



DUCKER

RESEARCH &
CONSULTING



North American Automotive Aluminum Update 2022 and Beyond

Platts Aluminum Symposium 2022

January 30th – February 2nd

The Wigwam Resort, Litchfield Park, Arizona



Scott Ulnick

Managing Principal
sulnick@ducker.com
+1 248 875 5501



Abey Abraham

Managing Director
abraham@ducker.com
+1 248 792 1315



Intelligent, Fact-Based Solutions

Proprietary data and strategic tools that deliver superior client performance

- Market, Customer and Competitive Research
- Commercial Growth Strategy Consulting
- M&A Transaction Support and Advisory Services



Industry Expertise and Access

6 Leading industries and over 250 sector specialties

- Automotive and Transportation
- Building and Construction
- Industrial and Manufacturing
- Heavy Equipment & Infrastructure
- Materials and Chemicals
- Healthcare



Global Offices and Regional Coverage

7 Global Offices, with 150 consultants serving all leading geographies

- Americas: Troy, Michigan; New York, NY
- EU: Paris, France; Berlin, Germany
- UK: London, England
- India: Bangalore, India
- China/APAC: Shanghai, China

DUCKER

Founded in 1961, Ducker is a global market research, strategy consulting and M&A Advisory firm that delivers custom, industry-centric solutions which *improve client performance and enable business growth* across complex markets.

No other firm can match our unique formula of industry expertise, primary research and market access. Our global offices and expert teams stand ready to address the unique opportunities facing your business and will be your partner to *achieve exceptional outcomes.*

Ducker leverages expansive research and proven strategic frameworks that improve client business performance, define opportunities for growth and advise dealmakers on M&A strategies and transactions



MARKET

Evaluate your markets & adjacent sectors to optimize the firm's position and performance



CUSTOMERS

Build a more customer centric business that attracts customers & creates lasting loyalty



PRODUCTS & SERVICES

Develop innovative products and services. Design & execute winning commercialization strategies



CHANNELS

Examine shifting routes to market to further optimize channel & digital business strategies



COMPETITORS

Benchmark competition to disrupt & outperform industry norms & customer expectations



M&A

Identify, evaluate & prepare successful M&A transactions that support growth & portfolio returns

Business Improvement and Growth Strategies

Successful M&A and Portfolio Growth

Insightful Advice and Support for Advantage

Research & Consulting

Ducker solutions are data-driven, industry-centric and customized for superior client outcomes



Market Intelligence and Strategy

- Market prioritization
- Market opportunity assessment
- Growth forecasts and predictive analytics
- Scenario planning
- Custom market/industry monitoring
- Channel assessment
- Product development
- Key success factors to win in the most attractive markets and segments
- Pricing analytics



Customer Insights and Experience

- Voice of customer analysis
- Customer segmentation
- Customer personas
- Customer journey mapping
- Customer buying process
- New product evaluations
- Brand equity assessment
- Customer satisfaction measurement and tracking
- Market messaging and communications
- Price sensitivity



Competitive Benchmarking and Positioning

- Competitive landscape analysis
- Competency and capability benchmarking
- Sales, pricing and GTM analysis
- Competitive positioning and share analysis
- Competitive structure and value propositions
- Competitive performance measurement and tracking



Online Communities and Knowledge Management

- Continuous connectivity with customers and influencers using technology platform to moderate interactive events and deliver deep insights
- Increased access in real time to influencers, customers and industry participants
- Accelerated NPD and time to market
- Increased customer loyalty
- Reinforced market leader position

Primary Research Capabilities with Proprietary Data

Research Sciences, Technology and Advanced Analytics

Time-tested solution frameworks and Historic Industry Benchmarks

M&A Transaction Support

Compelling Ideas for Capital Transactions



Market Studies

Independent market studies, detailing industry size and forecast, growth opportunities, competitive landscape and customer feedback



