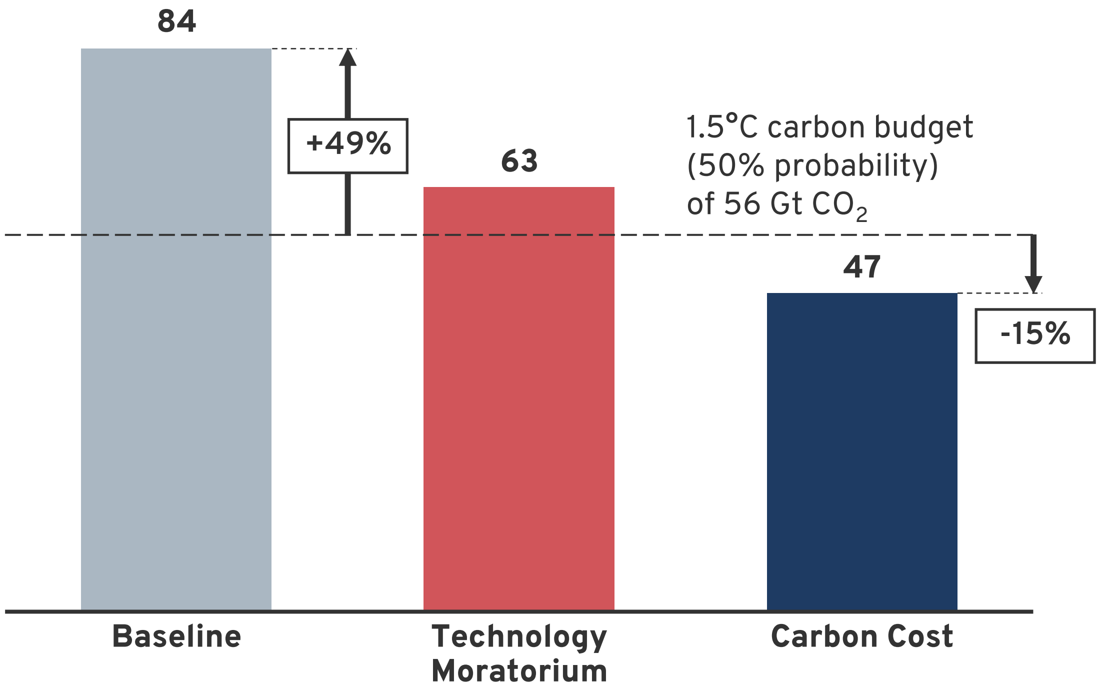
Source: MPP analysis

ANNUAL EMISSIONS TRAJECTORIES AND CUMULATIVE EMISSIONS IN THE STEEL INDUSTRY

Annual emissions (Scope 1 and Scope 2), in Gt CO_2/y



1.5°C carbon budget for global steel vs. cumulative CO_2 emissions of modelled scenarios,
in Gt CO_2 between 2020 and 2050

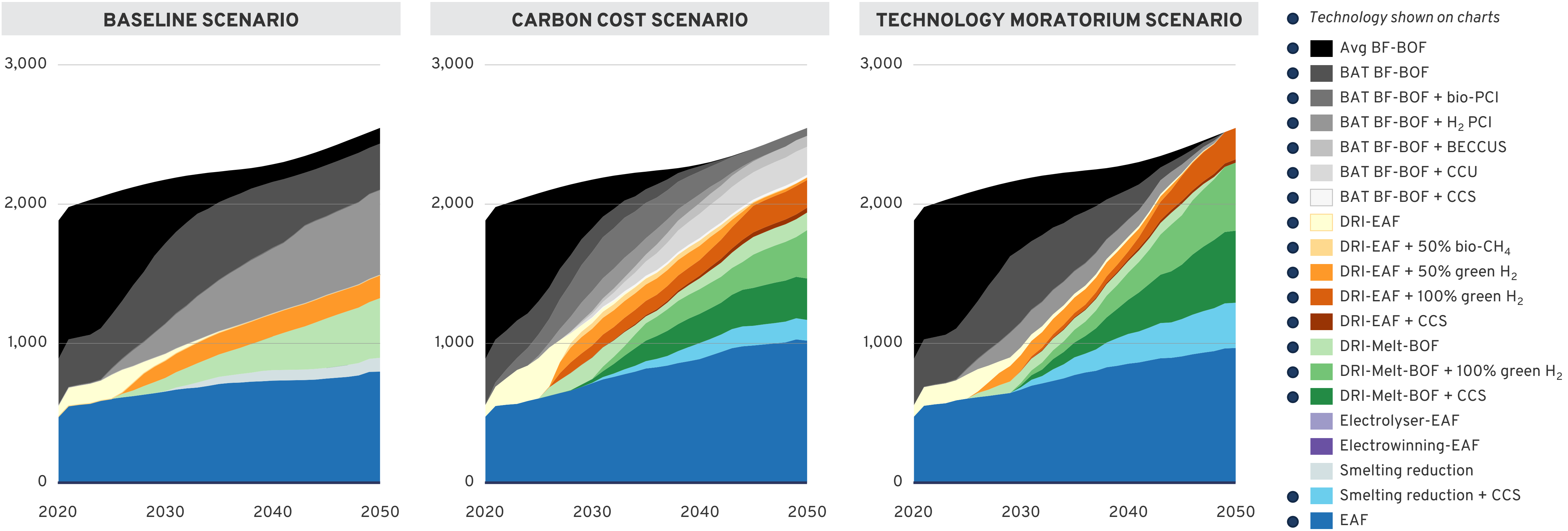


Note: The left panel includes the ramp-up of carbon dioxide removals (CDRs) required to abate residual industry emissions by 2050 and ensure the sector reaches net zero.

