



Impact of IRA, IIJA, CHIPS, and Energy Act of 2020 on Clean Technologies

Deep Dive | Electric Vehicles

APRIL 2023



Background | Objectives and context of this work

Objective

- Explore impacts of recent legislation¹ on U.S. opportunity and remaining challenges for emerging clean technology deployment

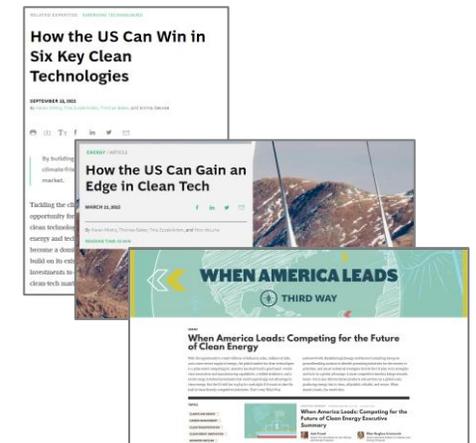
Stakeholders involved

- Analysis was commissioned by Breakthrough Energy and Third Way, with input from stakeholders across the public and private sectors



Related publications

- BCG report | How the US Can Win in Six Key Clean Technologies
- BCG report | How the US Can Gain an Edge in Clean Tech
- Third Way publication | When America Leads: Competing for the Future of Clean Energy



1. Legislation assessed here includes Inflation Reduction Act (IRA), Infrastructure Investment and Jobs Act, CHIPS and Science Act, and the Energy Act of 2020
Source: BCG analysis

~6,500 Mtpa

Annual global abatement potential in 2050

\$27-32T

Cumulative US domestic market '20-'50

\$6-7B

Cumulative US exports '20-'50

~1.2M³

Cumulative job creation through 2050

Electric Vehicles | Executive Summary

- IRA provisions provide significant demand and supply side stimulus to encourage expansion of domestic U.S. EV supply chain, supporting both infrastructure and consumer uptake, though global raw material supply chains and domestic power infrastructure bottlenecks may limit domestic deployments
- Strong demand-side incentives accelerate U.S. LDV¹ EV deployment by ~50% by 2030 by bringing EVs to purchase price parity in the immediate term compared to traditional ICE² vehicles
- Significant supply-side incentives support expansion of domestic EV manufacturing capacity, battery production, and buildout of EV charging station networks due to manufacturing incentives combined with tax credits tied to domestic content requirements
- “Friend-shoring” of upstream supply chains enhances critical mineral security and is encouraged by IRA tax credit qualifiers for both battery minerals sourced domestically or from free trade agreement partners and battery components sourced from North America
- However, while IRA provisions provide support, global raw material supply chain bottlenecks in critical battery minerals must be addressed by actively facilitating expansion of existing and new mines and refining facilities in trusted partner countries
- Similarly, continued focus on expanding supporting EV infrastructure, such as public charging points and associated grid expansion, will enable the domestic market to rapidly expand, unlocking the potential of the IRA provisions

1. Light duty vehicle 2. Internal Combustion Engine 3. Total number of positions created through 2050; incremental new jobs calculated as the sum of all non-negative one-year differences in # job-years (e.g., 2021 job-years minus 2020 job-years gives 2021 new jobs); incremental new jobs added to sum from prior period for cumulative calculation

Note: Numbers on the left are based on IEA's Announced Pledges (APS) scenario summed up across all value chain segments from 2020-2050
Source: IEA, BCG Analysis

Recent US policies (e.g., IRA, IIJA) have resulted in significant increases in projected size of domestic market, exports, and jobs within EVs



US domestic market

US cumulative domestic market through 2030 increased from ~\$2T to ~\$3T after IRA/IIJA due to increased demand-side incentives

\$B in market size¹



US exports

US cumulative exports through 2030 increased from \$530B to \$640B after IRA/IIJA, a smaller increase as IRA/IIJA mostly affect domestic manufacturing and demand

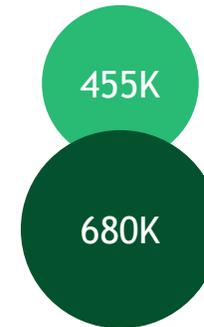
\$B in exports²



US job creation

New job creation in US EV industry through 2030 grew from ~455K to ~680K after IRA/IIJA primarily due to domestic manufacturing incentives

Number of jobs¹



1. Market size and number of jobs increase by 50% post-IRA based on the increase in 2030 EV volume. 2. Given a SOM of 11% for EVs, exports increase by 11% of \$1T (difference in market size pre- and post-IRA) to reflect increased demand for domestic production. Note: Pre-IRA numbers based on phase 1 EV model over timeframe from 2020-2030; Source: BCG analysis