Transaction Diligence

Commercial diligence focused on industry, customers, competitors and technology



Post Deal Support

- 90 Day Plans
- Bolt-ons
- Organic growth
- Networking
- Exit strategy

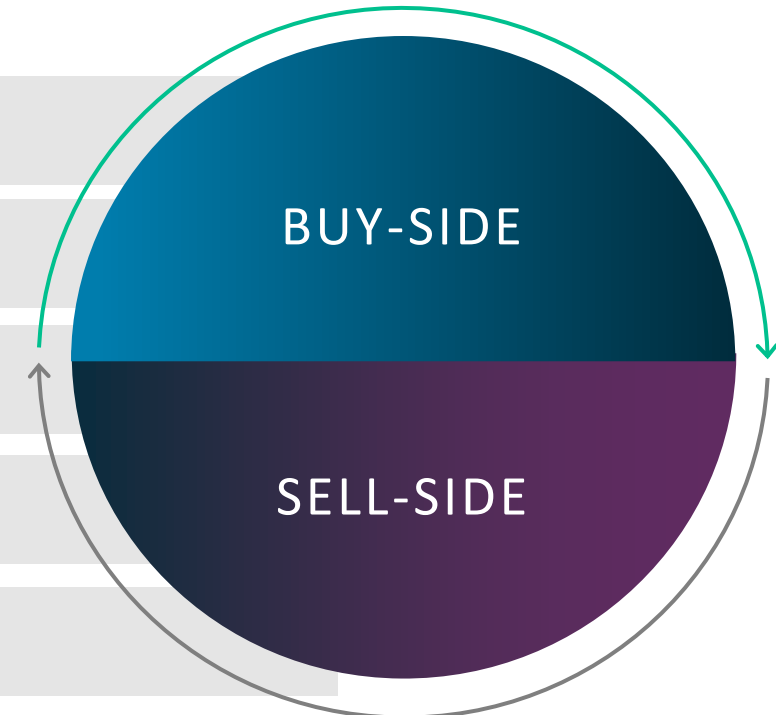
DEAL LANDSCAPE

COMMERCIAL TRANSACTION DILIGENCE

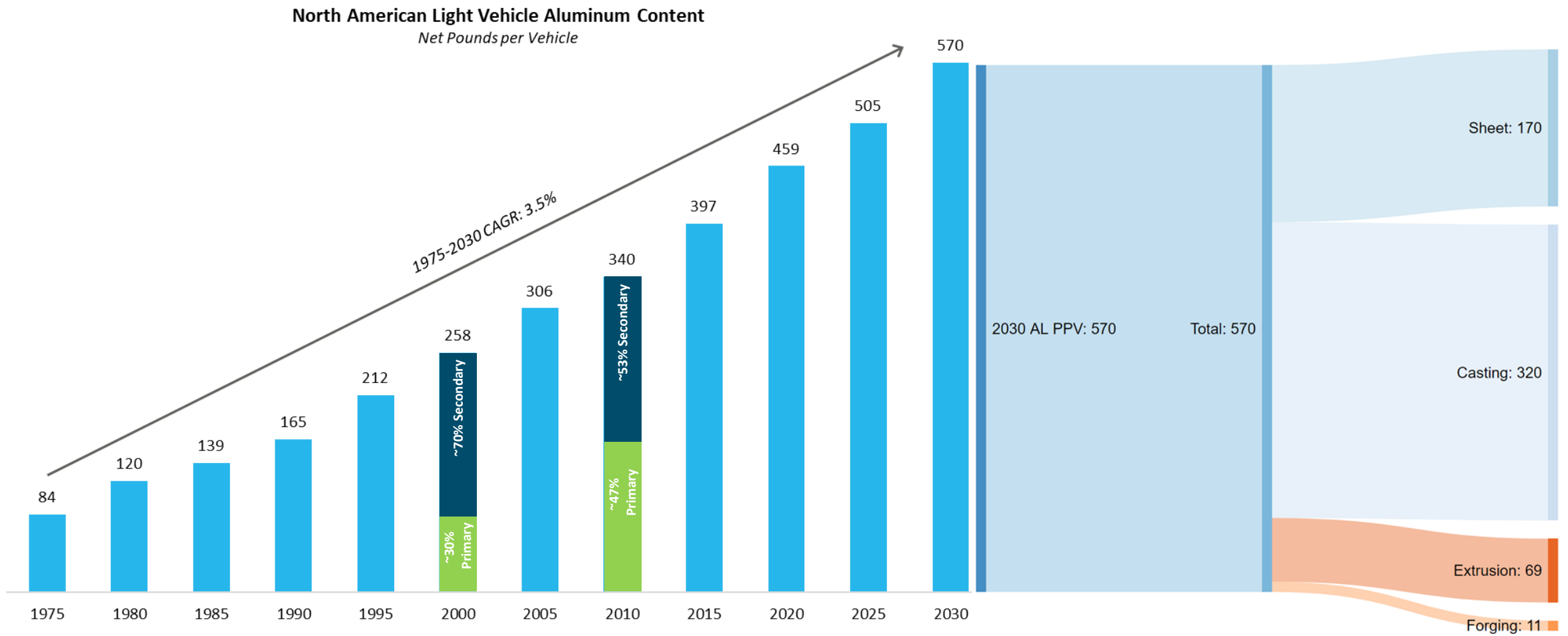
QUALITY OF REVENUE ANALYSIS

BUY-SIDE TARGETING & DEAL MANAGEMENT

ACQUISITION RECEPTIVITY



North American Light Vehicle Aluminum Content and Growth Outlook

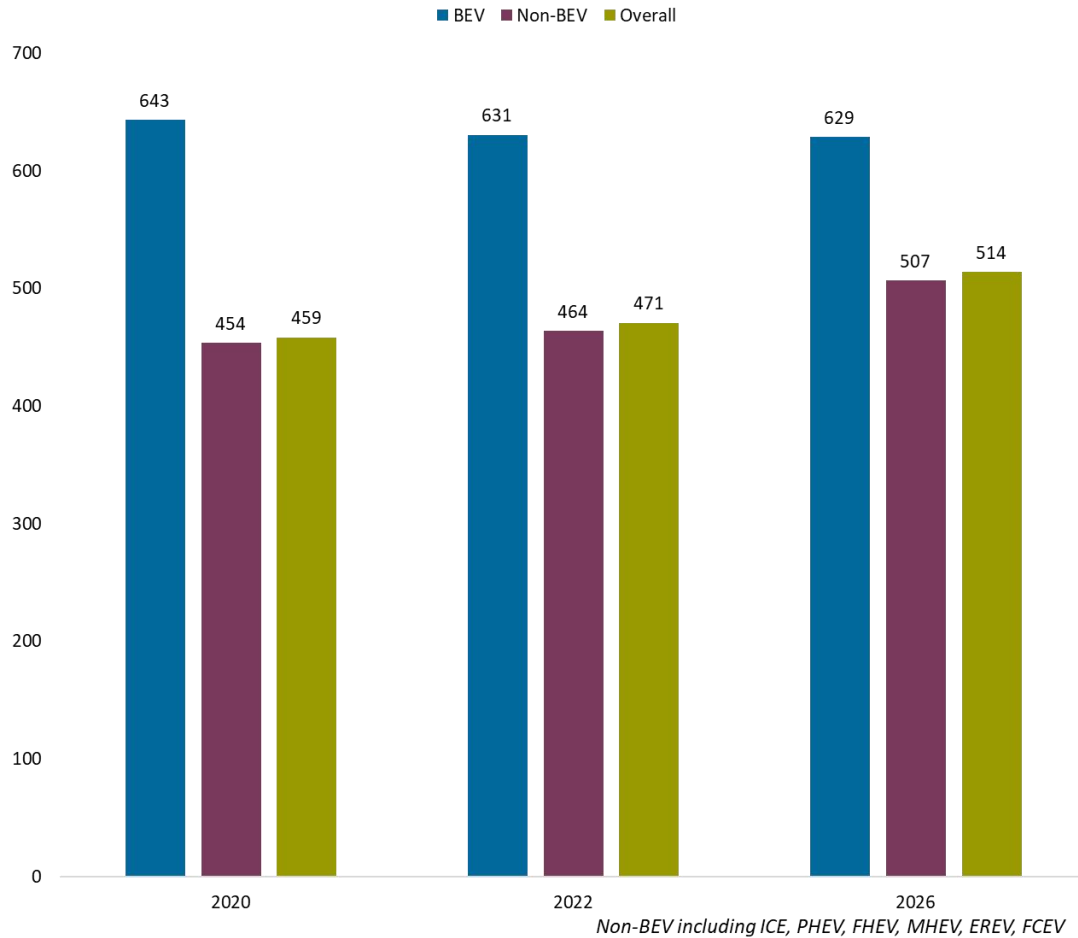


Source: Ducker April 2020 data, Aluminum Association 2020 Report

