

Private Markets

**Transition
Center of
Expertise:
Mobility - Land**

BlackRock

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The electrification moment

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Key takeaways

- ✓ The passenger EV industry has entered its growth stage, with rapid increases in adoption and usage, as well as improving technology and falling costs.
- ✓ Different regions are at different stages in the EV-adoption curve. China and Europe have taken the lead, followed by the U.S.
- ✓ Investment opportunities extend beyond the vehicles themselves to charging infrastructure, battery technology and other emerging fields.
- ✓ Given the cost of capital, and the high capital expenditure requirements in many areas of EV manufacturing and infrastructure, we expect further consolidation.
- ✓ Risks include lower-than-expected adoption rates, thinner profit margins on energy resale, technology obsolescence, and grid-capacity or supply-chain bottlenecks.
- ✓ Opportunities in this space are diverse across public and private markets, and in maturity from venture-stage companies to large-scale infrastructure plays.

Introduction

The movement of people and goods over land represents about 12% of global greenhouse gas emissions¹. Enabled by recent advances in battery energy storage, we believe the electrification of road transport will be central in the transition to a low-carbon economy.

The BlackRock Investment Institute Transition Scenario projects that demand for electric vehicles will increase roughly seven times by 2030 from today's levels, led by growth in the U.S. The reasons include lower costs, the growing availability of public charging infrastructure, and a wave of policies banning the sale or manufacture of internal combustion engine vehicles in the 2030s. As a result, we expect nearly every new car in the world to be electric by 2050.

There are historical parallels to this moment. At the turn of the 20th century, electric cars accounted for about one-third² of all vehicles on the road in the U.S.

Then came both Ford's Model T and cheap Texas crude oil, which quickly shifted automakers toward liquid fuels. A retail network of filling stations sprang up seemingly overnight.

Today, a similar expansion of the supporting infrastructure that underpins electrified transport is unfolding. While most demand for EV charging is currently met using at-home ports for passenger cars, public charging will be necessary to facilitate large-scale adoption, improve accessibility and mitigate range anxiety. We expect most EVs to be charged outside of homes, creating urgency in the public charging space.

In 2022, global deployment of public charging infrastructure grew by 55% to reach 2.7 million public charging points³, led by China. But the distribution of public EV charging stations remains uneven globally.

Source: 1. World Resources Institute, 2020; 2. Energy.gov: History of the Electric Car, 2015; 3. IEA: EV Global Outlook 2023.

About BlackRock's Transition Centers of Expertise

The transition to a low-carbon economy is among a handful of major structural shifts that we see rewiring economies, sectors and businesses. The transition will likely cause ripple effects around the globe and change where revenues and profits are generated.

The transition's pace of change, however, is highly uncertain, which creates complexity and risk – as well as opportunity – for companies and investors alike.

At BlackRock, we define transition investing as: Investing with a focus on preparing for, being aligned to, benefitting from and/or contributing to the transition to a low-carbon economy. We recognize that clients across the world are investing in the transition to a low-carbon economy to generate returns, manage risk, or execute on commitments.

BlackRock's new Transition Centers of Expertise (CoEs), of which our Mobility CoE is one, bring together the knowledge of our more than 600 sustainable and transition specialists across the firm, as well as external experts and industry associations. These virtual communities, organized by sector technology, encompass expert views throughout the capital stack and across industry value chains, contribute to the assumptions used in the BlackRock Investment Institute Transition Scenario (BIITS), and help source new opportunities for our clients.

We hope the insights developed by the CoEs will lead to a better understanding of the uncertainty around the transition by bringing together a range of perspectives and experience.

We currently have more than US\$110 billion invested in transition-related assets globally, across asset classes and industries in both public and private markets. These investments range from large-scale infrastructure projects to seed funding for technology startups. They could also potentially include stock or bond holdings of a business reducing its emissions or investing in low carbon solutions. This paper is produced in close cooperation with our Mobility CoE.

In the U.S., the Bipartisan Infrastructure Law allocates funding toward the federal target of 500,000 public chargers nationwide by 2050¹. That could open up opportunities for infrastructure investment in U.S. EV charging networks.