Source: MPP analysis

EVOLUTION OF THE STEEL PRODUCTION TECHNOLOGY MIX

Crude steel production, in Mt



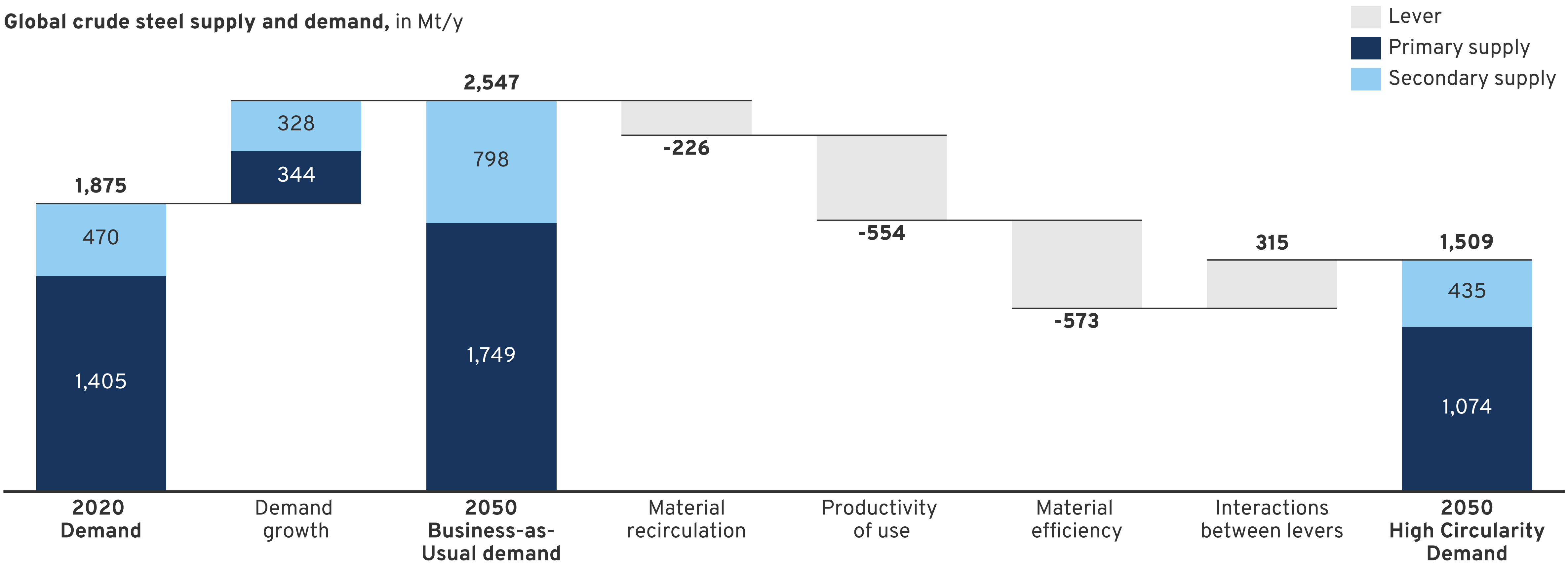
Note: The technology configurations comprise variations on two key processes, ironmaking and steelmaking. Ironmaking routes available today include conventional blast furnaces (BFs) or direct reduced iron (DRI) technologies. Electrolyser and electrowinning are novel ironmaking technologies that are not yet commercially available. These ironmaking technologies are then paired primarily with either a basic oxygen furnace (BOF) or an electric arc furnace (EAF) for steelmaking, both common today. Smelting reduction is an innovative technology that remains in development. Within these overarching routes there are additional subvariations: BF-BOFs can be designated as average or best available technology (BAT), or include the pulverised coal injection (PCI) process supplemented by additional feedstocks. Similarly, DRI technology can be made to work with a BOF by adding a melter (Melt) to the process. Lastly, all fossil fuel–based technologies can be paired with carbon capture, utilisation (CCU), and storage (CCUS) systems, which can derive their inputs from bioenergy (BECCUS). Please see the Glossary for additional details of the different production technology archetypes and their corresponding acronyms.