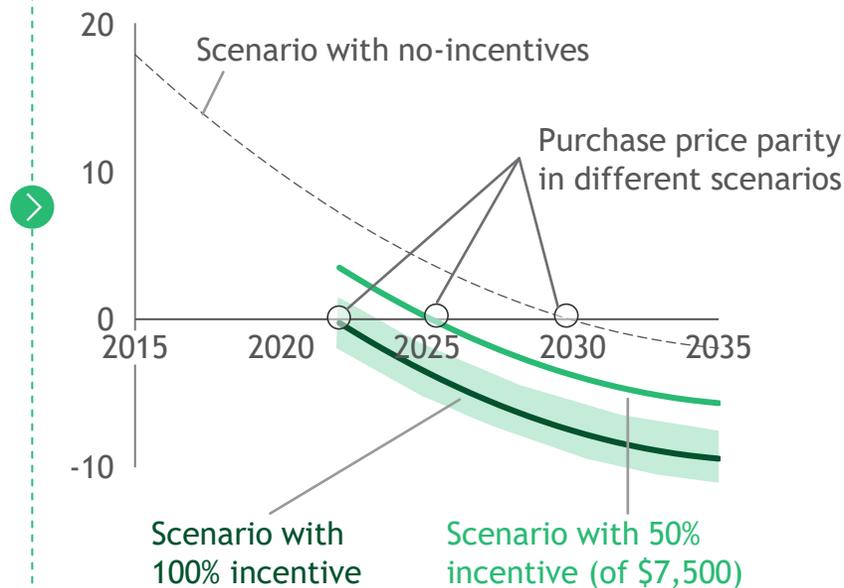
Demand-side incentives | IRA & IIJA support of electric vehicles expected to increase domestic uptake ~50% by accelerating the path to cost parity

Demand-side incentives for EVs from the IRA include:

- 1 **\$12B for personal and commercial clean vehicles**, up to \$7,500 for personal and up to 30% for commercial
- 2 **\$3B for USPS** to acquire EVs and support infrastructure
- 3 **\$11B to transition school buses, transit buses, and passenger ferries** to low or zero-emission vehicles

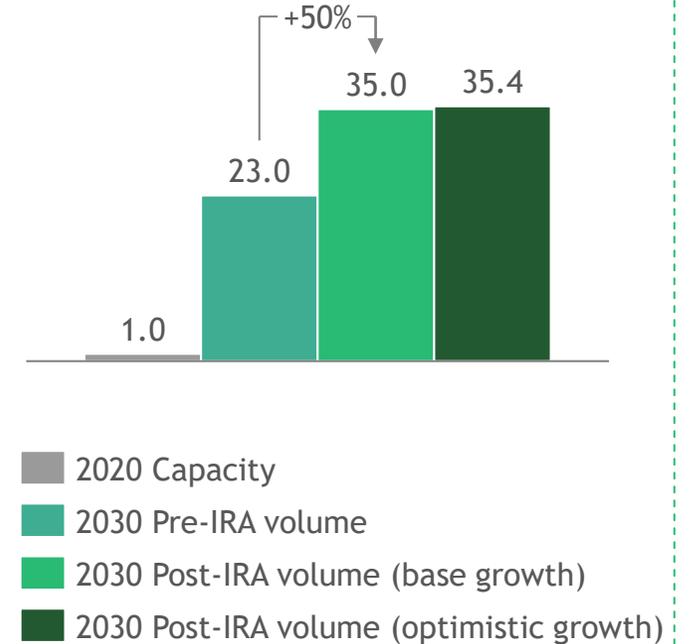
Incentives will reduce EV costs by accelerating cost parity ...

EV cost premium relative to ICE vehicles (%)