Aluminum Content Evolution in NA: BEV Aluminum Content Outpaces Average Use

Vehicle aluminum content - BEV vs. ICE based

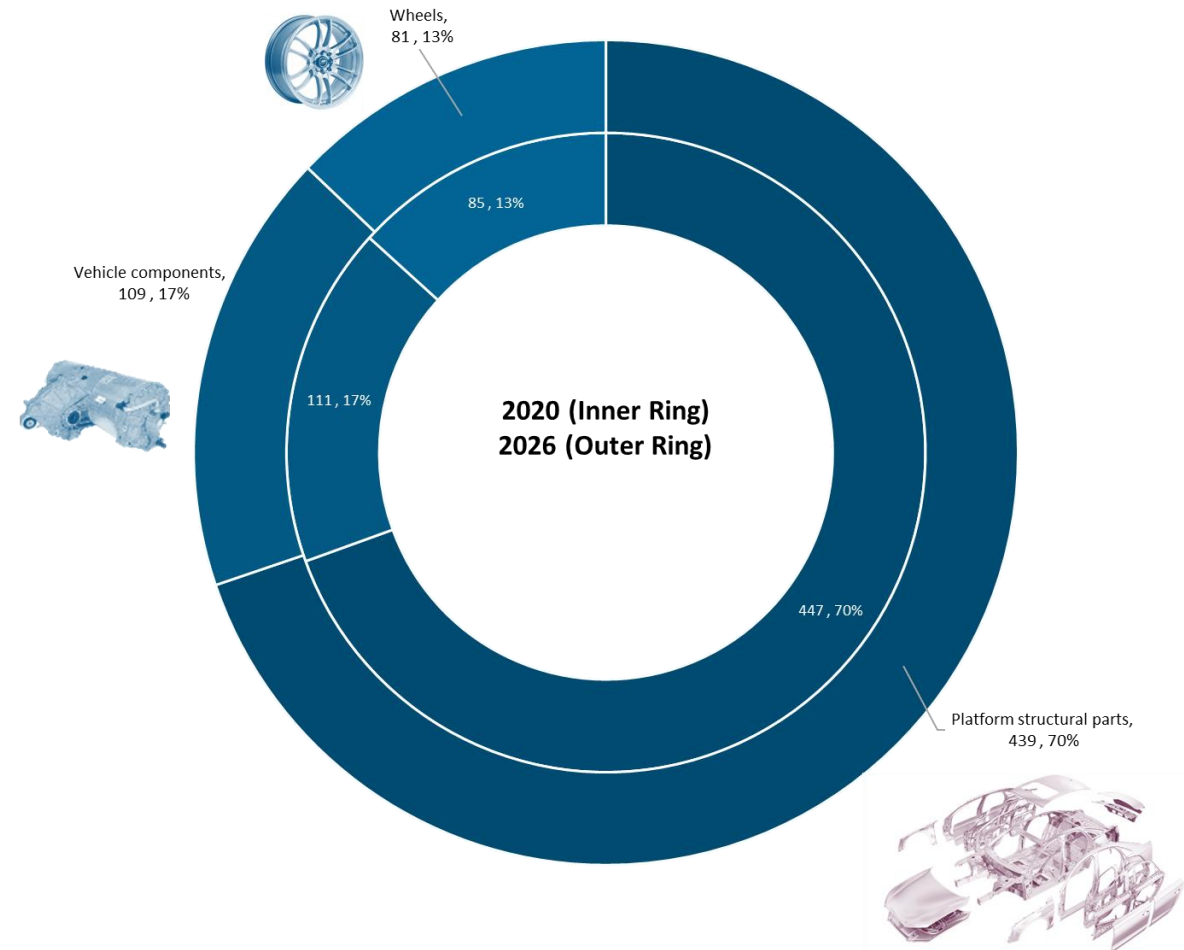
Weight in pounds per vehicle (PPV)

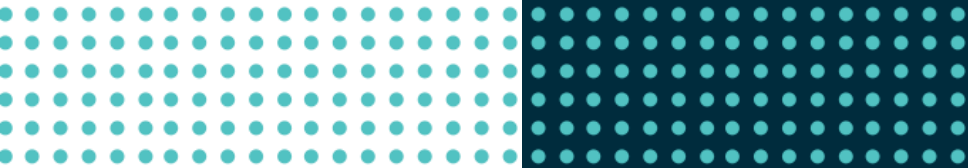


Source: Ducker April 2020 data, Aluminum Association 2020 Report

BEV aluminum content - Share by Part Family

Weight in pounds per vehicle (PPV)

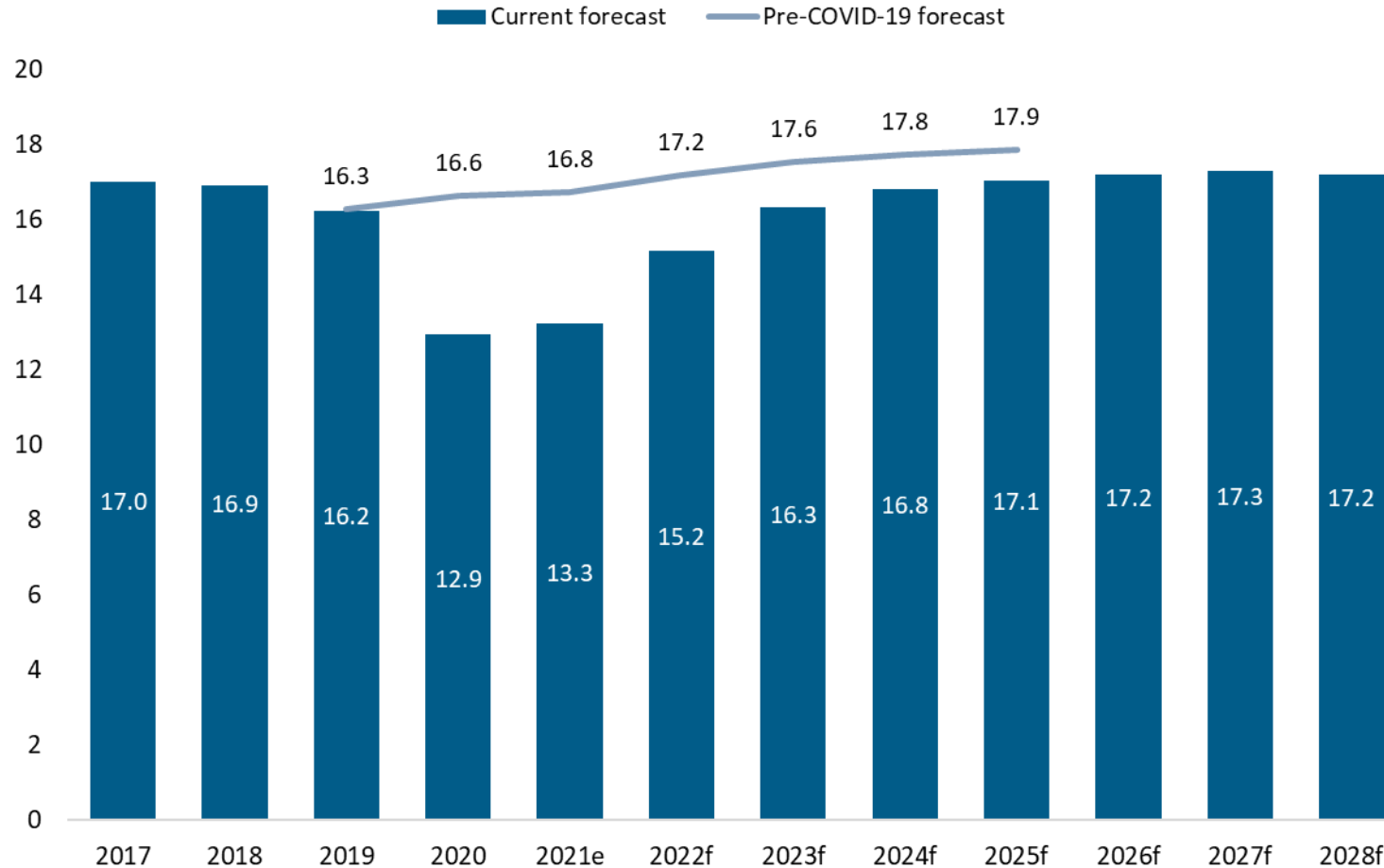




Automotive Market Overview

NA Light Vehicle Production

NA Light Vehicle Production Forecast
Million units (light vehicles)