Source: MPP analysis

KEY LEVERS TO REDUCE PRIMARY STEEL DEMAND

HIGH CIRCULARITY SCENARIO

Global crude steel supply and demand, in Mt/y



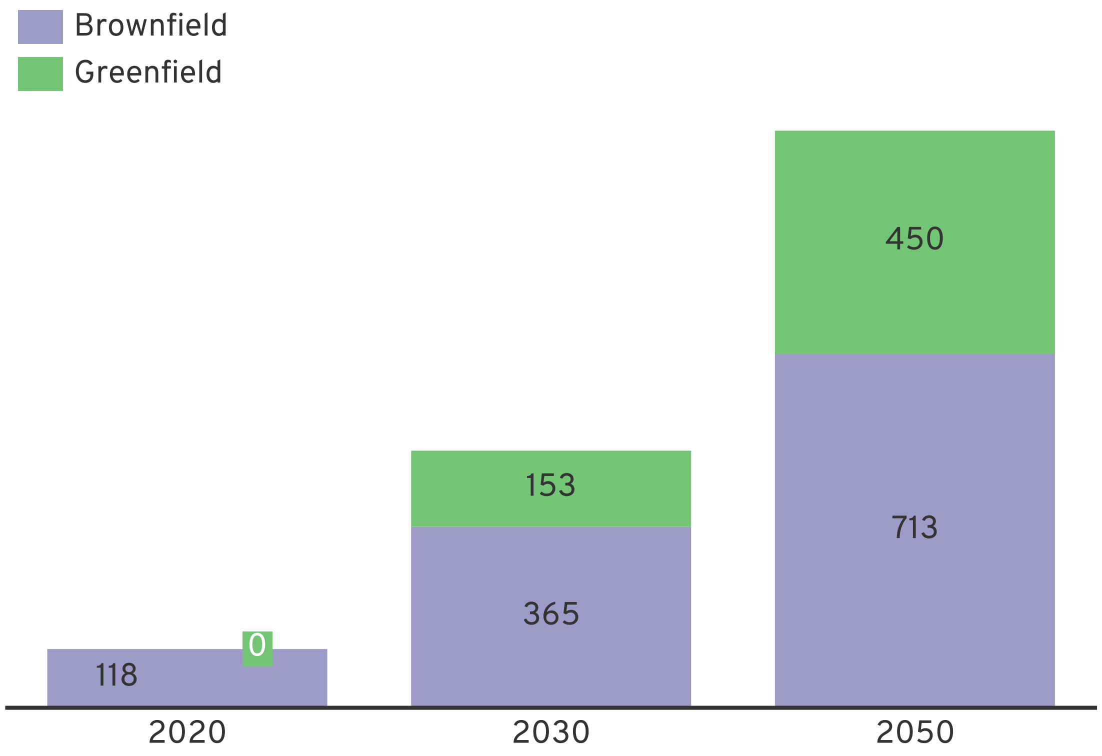
Note: The Interactions lever refers to how preceding levers support and rely on one another to achieve the greatest possible impact.