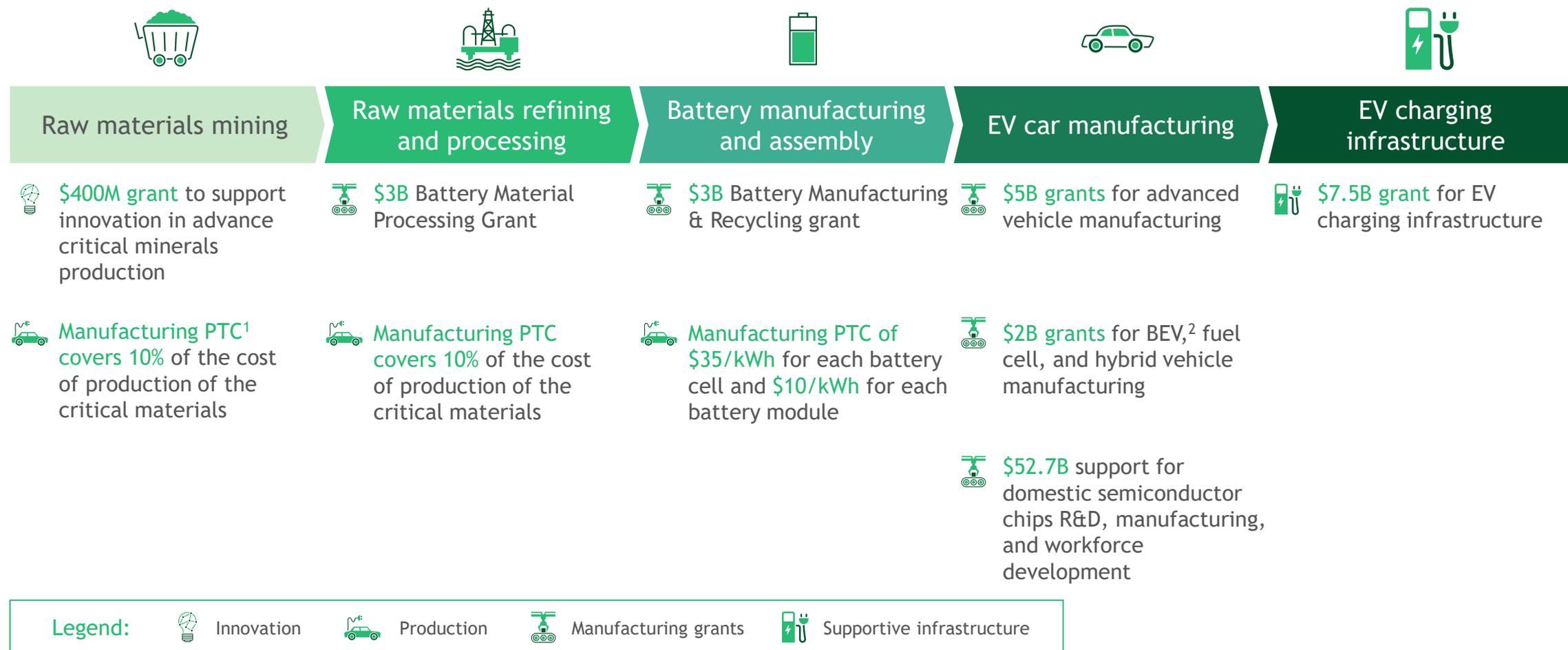


... increasing the number of EVs by ~50% in the U.S. by 2030

Number of EVs (Million)



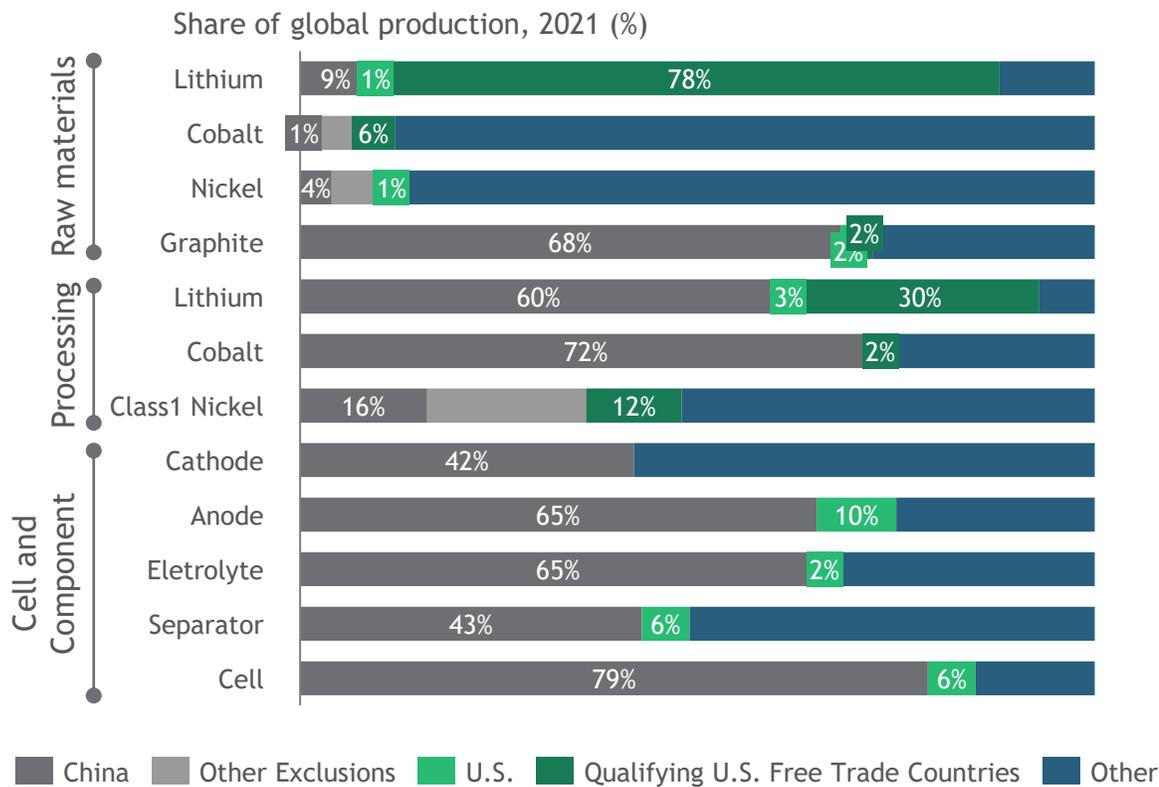
Supply-side incentives | IRA, IIJA, and the CHIPS Act provide significant funding to build an end-to-end domestic supply chain given growing demand for EVs