One fundamental question we're tracking is the degree to which the availability of public EV charging stations will be an essential tailwind for the broader adoption of EVs. This question is complicated by both consumer preferences and technical dynamics.

Consumer preferences

The degree to which consumers choose to charge their EVs at home or use public chargers will depend, in part, on the availability of power delivery and resultant charging speeds, which can vary from minutes to hours². Those speeds will likely increase as technology improves and high-power charging (150kW and higher) becomes more widely available.

These factors look different for medium and heavy-duty road vehicles including buses and trucks, however. Such vehicles drive longer distances, carry heavier loads and are on the road for a substantially larger portion of the day, which means they require bigger batteries, higher capacity charging, and often charging depots with schedules that optimize logistic.

That could mean fleet operators with effective time- and demand-based charging strategies or dedicated heavy-duty charging networks will best be able to minimize their fleet downtimes as public infrastructure networks continue to be built out.

Technical dynamics

The added load of EV charging on regional electric grids is projected to elevate global power consumption by approximately 15% by 2050⁴. While this could prove to be a headwind, the anticipated increase in demand spans decades, providing system operators with ample time to refurbish and expand their existing networks.

One outstanding challenge remains, however, in the form of grid connection delays. It's possible that system operators may struggle to keep pace with escalating connection requests.

On the more positive side are vehicle-to-grid technologies, by which electric vehicle owners can offer energy storage to grid operators using their vehicle batteries. This would contribute to grid stability while allowing users to benefit from the evolving energy landscape.

Valuations

Changes in technology, policy and the shifting preferences of consumers and investors can move technologies or sectors from being on a gradual, linear path of decarbonization to an exponential acceleration after they reach a tipping point.

Markets will sometimes anticipate future earnings growth and price it in before the tipping point is reached, however, changing the potential investment opportunity. In some cases, valuations can get ahead of themselves.

For example, we have seen the valuations of many EV companies surged before pulling back last year, even as their overall market share kept growing⁵. For this reason, we believe finding transition-related opportunities that are not priced in yet requires granular analysis.

Opportunities

We see attractive investment opportunities across the clean transport value chain and in adjacent businesses.

Competitive advantages are emerging for companies with existing assets or partners in areas such as retail fueling locations, where customer convenience reigns.

For public chargers, adjacent business models that deliver retail and services to customers while they wait may see strong growth, exemplified by BP's recent acquisition⁶ of Travel Centers of America to expand its convenience retail and EV charging business.

In the transition to a low-carbon economy, electrification is an immediate and vital phase, making it front-and-center in terms of investible opportunities.

Government incentives, changing consumer preferences and technological developments, especially in batteries, are rapidly altering the landscape for EVs and related infrastructure, and making it an opportunity worth exploring.

Source: 1. Whitehouse.gov, February 2023; 2. Transportation.gov, 2023; 3., 4., 5. Bloomberg NEF Global EV Outlook 2023; 6. BP: February 2023.

Investor Q&A

BlackRock’s Centers of Expertise bring together our leading experts for specific industries that we believe will likely play a key role in the low-carbon transition. Our Mobility CoE includes Patrick Bydume, an investor in energy-related infrastructure, SuetChee Chiong, who invests in early-stage private companies, Giovanni D’Andria, who specializes in energy infrastructure across Europe, Hannah Johnson, an active manager in public markets and Paddy O’Kane, Chair of the BlackRock Mobility Center of Expertise.

How has the transport industry evolved in recent years?

SuetChee Chiong: EVs have become a central investment opportunity related to the transition to a low-carbon economy. One major development is the way that many risks of EVs have been reduced from an investment perspective. This is especially true on the technology side, which is at a stage now where many core technologies are largely proven, reliable and falling in cost.

Hannah Johnson: At the same time, we have also seen huge growth in EV sales and new auto manufacturers.

In Europe and North America, this growth has been disruptive in the premium segment where legacy automakers have historically made the majority of their profits. Established players have defended their share with new EV model launches of their own. This increased competition is leading to price declines, which are great for the consumer and needed for broader EV adoption but weigh on returns. In response, some automakers have become more cautious in terms of increasing their investment in EVs.