Source: MPP analysis

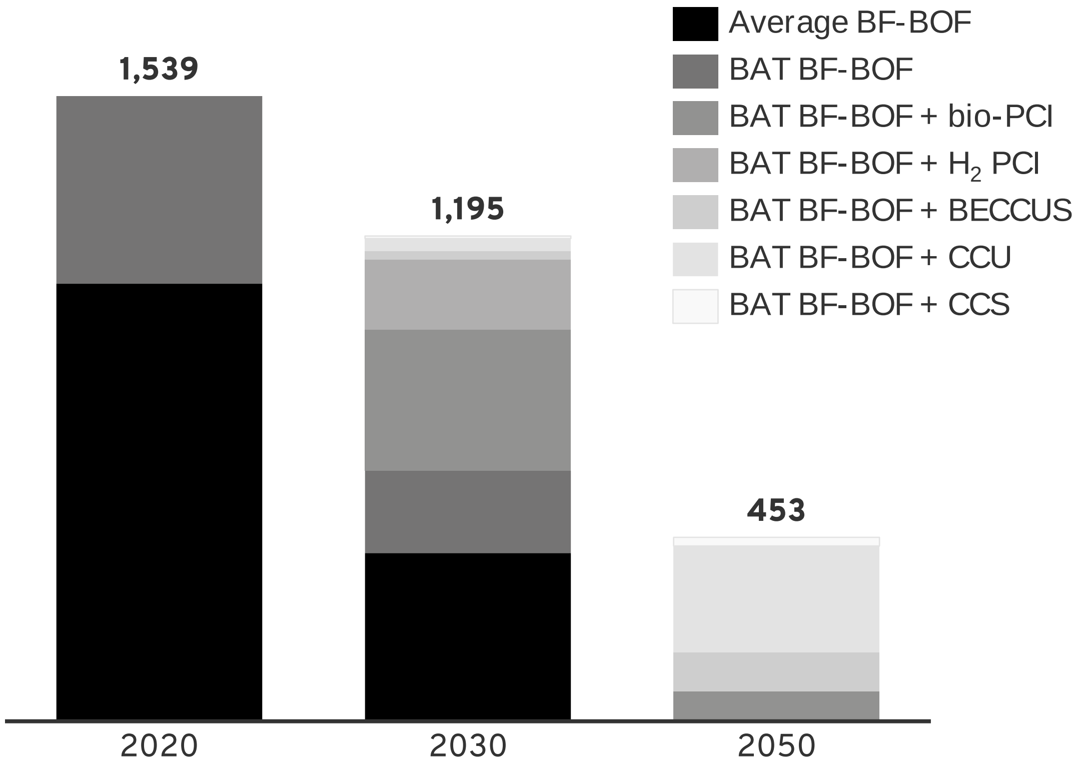
EVOLUTION OF DRI AND BLAST FURNACE STEELMAKING

CARBON COST SCENARIO

Global DRI-based steelmaking capacity, in Mt/y



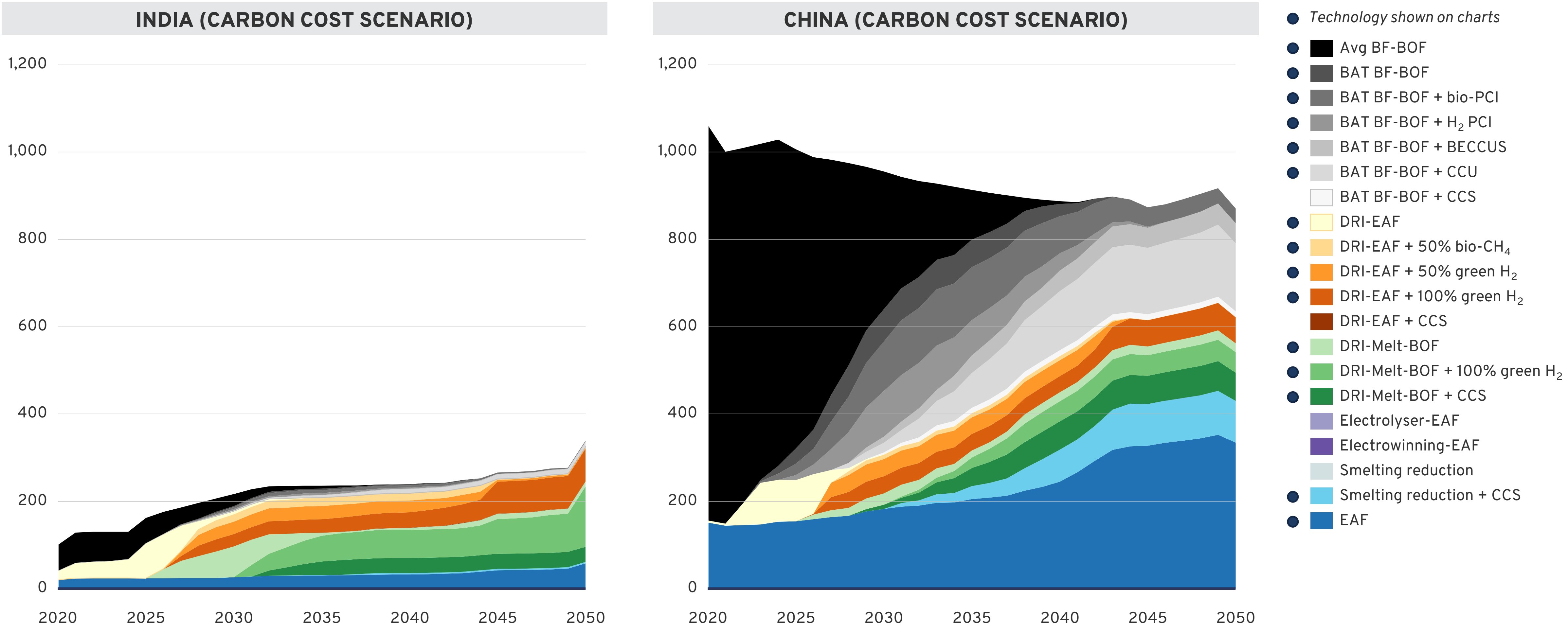
Global blast furnace-based steelmaking capacity, in Mt/y



