

breach requirements if, for example, third parties improperly obtain and use the personal information of our customers or we otherwise experience a data loss with respect to customers' personal information. A major breach of our network security and systems may result in fines, penalties and damages and harm our brand, prospects and operating results.

We could be subject to liability, penalties and other restrictive sanctions and adverse consequences arising out of certain governmental investigations and proceedings.

We are cooperating with certain government investigations as discussed in *Note 15, Commitments and Contingencies*, to the consolidated financial statements included elsewhere in this Annual Report on Form 10-K. To our knowledge, no government agency in any such ongoing investigation has concluded that any wrongdoing occurred. However, we cannot predict the outcome or impact of any such ongoing matters, and there exists the possibility that we could be subject to liability, penalties and other restrictive sanctions and adverse consequences if the SEC, the U.S. Department of Justice or any other government agency were to pursue legal action in the future. Moreover, we expect to incur costs in responding to related requests for information and subpoenas, and if instituted, in defending against any governmental proceedings.

For example, on October 16, 2018, the U.S. District Court for the Southern District of New York entered a final judgment approving the terms of a settlement filed with the Court on September 29, 2018, in connection with the actions taken by the SEC relating to Mr. Musk's statement on August 7, 2018 that he was considering taking Tesla private. Pursuant to the settlement, we, among other things, paid a civil penalty of \$20 million, appointed an independent director as the chair of our board of directors, appointed two additional independent directors to our board of directors and made further enhancements to our disclosure controls and other corporate governance-related matters. On April 26, 2019, this settlement was amended to clarify certain of the previously-agreed disclosure procedures, which was subsequently approved by the Court. All other terms of the prior settlement were reaffirmed without modification. Although we intend to continue to comply with the terms and requirements of the settlement, if there is a lack of compliance or an alleged lack of compliance, additional enforcement actions or other legal proceedings may be instituted against us.

We may face regulatory challenges to or limitations on our ability to sell vehicles directly.

While we intend to continue to leverage our most effective sales strategies, including sales through our website, we may not be able to sell our vehicles through our own stores in certain states in the U.S. with laws that may be interpreted to impose limitations on this direct-to-consumer sales model. It has also been asserted that the laws in some states limit our ability to obtain dealer licenses from state motor vehicle regulators, and such assertions persist. In certain locations, decisions by regulators permitting us to sell vehicles have been, and may be, challenged by dealer associations and others as to whether such decisions comply with applicable state motor vehicle industry laws. We have prevailed in many of these lawsuits and such results have reinforced our continuing belief that state laws were not intended to apply to a manufacturer that does not have franchise dealers. In some states, there have also been regulatory and legislative efforts by dealer associations to propose laws that, if enacted, would prevent us from obtaining dealer licenses in their states given our current sales model. A few states have passed legislation that clarifies our ability to operate, but at the same time limits the number of dealer licenses we can obtain or stores that we can operate. The application of state laws applicable to our operations continues to be difficult to predict.

Internationally, there may be laws in jurisdictions we have not yet entered or laws we are unaware of in jurisdictions we have entered that may restrict our sales or other business practices. Even for those jurisdictions we have analyzed, the laws in this area can be complex, difficult to interpret and may change over time. Continued regulatory limitations and other obstacles interfering with our ability to sell vehicles directly to consumers may harm our financial condition and operating results.

Risks Related to the Ownership of Our Common Stock

The trading price of our common stock is likely to continue to be volatile.

The trading price of our common stock has been highly volatile and could continue to be subject to wide fluctuations in response to various factors, some of which are beyond our control. Our common stock has experienced over the last 52 weeks an intra-day trading high of \$1,243.49 per share and a low of \$539.49 per share. The stock market in general, and the market for technology companies in particular, has experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of those companies. In particular, a large proportion of our common stock has been historically and may in the future be traded by short sellers which may put pressure on the supply and demand for our common stock, further influencing volatility in its market price. Public perception and other factors outside of our control may additionally impact the stock price of companies like us that garner a disproportionate degree of public attention, regardless of actual operating performance. In addition, in the past, following periods of volatility in the overall market or the market price of our shares, securities class action litigation has been filed against us. While we defend such actions vigorously, any judgment against us or any future stockholder litigation could result in substantial costs and a diversion of our management's attention and resources.

Our financial results may vary significantly from period to period due to fluctuations in our operating costs and other factors.

We expect our period-to-period financial results to vary based on our operating costs, which we anticipate will fluctuate as the pace at which we continue to design, develop and manufacture new products and increase production capacity by expanding our current manufacturing facilities and adding future facilities, may not be consistent or linear between periods. Additionally, our revenues from period to period may fluctuate as we introduce existing products to new markets for the first time and as we develop and introduce new products. As a result of these factors, we believe that quarter-to-quarter comparisons of our financial results, especially in the short term, are not necessarily meaningful and that these comparisons cannot be relied upon as indicators of future performance. Moreover, our financial results may not meet expectations of equity research analysts, ratings agencies or investors, who may be focused only on short-term quarterly financial results. If any of this occurs, the trading price of our stock could fall substantially, either suddenly or over time.

We may fail to meet our publicly announced guidance or other expectations about our business, which could cause our stock price to decline.

We may provide from time to time guidance regarding our expected financial and business performance. Correctly identifying key factors affecting business conditions and predicting future events is inherently an uncertain process, and our guidance may not ultimately be accurate and has in the past been inaccurate in certain respects, such as the timing of new product manufacturing ramps. Our guidance is based on certain assumptions such as those relating to anticipated production and sales volumes (which generally are not linear throughout a given period), average sales prices, supplier and commodity costs and planned cost reductions. If our guidance varies from actual results due to our assumptions not being met or the impact on our financial performance that could occur as a result of various risks and uncertainties, the market value of our common stock could decline significantly.

Transactions relating to our convertible senior notes may dilute the ownership interest of existing stockholders, or may otherwise depress the price of our common stock.

