September 2022

EFFICIENT ELECTRIFICATION

In this month's *Efficient Electrification*, we take a closer look at the Inflation Reduction Act and what this means for electric vehicle (EV) tax credits. The $369 billion bill was signed into law in August 2022 and included support for the anticipated boom in consumer and commercial EV adoption.

In our second article, we revisit EPRI's Energy Storage Roadmap which recently received a robust refresh. The updated roadmap reflects industry progress and new opportunities for research and development advancement. Learn more about what's next for battery storage in the key areas of safety, reliability, affordability, environmental responsibility, and innovation.

We hope you enjoy this edition and appreciate your ongoing collaboration.

Inflation Reduction Act: A New World for Electric Vehicle Incentives

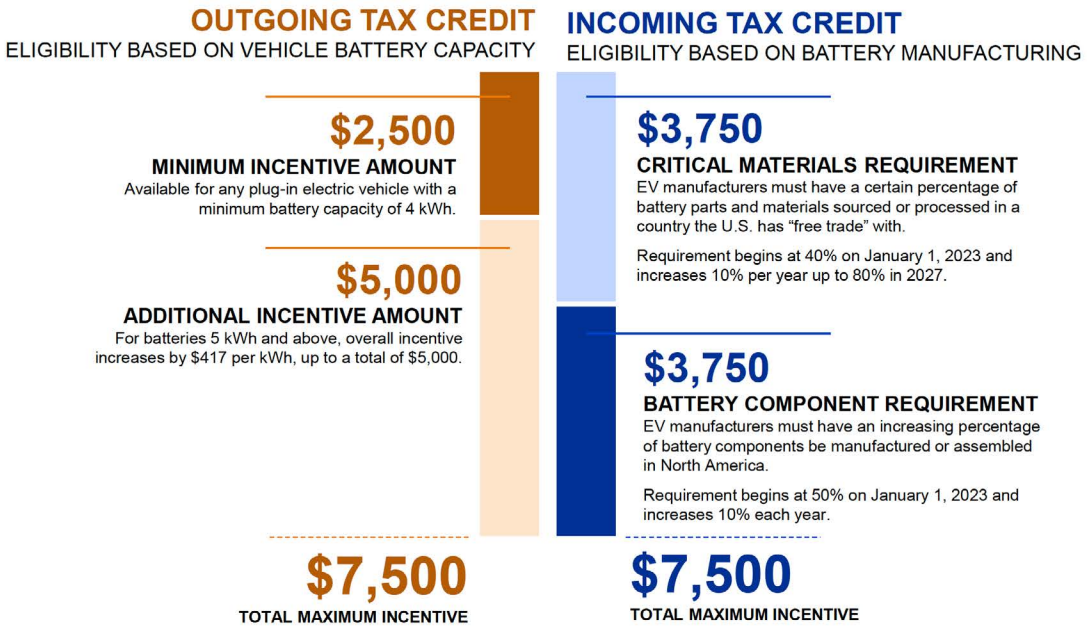
Even before the $369 billion Inflation Reduction Act (IRA) was passed and signed into law in August 2022, forecasts of electric vehicle (EV) growth were robust. For instance, Bloomberg New Energy Finance's (BNEF) most recent Electric Vehicles Outlook 2022 report projected that EV sales globally would reach nearly 11 million this year and climb to more than 20 million by 2025.

There is also growing evidence that EVs are quickly moving into the mainstream. In fact, six of the seven car commercials that ran during the Super Bowl featured EVs, including ads for Kia, GM, Nissan, BMW, and Polestar. The focus on EVs was notable, but it also reflects the strategy multiple automakers are following. A survey of auto executives found that, on average, car companies expect more than 50 percent of their vehicles sales to be EVs by 2030.

One of the aims of the IRA was to accelerate the adoption of EVs, both for passenger cars and trucks, as well as commercial vehicles. But the new law has other objectives as well, including supporting a domestic EV supply chain and expanding access to EVs. "We see that the demographic breakdown of EV owners today is disproportionately high-income and well-educated," said Allan Zhao, an EPRI engineer and scientist who recently analyzed how the IRA changes EV incentives. "There were a number of measures taken to make EVs more accessible to a wider range of people."

Tax credits can be a powerful tool that federal policymakers have to encourage EV adoption. The IRA includes a host of changes to the existing EV tax credit, as well as the addition of new credits to make EV ownership more equitable and make the purchase of EVs more financially attractive to companies.