Source: MPP analysis

REGIONAL EVOLUTION OF THE STEEL PRODUCTION TECHNOLOGY MIX

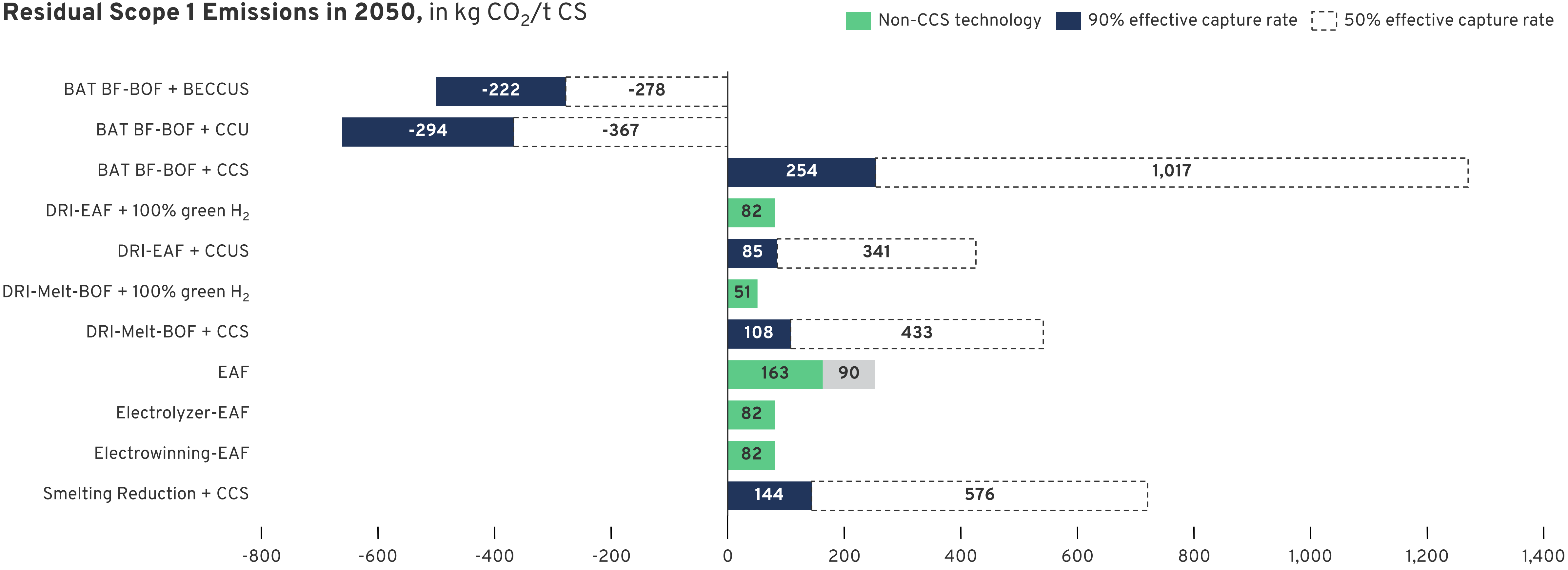
Crude steel production, in Mt



Source: MPP analysis

RESIDUAL EMISSIONS OF NET-ZERO-COMPATIBLE STEELMAKING TECHNOLOGIES

Residual Scope 1 Emissions in 2050, in kg CO_2/t CS

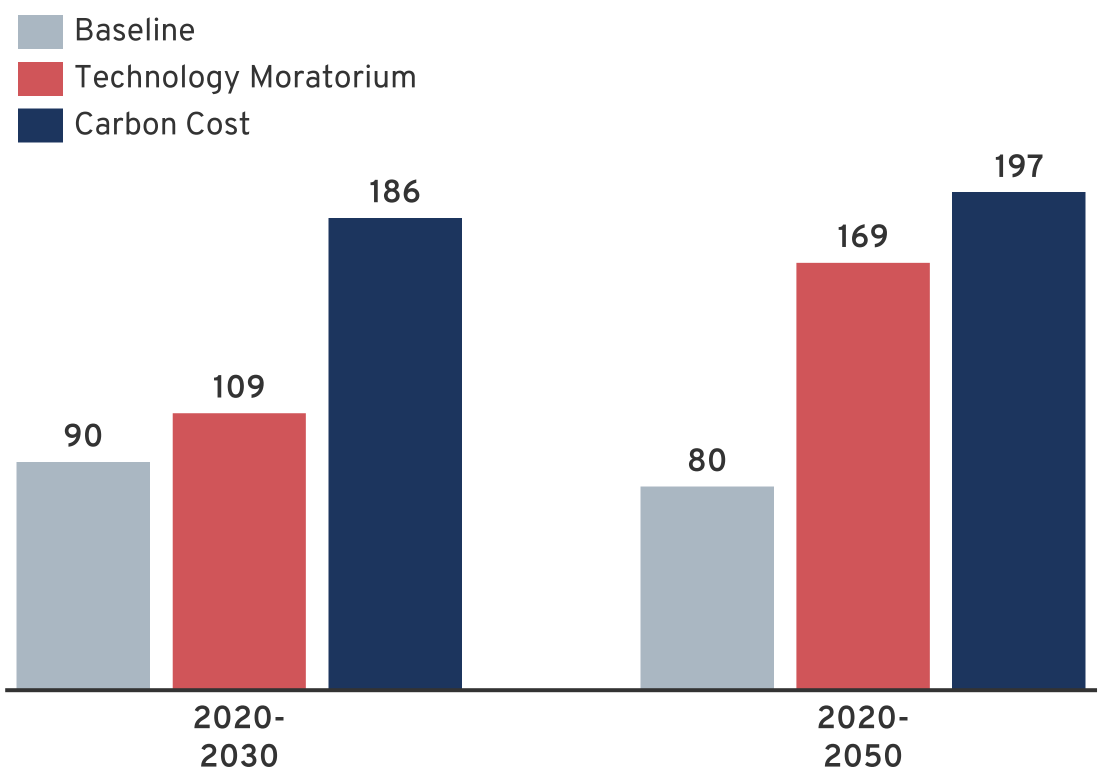


Note: The range of residual emissions from EAF production depends on the presence of natural gas in the preheating and finishing steps. Both the BAT BF-BOF + CCU and BAT BF-BOF + BECCUS archetypes achieve negative emissions through bioenergy use.