The conversion of some or all of the convertible senior notes issued by us or our subsidiaries would dilute the ownership interests of existing stockholders to the extent we deliver shares upon conversion of any of such notes by their holders, and we may be required to deliver a significant number of shares. Any sales in the public market of the common stock issuable upon such conversion could adversely affect their prevailing market prices. In addition, the existence of the convertible senior notes may encourage short selling by market participants because the conversion of such notes could be used to satisfy short positions, or the anticipated conversion of such notes into shares of our common stock could depress the price of our common stock.

If Elon Musk were forced to sell shares of our common stock that he has pledged to secure certain personal loan obligations, such sales could cause our stock price to decline.

Certain banking institutions have made extensions of credit to Elon Musk, our Chief Executive Officer, a portion of which was used to purchase shares of common stock in certain of our public offerings and private placements at the same prices offered to third-party participants in such offerings and placements. We are not a party to these loans, which are partially secured by pledges of a portion of the Tesla common stock currently owned by Mr. Musk. If the price of our common stock were to decline substantially, Mr. Musk may be forced by one or more of the banking institutions to sell shares of Tesla common stock to satisfy his loan obligations if he could not do so through other means. Any such sales could cause the price of our common stock to decline further.

Anti-takeover provisions contained in our governing documents, applicable laws and our convertible senior notes could impair a takeover attempt.

Our certificate of incorporation and bylaws afford certain rights and powers to our board of directors that may facilitate the delay or prevention of an acquisition that it deems undesirable. We are also subject to Section 203 of the Delaware General Corporation Law and other provisions of Delaware law that limit the ability of stockholders in certain situations to effect certain business combinations. In addition, the terms of our convertible senior notes may require us to repurchase such notes in the event of a fundamental change, including a takeover of our company. Any of the foregoing provisions and terms that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

We are headquartered in Austin, Texas. Our principal facilities include a large number of properties in North America, Europe and Asia utilized for manufacturing and assembly, warehousing, engineering, retail and service locations, Supercharger sites and administrative and sales offices. Our facilities are used to support both of our reporting segments, and are suitable and adequate for the conduct of our business. We primarily lease such facilities with the exception of some manufacturing facilities. The following table sets forth the location of our primary owned and leased manufacturing facilities.

Primary Manufacturing Facilities	Location	Owned or Leased
Gigafactory Texas	Austin, Texas	Owned
Fremont Factory	Fremont, California	Owned
Gigafactory Nevada	Sparks, Nevada	Owned
Gigafactory Berlin	Grunheide, Germany	Owned
Gigafactory Shanghai	Shanghai, China	*
Gigafactory New York	Buffalo, New York	Leased

* We own the building and the land use rights with an initial term of 50 years. The land use rights are treated as operating lease right-of-use assets.

ITEM 3. LEGAL PROCEEDINGS

For a description of our material pending legal proceedings, please see *Note 15, Commitments and Contingencies*, to the consolidated financial statements included elsewhere in this Annual Report on Form 10-K.

In addition, each of the matters below is being disclosed pursuant to Item 103 of Regulation S-K because it relates to environmental regulations and aggregate civil penalties that we currently believe could potentially exceed \$1 million. We believe that any proceeding that is material to our business or financial condition is likely to have potential penalties far in excess of such amount.

The German Umweltbundesamt has issued our subsidiary in Germany a notice and fine in the amount of 12 million euro alleging its non-compliance under applicable laws relating to market participation notifications and take-back obligations with respect to end-of-life battery products required thereunder. In response to Tesla's objection, the German Umweltbundesamt issued Tesla a revised fine notice dated April 29, 2021 in which it reduced the original fine amount to 1.45 million euro. This is primarily relating to administrative requirements, but Tesla has continued to take back battery packs, and although we cannot predict the outcome of this matter, including the final amount of any penalties, we filed a new objection in June 2021 and it is not expected to have a material adverse impact on our business.

In April 2021, we received a notice from the Environmental Protection Agency (the "EPA") alleging that Tesla failed to provide records demonstrating compliance with certain requirements under the applicable National Emission Standards for Hazardous Air Pollutants under the Clean Air Act of 1963, as amended, relating to Surface Coating of Automobiles and Light-Duty Trucks regulations. Tesla has responded to all information requests from the EPA and refutes the allegations. Tesla continues to cooperate with the EPA in resolving this matter, and it is not currently expected to have a material adverse impact on our business.

District attorneys in certain California counties are conducting an investigation into Tesla's waste segregation practices pursuant to Cal. Health & Saf. Code section 25100 et seq. and Cal. Civil Code § 1798.80. Tesla has implemented various remedial measures, including conducting training and audits, and enhancements to its site waste management programs. While the outcome of this matter cannot be determined at this time, it is not currently expected to have a material adverse impact on our business.

ITEM 4. MINE SAFETY DISCLOSURES

Not applicable.

PART II

ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Market Information

Our common stock has traded on The NASDAQ Global Select Market under the symbol "TSLA" since it began trading on June 29, 2010. Our initial public offering was priced at \$3.40 per share on June 28, 2010 as adjusted to give effect to the five-for-one stock split effected in the form of a stock dividend in August 2020.

Holders

As of January 31, 2022, there were 7,051 holders of record of our common stock. A substantially greater number of holders of our common stock are "street name" or beneficial holders, whose shares are held by banks, brokers and other financial institutions.

