Why developing a robust, competitive, resilient, sovereign & sustainable battery industry is critical to succeed the Green Energy transition

Battery Study| Paris, 16th October 2023

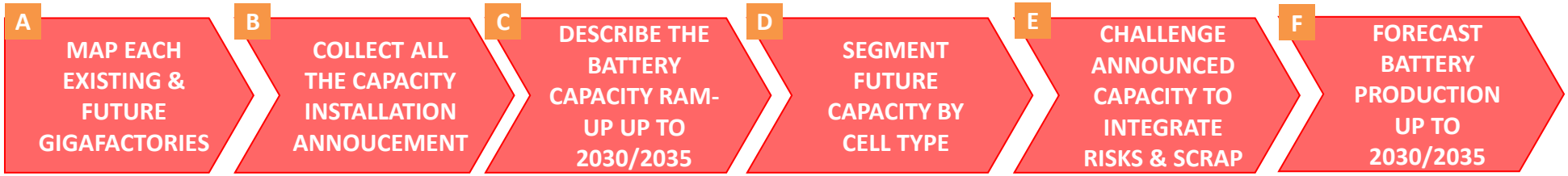
STRAT ANTICIPATION | *Be One Step Ahead*

Strat Anticipation has developed a bottom-up granular approach to assess & forecast Li-Ion battery demand & supply for light & heavy-duty vehicles up to 2035.

Strat Anticipation demand & supply forecast methodology

DEMAND FORECAST KEY STEPS

SUPPLY FORECAST KEY STEPS



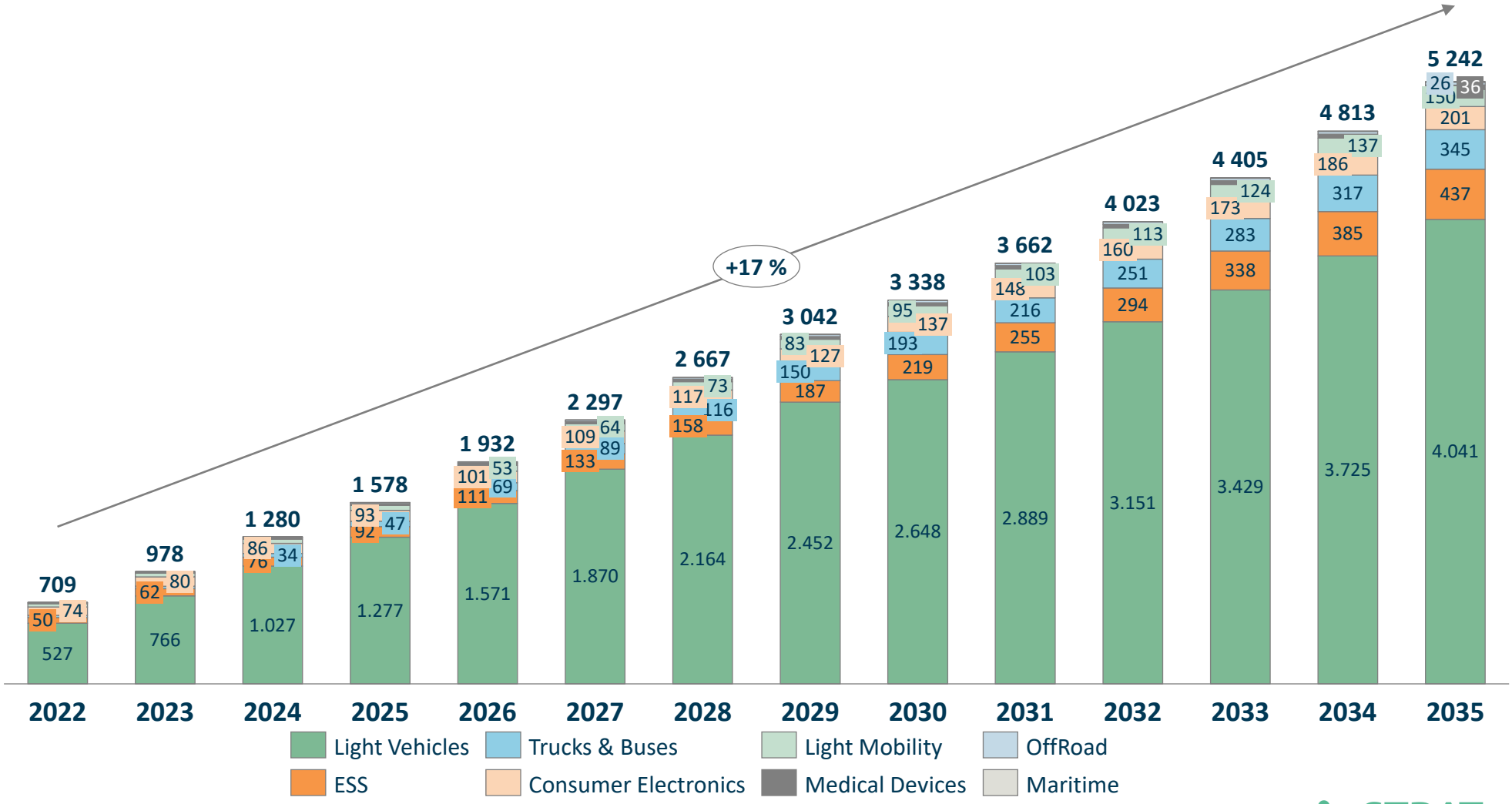
GRANULAR BOTTOM-UP APPROACHES ARE MORE ROBUST & ALLOW TO MAKE SCENARIOS

Source : Strat Anticipation research & analysis

Global demand reaches 3.3 TWh by 2030 & 5.2 TWh by 2035 with light vehicles representing 80% of demand in 2030 & 77% in 2035