NEW INCENTIVE CALCULATION METHOD FOR IRC 30D



Therefore, the EV tax credits included in the IRA are significantly different than the previous credit (known as IRC 30D), which began to phase out on Aug.16, 2022. Due to these changes, EPRI decided to study the new provisions and communicate their impact. "While there are some similarities between the new and old incentives, they are fundamentally different policies," Zhao said. "This was an exercise to catch ourselves up to speed and then put it together for energy providers and customers to understand how the changes impact them, especially if they're planning to buy an EV."

How the Previous EV Tax Credit Worked

To better understand changes to the EV tax credits, it's helpful to learn the details of the pre-IRA credit. The previous tax credit had these basic elements:

- To be eligible for the incentive , an EV had to have a minimum battery capacity of 4 kilowatt-hours. If an EV met that minimum battery capacity, it was eligible for a $2,500 tax credit.

- Vehicles equipped with larger batteries were eligible for an increased tax credit. The incentive amount increased proportionally with battery capacity, up to a maximum of $5,000. Taken together, the total maximum incentive was $7,500.

- There was a cap on the total number of vehicles made by a manufacturer that were eligible for the incentive. A total of 200,000 EVs made by each automaker qualified for the full credit. Many of the major EV manufacturers, including Tesla and General Motors, surpassed that cap some time ago.

- Drivers who qualified for the tax credit also had to wait until the year after they purchased an EV to claim the incentive when they filed their taxes.

A Focus on Battery Manufacturing

The IRA includes significant revisions to the existing EV tax credit, which is now known as the Clean Vehicle Credit. Here is what hasn't changed: The total maximum incentive remains at $7,500. Many other provisions have changed, including the eligibility requirements and timeline for claiming the tax incentive.

At a high level, the eligibility requirements are based on the battery materials and components, and where the EV was assembled. Here's what needs to be in place for an EV to qualify for the full $7,500 credit and changes to the eligibility criteria:

- Even before considering the new eligibility requirements around battery materials and components, EVs must first have a minimum battery capacity of 7 kilowatt-hours. In addition, final vehicle assembly must take place in North America and the manufacturer's suggested retail price (MSRP) must be less than $55,000 for sedans and lower than $80,000 for SUVs, trucks, and vans. The National Highway Traffic Safety Administration provides a vehicle identification number (VIN) tool to determine where a vehicle was assembled and the Department of Energy (DOE) maintains a list of EVs that might meet the assembly requirement.

- Batteries are made using a wide array of raw materials, including lithium, cobalt, nickel, aluminum, and many others. In the updated EV incentive, an escalating percentage of the materials used in batteries must come from a domestic source or from a country the United States has a free trade agreement with in order to secure $3,750 of the $7,500 credit. This requirement begins Jan. 1, 2023, when 40 percent of the critical materials used in batteries must be sourced from free trade countries. The percentage then increases 10 percent each year until it reaches 80 percent in 2027.

- EVs that meet the critical materials requirement can claim the remaining $3,750 of the credit if an increasing percentage of battery components are made or assembled in North America. Similar to the critical materials provision, this requirement also begins on Jan. 1, 2023, when 50 percent of battery components must be manufactured or assembled in North America. The percentage increases annually until reaching 100 percent in 2028.

- For EV buyers, the modified incentive now has income eligibility requirements. To receive the tax credit, those who file their taxes individually cannot make more than $150,000, joint filers can't make more than $300,000 and single heads of households have an income cap of $225,000.

- There are two other important modifications to the EV tax credit. Starting on Jan. 1, 2024, vehicle purchasers can claim the credit when they buy a new car or truck. This change is designed to remove the barrier of having to wait months to file their taxes before receiving a credit – a significant barrier for some buyers due to the high upfront cost of many EVs. Finally, the modified credit eliminates the cap that limited incentives to 200,000 vehicles per manufacturer.

New Credits to Support Purchases of Used EVs and Commercial Vehicles

The IRA also includes two entirely new EV tax credits. One is meant to make EVs more readily available to people who haven't been able to afford them in the past. The Previously-Owned Clean Vehicle Credit (known as IRC 25E) provides a tax credit of up to $4,000 for used EVs at least two model years old. The credit is available starting on Jan. 1, 2023 through Dec. 1, 2032. While the credit supporting used EVs doesn't have the same requirements around battery raw materials and components, it does have other criteria, including:

- The purchase price of the used EV must be less than $25,000.

- The credit covers 30 percent of the vehicle's purchase price, up to a maximum of $4,000.

- There are also income caps for purchasers to be eligible. Those filing taxes as individuals can't make more than $75,000 to qualify. Joint filers are subject to a $125,000 income cap to be eligible, while single heads of households must have income below $112,500.