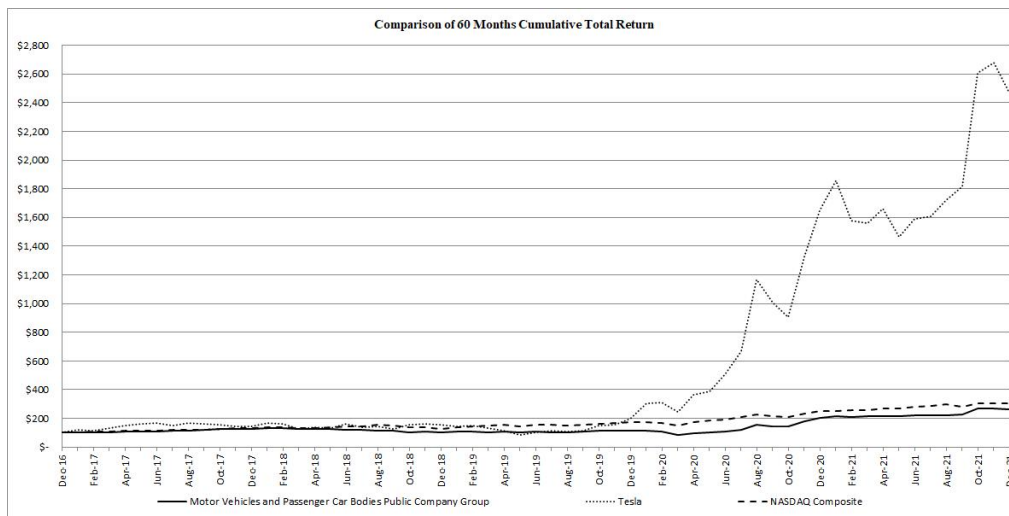
Dividend Policy

We have never declared or paid cash dividends on our common stock. We currently do not anticipate paying any cash dividends in the foreseeable future. Any future determination to declare cash dividends will be made at the discretion of our board of directors, subject to applicable laws, and will depend on our financial condition, results of operations, capital requirements, general business conditions and other factors that our board of directors may deem relevant.

Stock Performance Graph

This performance graph shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), or incorporated by reference into any filing of Tesla, Inc. under the Securities Act of 1933, as amended (the "Securities Act"), or the Exchange Act, except as shall be expressly set forth by specific reference in such filing.

The following graph shows a comparison, from January 1, 2017 through December 31, 2021, of the cumulative total return on our common stock, The NASDAQ Composite Index and a group of all public companies sharing the same SIC code as us, which is SIC code 3711, "Motor Vehicles and Passenger Car Bodies" (Motor Vehicles and Passenger Car Bodies Public Company Group). Such returns are based on historical results and are not intended to suggest future performance. Data for The NASDAQ Composite Index and the Motor Vehicles and Passenger Car Bodies Public Company Group assumes an investment of \$100 on January 1, 2017 and reinvestment of dividends. We have never declared or paid cash dividends on our common stock nor do we anticipate paying any such cash dividends in the foreseeable future.



Unregistered Sales of Equity Securities and Use of Proceeds

In connection with the offering of 2.00% Convertible Senior Notes due 2024 in May 2019, we sold warrants to each of Société Générale, Wells Fargo Bank, National Association, Goldman, Sachs & Co. LLC and Credit Suisse Capital LLC. On October 26, 2021, we agreed with each of Société Générale, Wells Fargo Bank, National Association and Credit Suisse Capital LLC to partially terminate such warrants, and in connection with such partial termination, we issued an aggregate of 2,711,289 shares of our common stock to Société Générale, Wells Fargo Bank, National Association and Credit Suisse Capital LLC. Such shares were issued pursuant to an exemption from registration provided by Rule 3(a)(9) of the Securities Act of 1933.

Purchases of Equity Securities by the Issuer and Affiliated Purchasers

None.

ITEM 6. [RESERVED]

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion and analysis should be read in conjunction with the consolidated financial statements and the related notes included elsewhere in this Annual Report on Form 10-K. For discussion related to changes in financial condition and the results of operations for fiscal year 2019-related items, refer to Part II, Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations in our Annual Report on Form 10-K for fiscal year 2020, which was filed with the Securities and Exchange Commission on February 8, 2021.

Overview and 2021 Highlights

Our mission is to accelerate the world's transition to sustainable energy. We design, develop, manufacture, lease and sell high-performance fully electric vehicles, solar energy generation systems and energy storage products. We also offer maintenance, installation, operation, financial and other services related to our products. Additionally, we are increasingly focused on products and services based on artificial intelligence, robotics and automation.

In 2021, we produced 930,422 vehicles and delivered 936,222 vehicles. We are currently focused on increasing vehicle production and capacity, improving and developing battery technologies, improving our FSD capabilities, increasing the affordability and efficiency of our vehicles and expanding our global infrastructure.

In 2021, we deployed 3.99 GWh of energy storage products and 345 megawatts of solar energy systems. We are currently focused on ramping production of energy storage products, improving our Solar Roof installation capability and efficiency, and increasing market share of retrofit and new build solar energy systems.

In 2021, we recognized total revenues of \$53.82 billion, representing a 71% increase compared to the prior year. We continue to ramp production, build new manufacturing capacity and expand our operations to enable increased deliveries and deployments of our products and further revenue growth.

In 2021, our net income attributable to common stockholders was \$5.52 billion, representing a favorable change of \$4.80 billion, compared to the prior year. We continue to focus on improving our profitability through production and operational efficiencies.

We ended 2021 with \$17.58 billion in cash and cash equivalents, representing a decrease of \$1.81 billion from the end of 2020. Our cash flows provided by operating activities during 2021 was \$11.50 billion, representing an increase of \$5.55 billion compared to \$5.94 billion during 2020, and capital expenditures amounted to \$6.48 billion during 2021, compared to \$3.16 billion during 2020. Sustained growth has allowed our business to generally fund itself, but we will continue investing in a number of capital-intensive projects in upcoming periods.

Management Opportunities, Challenges and Risks and 2022 Outlook

Impact of COVID-19 Pandemic

Beginning in the first quarter of 2021, there has been a trend in many parts of the world of increasing availability and administration of vaccines against COVID-19, as well as an easing of restrictions on social, business, travel and government activities and functions. On the other hand, infection rates and regulations continue to fluctuate in various regions and there are ongoing global impacts resulting from the pandemic, including challenges and increases in costs for logistics and supply chains, such as increased port congestion, intermittent supplier delays and a shortfall of semiconductor supply. We have also previously been affected by temporary manufacturing closures, employment and compensation adjustments, and impediments to administrative activities supporting our product deliveries and deployments.