1. PTC = production tax credit, 2. BEV = battery electric vehicle
Source: BCG analysis

Raw materials security | IRA encourages friend-shoring for critical inputs to decrease dependence on highly concentrated supply sources

EV batteries' raw materials dominated by China today, with limited capacity in US



IRA mandates sourcing requirements that benefit free-trade partners

IRA eligibility criteria¹

Critical minerals

40% sourced from or processed in US or country with free trade agreement²

Content requirement increases by 10 pts per year up to 80%

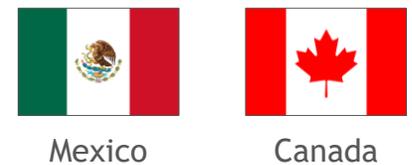
Countries that benefit



Battery components

50% of battery components manufactured in US, Mexico, and Canada^{2,3}

Content requirement increases by 10 pts per year up to 100%

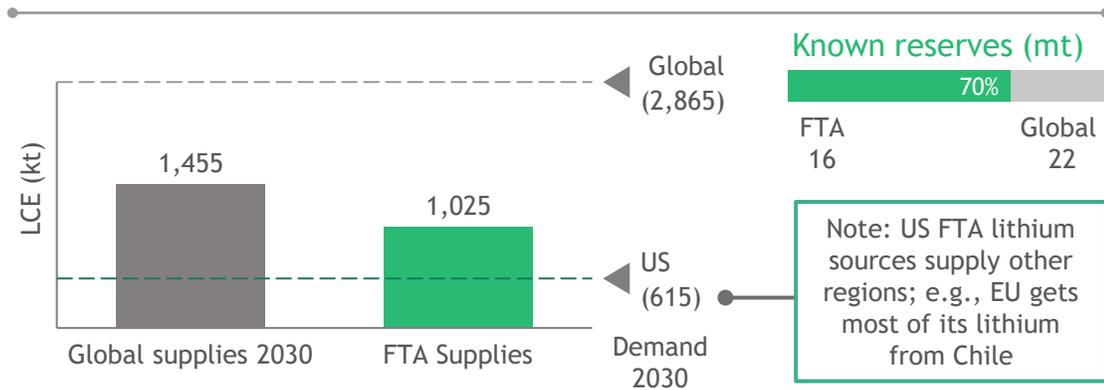


1. Does not apply to commercial vehicle tax credit of \$40,000 2. IRA excludes minerals (raw, processed) and components sourced from foreign entities of concern (i.e., China, Russia, North Korea, Iran), preventing countries from free trade agreements from sourcing from these foreign entities 3. Including recycling done in North America
 Note: All dates refer to when construction must start by or safe harbor achieved by. Source: H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022, BCG Analysis

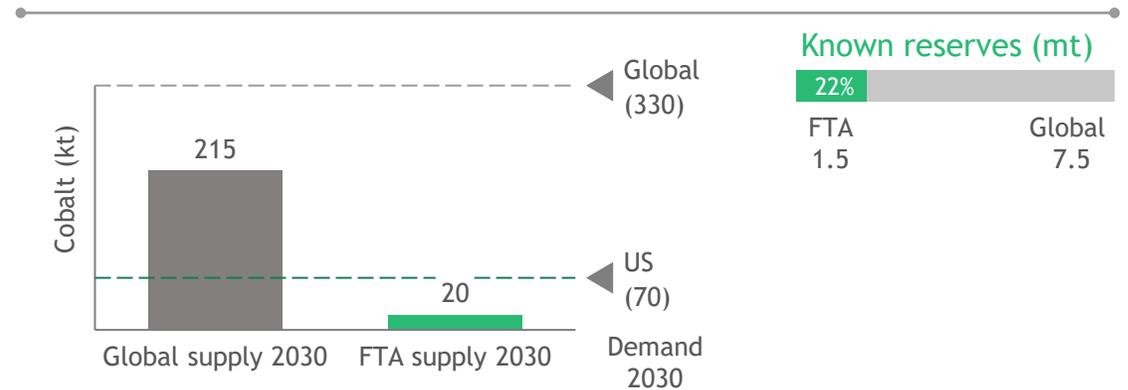
Raw materials security | However, global supply chains must ramp up quickly to qualify for the incentives, limiting IRA benefit realization