The IRA also offers a new Credit for Qualified Commercial Clean Vehicles (known as IRC 45W), which is designed to incentivize companies to electrify their vehicle fleets. The credit begins on Jan. 1, 2023 through Dec. 1, 2032.

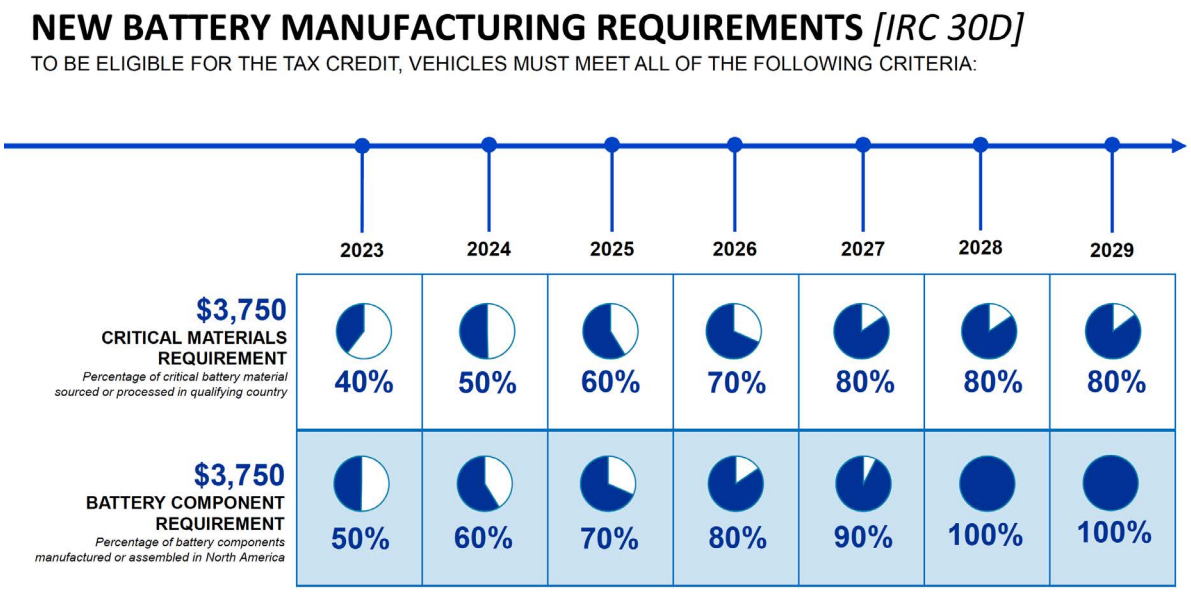
The credit is calculated by using the lower to two calculated values, which are:

- An amount equal to the excess of the purchase price of a comparable vehicle or 15 percent of the purchase price.

- If the qualified clean commercial vehicle is not equipped with an internal combustion engine, the incentive rises to up to 30 percent of the vehicle purchase price.

The credit can also not exceed $7,500 for vehicles with a gross weight rating below 14,000 pounds. For all other vehicles, the credit can't exceed $40,000.

EPRI will continue to analyze changes in EV incentives and will work to communicate both their details and implications. To that end, EPRI is assembling consumer guides for both light-duty and heavy-duty EVs. "We are continuing to work on clarifying and exploring the implications of the IRA and other changes," Zhao said. "Energy providers can use these resources as a way to educate customers and clear up as much confusion as possible."



Turning a Vision for Energy Storage into Reality

Recent data about the energy storage market in the U.S. and around the world tells a story of both robust growth and short and long-term challenges. For example, the consultancy Wood Mackenzie Power & Renewables (WoodMac) recently reported that U.S. installations of grid-scale and residential storage reached record levels in the second quarter of 2022.

Even though energy storage deployments were at all-time highs, the volume of new installations could have been significantly higher. For instance, while WoodMac reported that 2,608 megawatt-hours of grid-scale storage came online in the second quarter, delays prevented another 1.1 gigawatts from being completed. The reasons: supply chain problems, transportation delays, and long interconnection queues.

In many ways, the simultaneously positive and challenging tale of the second quarter U.S. energy storage market is symbolic of the state of energy storage overall. On the one hand, energy storage appears an essential technology to achieve the goal of a decarbonized and resilient electricity grid. Forecasts of the future growth of energy storage demonstrate the importance of energy storage as a tool to help integrate large volumes of variable renewable generation, like wind and solar. For example, Bloomberg New Energy Finance (BNEF) forecast that the global energy storage market would grow 30 percent annually through 2030.