Ultimately, we cannot predict the duration of the COVID-19 pandemic. We will continue to monitor macroeconomic conditions to remain flexible and to optimize and evolve our business as appropriate, and we will have to accurately project demand and infrastructure requirements globally and deploy our production, workforce and other resources accordingly.

Automotive—Production

The following is a summary of the status of production of each of our announced vehicle models in production and under development, as of the date of this Annual Report on Form 10-K:

Production Location	Vehicle Model(s)	Production Status
Fremont Factory	Model S / Model X	Active
	Model 3 / Model Y	Active
Gigafactory Shanghai	Model 3 / Model Y	Active
Gigafactory Berlin	Model Y	Equipment test
Gigafactory Texas	Model Y	Equipment test
	Cybertruck	In development
TBD	Tesla Semi	In development
TBD	Tesla Roadster	In development

We are focused on ramping all of our production vehicles to their installed production capacities as well as increasing capacity at our current factories. Our current production continues to be affected by the industry-wide semiconductor and other component shortages, requiring additional workaround manufacturing and production design solutions to be implemented which may be difficult to sustain. Builds of Model Y in Gigafactory Texas and equipment testing through the vehicle production process in Gigafactory Berlin started in late 2021. The next phase of production growth will depend on the testing and ramp at Gigafactory Berlin and Gigafactory Texas, as well as our ability to add to our available sources of battery cell supply by manufacturing our own cells that we are developing to have high-volume output, lower capital and production costs and longer range. Consistent with our approach of innovating manufacturing techniques at our new factories, we expect as well to pioneer new methods related to the mass production of these cells and our unique structural battery pack concept. Our goals are to improve vehicle performance, decrease production costs and increase affordability.

However, these plans are subject to uncertainties inherent in establishing and ramping manufacturing operations, which may be exacerbated by the number of concurrent international projects, any industry-wide component constraints which may increase the number of manufacturing and production design workaround solutions required, labor shortages and any future impact from events outside of our control such as the COVID-19 pandemic. Moreover, we must meet ambitious technological targets with our plans for battery cells as well as for iterative manufacturing and design improvements for our vehicles with each new factory.

Automotive—Demand and Sales

Our cost reduction efforts and additional localized procurement and manufacturing are key to our vehicles' affordability, and for example, have allowed us to competitively price our vehicles in China. In addition to ramping production in 2022, we will also continue to generate demand and brand awareness by improving our vehicles' performance and functionality, including through products based on artificial intelligence such as Autopilot and FSD, and other software features. Moreover, we expect to continue to benefit from a spike in demand in the automotive industry generally, as well as ongoing electrification of the automotive sector and increasing environmental awareness.

However, we operate in a cyclical industry that is sensitive to trade, environmental and political uncertainty, all of which may also be compounded by any future global impact from the COVID-19 pandemic. Moreover, as additional competitors enter the marketplace and help bring the world closer to sustainable transportation, we will have to continue to execute well to maintain our momentum.

Automotive—Deliveries and Customer Infrastructure

As our deliveries increase, we must work constantly to prevent our vehicle delivery capability from becoming a bottleneck on our total deliveries. Increasing the exports of vehicles manufactured at Gigafactory Shanghai has been effective in mitigating the strain on our deliveries in markets outside of the United States, and we expect to benefit further from situating additional factories closer to local markets. As we expand our manufacturing operations globally, we will have to continue to increase and staff our delivery, servicing and charging infrastructure accordingly, maintain our vehicle reliability and optimize our Supercharger locations to ensure cost effectiveness and customer satisfaction. In particular, we remain focused on increasing the capability and efficiency of our servicing operations.

Energy Generation and Storage Demand, Production and Deployment

The long-term success of this business is dependent upon increasing margins through greater volumes. We continue to increase the production of our energy storage products to meet high levels of demand, including beginning construction of our Megafactory in Lathrop, California, but such production is also sensitive to global component constraints. For Megapack, energy storage deployments can vary meaningfully quarter to quarter depending on the timing of specific project milestones. For Powerwall, better availability and growing grid stability concerns drive higher customer interest, and we are emphasizing cross-selling with our residential solar energy products. We remain committed to growing our retrofit solar energy business by offering a low-cost and simplified online ordering experience. In addition, we continue to improve our installation capabilities and price efficiencies for Solar Roof by on-boarding and training new installers, as well as collaborating with real estate developers and builders on new homes to reduce installation time and costs. As these product lines grow, we will have to maintain adequate battery cell supply for our energy storage products and hire additional personnel, particularly skilled electricians, to support the ramp of Solar Roof.

Cash Flow and Capital Expenditure Trends

Our capital expenditures are typically difficult to project beyond the short term given the number and breadth of our core projects at any given time, and may further be impacted by uncertainties in future global market conditions. We are simultaneously ramping new products in the new Model S and Model X, Megapack and Solar Roof, ramping manufacturing facilities on three continents and piloting the development and manufacture of new battery cell technologies, and the pace of our capital spend may vary depending on overall priority among projects, the pace at which we meet milestones, production adjustments to and among our various products, increased capital efficiencies and the addition of new projects. Owing and subject to the foregoing as well as the pipeline of announced projects under development and all other continuing infrastructure growth, we currently expect our capital expenditures to be between \$5.00 to \$7.00 billion in 2022 and each of the next two fiscal years.

Our business has recently been consistently generating cash flow from operations in excess of our level of capital spend, and with better working capital management resulting in shorter days sales outstanding than days payable outstanding, our sales growth is also facilitating positive cash generation. On the other hand, we are likely to see heightened levels of capital expenditures during certain periods depending on the specific pace of our capital-intensive projects and rising material prices and increasing supply chain and labor expenses resulting from changes in global trade conditions and labor availability associated with the COVID-19 pandemic. Moreover, as our stock price has significantly increased, we have seen higher levels of early conversions of “in-the-money” convertible senior notes, which obligates us to deliver cash and or shares pursuant to the terms of those notes. Overall, we expect our ability to be self-funding to continue as long as macroeconomic factors support current trends in our sales.