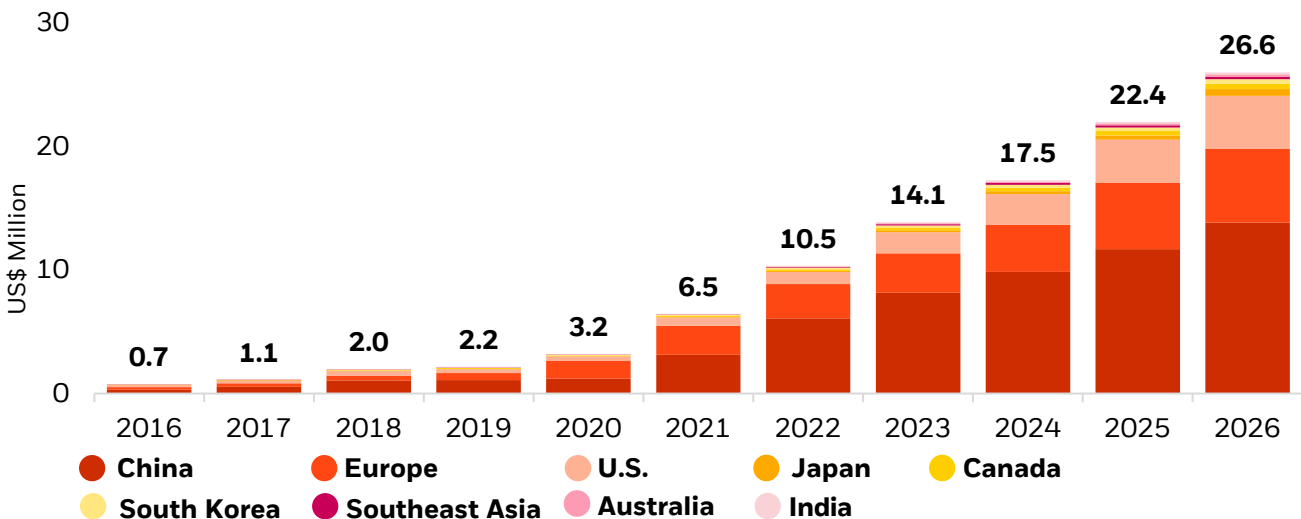
I’d note that growth in the Chinese market has been much broader. Companies there have launched new EVs that retail at around US\$30,000 to appeal to the mass market customer domestically and for exports, which are rapidly growing. Adoption is much higher in China as these cheaper EVs have penetrated the mass market.

SC: I agree that the advances aren’t uniform around the globe. Right now, China is leading the pack in terms of both adoption and production of EVs, a shift that came about as a result of top-down policy incentives. But the total cost of ownership for EVs worldwide is reaching levels where it’s comparable to combustion-powered vehicles, and that’s without subsidies. And many emerging countries, such as India, are potentially leapfrogging combustion engines altogether and going directly to electric models in their adoption of two- and three-wheelers.

Patrick Bydume: Yes, exactly – I think that’s an important observation and it really applies beyond just the equipment manufacturers themselves to the theme of electrification in the transport space, which has been playing

Regional differences

EV sales are growing, but at different paces across markets



Source: BloombergNEF, June 2023. Note: Europe includes the EU, the UK and European Free Trade Association (EFTA) countries. EV includes battery electric vehicles and plug-in hybrid electric vehicles. Forward looking estimates may not come to pass

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out pretty differently by region. The ways to participate in this theme from an investment perspective can vary meaningfully from region to region. And it's the unevenness of the opportunity set that can make it such a fertile ground for investors.