2030 view

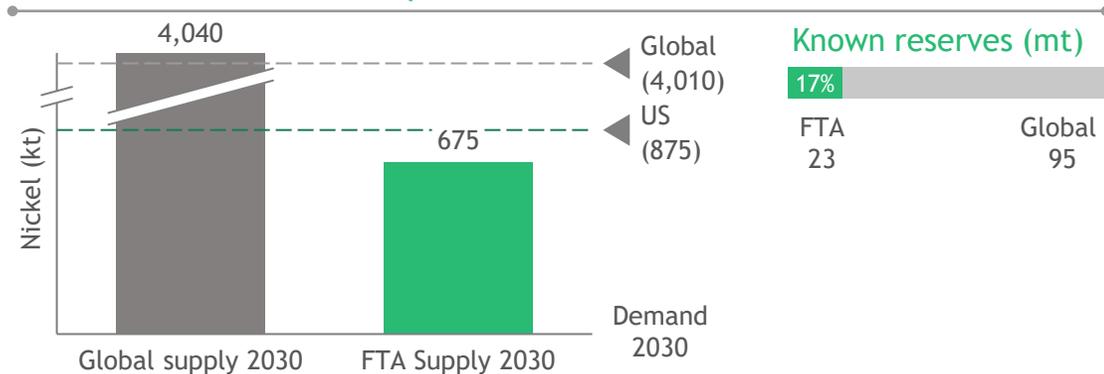
Lithium: Global supply shortage projected to become acute by 2030 as planned production capacity may fail to meet demand



Cobalt: Supply chain risk due to geopolitical issues and reliance on single country (DRC) which houses 70% of global supply



Nickel: Risk of becoming dependent on Indonesia in the long-term; Ni bottlenecks expected in the medium-term



Manganese: US and Europe to localize supply given likely concentration risks in high-grade ore and processing



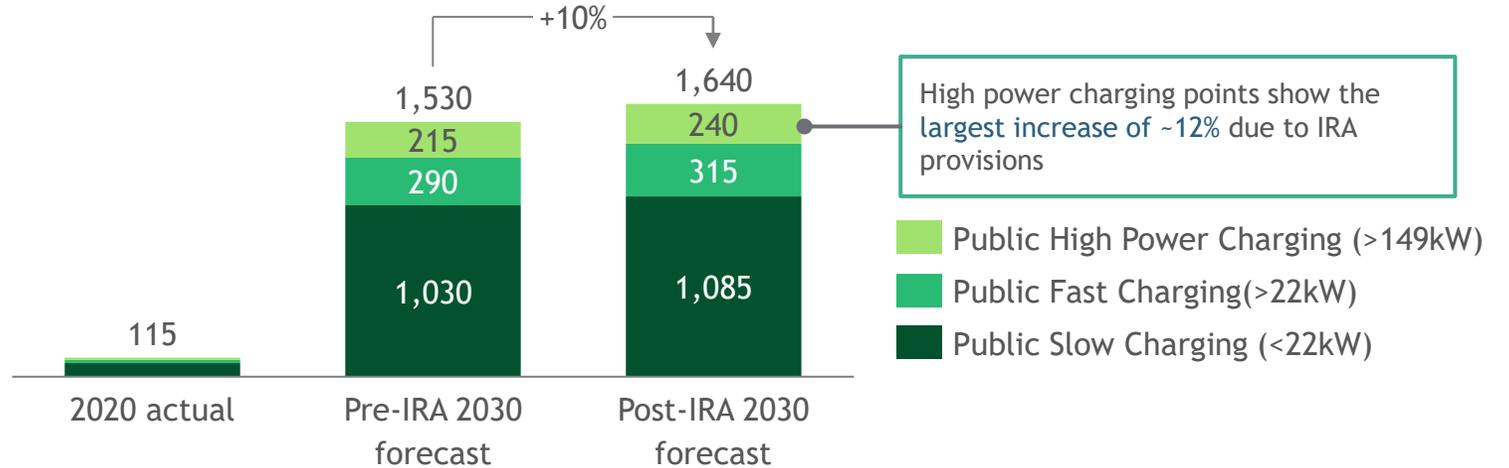
Note: FTA = Free trade agreement countries; LCE = Lithium carbonate equivalents; DRC = Democratic Republic of Congo; Units in kilo- or megatons (kt, mt)
Source: S&P Capital IQ; USGS Minerals Commodity Summaries; BCG analysis