Industry stalled due to COVID-19 in 2020 following lockdowns and low mobility needs

2021 production volumes 19% below pre-COVID, chip shortages create supply chain disruptions

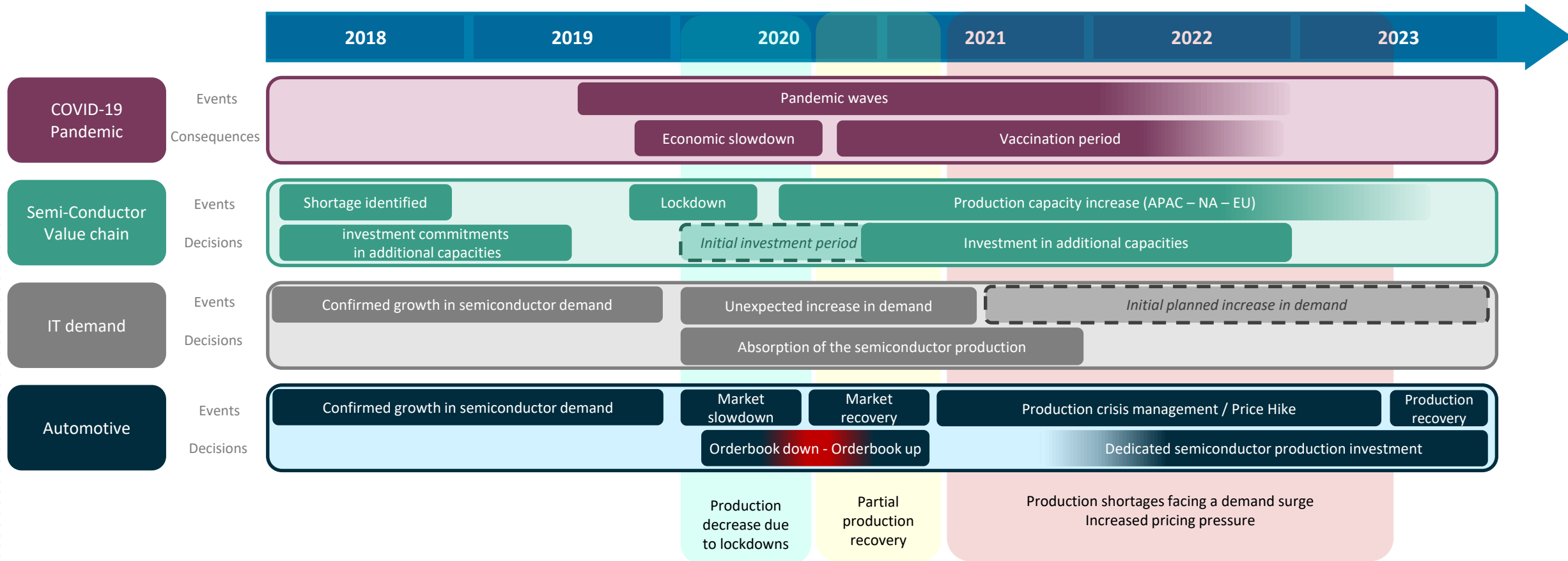
Market is unlikely to return to normal production levels before the first half of 2023