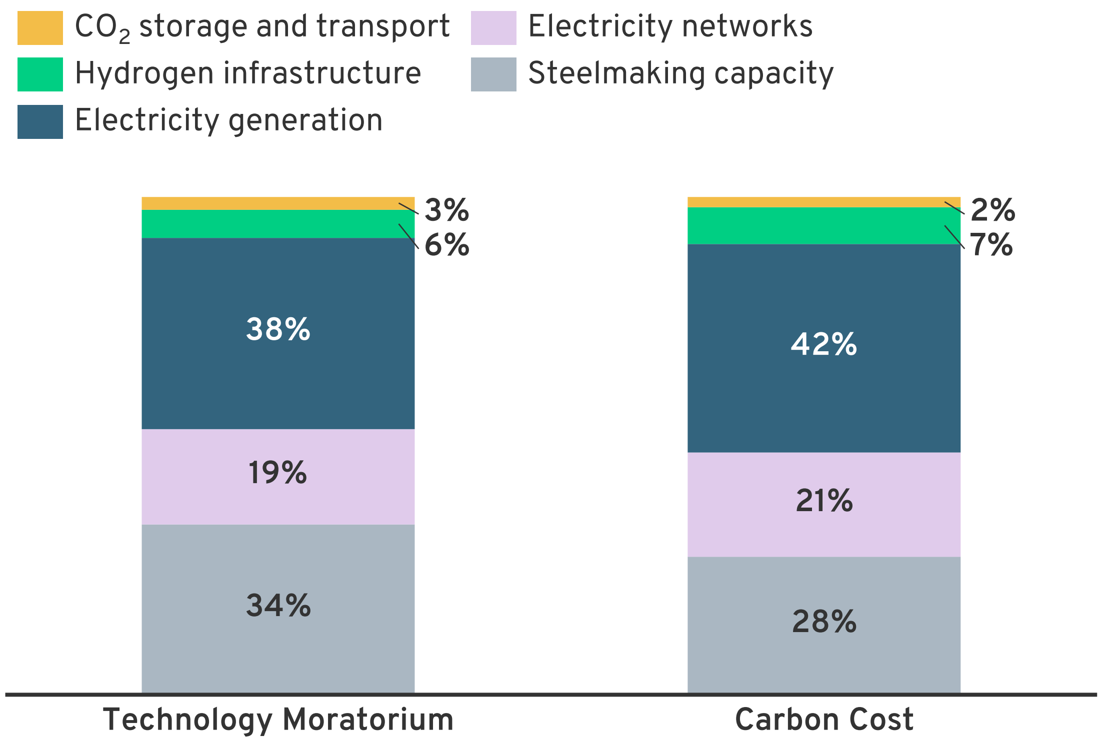
Source: MPP analysis

SUMMARY AND BREAKDOWN OF THE TOTAL INVESTMENT INVOLVED IN THE NET-ZERO STEEL TRANSITION

Average annual cross-value chain capital investment, in billion $ per year

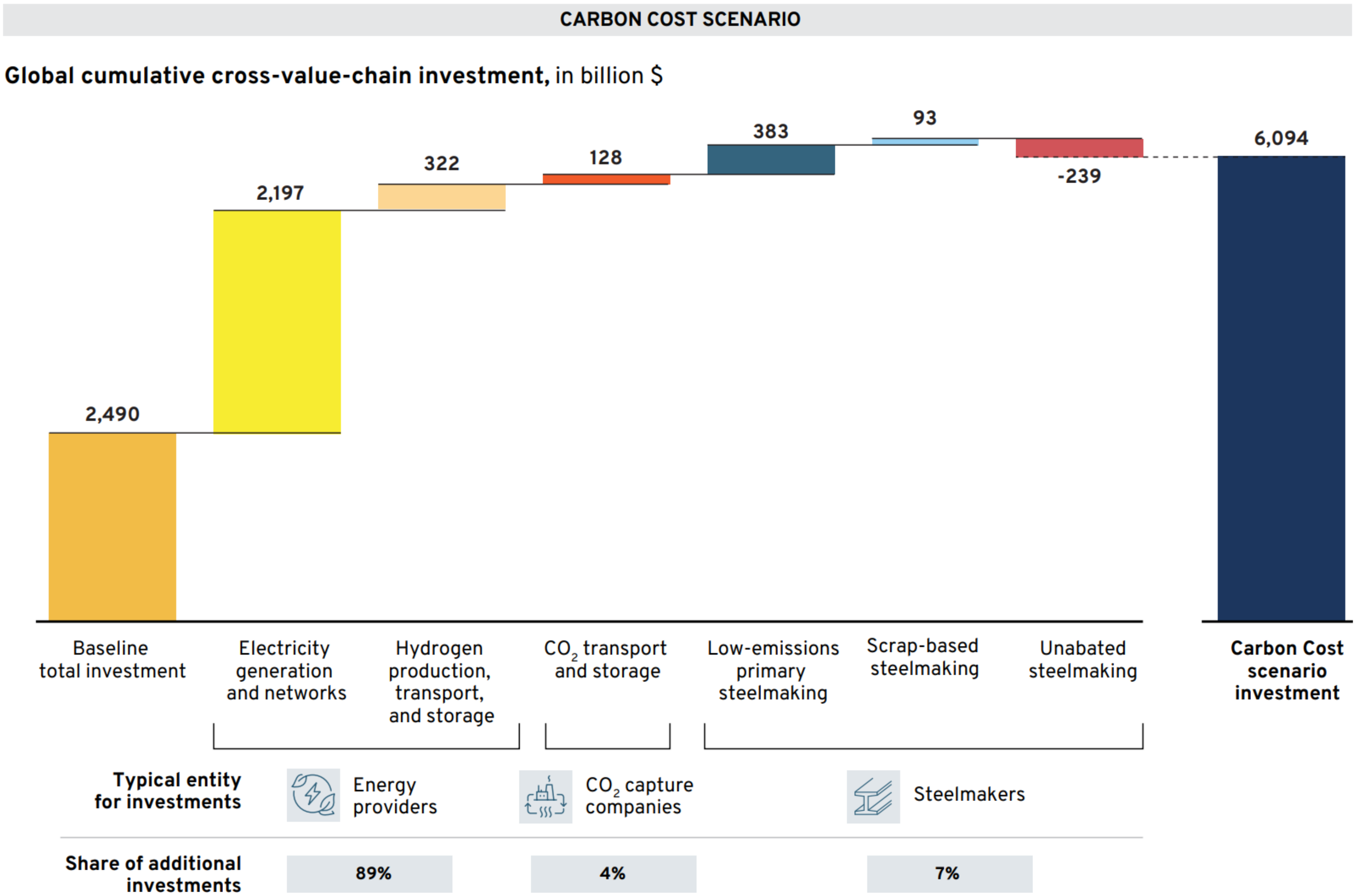