Operating Expense Trends

As long as we see expanding sales, and excluding the potential impact of macroeconomic conditions including increased labor costs and impairment charges on certain assets as explained below, we generally expect operating expenses relative to revenues to decrease as we continue to increase operational efficiency and process automation. We expect operating expenses to grow in 2022 as we are expanding our operations globally.

In the first quarter of 2021, we invested an aggregate \$1.50 billion in bitcoin. We believe in the long-term potential of digital assets both as an investment and also as a liquid alternative to cash. As with any investment and consistent with how we manage fiat-based cash and cash-equivalent accounts, we may increase or decrease our holdings of digital assets at any time based on the needs of the business and our view of market and environmental conditions. Digital assets are considered indefinite-lived intangible assets under applicable accounting rules. Accordingly, any decrease in their fair values below our carrying values for such assets at any time subsequent to their acquisition will require us to recognize impairment charges, whereas we may make no upward revisions for any market price increases until a sale. For any digital assets held now or in the future, these charges may negatively impact our profitability in the periods in which such impairments occur even if the overall market values of these assets increase. For example, in the year ended December 31, 2021, we recorded approximately \$101 million of impairment losses resulting from changes to the carrying value of our bitcoin and gains of \$128 million on certain sales of bitcoin by us.

Critical Accounting Policies and Estimates

The consolidated financial statements are prepared in accordance with accounting principles generally accepted in the U.S. (“GAAP”). The preparation of the consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues, costs and expenses and related disclosures. We base our estimates on historical experience, as appropriate, and on various other assumptions that we believe to be reasonable under the circumstances. Changes in the accounting estimates are reasonably likely to occur from period to period. Accordingly, actual results could differ significantly from the estimates made by our management. We evaluate our estimates and assumptions on an ongoing basis. To the extent that there are material differences between these estimates and actual results, our future financial statement presentation, financial condition, results of operations and cash flows may be affected.

Due to the COVID-19 pandemic, there has been uncertainty and disruption in the global economy and financial markets. The estimates used for, but not limited to, determining significant economic incentive for resale value guarantee arrangements, sales return reserves, the collectability of accounts receivable, inventory valuation, fair value of long-lived assets, goodwill, fair value of financial instruments, fair value and residual value of operating lease vehicles and solar energy systems subject to leases could be impacted. We have assessed the impact and are not aware of any specific events or circumstances that required an update to our estimates and assumptions or materially affected the carrying value of our assets or liabilities as of the date of issuance of this Annual Report on Form 10-K. These estimates may change as new events occur and additional information is obtained. Actual results could differ materially from these estimates under different assumptions or conditions.

Revenue Recognition

Automotive Sales without Resale Value Guarantee

Automotive sales revenue includes revenues related to deliveries of new vehicles and pay-per-use charges, and specific other features and services that meet the definition of a performance obligation under ASC 606, including access to our Supercharger network, internet connectivity, FSD features and over-the-air software updates. We recognize revenue on automotive sales upon delivery to the customer, which is when the control of a vehicle transfers. Payments are typically received at the point control transfers or in accordance with payment terms customary to the business. Other features and services such as access to our Supercharger network, internet connectivity and over-the-air software updates are provisioned upon control transfer of a vehicle and recognized over time on a straight-line basis as we have a stand-ready obligation to deliver such services to the customer. We recognize revenue related to these other features and services over the performance period, which is generally the estimated useful life of the vehicle. Revenue related to FSD features is recognized when functionality is delivered to the customer. For our obligations related to automotive sales, we estimate standalone selling price by considering costs used to develop and deliver the service, third-party pricing of similar options and other information that may be available.

At the time of revenue recognition, we reduce the transaction price and record a sales return reserve against revenue for estimated variable consideration related to future product returns. Such return rate estimates are based on historical experience and are immaterial in all periods presented. In addition, any fees that are paid or payable by us to a customer's lender when we arrange the financing are recognized as an offset against automotive sales revenue.

Costs to obtain a contract mainly relate to commissions paid to our sales personnel for the sale of vehicles. Commissions are not paid on other obligations such as access to our Supercharger network, internet connectivity, FSD features and over-the-air software updates. As our contract costs related to automotive sales are typically fulfilled within one year, the costs to obtain a contract are expensed as incurred. Amounts billed to customers related to shipping and handling are classified as automotive sales revenue, and we have elected to recognize the cost for freight and shipping when control over vehicles, parts or accessories have transferred to the customer as an expense in cost of automotive sales revenue. Our policy is to exclude taxes collected from a customer from the transaction price of automotive contracts.

Automotive Sales with Resale Value Guarantee or a Buyback Option

We offer resale value guarantees or similar buy-back terms to certain international customers who purchase vehicles and who finance their vehicles through one of our specified commercial banking partners. We also offer resale value guarantees in connection with automotive sales to certain leasing partners. Under these programs, we receive full payment for the vehicle sales price at the time of delivery and our counterparty has the option of selling their vehicle back to us during the guarantee period, which currently is generally at the end of the term of the applicable loan or financing program, for a pre-determined resale value.

We recognize revenue when control transfers upon delivery to customers in accordance with ASC 606 as a sale with a right of return when we do not believe the customer has a significant economic incentive to exercise the resale value guarantee provided to them at contract inception. The process to determine whether there is a significant economic incentive includes a comparison of a vehicle's estimated market value at the time the option is exercisable with the guaranteed resale value to determine the customer's economic incentive to exercise. The performance obligations and the pattern of recognizing automotive sales with resale value guarantees are consistent with automotive sales without resale value guarantees with the exception of our estimate for sales return reserve. Sales return reserves for automotive sales with resale value guarantees are estimated based on historical experience plus consideration for expected future market values. On a quarterly basis, we assess the estimated market values of vehicles sold with resale value guarantees to determine whether there have been changes to the likelihood of future product returns. As we accumulate more data related to the resale values of our vehicles or as market conditions change, there may be material changes to their estimated values.