Baseline Scenario - Global Battery demand by Market Segment

BASELINE SCENARIO - LITHIUM & NA-ION BATTERY DEMAND PER APPLICATION MARKET | GWh, Worldwide, 2022 – 2035

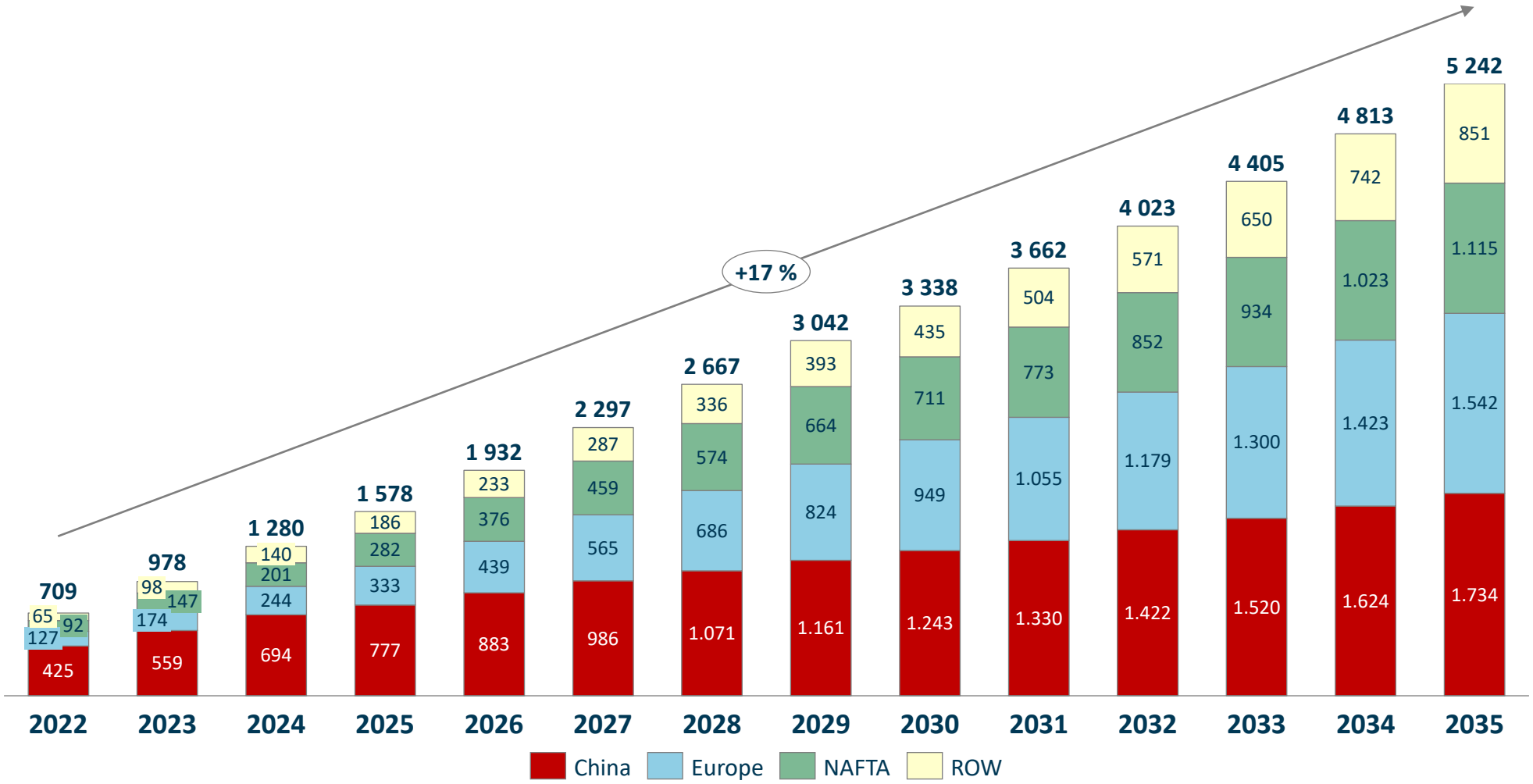


Source: Strat Anticipation Research & Analysis, LMCA 2023

China is expected to stay market leader for battery demand. Its market share of 57% in 2023 will decrease to 33% in 2035. EU will move into second place before NA

Baseline Scenario - Global Battery demand by Region

BASELINE SCENARIO - LITHIUM & NA-ION BATTERY DEMAND PER REGION | GWh, Worldwide , 2022 – 2035



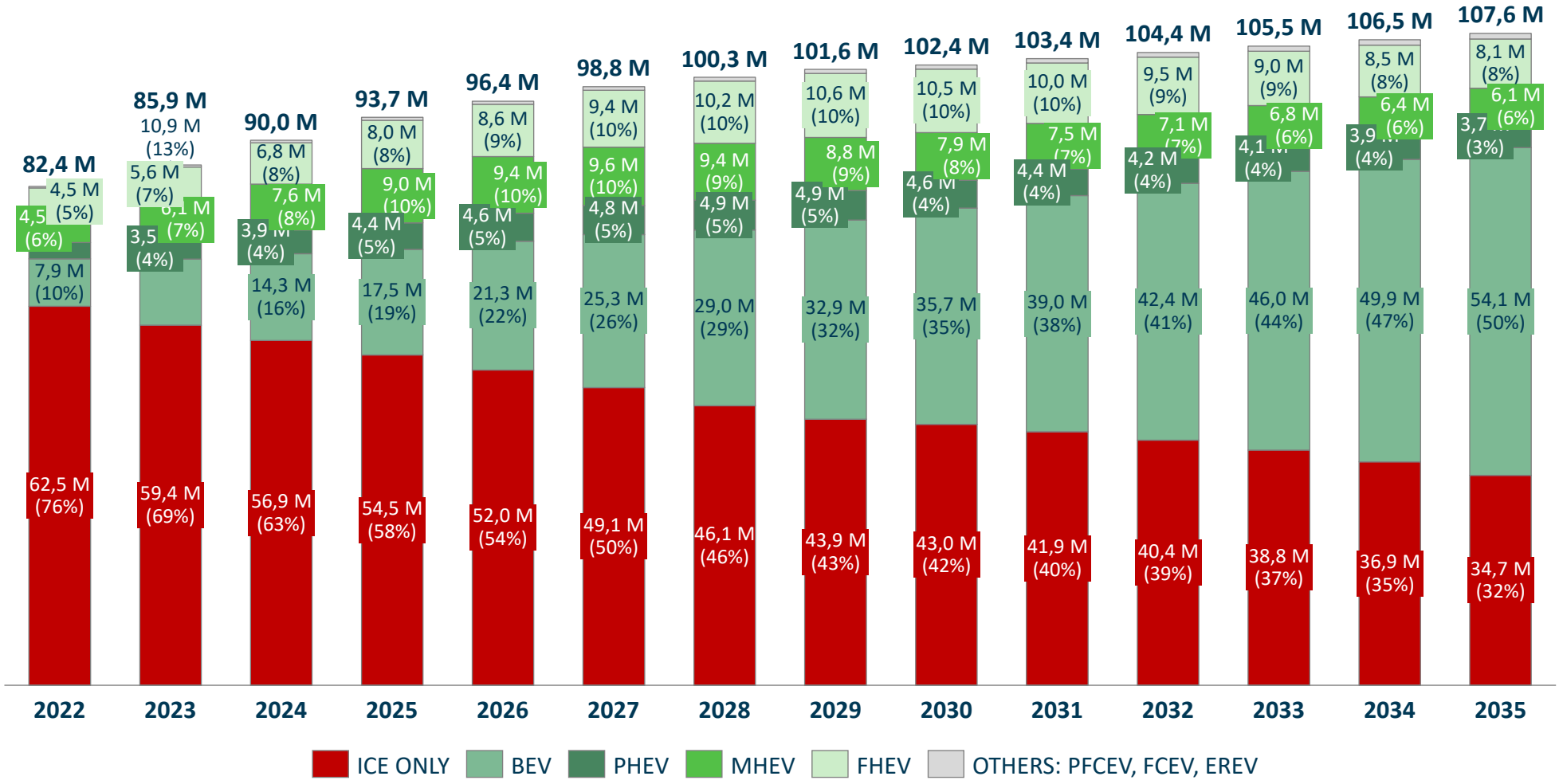
Source: Strat Anticipation Research & Analysis, LMCA 2023

BEVs will make up 35% of worldwide vehicle production (36 million units) by 2030 and market share will increase to 50% market share (54 million units) by 2035