EV infrastructure |
 Additional ~\$24B
 public charging
 infrastructure funding
 is needed beyond the
 \$7.5B from the IRA



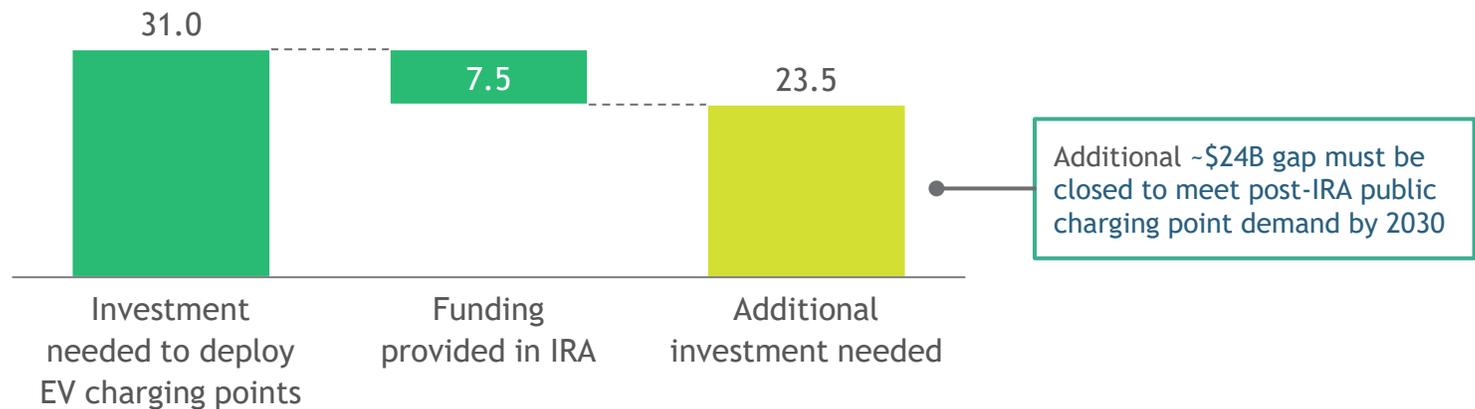
IRA provisions to drive a ~10% increase in public EV charging points ...

Number of EV charging points (k)



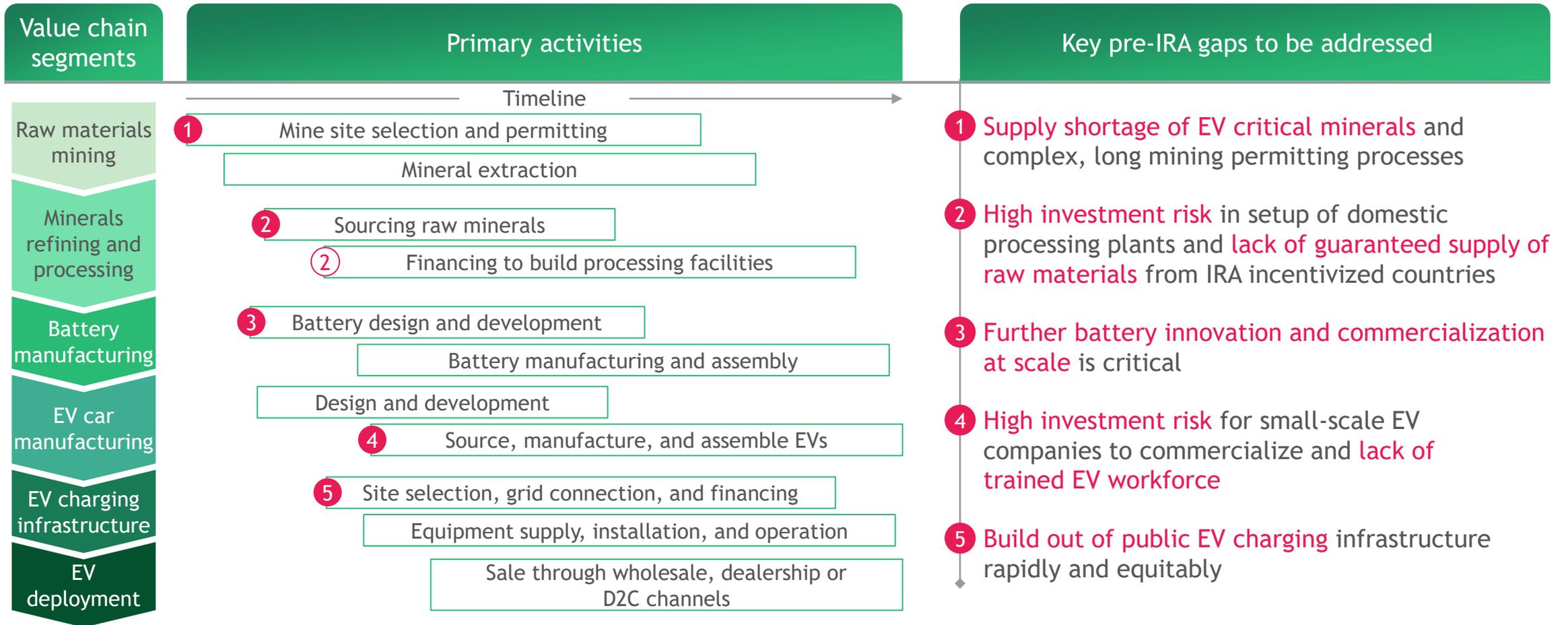
... but additional investment is needed to expand charging infrastructure