Inventory Valuation

Inventories are stated at the lower of cost or net realizable value. Cost is computed using standard cost for vehicles and energy storage products, which approximates actual cost on a first-in, first-out basis. In addition, cost for solar energy systems is recorded using actual cost. We record inventory write-downs for excess or obsolete inventories based upon assumptions about current and future demand forecasts. If our inventory on-hand is in excess of our future demand forecast, the excess amounts are written-off.

We also review our inventory to determine whether its carrying value exceeds the net amount realizable upon the ultimate sale of the inventory. This requires us to determine the estimated selling price of our vehicles less the estimated cost to convert the inventory on-hand into a finished product. Once inventory is written-down, a new, lower cost basis for that inventory is established and subsequent changes in facts and circumstances do not result in the restoration or increase in that newly established cost basis.

Should our estimates of future selling prices or production costs change, additional and potentially material write-downs may be required. A small change in our estimates may result in a material charge to our reported financial results.

Warranties

We provide a manufacturer's warranty on all new and used vehicles and a warranty on the installation and components of the energy generation and storage systems we sell for periods typically between 10 to 25 years. We accrue a warranty reserve for the products sold by us, which includes our best estimate of the projected costs to repair or replace items under warranties and recalls if identified. These estimates are based on actual claims incurred to date and an estimate of the nature, frequency and costs of future claims. These estimates are inherently uncertain given our relatively short history of sales, and changes to our historical or projected warranty experience may cause material changes to the warranty reserve in the future. The warranty reserve does not include projected warranty costs associated with our vehicles subject to operating lease accounting and our solar energy systems under lease contracts or PPAs, as the costs to repair these warranty claims are expensed as incurred. The portion of the warranty reserve expected to be incurred within the next 12 months is included within Accrued liabilities and other, while the remaining balance is included within Other long-term liabilities on the consolidated balance sheets. Warranty expense is recorded as a component of Cost of revenues in the consolidated statements of operations. Due to the magnitude of our automotive business, accrued warranty balance is primarily related to our automotive segment.

Stock-Based Compensation

We use the fair value method of accounting for our stock options and restricted stock units ("RSUs") granted to employees and for our employee stock purchase plan (the "ESPP") to measure the cost of employee services received in exchange for the stock-based awards. The fair value of stock option awards with only service and/or performance conditions is estimated on the grant or offering date using the Black-Scholes option-pricing model. The Black-Scholes option-pricing model requires inputs such as the risk-free interest rate, expected term and expected volatility. These inputs are subjective and generally require significant judgment. The fair value of RSUs is measured on the grant date based on the closing fair market value of our common stock. The resulting cost is recognized over the period during which an employee is required to provide service in exchange for the awards, usually the vesting period, which is generally four years for stock options and RSUs and six months for the ESPP. Stock-based compensation expense is recognized on a straight-line basis, net of actual forfeitures in the period.

For performance-based awards, stock-based compensation expense is recognized over the expected performance achievement period of individual performance milestones when the achievement of each individual performance milestone becomes probable. For performance-based awards with a vesting schedule based entirely on the attainment of both performance and market conditions, stock-based compensation expense associated with each tranche is recognized over the longer of (i) the expected achievement period for the operational milestone for such tranche and (ii) the expected achievement period for the related market capitalization milestone determined on the grant date, beginning at the point in time when the relevant operational milestone is considered probable of being achieved. If such operational milestone becomes probable any time after the grant date, we will recognize a cumulative catch-up expense from the grant date to that point in time. If the related market capitalization milestone is achieved earlier than its expected achievement period and the achievement of the related operational milestone, then the stock-based compensation expense will be recognized over the expected achievement period for the operational milestone, which may accelerate the rate at which such expense is recognized. The fair value of such awards is estimated on the grant date using Monte Carlo simulations.

As we accumulate additional employee stock-based awards data over time and as we incorporate market data related to our common stock, we may calculate significantly different volatilities and expected lives, which could materially impact the valuation of our stock-based awards and the stock-based compensation expense that we will recognize in future periods. Stock-based compensation expense is recorded in Cost of revenues, Research and development expense and Selling, general and administrative expense in the consolidated statements of operations.

Income Taxes

We are subject to taxes in the U.S. and in many foreign jurisdictions. Significant judgment is required in determining our provision for income taxes, our deferred tax assets and liabilities and any valuation allowance recorded against our net deferred tax assets. We make these estimates and judgments about our future taxable income that are based on assumptions that are consistent with our future plans. Tax laws, regulations and administrative practices may be subject to change due to economic or political conditions including fundamental changes to the tax laws applicable to corporate multinationals. The U.S., many countries in the European Union and a number of other countries are actively considering changes in this regard. As of December 31, 2021, we had recorded a full valuation allowance on our net U.S. deferred tax assets because we expect that it is more likely than not that our U.S. deferred tax assets will not be realized. Should the actual amounts differ from our estimates, the amount of our valuation allowance could be materially impacted.

Furthermore, significant judgment is required in evaluating our tax positions. In the ordinary course of business, there are many transactions and calculations for which the ultimate tax settlement is uncertain. As a result, we recognize the effect of this uncertainty on our tax attributes or taxes payable based on our estimates of the eventual outcome. These effects are recognized when, despite our belief that our tax return positions are supportable, we believe that it is more likely than not that some of those positions may not be fully sustained upon review by tax authorities. We are required to file income tax returns in the U.S. and various foreign jurisdictions, which requires us to interpret the applicable tax laws and regulations in effect in such jurisdictions. Such returns are subject to audit by the various federal, state and foreign taxing authorities, who may disagree with respect to our tax positions. We believe that our consideration is adequate for all open audit years based on our assessment of many factors, including past experience and interpretations of tax law. We review and update our estimates in light of changing facts and circumstances, such as the closing of a tax audit, the lapse of a statute of limitations or a change in estimate. To the extent that the final tax outcome of these matters differs from our expectations, such differences may impact income tax expense in the period in which such determination is made. The eventual impact on our income tax expense depends in part if we still have a valuation allowance recorded against our deferred tax assets in the period that such determination is made.