Baseline Scenario - Worldwide Light Vehicle Production per Engine Type

FORECAST APRIL 2023

LIGHT VEHICLE PRODUCTION PER ENGINE TYPE (INCLUDING VANS AND LIGHT TRUCKS) | # M Units, 2022 – 2035



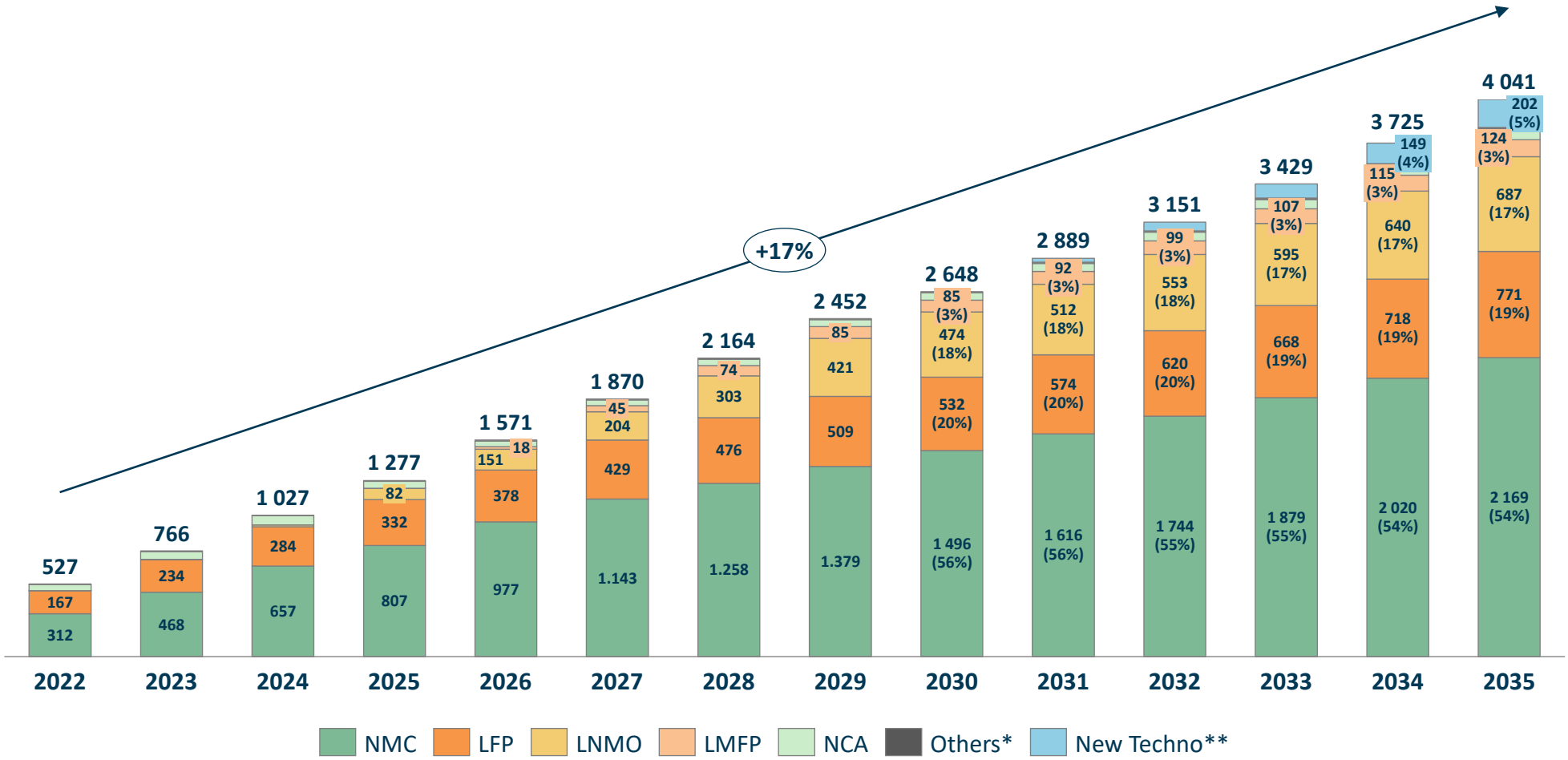
Note: BEV & PHEV Volumes 2031-2035 comes from LMCA. A 1% growth has been applied to global volume representing world growth and development in South Asia. Hybrid Vehicle Volumes are deduced from 2028-2030 trend.

Source: LMCA 2023, Strat Anticipation analysis for 2031-2035

NMC & LFP, the current dominant Li-ion battery technologies, will face competition from Co-free, Ni & Mn rich chemistries such as NMX, LMFP, LNMO & LMR after 2025.

Baseline Scenario - Worldwide Electrified Light vehicle battery demand forecasts by Cathode Chemistry

ELECTRIFIED LIGHT VEHICLE BATTERY DEMAND PER CATHODE CHEMISTRY (INCLUDING VANS AND LIGHT TRUCKS) | # GWh, 2022 – 2035



*Others include NiOH, LMO, LTO
**New techno covers Na-Ion, Li-Metal, SSB

Note: LNMO refers to Cobalt Free Nickel Magnesium cathodes. These cathodes can be Manganese Rich as the one developed by Powerco for VW, with high-purity Nickel as developed by ACC for Stellantis, or using Aluminium.

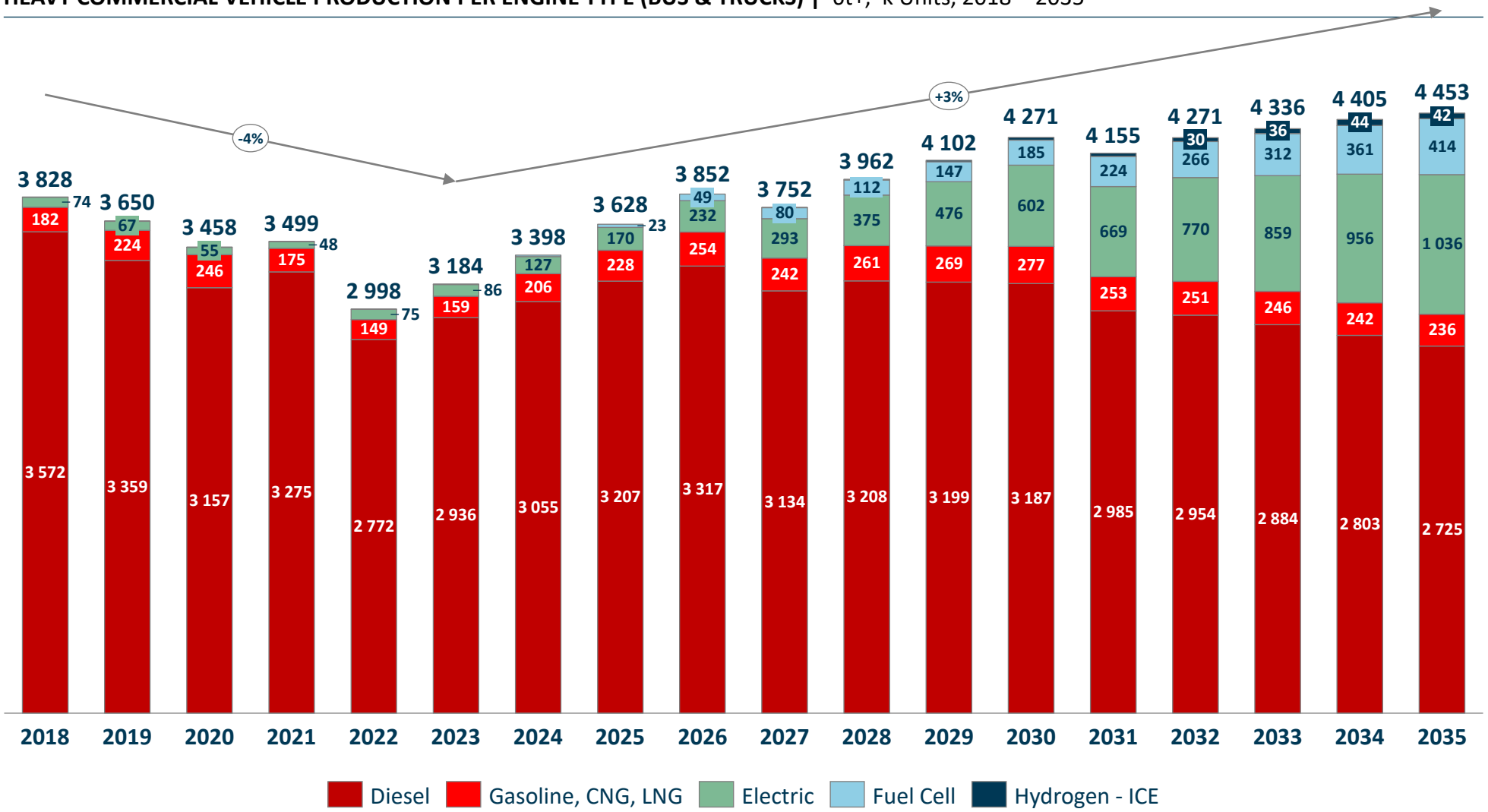
Source: LMCA 2023 for number until 2030, Strat Anticipation analysis for 2031-2035

The Bus & Truck market is projected to complete recovery by 2026, reaching pre-COVID levels. By 2035, electric & hydrogen trucks will make up 1/3 of production.