Breakdown of total cross-value chain capital investment, 2020–2050, percentage



Source: MPP analysis

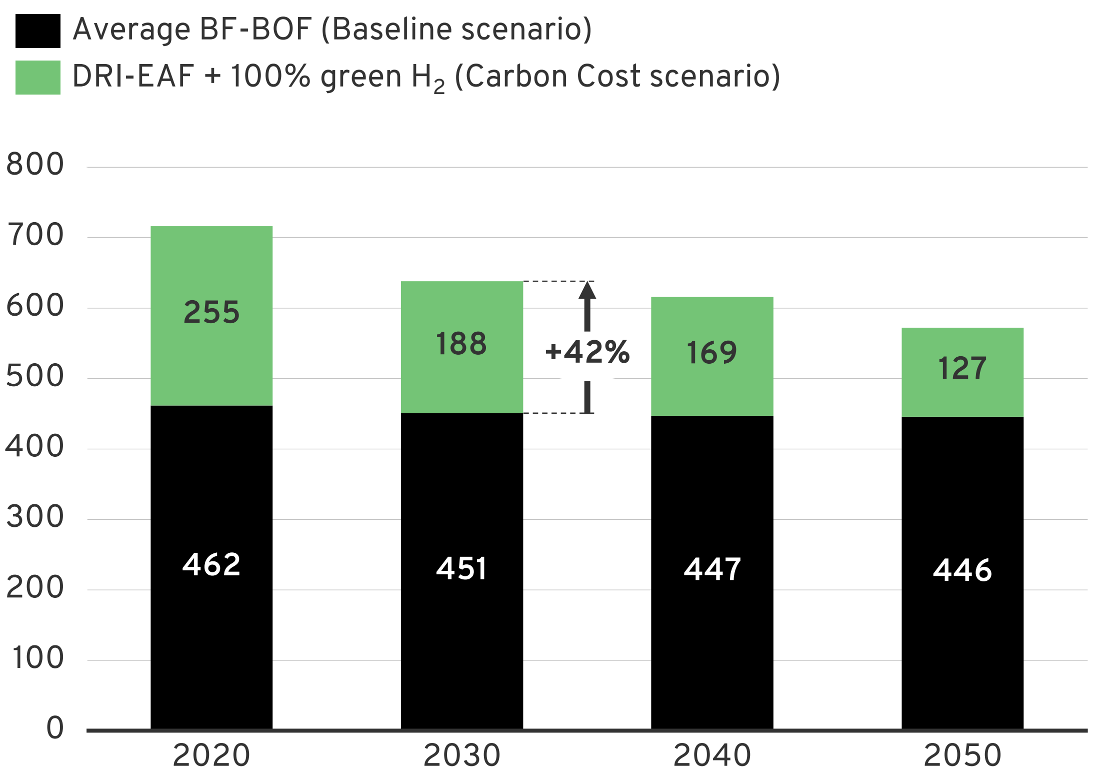
TOTAL ADDITIONAL SYSTEM INVESTMENT FROM BASELINE REQUIRED TO ACHIEVE A NET-ZERO STEEL INDUSTRY