Lost volume recovery is not expected before 2024

Source: Ducker, LMC Automotive Q3-2021

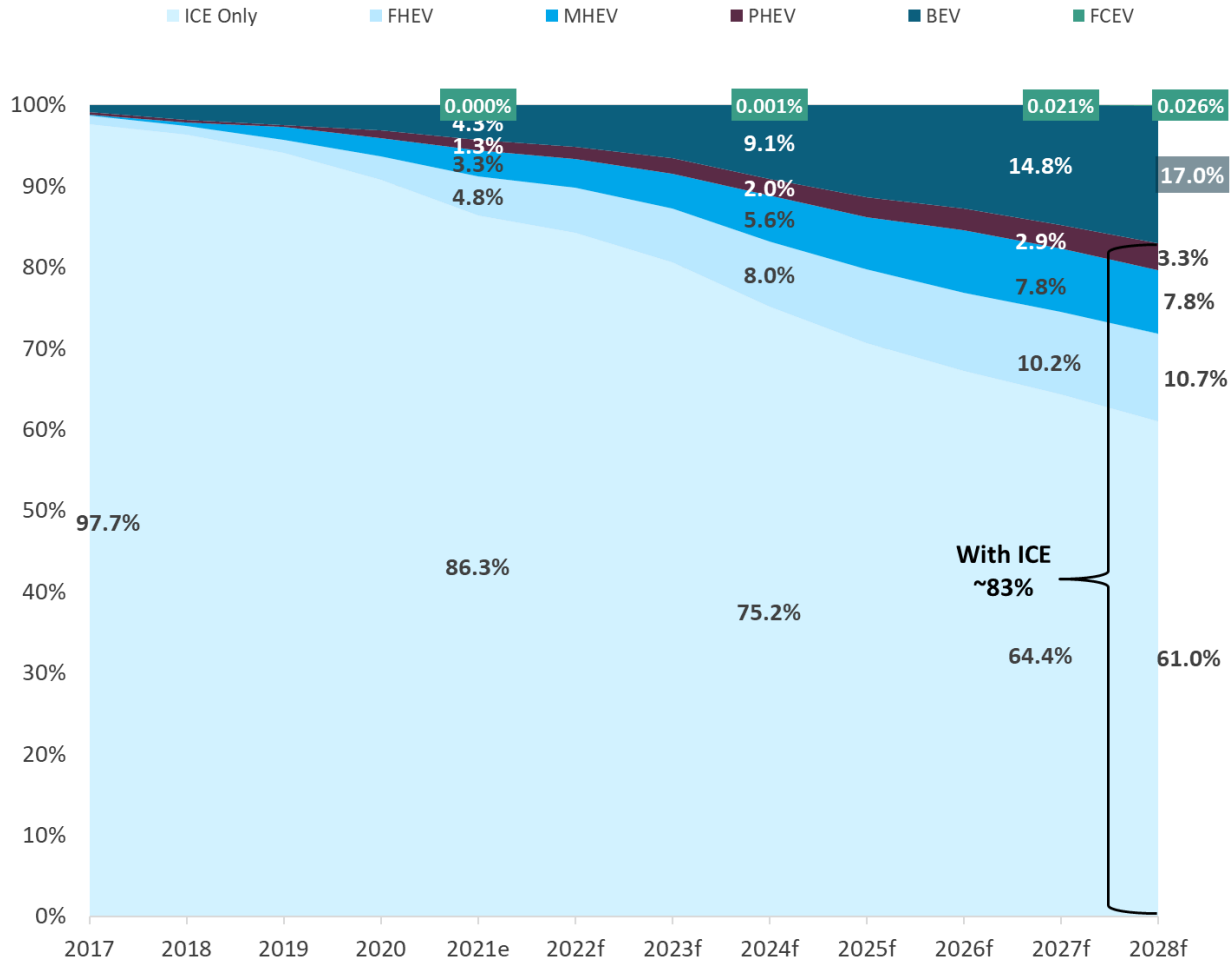
Current Semiconductor Shortage Timeline

- Initial shortage was identified for 2022/2023
- Demand for semiconductors soared during COVID lockdown while productions went down
- New factories (Intel, TSMC, TI, etc.) won't hit full production capacity before 2023
- As of 2020, vehicles have about 1,400 semiconductors (average content)
- The average content value is expected to rise from \$330 to \$600 by 2022/2023
- Hybrid vehicles have over 3,500 semiconductors for total value of \$1,000 (EV powertrain)



Source: Ducker

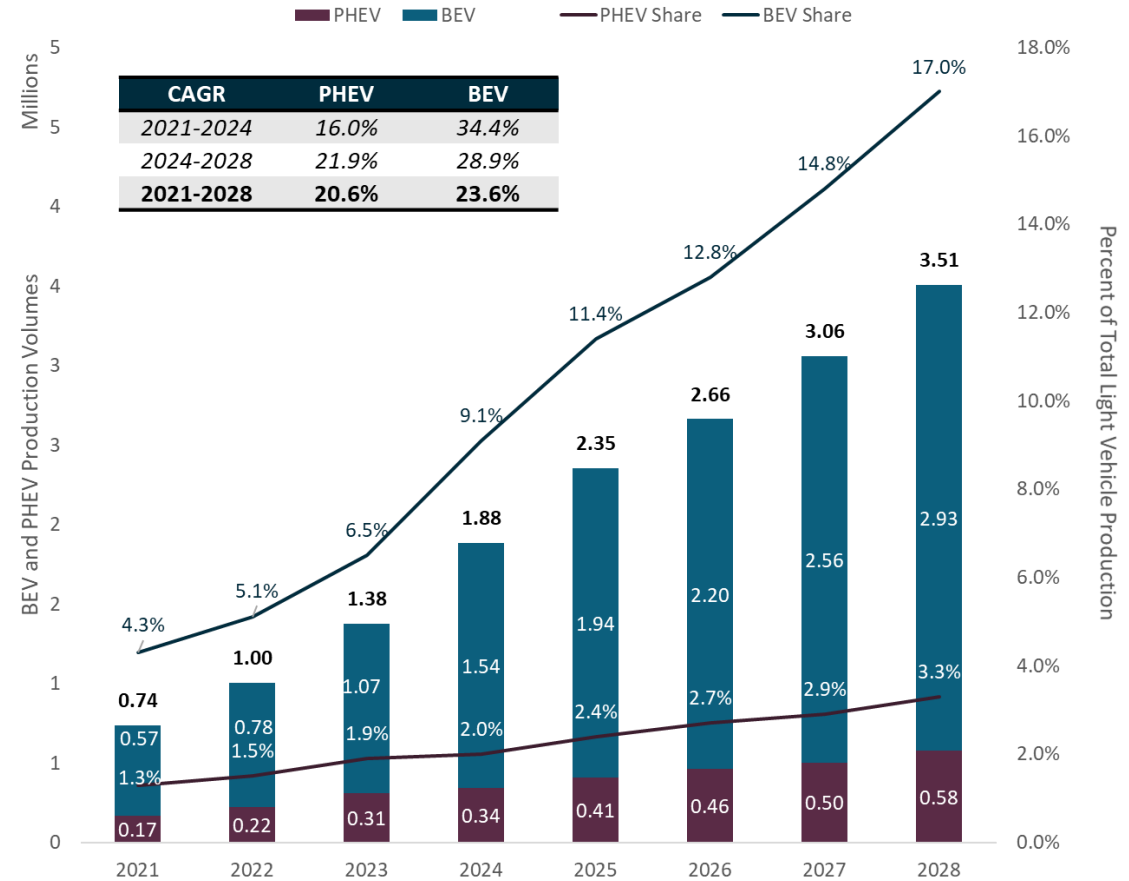
NA Light Vehicles Powertrain Shares



Source: Ducker, LMC Automotive Q3-2021

NA Light Vehicle BEV-PHEV Production Forecast

Million units (passenger vehicles)