EV charging station investment required through 2030 (\$B)

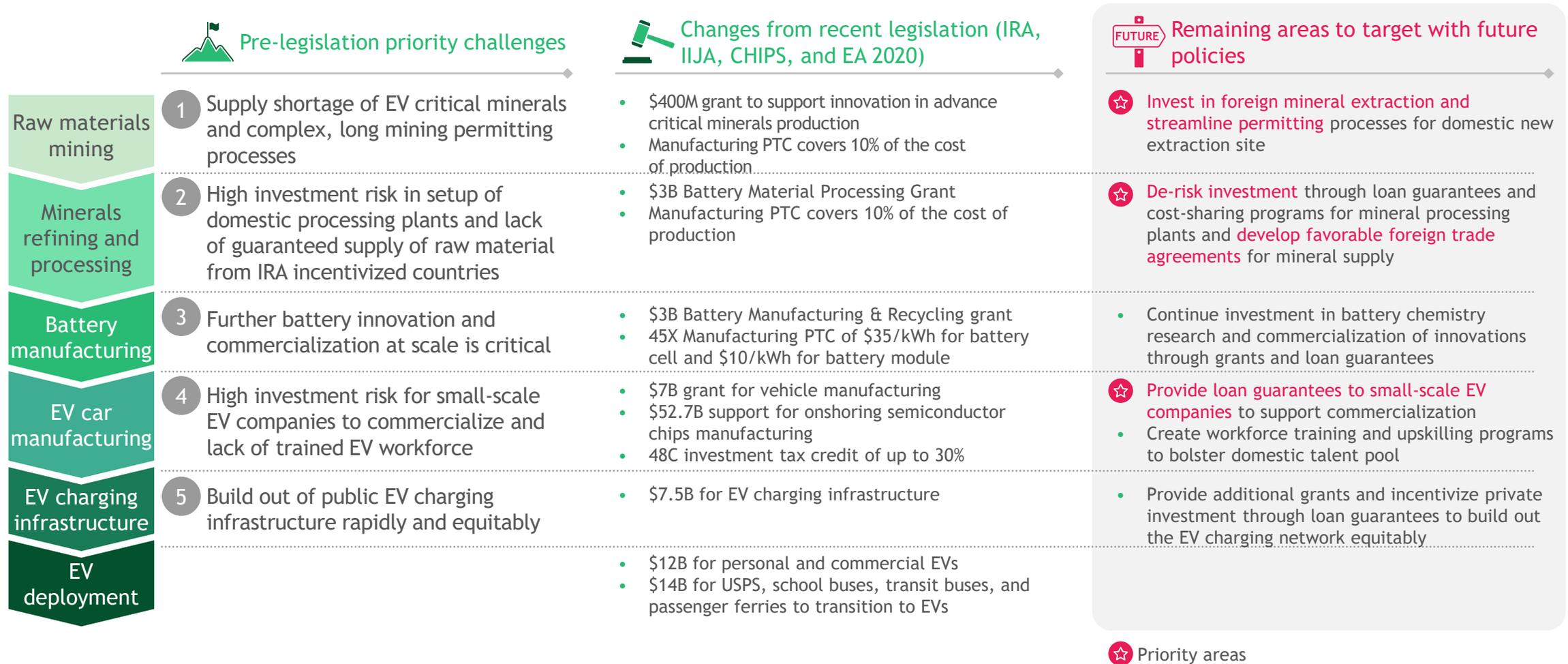


Pre-legislation challenges | To support EV deployment, several challenges needed to be addressed across the value chain