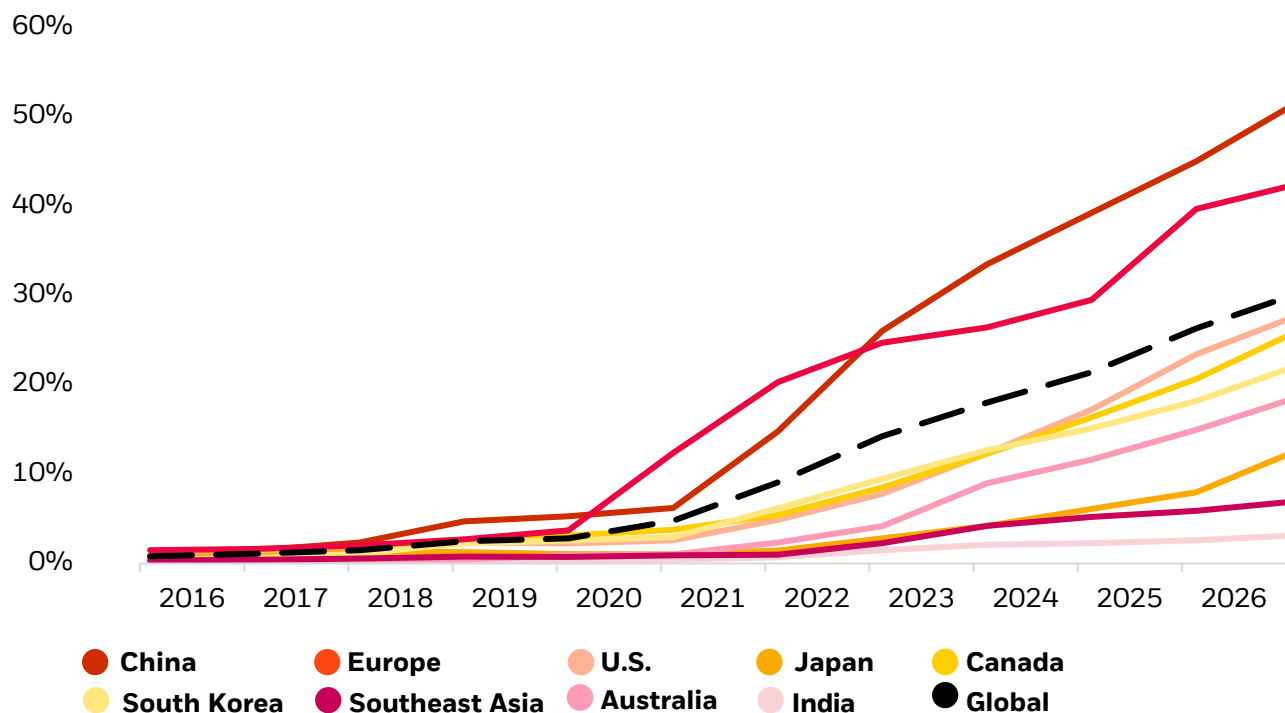
In the U.S., for example, we've been very focused on the commercial vehicle market. And there have been tremendous leaps in technology that will likely lead to a rapid acceleration in commercial EV adoption in the U.S., probably starting around 2025 and accelerating through the end of the decade.

At the same time, the regulatory environment continues to shift on both the national and local levels in the U.S. California is a great example of a state that's leading the way, with legislation that mandates commercial vehicle manufacturers and fleet operators electrify more of their vehicles.

And in New York City, the Green Rides Initiative from Mayor Eric Adams and the Taxi and Limousine Commission similarly requires that an increasing percentage of all high-volume ride-hailing service trips rely on EVs. The rule is heavy on incentives and benefits for rideshare service drivers, which can be even more of a catalyst for adoption than the penalties for non-compliance.

New normal

Recent and projected EV share of new passenger vehicle sales by market



Source: BloombergNEF, June 2023. Note: Europe includes the EU, the UK and European Free Trade Association (EFTA) countries. EV includes battery electric vehicles and plug-in hybrid electric vehicles. Forward looking estimates may not come to pass.

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Where do you see the most compelling opportunities in electrifying ground transport?

Giovanni D'Andria: Even as we focus on individual opportunities, it's important to remember just how wide the range of opportunities really is. From an infrastructure standpoint, there's a clear gap – and we believe there's a clear investment opportunity – between the vehicles on the road and the public charging stations.

This gap takes a few forms, and the priority is making sure that there's charging infrastructure available. And there are other related gaps in spaces like high-powered charging infrastructure. There's also a new focus on charging-station networks for long-distance travel, whereas at the beginning people were just focusing on EVs for local use.

Now we're seeing opportunities to invest in chargers that are more future-proofed, so that the investment can last longer. And as the sector becomes more technologically sophisticated it increases the barriers to entry for many potential competitors. We think it's really going to be a few players that will dominate the sector.