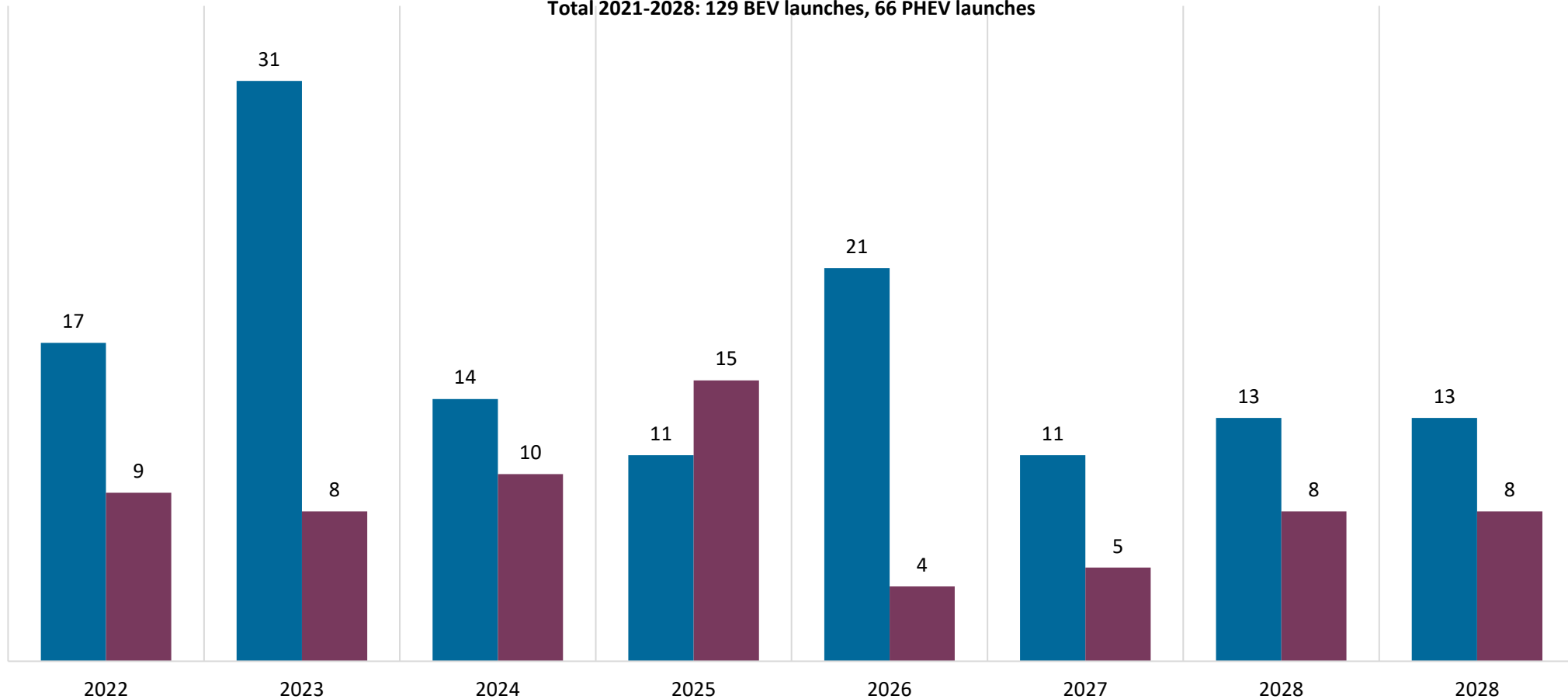


CAGR	PHEV	BEV
2021-2024	16.0%	34.4%
2024-2028	21.9%	28.9%
2021-2028	20.6%	23.6%

New PHEV and BEV Launches

■ BEV Launch ■ PHEV Launch

Total 2021-2028: 129 BEV launches, 66 PHEV launches



Source: Ducker, LMC Automotive Q3-2021

Revised Standards, OEMs are Backing the Government



- The Biden administration unveiled a target average fleet standard of 52mpg (4.5L/100km) for 2026
 - 10% fuel efficiency boost for the 2023 model year
 - 5% improvement increase through 2026
 - The EPA version calls for 8% per year improvement after 2024
- **General Motors, Ford and Stellantis publicly supported the Build Back Better agenda, a way to get the return on investment spent over the past decade for electrification strategies**
 - “By MY 2026, EPA projects that the final standards can be met with sales of about 17 percent electric vehicles (EVs), and wider uptake of advanced gasoline engine and vehicle technologies available today”. [EPA, December 20, 2021](#)
- R&D based strategy to **create jobs and manufacturing capabilities before incentivizing the market**
 - \$174 billion invested towards carbon neutrality in mobility
 - Over \$46 billion invested in ZEV technologies (PHEV, BEV and FCEV)
 - 647,000 jobs created including about 270,000 added through investment in manufacturing based on incentives
- **50% Zero-Emission Vehicles (capable) targeted for 2030** considers all plug-in vehicles (PHEV included)
- Policy to **increase incentive programs up to \$12,500 for new EVs** is not yet passed
 - Only vehicles below \$80,000 will qualify for tax credit
 - Only households with gross income below \$250,000 (\$500,000 for joint filers) will qualify (currently \$400k/\$800k)
 - 200,000-vehicle phase-out threshold removal
 - \$7,500 tax credit for all plug-in electric vehicle acquisition
 - \$500 additional tax credit if the battery is made in the USA
 - \$4,500 additional tax credit if the vehicle is assembled in a unionized plant

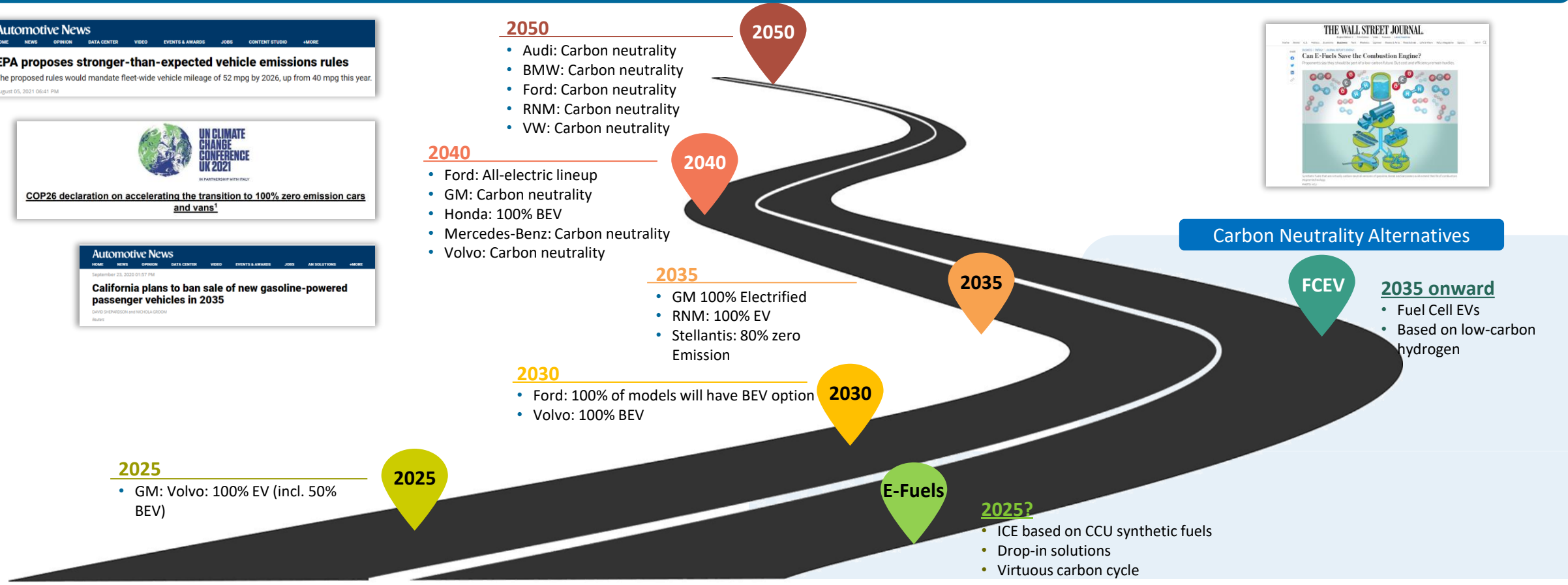


The Road to Carbon Neutrality

Sustainable

DUCKER

OEMs and Tier 1s are looking forward to implementing carbon neutral solutions for vehicle production, component manufacturing, and emission. Michigan and the Detroit area are engaged in road infrastructure for the development of electrified and alternative carbon neutral solutions to help carmakers and suppliers achieve carbon neutrality (in 2040-2050)



Carbon Neutrality Alternatives

Influencers



Source: Ducker

Regulatory Environment – Most Stringent Requirements form Baselines



Safety Standards

The strong push towards net-zero carbon solutions are leading to reflections on a local standard for EVs, however, the need for regulation is fulfilled by the UNECE R100 rule as long as EV norms won't be written and adopted into the FMVSS² rule