An Energy Storage Roadmap

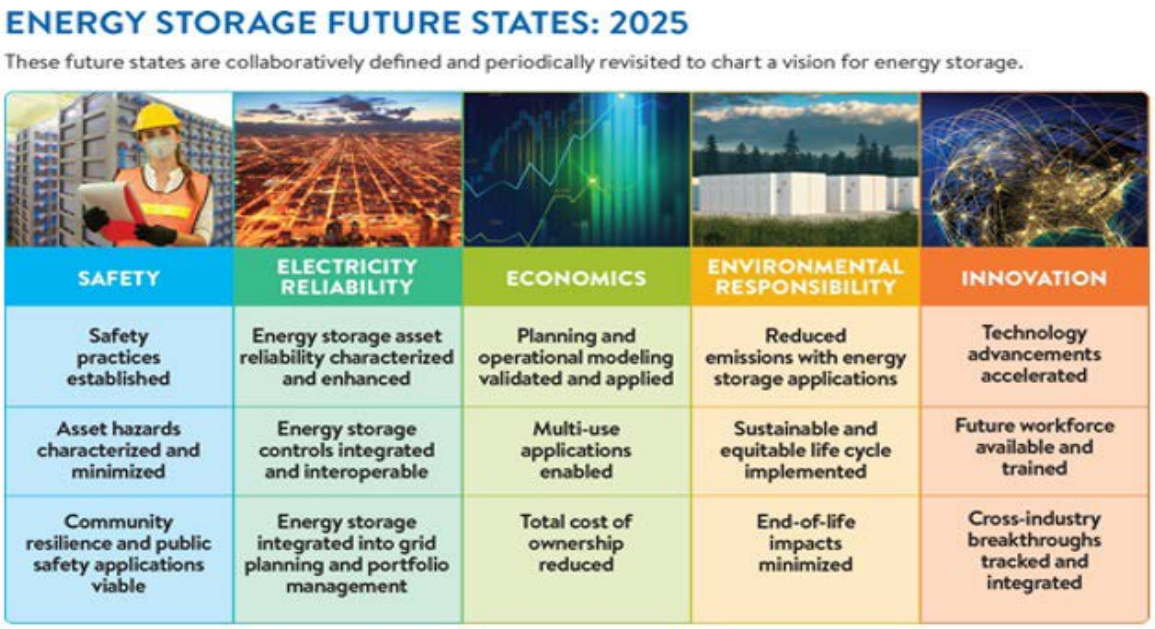
However, big picture forecasts of energy storage's total market size and role in decarbonizing the grid tell only part of the story. The reality is that a significant amount of research, development, innovation, and education are needed for energy storage to safely, reliably, and cost-effectively deliver many potential benefits. Put another way, energy storage needs a plan.

In 2020, EPRI released an Energy Storage Roadmap, Vision for 2025 report. The roadmap was the result of two years of collaborative development involving energy providers and EPRI energy storage experts. Earlier this summer, the report was refreshed to better reflect the latest research findings and priorities.

The objective of the roadmap was to clearly outline the energy storage goals, the barriers to achieving them, and a research plan to address them. "As we went through the development process, we identified why there was so much interest in energy storage and why and how it would be used," said Eva Gardow, a technical executive in EPRI's Energy Storage and Distributed Generation program. "Then, based on that, we said what does the future state need to look like in five years to achieve that vision and what are the gaps that need to be filled?"

The initial roadmap set out a vision of 15 future states for energy storage, separated into five categories. They are:

- Safety, including the establishment of necessary safety practices to mitigate, prepare for, and respond to extreme weather events and fires, as well as the development of standards and codes.
- Electricity reliability, such as an understanding of how to integrate energy storage into grid planning and portfolio management, as well as improved characterizations of energy storage reliability.
- Economics, particularly providing education about how to value energy storage use cases and identifying multiple revenue streams for energy storage. Another objective is to understand cost projections of energy storage ownership.
- Environmental responsibility, including identifying ways to minimize the end-of-life impacts of energy storage and maximize emissions reductions throughout the grid.



- Innovation to accelerate technology advancements to push product availability and adoption, as well as to integrate breakthroughs that have already had an impact in other industries.

These pillars align closely with EPRI's vision and offer a tangible action plan. "Sometimes people write roadmaps and forget about them," Gardow says. "We align our research and everyday work to this document, and it is our guide and map."

A Flexible Approach to Research

Given the rapid pace of change in the electric power industry today, it's inevitable that research priorities will change. The updated roadmap provides more detail and better reflects the changing needs of members, the energy storage industry and society as a whole.