Heavy Duty | Baseline Scenario - Worldwide Heavy Vehicle Production Per Engine Type – Bus & Trucks

FORECAST APRIL 2023

HEAVY COMMERCIAL VEHICLE PRODUCTION PER ENGINE TYPE (BUS & TRUCKS) | 6t+, k Units, 2018 – 2035



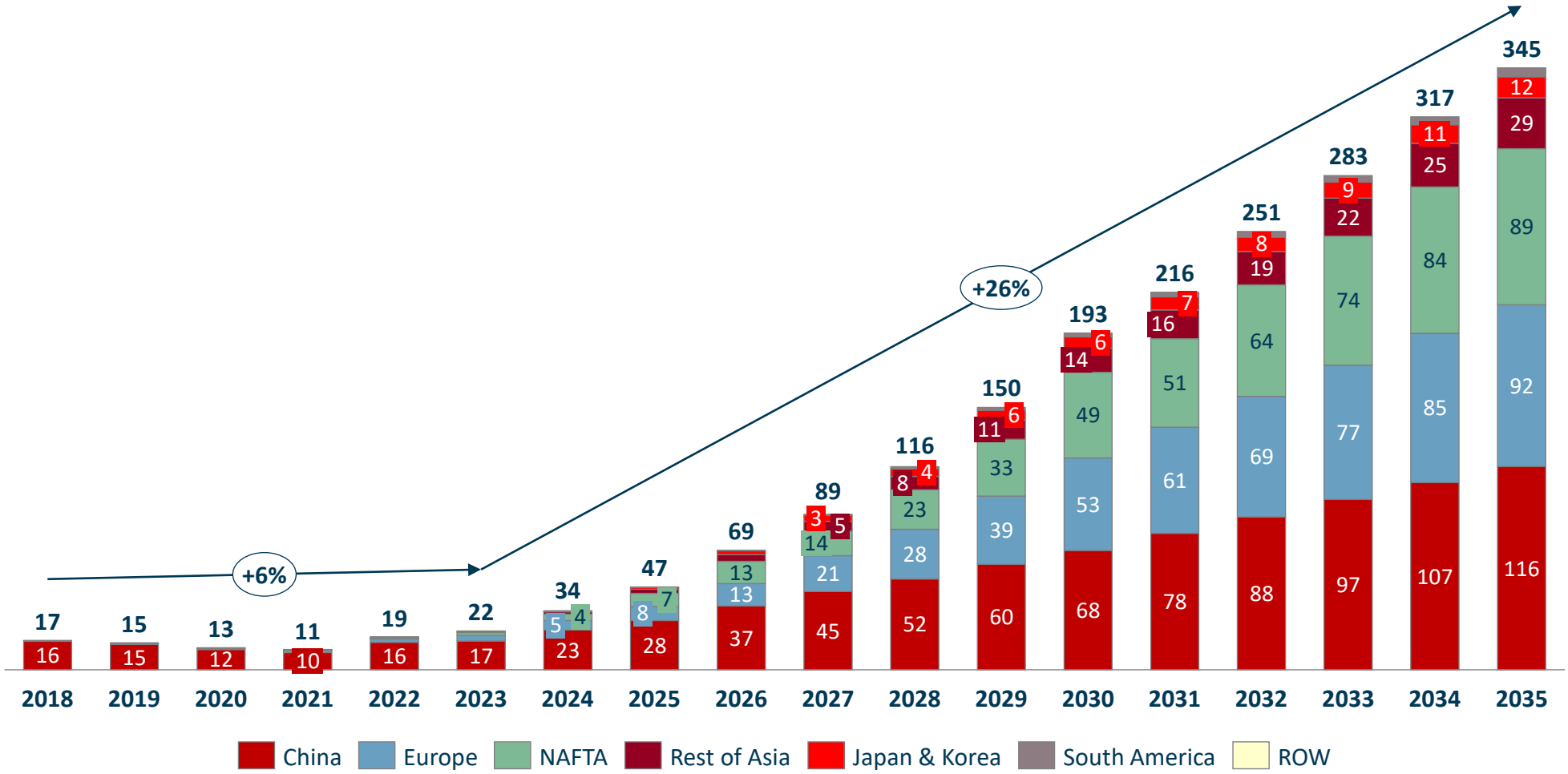
Note: Hydrogen ICE vehicles correspond to Volvo, Traton, Daimler & Paccar Trucks powered with Cummins Serie X Motor.
Discrepancies are due to two prebuy/payback cycles, one in 2026-2027 and another in 2030-2031, due to the EPA Clean Truck Plan in the USA.

Source: LMCA 2023, Strat Anticipation analysis

On electrified heavy-duty vehicle, China was nearly the only player from 2018 to 2022. Other regions are catching up, but China is expected to stay the largest market

Heavy Duty | Baseline Scenario - Worldwide Heavy Vehicle Battery Demand Forecasts per Region – Bus & Trucks

ELECTRIFIED HEAVY COMMERCIAL VEHICLE BATTERY DEMAND PER REGION (BUS & TRUCKS) | 6t+, GWh, 2018 – 2035

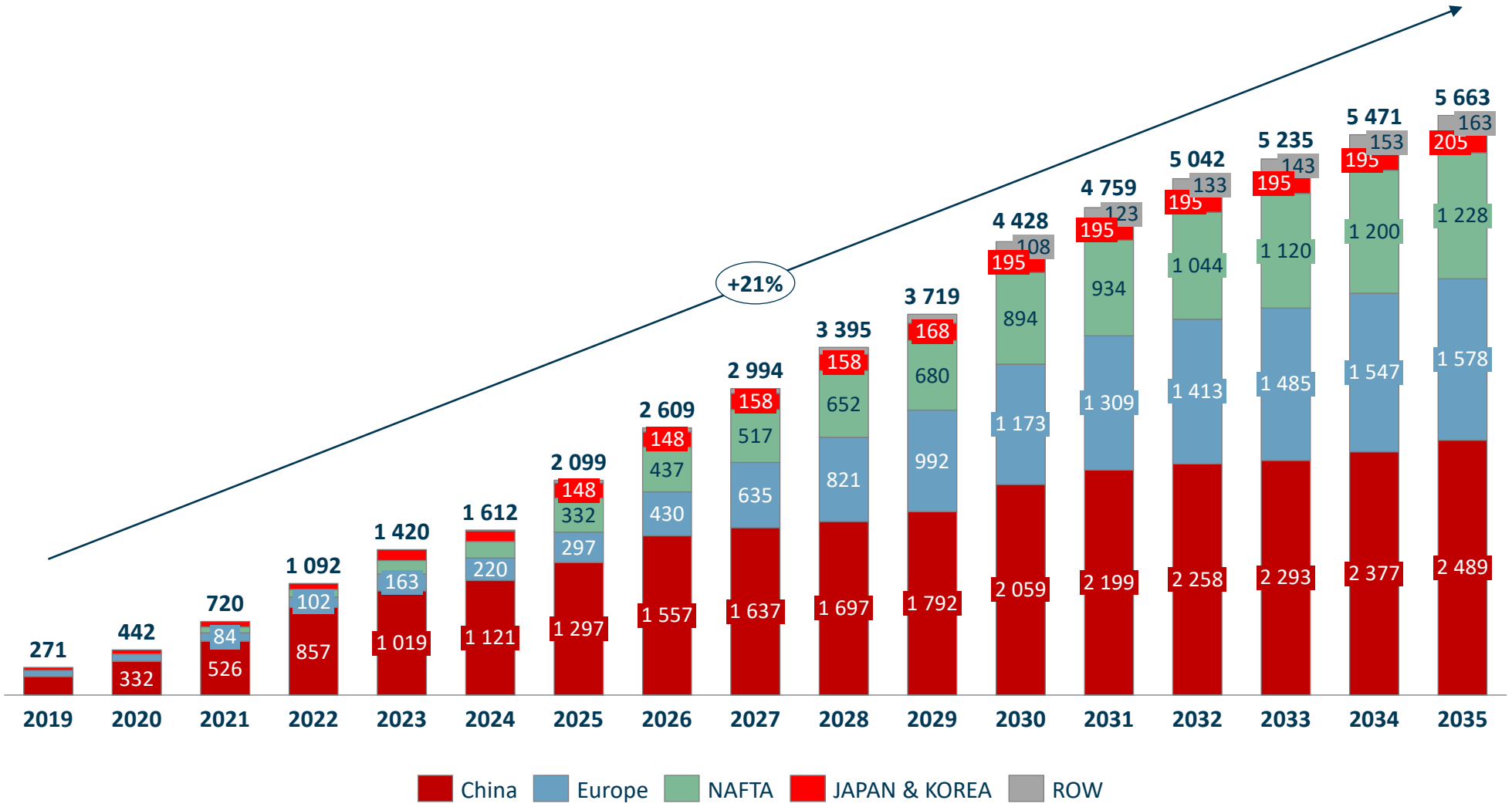


Source: LMCA 2023, Strat Anticipation analysis

Total global capacity announcements reached 4.4 TWh by 2030 & 5.7 TWh by 2035 with China & Europe together accounting for 72% of announcements in 2035.