UNECE¹ expands to 56 countries regions, including US and Canada



European Commission (DG GROW) is working on its own standards for battery testing and certification with the support from the [FSITA](#) associated organizations. The regulatory requirements will be compliant with the UNECE¹ existing standards



China has recently increased fire resistance to 5 minutes (vs 4 previously) after several issues from runaway cells and battery management systems from parked cars (Nio and Tesla). Rumors mentioned potential increase of fire mitigation time to 45 minutes to secure the arrival of first responder, but it is unlikely given the current state of the technology

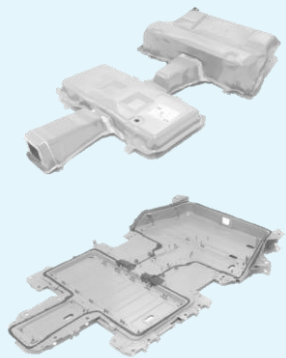
- As BEVs become more global, carmakers must comply with up to 100 different standards beyond the usual automotive and road regulations
- OEMs apply the most stringent regulations across all models and regions in order to simplify designs and secure certification
 - US FMVSS
 - UNECE R100 Revision 2
 - China GB 38031-2020
- Battery safety and regulations consider the following key elements:
 - Secure the battery integrity from the intrusion of external objects
 - Secure the environment from leaks
 - Secure functional safety (EMC, etc.)
 - Prevent fire
 - Secure occupants in case of a crash (time to exit the vehicle, protection from hazardous fumes, etc.)
- Fire mitigation has become the most regarded safety issue influencing battery chemistry, architecture, housing design and material choices
 - Resistance to flames is set to 1 minute in North America, 2 minutes in Europe, and 5 minutes in China (GB 38031-2020, appendix)

Battery Housing Material Solutions –

Aluminum utilization in battery housings is mature | Steel provides in-sourcing / vertical integration options for higher volume common platforms | Cell-to-chassis tends to favor structural castings – aluminum/steel have opportunities to explore

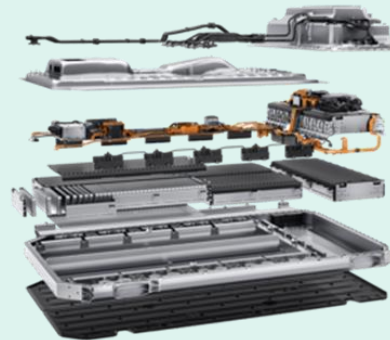
Steel housings

- GM is one of the first OEMs to implement a full-steel housing for its first Ultium applications
- Full-steel housings are usually cost-driven solutions that eventually offer in-house manufacturing opportunities as most OEMs have steel stamping capabilities
- Space sensitive PHEVs may shift to steel housings in the future



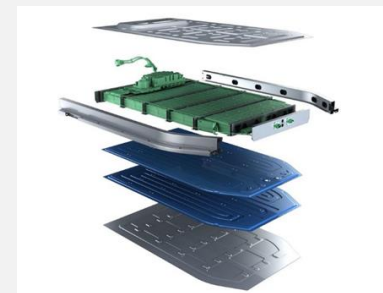
Multimaterial housings

- Multimaterial solutions are driven by safety, cost, and thermal efficiency goals
- May have stamped steel top cover, bottom cover, crossmembers (extruded aluminum or roll-formed AHSS) with an aluminum frame (typically extruded) or a stamped aluminum tray



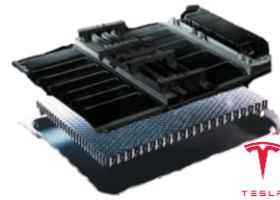
Aluminum Housings

- Aluminum is the incumbent material for BEV battery housings as weight reduction has been a critical driver while battery cell chemistry technologies improve
- Premium brands are expected to keep full-aluminum housings due to weight, performance, and integration
- Scalability of aluminum solutions are preferred for lower volume vehicle models



Cell-to-chassis

- This path is being explored by Tesla for future applications
- Requires reinforcement of the floorpan for crashworthiness and fire resistance
- Sealing between the tray and the floorpan is a critical challenge to tackle