HJ: Yes, there's a winner-takes-all situation emerging for the most competitive offerings. There are more situations where consolidation

may occur among the listed infrastructure players, especially as valuations fall. Consolidation, by bringing greater standardization, should help to derisk the technology aspect.

In components like the electric motor, the battery, the raw materials and software, there could be volume plays. In technology, for instance, a software system can see its profit margins grow rapidly as you increase its adoption.

SC: As EV technology matures, the deal opportunities have moved toward private equity and infrastructure rather than venture capital, especially in the equipment manufacturing and charging space.

But that maturity isn't uniform. The passenger EV space is reasonably mature, while the commercial vehicle sector is only just starting to electrify. Currently, the users are primarily logistics players who are actively lowering their carbon footprint and attracted to the lower total-cost-of-ownership economics of electric fleets. This is because commercial buyers are more driven by economics and a clear business case and not driven by emotions.

We're starting to see innovative commercial EV business-services models, which will further accelerate the electrification of commercial vehicles. The majority of traditional logistics fleet owners have a competency gap in this area, which opens up space for these EV-services businesses.

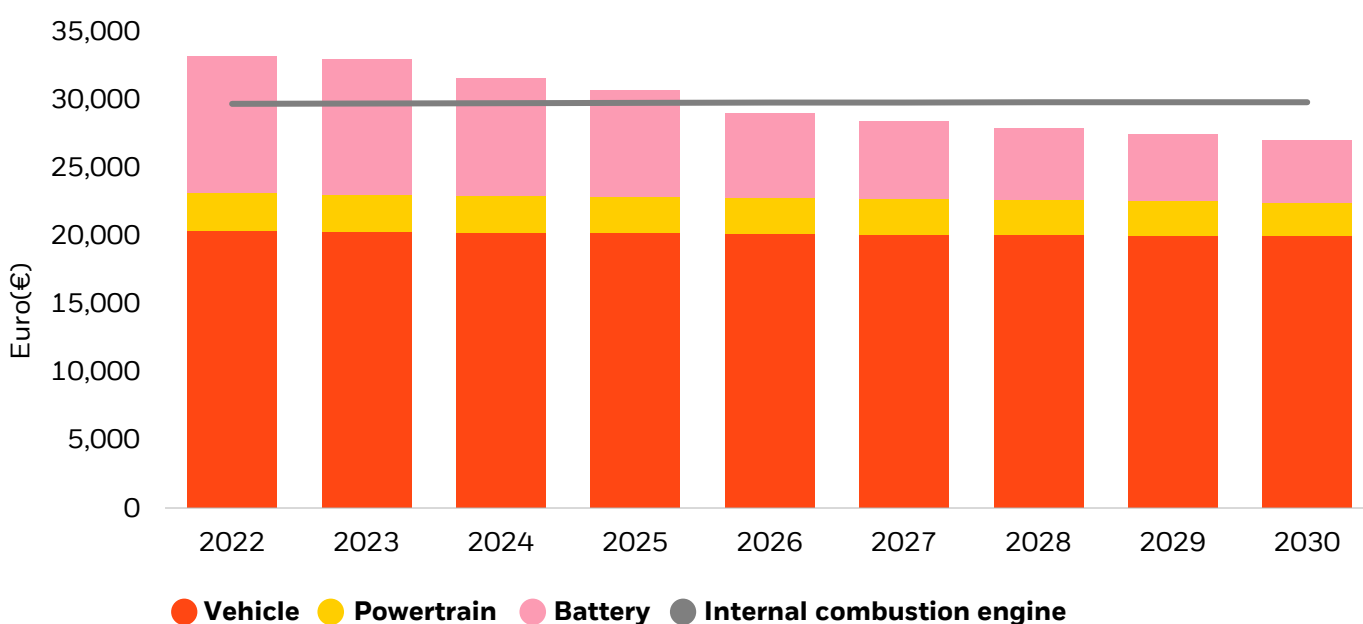
PB: We're seeing exactly the same thing play out. It's ultimately down to the fact that managing an EV fleet means your fuel is electric power. Dealing with power as a commodity requires huge amounts of expertise to, for example, develop and connect the infrastructure to the grid, interface with electric utilities and navigate their complex rate structures. In the end, the advantages can be enormous and drive overall savings, as you mentioned. But for better or worse it's currently far more complex to manage than gas or diesel as a fuel. Many commercial fleet operators just don't have that expertise in-house. For that reason, the amount of diversity in terms of business models is enormous.