Worldwide battery cell production capacity announcement per region

BATTERY CELL PRODUCTION CAPACITY ANNOUNCEMENT PER REGION | # Through Roll Out Analysis, GWh, 2019 – 2035

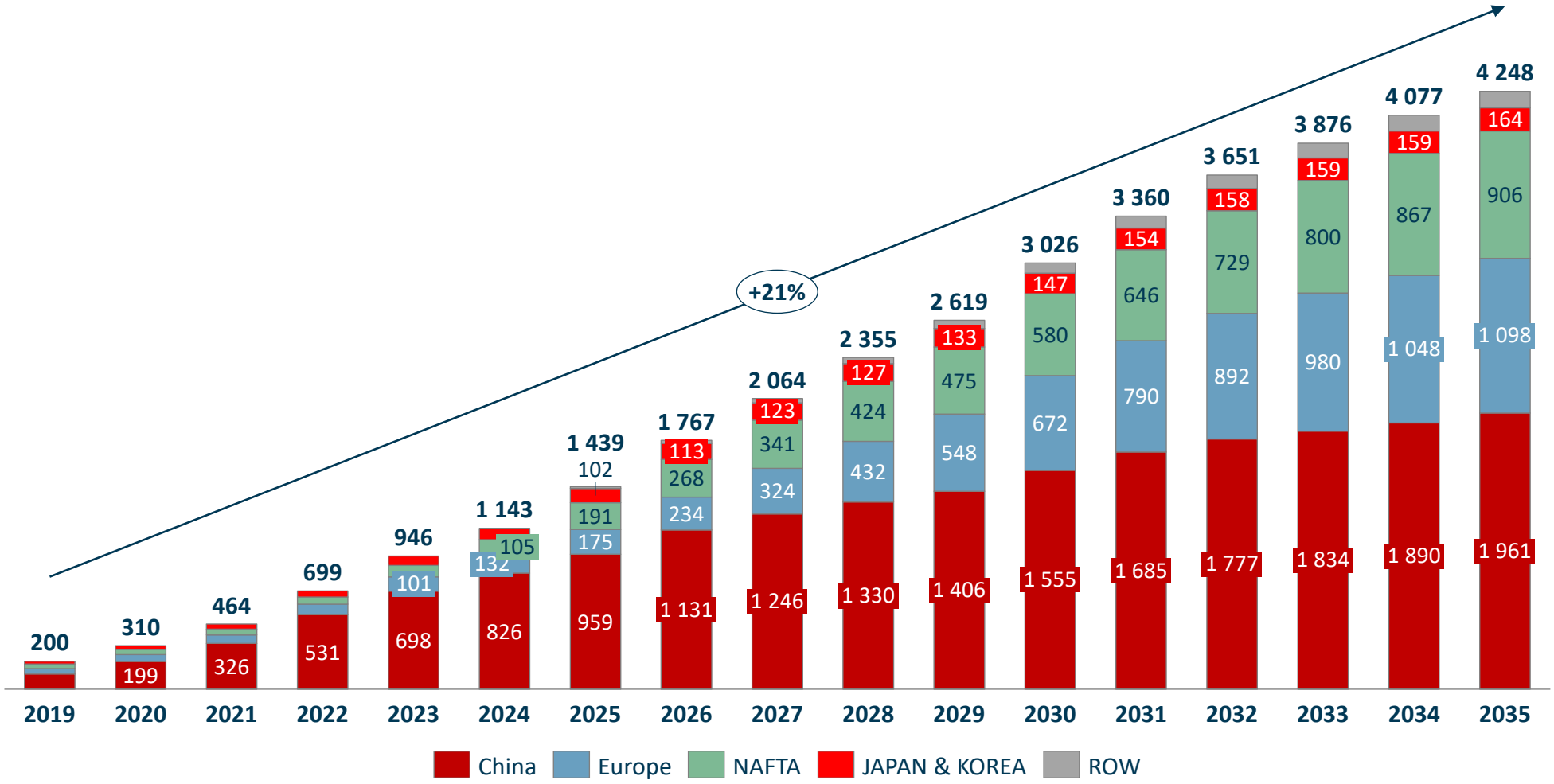


Source: Strat Anticipation Bottom-Up analysis & Risk Model

Total realistic battery supply should reach 3 TWh by 2030 & 4.2 TWh by 2035 after risk assessment & capacity usage analysis - China supply accounts for 47% by 2035

Worldwide realistic battery cell available production per region, through risk & capacity usage analysis

REALISTIC BATTERY CELL AVAILABLE PRODUCTION PER REGION | # Through Roll Out Analysis, GWh, 2019 – 2035

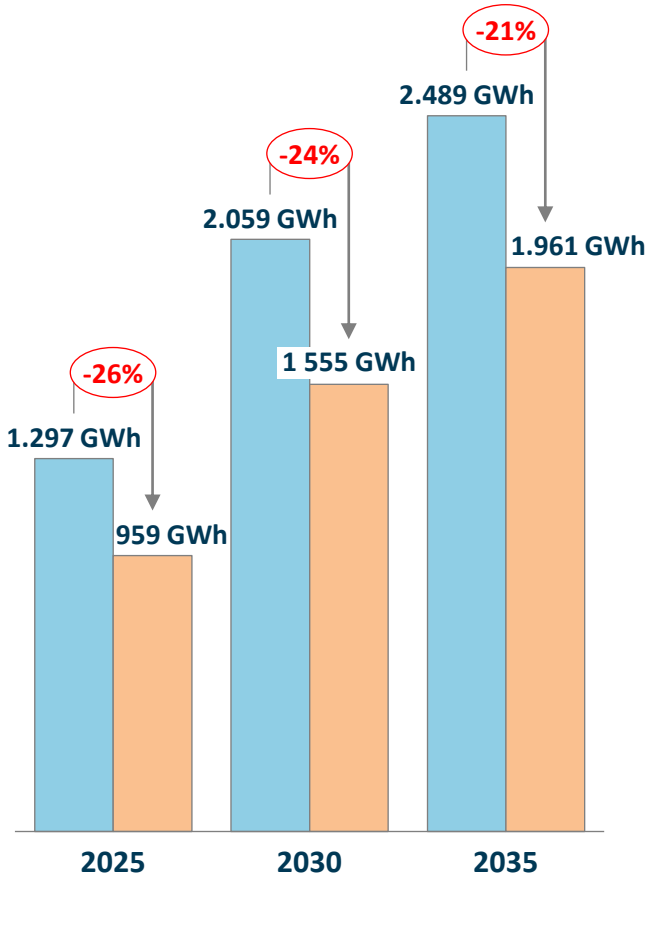


Note: Probability of Defect have been applied uniformly toward all Gigafactories presenting same risks factors
Battery cell Production in 2019 to 2022 is different from battery cell capacity due to Scrap and capacity usage under 100%
Source: Strat Anticipation Bottom-Up analysis & Risk Model

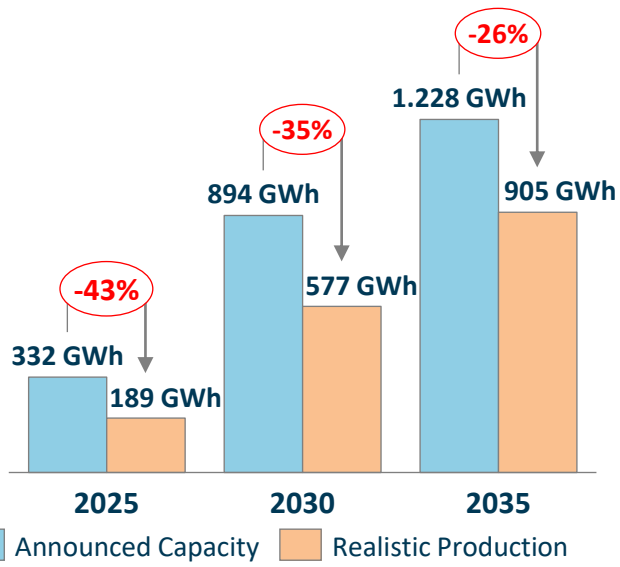
Europe & NAFTA are lagging behind China taking into account larger uncertainties, higher scrap rates and the resulting delays leading to lower realistic capacities