Results of Operations

Revenues

(Dollars in millions)	Year Ended December 31,			2021 vs. 2020 Change		2020 vs. 2019 Change	
	2021	2020	2019	\$	%	\$	%
Automotive sales	\$ 44,125	\$ 24,604	\$ 19,358	\$ 19,521	79 %	\$ 5,246	27 %
Automotive regulatory credits	1,465	1,580	594	(115)	-7 %	986	166 %
Automotive leasing	1,642	1,052	869	590	56 %	183	21 %
Total automotive revenues	47,232	27,236	20,821	19,996	73 %	6,415	31 %
Services and other	3,802	2,306	2,226	1,496	65 %	80	4 %
Total automotive & services and other segment revenue	51,034	29,542	23,047	21,492	73 %	6,495	28 %
Energy generation and storage segment revenue	2,789	1,994	1,531	795	40 %	463	30 %
Total revenues	\$ 53,823	\$ 31,536	\$ 24,578	\$ 22,287	71 %	\$ 6,958	28 %

Automotive & Services and Other Segment

Automotive sales revenue includes revenues related to cash deliveries of new Model S, Model X, Model 3 and Model Y vehicles, including access to our Supercharger network, internet connectivity, FSD features and over-the-air software updates. Cash deliveries are vehicles that are not subject to lease accounting.

Automotive regulatory credits includes sales of regulatory credits to other automotive manufacturers. Our revenue from automotive regulatory credits is directly related to our new vehicle production, sales and pricing negotiated with our customers. We monetize them proactively as new vehicles are sold based on standing arrangements with buyers of such credits, typically as close as possible to the production and delivery of the vehicle or changes in regulation impacting the credits.

Automotive leasing revenue includes the amortization of revenue for vehicles under direct operating lease agreements as well as those sold with resale value guarantees accounted for as operating leases under lease accounting. Additionally, automotive leasing revenue includes direct sales-type leasing programs where we recognize all revenue associated with the sales-type lease upon delivery to the customer.

Services and other revenue consists of non-warranty after-sales vehicle services, sales of used vehicles, retail merchandise, sales by our acquired subsidiaries to third party customers and vehicle insurance revenue.

2021 compared to 2020

Automotive sales revenue increased \$19.52 billion, or 79%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase of 433,815 Model 3 and Model Y cash deliveries year over year from production ramping at both Gigafactory Shanghai and the Fremont Factory at a slightly higher combined average selling price from a higher proportion of Model Y sales offset by regional sales mix. Additionally, we had a \$365 million net release of our sales return reserve on vehicles sold with resale value guarantees, which increased our automotive sales revenue, due to actual return rates being lower than expected and increases in resale values of our vehicles in 2021. The increases in automotive sales revenue were partially offset by a decrease of 28,819 Model S and Model X cash deliveries at a higher combined average selling price as deliveries of the new versions of Model S and Model X only began ramping in the second and fourth quarters of 2021, respectively.

Automotive regulatory credits revenue decreased \$115 million, or 7%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to changes in regulation which entitled us to additional credits in the prior year and changes in pricing in certain regions.

Automotive leasing revenue increased \$590 million, or 56%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase in cumulative vehicles under our direct operating lease program and an increase in direct sales-type leasing revenue as we have a full year of sales in 2021 since we began offering the program during the third quarter of 2020. These increases were partially offset by the decrease in automotive leasing revenue associated with our resale value guarantee leasing programs accounted for as operating leases as those portfolios have declined.

Services and other revenue increased \$1.50 billion, or 65%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase in used vehicle revenue driven by increases in volume and average selling prices of used vehicles, non-warranty maintenance services revenue as our fleet continues to grow and retail merchandise revenue.

Energy Generation and Storage Segment

Energy generation and storage revenue includes sales and leasing of solar energy generation and energy storage products, services related to such products and sales of solar energy systems incentives.

2021 compared to 2020

Energy generation and storage revenue increased by \$795 million, or 40%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase in deployments of Megapack, solar cash and loan jobs, Powerwall and Solar Roof, partially offset by a decrease in Powerpack deployments as we phase out the product following the introduction of Megapack.

Cost of Revenues and Gross Margin

(Dollars in millions)	Year Ended December 31,			2021 vs. 2020 Change		2020 vs. 2019 Change	
	2021	2020	2019	\$	%	\$	%
Cost of revenues							
Automotive sales			15,939				
Automotive leasing	\$ 32,415	\$ 19,696	\$ 9	\$ 12,719	65 %	\$ 3,757	24 %
Total automotive cost of revenues	978	563	459	415	74 %	104	23 %
Services and other	33,393	20,259	8	13,134	65 %	3,861	24 %
Total automotive & services and other segment cost of revenues	3,906	2,671	2,770	1,235	46 %	(99)	-4 %
Energy generation and storage segment	37,299	22,930	8	14,369	63 %	3,762	20 %
Total cost of revenues	2,918	1,976	1,341	942	48 %	635	47 %
	\$ 40,217	\$ 24,906	\$ 9	\$ 15,311	61 %	\$ 4,397	21 %
Gross profit total automotive	\$ 13,839	\$ 6,977	\$ 4,423				
Gross margin total automotive	29.3 %	25.6 %	21.2 %				
Gross profit total automotive & services and other segment	\$ 13,735	\$ 6,612	\$ 3,879				
Gross margin total automotive & services and other segment	26.9 %	22.4 %	16.8 %				
Gross profit energy generation and storage segment	\$ (129)	\$ 18	\$ 190				
Gross margin energy generation and storage segment	-4.6 %	0.9 %	12.4 %				
Total gross profit	\$ 13,606	\$ 6,630	\$ 4,069				
Total gross margin	25.3 %	21.0 %	16.6 %				

Automotive & Services and Other Segment

Cost of automotive sales revenue includes direct and indirect materials, labor costs, manufacturing overhead, including depreciation costs of tooling and machinery, shipping and logistic costs, vehicle connectivity costs, allocations of electricity and infrastructure costs related to our Supercharger network and reserves for estimated warranty expenses. Cost of automotive sales revenues also includes adjustments to warranty expense and charges to write down the carrying value of our inventory when it exceeds its estimated net realizable value and to provide for obsolete and on-hand inventory in excess of forecasted demand.