If you only focus on EV-charging infrastructure, even that has a tremendous variety in terms of business models. For example, an investor can be in five companies without there being any tremendous concern about overlap or cannibalization of efforts.

For example, there are opportunities focused on public charging for passenger cars, whether in various urban locations or highway charging. On the other end of the spectrum, you would have something like charging-as-a-service, which is provided to a commercial fleet and you're providing electric charging infrastructure that is bespoke, behind the fence. These private services related to commercial-vehicle charging could be on a three-, five-, or 10-year contract.

The low-cost option

In Europe, many EVs are projected soon be cheaper than their combustion-engine counterparts



Source: BloombergNEF, June 2023 Forecast: Forward looking estimates may not come to pass.

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So where are the investment opportunities in this space?

PB: There continue to be a range of opportunities to invest in companies across this continuum. We believe the key factor here is to be sure that investors' strategy and investment structure is highly customized and tailored to the specific company you're investing in and the specific region that the company operates in.

For instance, there are all sorts of revenue streams to consider beyond just selling power to charge an EV battery, but they vary significantly based on the business model and geography.

If you're a public charging station, having drivers pause their journey at your location to recharge creates opportunities for concessions and advertising revenues. But if you're a provider of depot-based charging infrastructure for a commercial fleet, there may be opportunities to earn ancillary revenues by selling grid services to the utility based on the commercial vehicle batteries.

GD: Right now, we believe there are several emerging dynamics that make the high-power-charging space very attractive. Because these 350kW chargers make significant demands on even a very strong grid, early movers here can effectively create a barrier to entry for other players. As an investment, it also offers the opportunity to achieve dominance from a location perspective.

There's also a glaring gap in terms of infrastructure for heavy-duty vehicles, especially in Europe, where we see electric trucks charging alongside cars. That creates a space issue and an investment opportunity.

What are the main criteria when considering investments?

SC: For mature technology companies, one major opportunity is among businesses with well-defined moats around them.

Some of these differentiating barriers to entry can include market-share leadership in their segments, cost leadership, digitalized product offerings, or access to preferential financing.

GD: I would add that legislative incentives such as the Inflation Reduction Act in the U.S., along with projected consumer trends lead us to view high-power charging as the most prominent area within charging infrastructure.

When looking at companies, another aspect is clearly the financials. You want to ask if these companies can develop a sustainable and profitable model in the long term.

Specifically, predictable cashflow is important. It can come from longer-term customer

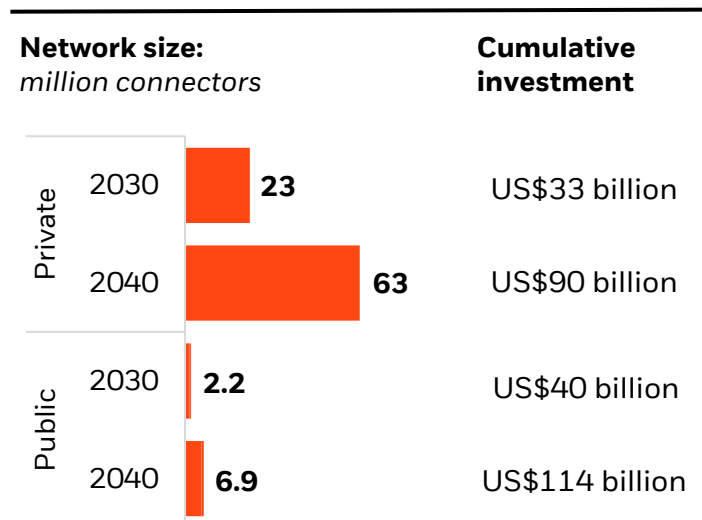
relationships, whether it's business-to-business or business-to-consumer. Scalability is another element – how the company is going to be able to develop and expand across different business segments.