Source: MPP analysis

IMPACT OF NEAR-ZERO-EMISSIONS PRIMARY STEELMAKING ON PRODUCTION COSTS AND FINAL CONSUMER GOODS

Global average levelised cost of steelmaking, in $/t CS



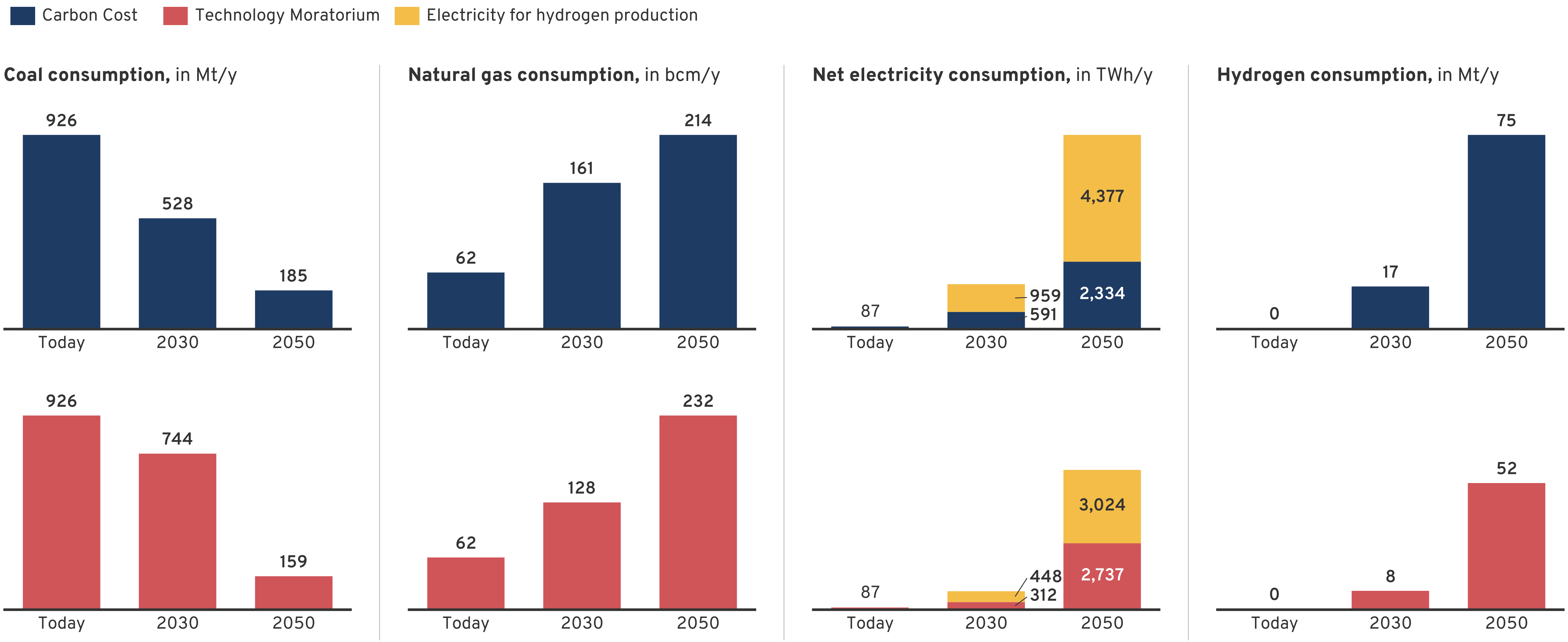
Price difference of consumer goods produced with near-zero-emissions hydrogen steel vs. conventional primary steel, %

Consumer Good	2030	2040	2050
Passenger car	+0.5%	+0.4%	+0.3%
Building	+2.1%	+1.9%	+1.4%
White good	+1.5%	+1.4%	+1.0%

Note: To provide a more illustrative comparison, the figures for average BF–BOF exclude any sort of carbon pricing, which would raise its production costs as a carbon intensive technology and further narrow the gap to near–zero-emissions alternatives.

Source: MPP analysis, ETC, Material Economics, McKinsey & Company

ENERGY CONSUMPTION SHIFTS DRIVEN BY THE NET-ZERO STEEL TRANSITION



Source: MPP analysis

KEY ACTIONS IN THE 2020S TO BRING THE IRON AND STEEL SECTOR ON A PATH TO NET-ZERO EMISSIONS BY 2050

POLICY

Multilateral solutions

- **Level playing field:** Establish an international forum/alliance to debate and resolve the issue of how to create a level playing field and create markets for low- and near-zero-emissions steel production
- **Definitions:** Develop stable and ambitious trade- and transaction-grade standards for low-emissions steel production

National/regional supply incentives

- **Regulatory reforms:** Accelerate and improve permitting procedure for steel and supporting infrastructure
- **Investment:** Combine concessional, blended finance, credit and loan guarantees, and CAPEX grants for first-of-a-kind (FoaK) commercial-scale projects
- **Infrastructure:** Coordinate plans and strategies for necessary infrastructure and raw materials

National/regional demand incentives

- **Demand creation:** Extend green public procurement to support industrial strategy and lead market creation

INDUSTRY

Supply-side

- **Projects:** Plan and deploy +70 near-zero-emissions primary steel mills by 2030
- **Target setting:** Set robust emissions reduction targets that are aligned with the goal of limiting global temperature rise to 1.5°C
- **Industry consortia:** Forge new partnerships across the steel value chain and upstream energy system
- **Common policy position:** Set out a joint high-ambition position to policymakers that reflects the role of international steel producers with assets in multiple geographies

Demand-side

- **Green premiums:** Agree to long-term off-take with a green premium that is proportional to production cost increment and associated risks for both supplier and buyer

FINANCE

Capital Allocation

- **Capital allocation:** Provide sufficient capital to enable at least $100 billion of additional investment in low-emissions steelmaking (and supporting infrastructure) each year until 2030
- **Business case innovation:** Co-develop strategies to manage the market, credit, liquidity, operational, and policy risks for FoaK projects

Climate alignment

- **Investment principles:** Implement 1.5°C-aligned investment principles and plan and support a moratorium of non-climate-aligned steel investment from 2030

Source: MPP analysis