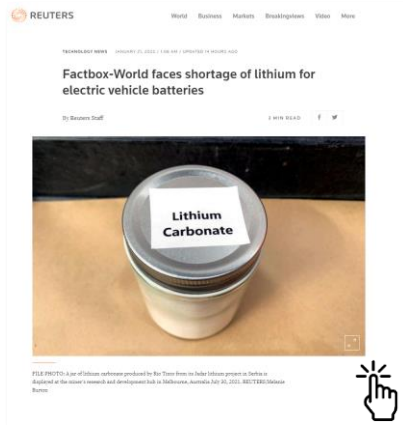
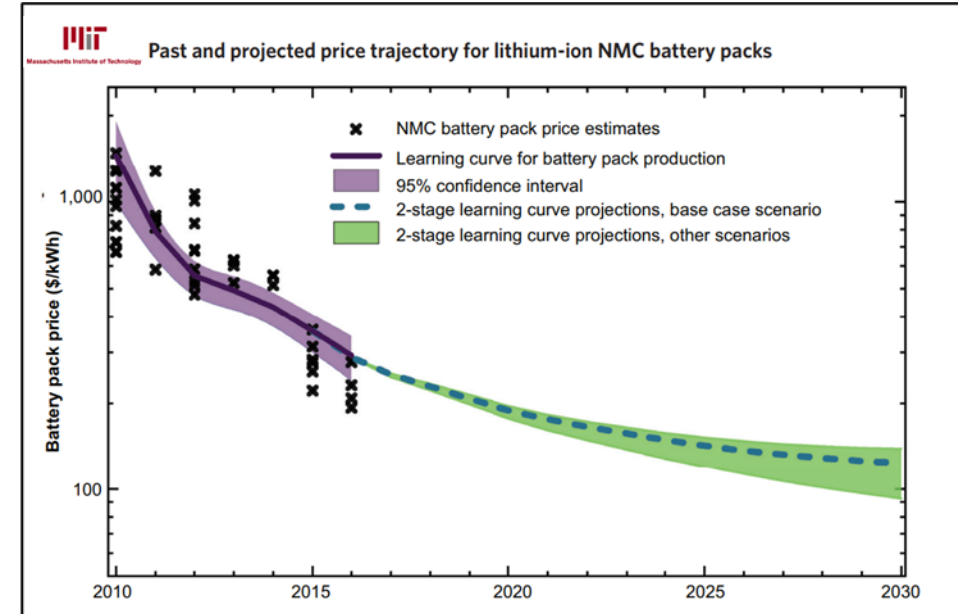
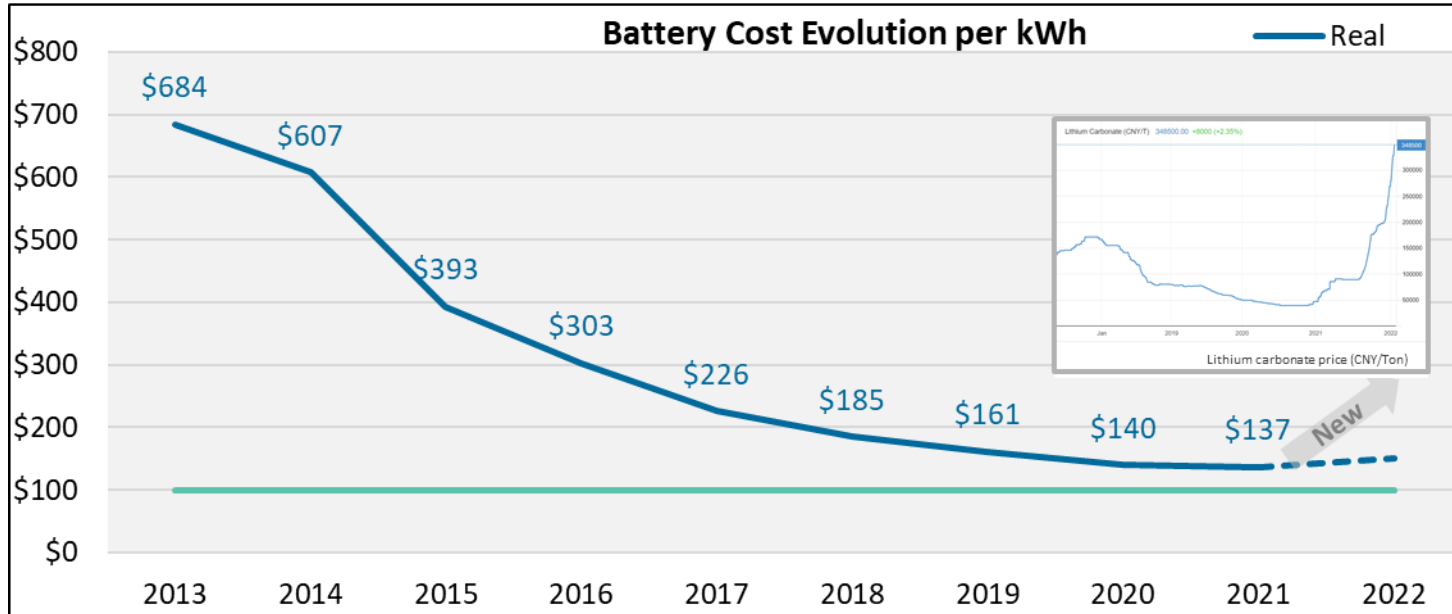


Composites

- Interest in composite top covers is growing as materials now offer both sufficient fire resistance and EMC capabilities
- Cost, recyclability, and space package management remain a challenge for composites to address



Electrification or Mass Reduction to Improve Range



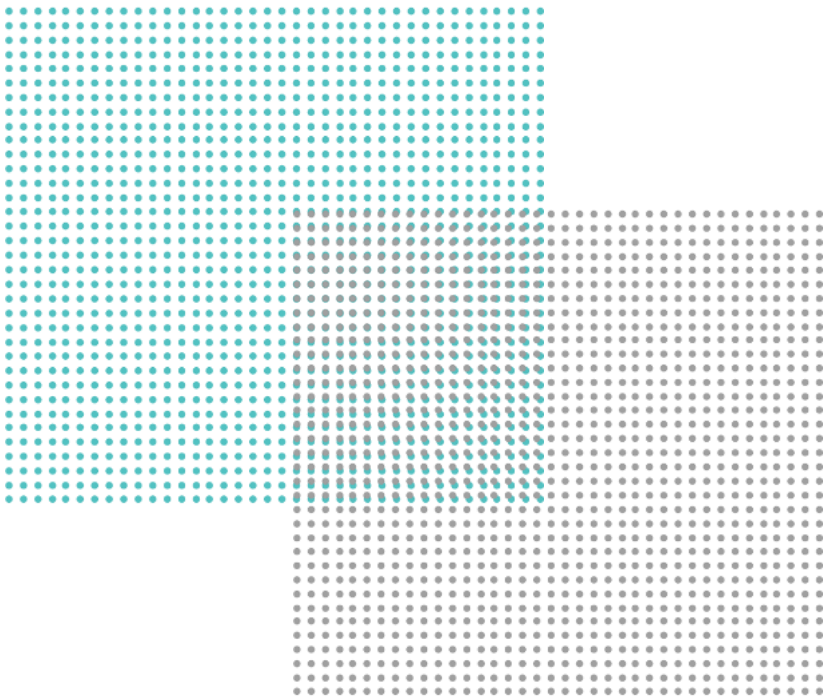
- **Lightweighting remains essential to keep up with range and cost** as battery costs will remain high and weight has an important impact on range, performance, and secondary costs (suspension, wheels, etc.)
- Most raw materials are expected to see prices increase in 2022, **Lithium could reach \$20k per ton by mid-year** as a shortage is expected for this year
- Due to material cost increase with higher demand, MIT considers that **battery cost will not be able to decrease below \$124 per kWh** before 2030
- Both volumetric energy density (related to the number of cell per battery in Wh/L) and gravimetric energy density (energy content capacity per cell in Wh/kg) are improving, but every Wh gain costs more in material than productivity gains given the current state of the technology

The Exception? Chevrolet Silverado EV

- The 200kWh battery adds weight and cost to the vehicle to offer a good performance level (about 400mi range)
- GM has targeted a low cost for the vehicle itself with an estimated \$42k entry price, a potential driver to select steel for some of its closures

Range	400 miles
Payload	1,300 lbs.
Towing	10,000 lbs.
Curb weight	8,000+ lbs. (Est.)

Sources: Ducker, Reuters, BNEF, MIT, GM, Trading Economics



THIS CONCLUDES OUR PRESENTATION. THANK YOU.

Today's presentation was prepared by Ducker Research and Consulting/Ducker Holdings LLC. To the fullest extent permissible by applicable law, all information contained herein is for informational purposes only and is provided "AS IS". The information is provided (i) with no guaranty of accuracy, completeness, timeliness or that any defects will be corrected and (ii) without any representations, warranties or other contractual terms of any kind including, without limitation, warranties of title, merchantability or fitness for a particular purpose. Even if Ducker was advised, knew or should have known that claims or damages could arise from the use, misuse or delay of use of the information, Ducker assumes no legal liability for any direct, indirect, consequential, special, punitive or similar claims or damages. The information contained herein does not represent financial, legal, regulatory or other advice and recommendations from Ducker. Any use of the information is undertaken at your sole risk.



RESEARCH &
CONSULTING

BANGALORE | BERLIN | DETROIT | LONDON | NEW YORK | PARIS | SHANGHAI

www.ducker.com