Realistic Battery Cell Supply & Demand Forecast for China, NAFTA & Europe

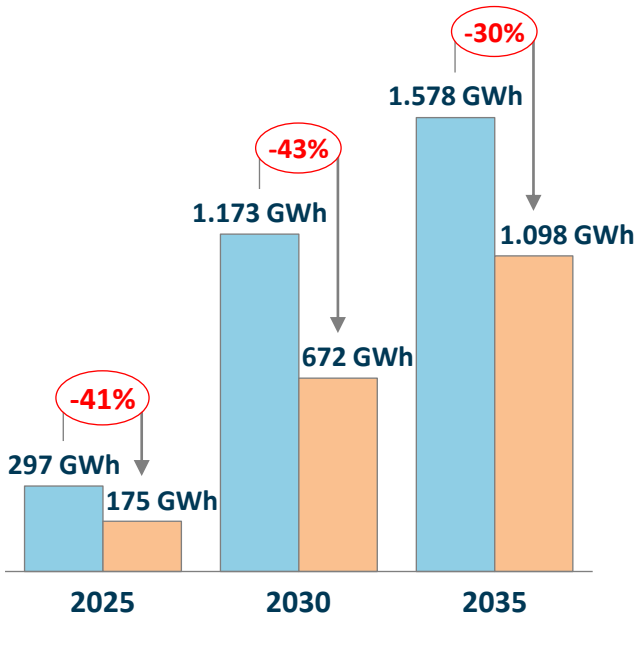
BATTERY CELL REALISTIC AVAILABLE PRODUCTION CAPACITY |
China, Forecasts, GWh, 2025-2030-2035



BATTERY CELL REALISTIC AVAILABLE PRODUCTION CAPACITY |
NAFTA, Forecasts, GWh, 2025-2030-2035



BATTERY CELL REALISTIC AVAILABLE PRODUCTION CAPACITY |
Europe, Forecasts, GWh, 2025-2030-2035



Announced Capacity | Realistic Production

CHINA'S EXPERIENCE IN BATTERIES ALLOWS IT TO MAINTAIN A HIGH PRODUCTION RATE.

Source: Strat Anticipation bottom-up research & analysis, LMCA 2023 for EV demand, expert interviews, granular capacity forecast model developed by Strat Anticipation

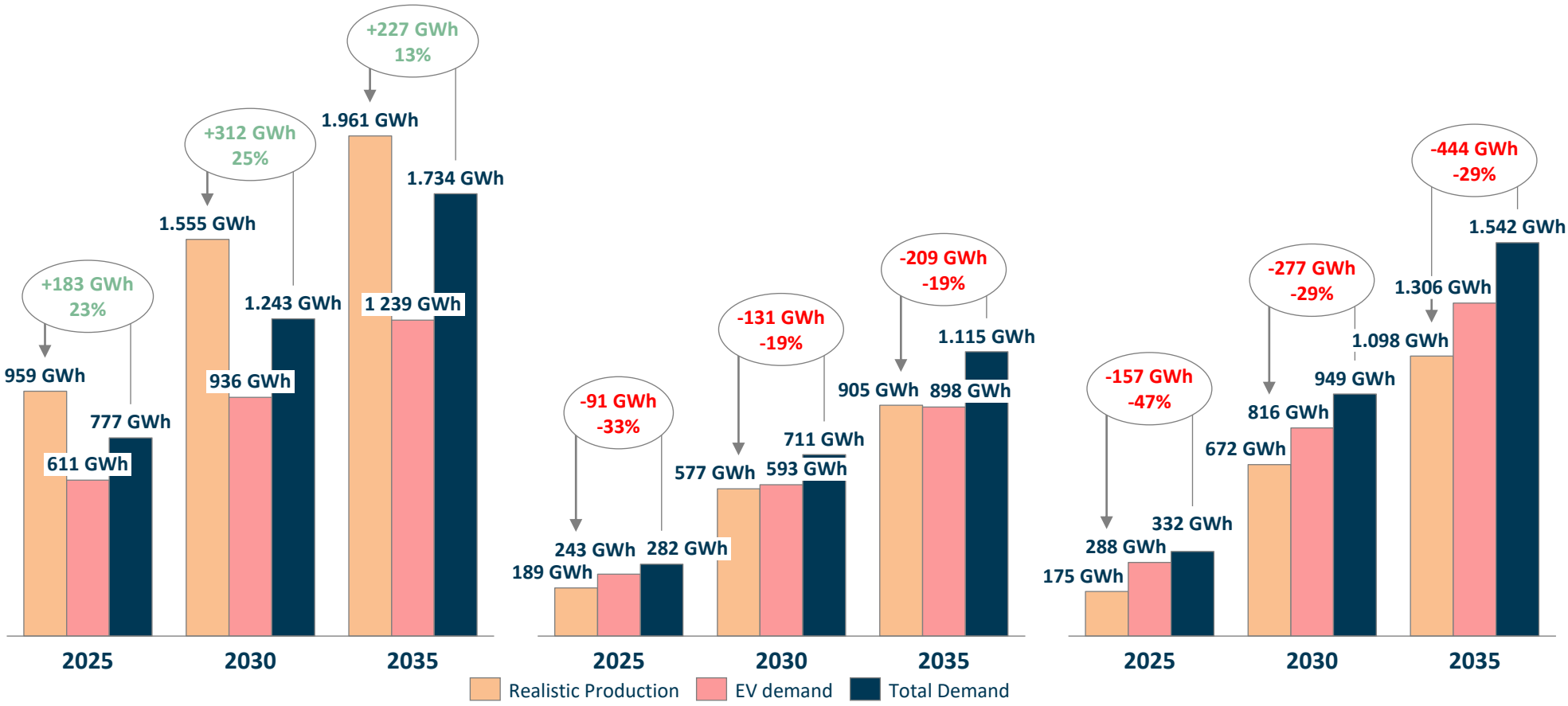
China is the only region that will be able to meet its battery demand due to its superior battery know-how, experience & its planned available production capacity

Battery cell realistic production supply & demand forecasts, China, NAFTA & Europe

BATTERY CELL REALISTIC AVAILABLE PRODUCTION, EV & TOTAL DEMAND | China, Forecasts, GWh, 2025-2030-2035

BATTERY CELL REALISTIC AVAILABLE PRODUCTION, EV & TOTAL DEMAND NAFTA, Forecasts, GWh, 2025-2030-2035

BATTERY CELL REALISTIC AVAILABLE PRODUCTION, EV & TOTAL DEMAND | Europe, Forecasts, GWh, 2025-2030-2035



EUROPE AND NAFTA STRUGGLE TO COVER THEIR FAST-GROWING DEMAND, ESPECIALLY AT THE END OF THIS DECADE & WILL HAVE TO IMPORT SIGNIFICANT QUANTITIES FROM ASIA IN PARTICULAR FROM CHINA

Source: Strat Anticipation bottom-up research & analysis, LMCA 2023 for EV demand, expert interviews, granular capacity forecast model developed by Strat Anticipation

Current announcement by players fall short of covering battery demand in 2025 and 2030, and the gap will explode to 1 TWh by 2035, driven by Europe and NAFTA deficit

Baseline Scenario | Gap between battery production & battery demand

DIFFERENCE BETWEEN SUPPLY & DEMAND, WORLWIDE, CHINA, EUROPE AND NAFTA | # in GWh, 2025-2030-2035

THE BATTERY MARKET WILL EXPERIENCE ONGOING TENSION DUE TO SUPPLY LAGGING BEHIND DEMAND FROM 2023 TO 2035, NECESSITATING CONTINUOUS ANNOUNCEMENTS AND FACTORY EXPANSIONS TO MEET GLOBAL NEEDS

Source: LMCA 2023, Strat Anticipation Analysis

New gigafactories face many issues and roadblocks to install their announced production capacities forcing downgraded forecasts due to 7 main reasons.