Cost of automotive leasing revenue includes the depreciation of operating lease vehicles, cost of goods sold associated with direct sales-type leases and warranty expense related to leased vehicles. Cost of automotive leasing revenue also includes vehicle connectivity costs and allocations of electricity and infrastructure costs related to our Supercharger network for vehicles under our leasing programs.

Cost of services and other revenue includes costs associated with providing non-warranty after-sales services, cost of used vehicles including refurbishment costs, costs for retail merchandise, and costs to provide vehicle insurance. Cost of services and other revenue also includes direct parts, material and labor costs and manufacturing overhead associated with the sales by our acquired subsidiaries to third party customers.

2021 compared to 2020

Cost of automotive sales revenue increased \$12.72 billion, or 65%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase of 433,815 Model 3 and Model Y cash deliveries. Additionally, the net release of our sales return reserve on vehicles sold with resale value guarantees resulted in a corresponding increase of \$286 million in cost of automotive sales revenue. These increases were partially offset by a decrease of 28,819 Model S and Model X cash deliveries at higher costs per unit due to temporary under-utilization of manufacturing capacity at lower production volumes during our current production ramp of the new versions of Model S and Model X. Additionally, there was a decrease in combined average Model 3 and Model Y costs per unit due to changes in regional production mix as Gigafactory Shanghai has ramped in capacity, where costs are lower from localized procurement and manufacturing in China.

Cost of automotive leasing revenue increased \$415 million, or 74%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase in cumulative vehicles under our direct operating lease program and an increase in direct sales-type leasing cost of revenues from more sales in the current year. These increases were partially offset by the decrease in cost of automotive leasing revenue associated with our resale value guarantee leasing programs accounted for as operating leases as those portfolios have declined.

Cost of services and other revenue increased \$1.24 billion, or 46%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to an increase in used vehicle cost of revenue driven by increases in volume and costs of non-Tesla used vehicles, costs to support our increase in non-warranty maintenance services revenue and costs of retail merchandise as our sales have increased.

Gross margin for total automotive increased from 25.6% in the year ended December 31, 2020 to 29.3% in the year ended December 31, 2021. The increase was primarily due to favorable changes in sales and production mix of Model 3 and Model Y as Gigafactory Shanghai has ramped in capacity. The average Model 3 and Model Y costs per unit have decreased significantly due to localized procurement and manufacturing in China despite rising raw material, commodity, logistics and expedite costs. Additionally, our Model Y gross margin has benefitted from shared manufacturing of Model 3 and learnings from the scaling of past products. These increases were partially offset by a decrease of \$115 million in sales of regulatory credits, which have negligible incremental costs associated with them.

Gross margin for total automotive & services and other segment increased from 22.4% in the year ended December 31, 2020 to 26.9% in the year ended December 31, 2021, primarily due to the automotive gross margin impacts discussed above and an improvement in our services and other gross margin. Additionally, there was a lower proportion of services and other, which operated at a lower gross margin than our automotive business, within the segment in the year ended December 31, 2021 compared to the prior year.

Energy Generation and Storage Segment

Cost of energy generation and storage revenue includes direct and indirect material and labor costs, warehouse rent, freight, warranty expense, other overhead costs and amortization of certain acquired intangible assets. Cost of energy generation and storage revenue also includes charges to write down the carrying value of our inventory when it exceeds its estimated net realizable value and to provide for obsolete and on-hand inventory in excess of forecasted demand. In agreements for solar energy system and PPAs where we are the lessor, the cost of revenue is primarily comprised of depreciation of the cost of leased solar energy systems, maintenance costs associated with those systems and amortization of any initial direct costs.

2021 compared to 2020

Cost of energy generation and storage revenue increased by \$942 million, or 48%, in the year ended December 31, 2021 as compared to the year ended December 31, 2020, primarily due to increases in deployments of Solar Roof, solar cash and loan jobs, Megapack and Powerwall, partially offset by reductions in average costs per unit of Solar Roof as deployments have increased and a decrease in Powerpack deployments as we phase out the product following the introduction of Megapack.

Gross margin for energy generation and storage decreased from 0.9% in the year ended December 31, 2020 to -4.6% in the year ended December 31, 2021, primarily due to a higher proportion of Solar Roof in our overall energy business which operated at a lower gross margin as a result of temporary manufacturing underutilization during product ramp despite an improvement in gross margin compared to the prior year and lower Powerpack gross margin as fixed cost absorptions are negatively impacted as we phase out the product following the introduction of Megapack. These decreases were partially offset by a higher proportion of Powerwall in our overall energy business which operated at a higher gross margin as well as an increase in Megapack gross margin as we continue to scale the products.

Research and Development Expense

	Year Ended December 31,			2021 vs. 2020 Change		2020 vs. 2019 Change	
	2021	2020	2019	\$	%	\$	%
(Dollars in millions)							
Research and development	\$ 2,593	\$ 1,491	\$ 1,343	\$ 1,102	74 %	\$ 148	11 %
As a percentage of revenues	5 %	5 %	5 %				

Research and development ("R&D") expenses consist primarily of personnel costs for our teams in engineering and research, manufacturing engineering and manufacturing test organizations, prototyping expense, contract and professional services and amortized equipment expense.