HJ: One important dynamic among public companies is possible volume plays that can benefit from the significant growth ahead, particularly in the form of companies with business models that aren't exposed to traditional combustion vehicles, but only electrification growth.

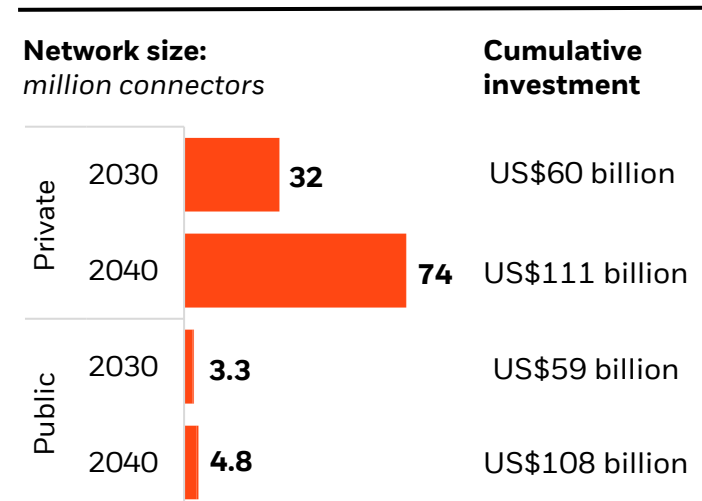
Billions in ramp-up

EV charging infrastructure rollout in the U.S. and Europe

U.S. passenger vehicles and vans



E.U. passenger vehicles and vans



Source: BloombergNEF, June 2023. Forward looking estimates may not come to pass.

As Giovanni says, the sustainability of the business model is also key. The winds have changed, and profitless tech businesses with no clear routes to cashflow generation have fallen from favor. We look for sustainable competitive advantages. These can be technological advances, partnerships, consumer adoption or an order book that's rapidly growing.

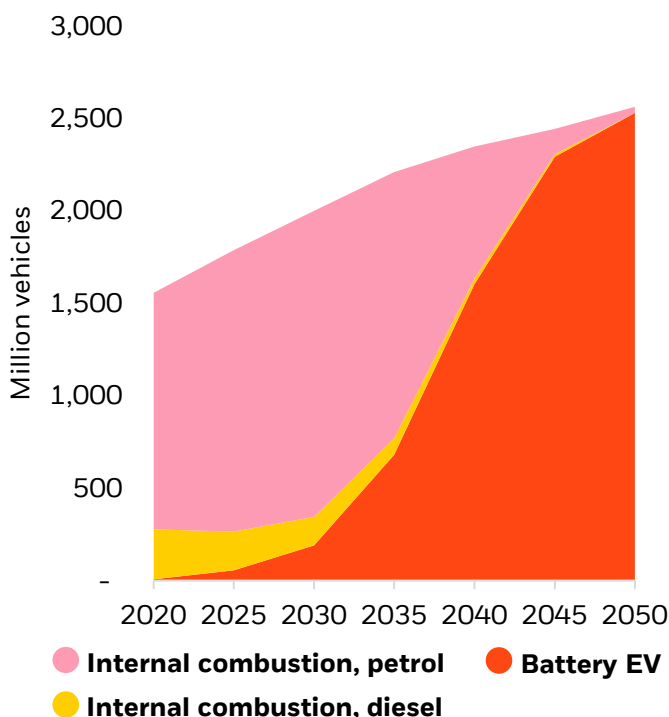
Valuation is a major criteria for these longer-term investments. And so is the near-term cashflow, especially if these businesses have financing needs and significant capital expenditure ahead.

PB: Another factor is market dynamics. In the U.S., given that adoption rates are lower relative to Europe and many parts of Asia, we're very much focused around business models that have some level of certainty behind the cashflow, either endemic to the business or through third-party contracts or subscriptions.

In Europe, there's already a much greater level of EV adoption and the need for a charging network is far greater. One reason is that there is a lower level of access to at-home charging in Europe because you have fewer single-family homes relative to the U.S., and that's an example of how facts on the ground affect how we approach EV charging in each region.