Main roadblocks to install massive battery cell production capacity

- DELAYS IN CONSTRUCTION & START UP OPERATION DIFFICULTIES ESPECIALLY FOR NEW ENTRANTS
- BATTERY CELL PRODUCTION EQUIPMENT SHORTAGE & COST COMPETITIVENESS VS ASIAN PLAYERS
- HIGH SCRAP LEVEL FOR CELLS DURING PRODUCTION START AND RAMP UP TO FULL VOLUME
- LACK OF QUALIFIED WORKERS TO BUILD & OPERATE GIGAFACTORIES IN EUROPE
- UNCERTAINTIES ABOUT PROJECT FUNDING
- UPSTREAM RAW MATERIALS SUPPLY FOR BATTERY CELLS ARE LIMITED & NOT SECURED
- SHIFT OF CAPACITY FROM EUROPE TO USA TO GET BETTER INVESTMENT INCENTIVES

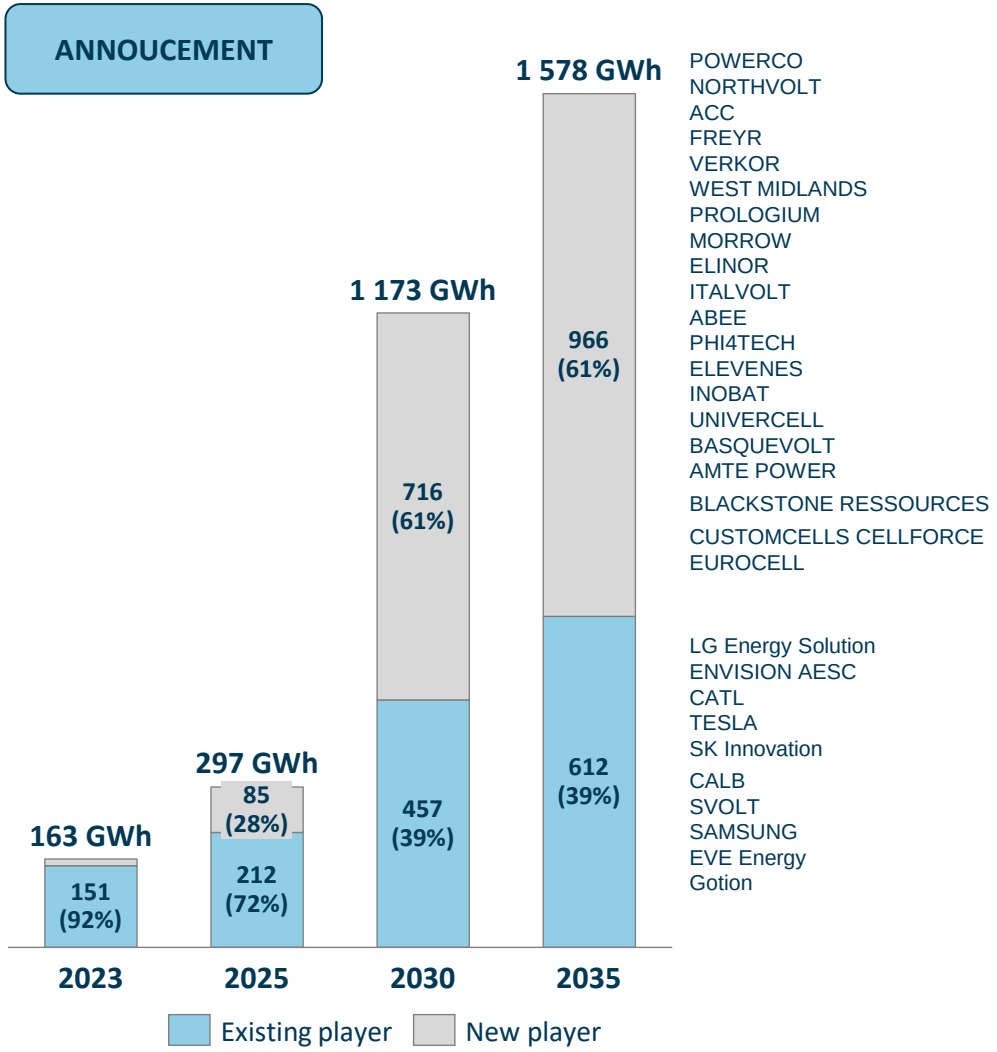
CONSTRUCTION DELAYS HAVE BEEN OBSERVED IN EUROPE AND NORTH AMERICA, PARTICULARLY FOR NEW ENTRANTS. DELAYS CAN ALSO ARISE FROM FACTORS LIKE OBTAINING CONSTRUCTION PERMITS AND ECOLOGICAL IMPACT CERTIFICATIONS. FUNDING PROBLEMS HAVE AFFECTED NEWCOMERS, EXEMPLIFIED BY THE BRITISHVOLT FACTORY BANKRUPTCY DUE TO EQUITY UNAVAILABILITY. ONCE THE FACTORY IS BUILT. ADDITIONAL RISKS EMERGE FOR NEW PLAYERS SUCH AS LIMITED CONTROL OVER RAW MATERIAL SUPPLY, LACK OF SKILLED WORKFORCE AND PRODUCTION EQUIPMENT.

Source : Strat Anticipation

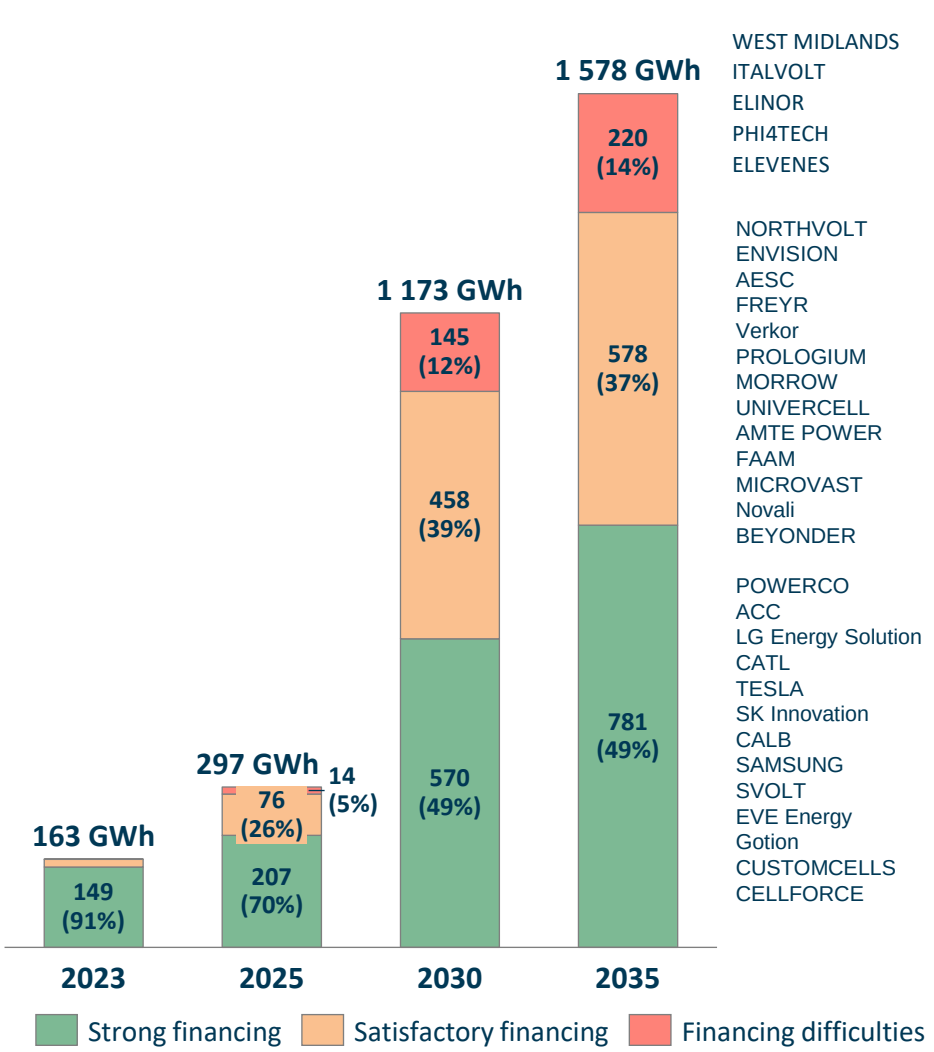
61 % of announced production capacity in EU are from by new entrants for 2030 and 2035 - 12 % of Gigafactory projected volumes might face financing difficulties