The roadmap will continue to be updated approximately every two years to better reflect the always-evolving understanding of energy storage technologies, their applications, and changing research priorities.

The updated roadmap provides both a significant level of detail about progress towards the original 2025 vision, descriptions of challenges and problems that still need to be solved, as well as links to EPRI resources that provide a more in-depth explanation of research findings. For example, safety is one of the pillars of the 2025 vision and its importance has been underscored in recent years by fires involving energy storage systems.

The updated roadmap focuses on three safety-related objectives: the establishment of safety practices; characterizing and minimizing the hazards of energy storage technologies; and improving the viability of energy storage to enhance public safety and community resilience.

In each of these areas, the roadmap provides an easily digestible way to understand both the complexity involved with achieving the 2025 vision and a sense of what has already been learned and accomplished.

For instance, safety standards to protect workers, first responders, and the public are essential for battery storage to scale to the level that will be required in an increasingly decarbonized power system.

Among the six gaps to establishing strong safety practices identified in the roadmap are protocols that guide how first responders should evaluate and handle an energy storage incident. Another gap highlighted is the need for guidelines operators can use to run energy storage systems in ways that reduce potential safety hazards.

In addition, the roadmap provides descriptions of current research activities that are designed to address some of these gaps. For example, EPRI has developed and maintains a public database that tracks energy storage failures around the world. The data about those incidents is being studied to develop lessons learned that can inform efforts to mitigate the risk of future incidents. Another ongoing research project is developing a fire prevention and mitigation toolkit that includes data sets, guidance documents, and a decision framework tool to guide the development of energy storage safety plans.

Future research plans are also described in the roadmap. That includes continuing work on the fire prevention and mitigation toolkit, as well as the development of a BESS (battery energy storage system) Augmented Reality Maintenance and Safety (ARMAS) tool that supports energy storage maintenance and safety event response. A video demonstration of ARMAS is available on YouTube.

A similar format and flow of information illuminate the research activities, gaps, and future plans for the other four pillars of the 2025 energy storage vision. For the energy providers already participating in the EPRI Energy Storage and Distributed Generation program, the updated roadmap is designed to help increase understanding about research activities and future plans. It's also an opportunity to weigh in on how the roadmap should change. "They can see how the roadmap aligns with their utility conditions and share how more research may be needed to address this gap or future state," Gardow says.

For energy providers and other stakeholders not involved with the EPRI program, the roadmap is a reminder of the work that still needs to be done to secure the potential of energy storage. "Storage has made a lot of progress in a short amount of time," Gardow says. "But if you were to put together a graph of where we are in maturity, we are probably about 20 percent up that graph. We still have a long way to go."

In the News

A new article from the Wall Street Journal looks at the questions California is asking to best prepare for the anticipated uptick in EV drivers and growing demands on the electric power grid. EPRI's Dan Bowermaster explains that key to the considerations include understanding customer behavior.

BloombergNEF report shows that solar power facilities accounted for half of all global capacity additions last year – coming in at 182 GW. The same study finds world's wind and solar projects combined to meet more than a tenth of global electricity demand for the first time in 2021. Learn more at Utility Dive.

EnergyWire's Peter Behr toured EPRI's Lenox labs, or the industry's 'proving ground' for technologies, innovations, and safety. From drone applications and arc flashing to simulations of falling trees on powerlines and aging assets, a day at Lenox provides a peek into the future of the power industry.

Upcoming Events

Distributech International, February 7 – 9, 2023, San Diego, Calif.

EPRI Resources

Heat Maps Visualize EV Market Share Across US – September 2022

Systemic Challenges and Barriers to Consumer EV Adoption: Introduction to the Root Cause Analysis – September 2022

Equity and Resilience: Implications at the Intersection of Climate Change and Community – September 2022

Energy Storage Roadmap: 2022 Update – June 2022

About EPRI's Efficient Electrification Initiative

In developed economies, electrification refers to the expanded use of electricity. This may involve powering new uses (such as cellular phones, computers, and server farms) or switching everyday technologies (such as automobiles, forklifts, and furnaces) from direct combus-tion of fossil fuels to electricity. Electrification offers potential to transform utilities and other industries in which power is a key input. As the electric supply becomes cleaner, electrification can reduce society's overall emissions. It can also lower costs and energy use for utility customers and improve economic efficiency, water use efficiency, grid utilization efficiency, productivity, indoor environments, and safety. Through collaborative research, development, and demonstration, EPRI's Efficient Electrification initiative is examining the impacts and tech-nical aspects of electrifying the end use of energy—where it is more efficient to do so—for the benefit of customers, the environment, and society.

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