Catching up

The number of passenger EVs is projected to grow rapidly in coming years



Source: Bloomberg NEF Global EV Outlook 2023. **There is no guarantee that any forecasts made will come to pass.**

GD: Today we see some players in EV charging start to struggle as a result of high capex requirements and low liquidity. They're not getting the right valuations for the financing they need to stay upfront in the market.

There's a trend of consolidation in Europe that's pitting the pan-European players against the more local champions. We believe there are going to be some local players that will survive.

And there will be a window of opportunity for those solid players to scale up pretty fast with some inorganic growth.

A deciding factor will be the partnerships they have in place with industry leaders, be they equipment manufacturers or truck makers, or oil and gas companies with an existing footprint of petrol stations.

PB: As battery and EV technology improves, the average range of new EVs will increase – so if you've designed a charging network based on the average EV being able to travel 250 miles with a full charge, your stations may no longer be in the optimal locations once the average EV can travel twice as far per charge.

Similarly, if you were establishing your charging network on the assumption that the average vehicle would charge at 300kW but the market has now moved to 1MW chargers, that may change the dwell time per customer, since the average driver can charge in a third of the time as before.

And if the average customer is now back on the road in 5-10 minutes instead of roughly 30 minutes does this mean you're earning less in concession revenues?

If so, are you able to make it up in greater power sales by serving more customers overall?

So it's a very complex puzzle that's going to continue to evolve over time as the technology on the battery side and the technology on the charging side continue to develop, and you want a partner that's able to adapt to maximize success.

Conclusion

In talking to our investors for this piece, one thing is clear: the passenger EV industry has passed the introductory stage, where the technology was largely unfamiliar and the market was driven by early adopters.

It's now in its growth stage, where we're seeing rapid increases in adoption and usage as the technology becomes more available and more proven, with longer ranges and falling costs.

This is marked by the approaching parity in the total cost of ownership between internal combustion vehicles and EVs.

Note that different regions are at different stages in the EV-adoption curve, leading to a wide range of risk-reward profiles.

China and Europe have taken the lead, closely followed by the U.S., though we're seeing some regions that are still in the early stages.

The opportunities for investors around EVs extend beyond the vehicles themselves into the supply chain and the broader landscape, including charging infrastructure, battery technology and other emerging fields.

Many companies are set to benefit from volume growth, particularly ones without exposure to legacy combustion engine technology. We believe there are also tailwinds from M&A, which is on the rise as industry players focus on new technologies.

Each space has its own nuances. In public charging we see opportunities in the form of high-power charging (150kW and higher) on highways as well as in specialist urban facilities, and destination charging (medium power level) at places like shopping centers and urban centers. Currently, we believe that high-power charging facilities are especially attractive, as they can potentially offer the greatest sales density.

While much of the focus to date has been on passenger EVs, we also see opportunities in other EV technology classes, which offer entry points at different stages of their lifecycles. These include electric commercial vehicles and fleets of heavy-duty trucks.

We expect a range of new EV opportunities to surface in the next three years, as corporates and governments work together to develop reliable, plug-and-charge EV networks.

There will also likely be a host of investment opportunities as the lessons and technology from passenger-car infrastructure ventures take root in new regions and in commercial and trucking fleets.

At the same time, there are risks, which must be monitored closely and factored into investment decisions.

One is adoption rates – will the market continue to grow as expected? We believe long-term it will, but this risk came to the fore in 2023 when there was a lull in EV sales in Europe and North America.

Profit margins are another concern, especially in charging infrastructure, which relies largely on marking up and reselling energy from the power grid.

With any burgeoning technology, obsolescence is also a danger. Early movers may need to overhaul their equipment sooner than expected to maintain market share.

At the same time, the supply chain for EV batteries and other components is subject to potential bottlenecks and price increases.

Even with those risks we are confident that the EV sector, along with its broader universe of manufacturers and infrastructure providers, will be a place of numerous attractive opportunities and growth for many years to come.

The opportunities in this space are diverse, extending across public and private markets, and ranging in maturity and risk profile from venture-stage companies to large-scale infrastructure plays.

As such, we believe it's an area that can be attractive for multiple risk profiles and multiple sleeves within a diversified portfolio.

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