Battery cell capacity announced split per type of player & per robustness of funding in Europe

BATTERY CELL CAPACITY ANNOUCED BY TYPE OF PLAYER |
Europe, Forecasts, GWh, 2023-2035, non-exhaustive



BATTERY CELL CAPACITY ANNOUNCED BY FINANCING QUALITY |
Europe, Forecasts, GWh, 2023-2035, non-exhaustive

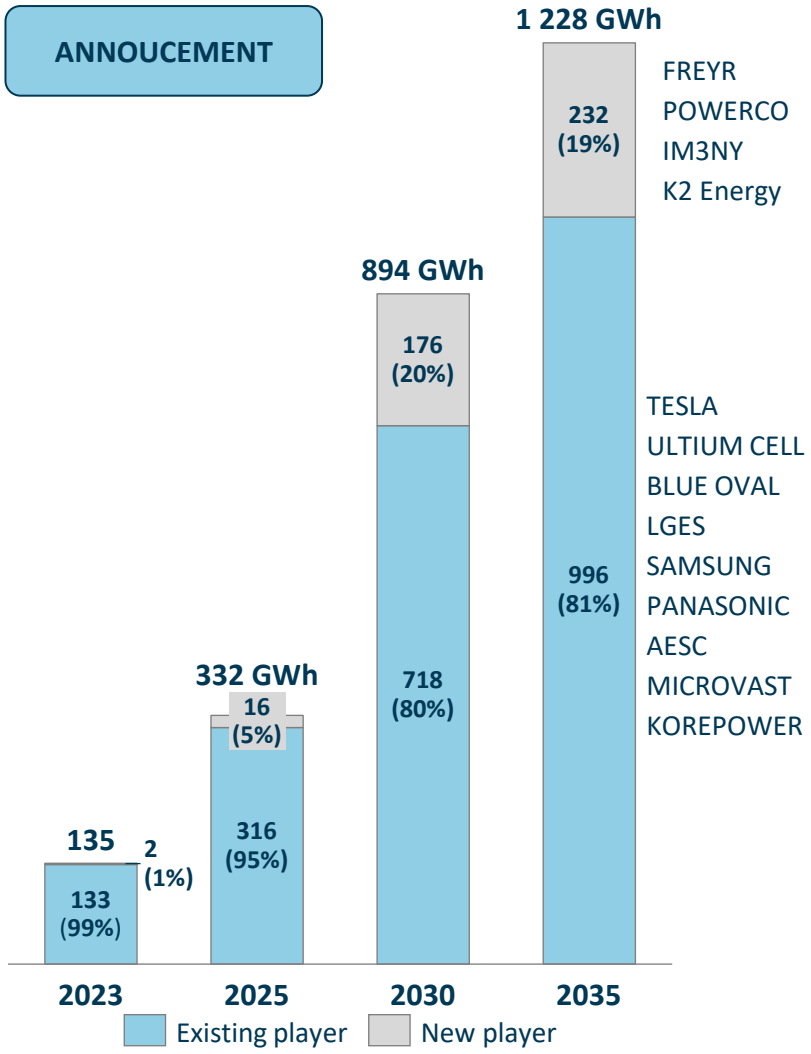


Source: Strat Anticipation bottom-up research & analysis

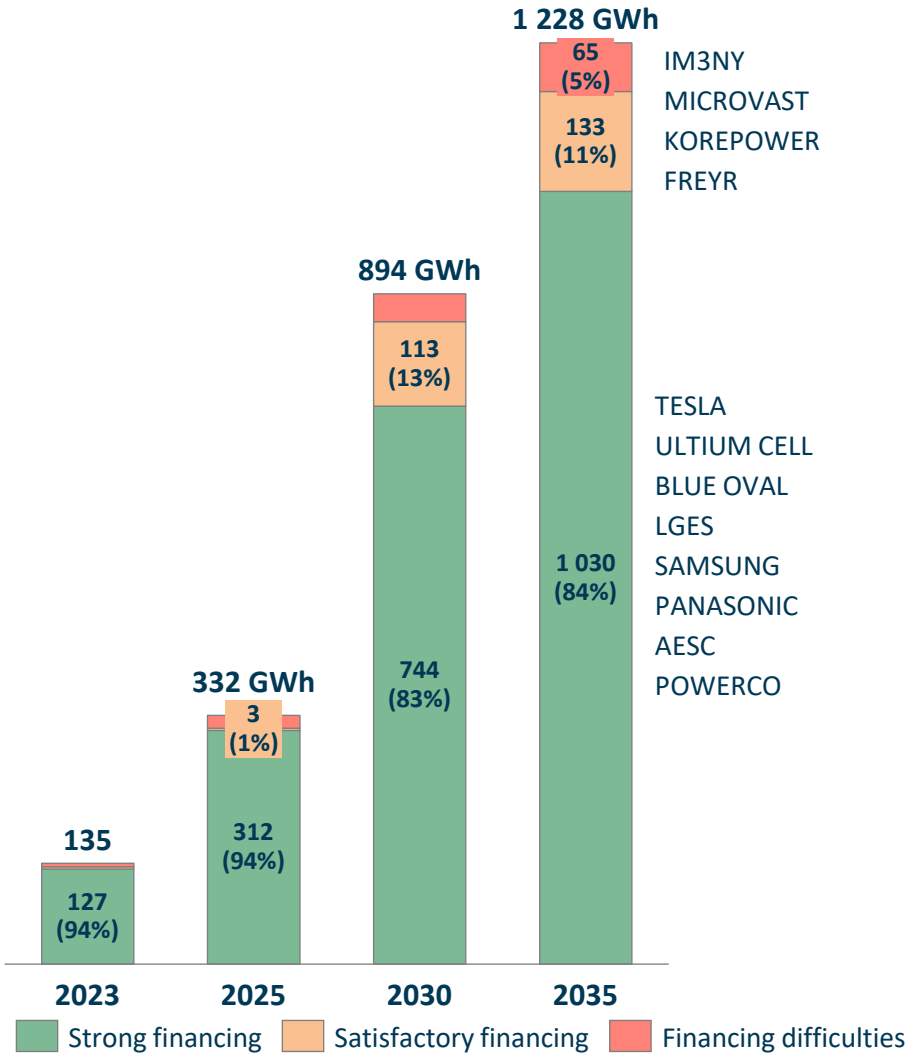
In NAFTA, about 80% of 2030 and 2035 projects will be led by established battery firms with strong funding - Few Gigafactories face funding risks.

Battery cell production capacity split per type of player & per quality of robustness in NAFTA

BATTERY CELL CAPACITY ANNOUCED BY TYPE OF PLAYER |
NAFTA, Forecasts, GWh, 2023-2035, non-exhaustive



BATTERY CELL CAPACITY ANNOUNCED BY FINANCING QUALITY |
NAFTA, Forecasts, GWh, 2023-2035, non-exhaustive



Source: Strat Anticipation bottom-up research & analysis

The European emerging battery industry needs to accelerate along 8 dimensions in order to successfully implement the Green Deal & converge towards net-zero carbon

Overview of key initiatives to be taken

- PRODUCTION EQUIPMENT
- UPSTREAM MATERIALS SUPPLY CHAIN
- PROJECT FINANCING
- QUALIFIED WORKFORCE SHORTAGE
- NEW BATTERY TECHNOLOGIES
- RECYCLING
- RECIPROCITY
- REGULATION FLEXIBILITY

Source: Strat Anticipation

STRAT ANTICIPATION
BE ONE STEP AHEAD

Rémi Cornubert

remi@stratanticipation.com

Mobile: +33 6 07 37 84 27

STRAT ANTICIPATION – 6 rue Alfred Roll – 75017 PARIS - FRANCE