Illustrative



Remaining challenges | While recent legislation has addressed many priority issues for EVs, additional policy could further boost U.S. competitiveness



 Priority areas

Summary actions | IRA provides significant support to accelerate EV adoption, but further action needs to be taken to boost U.S. competitiveness

Key levers that will enable the US to win the EV market



Permitting reform for mining EV minerals

Permitting reform for mining of critical EV minerals is needed to boost the build up of sufficient capacity of minerals domestically for manufacturers to take advantage of IRA incentives



Increase battery mineral production

Increased financing and licensing support to setup critical minerals mining and processing domestically and in FTA countries



Charging infrastructure expansion

Additional funding support to further expand charging infrastructure to enable and support the growing EV adoption



Grid upgrade and expansion

Additional support for transmission grid development to successfully connect EV charging infrastructure to existing grid network

Backup | New legislation provides incentives for facilities and production of EVs (I/II)

↑ Provision	📄 Summary	📋 Type	👤 Total investment
1 IRA Section 13401: Clean Vehicle credit	Extension of Section 30D tax credit; \$7,500 credit for purchase of clean vehicles ¹²	Investment Tax Credit (ITC)	\$7.54B to 2032
2 IRA Section 13402: Credit for previously owned clean vehicles	\$4,000 credit (or 30% of sales price) for qualifying used EVs ³ weighing less than 14klbs and costing less than \$25k	Investment Tax Credit (ITC)	\$1.34B to 2032
3 IRA Section 13403: Qualified commercial clean vehicles	Credit is an amount equal to the lesser of 15% of the basis of a taxpayer used vehicle ⁴ (30% in the case of a vehicle not powered by ICE), or the incremental cost of such vehicle; maximum credit per vehicle is \$7,500 for vehicles with gross vehicle weight ratings (GVWR) of less than 14,000 pounds, or \$40,000 for heavier vehicles	Investment Tax Credit (ITC)	\$3.58B to 2032
4 IRA Section 70002: USPS clean fleet investments	Appropriates \$3 billion to the United States Postal Service (USPS) to acquire zero-emission delivery vehicles (\$1.29B) and requisite infrastructure at USPS facilities (\$1.71B)	Grant	\$3.0B
5 IRA Section 60101: Zero - Emissions Heavy - Duty Vehicle Investments	Appropriates \$1 billion ⁵ to the Environmental Protection Agency to implement a grant and rebate program for clean heavy-duty vehicles	Grant	\$1.0B

1. Credit eligibility depends on MSRP, income, critical mineral sourcing, battery component, and assembly location requirements. For more detailed click [here](#)
2. Fuel cell vehicles - FCVs or Plug-in electric vehicles | PEVs
3. A qualifying vehicle must also be propelled to a significant extent by an electric motor that draws electricity from a battery, and which has a capacity of not less than 7 kWh, and is capable of being recharged from an external source of electricity; additional eligibility factors includes income, use of other clean vehicle credits and prior credits from the vehicle
4. For use on public streets, roads, and highways, or be mobile machinery
5. Of which \$400 million set aside for projects to replace vehicles serving communities located in an air quality nonattainment area for any air pollutant

Source: DOE, IRA, BCG Analysis

Backup | New legislation provides incentives for facilities and production of EVs (II/II)

↑ Provision	📄 Summary	📋 Type	👤 Total investment
6 IRA Section 13501: 48C Advanced Energy Manufacturing Project Tax Credit	Extension of the advanced energy manufacturing project credit. Base rate of 6% and 30% tax credit if wage and apprentice requirements are satisfied	Manufacturing Tax Credit	\$10B
7 IRA Section 13502: 45X Advanced Manufacturing Tax Credit	Advanced Manufacturing Tax Credit, is a credit for manufacturers of eligible components produced within the United States. Tax credits include US\$45 per KWh of capacity, which consists of (i) US\$35 per KWh of battery capacity for battery cells and (ii) US\$10 per KWh of capacity for battery modules. 10 percent of the cost to produce “electrode active materials” also qualifies for a Section 45X tax credit	Manufacturing Tax Credit	-
8 IIJA section 11115: congestion mitigation and air quality improvement	Allows states to spend up to 10 percent of CMAQ funds on various projects including purchase of medium- or heavy-duty zero emission vehicles and related charging equipment	Investment Tax Credit (ITC)	\$2.6B
9 CHIPS - Section 10771	Authorizes \$1.4 billion for research, development, and demonstration for sustainable transportation (part of a larger \$11.2b funding)	Grant	\$1.4B

IIJA includes legislation tangential to EVs authorizes ~\$20 billion for charging stations¹ and Battery investments and EV battery recycling programs²

1. Sec. 11401. Grants for charging and fueling infrastructure - \$2.5B; Sec. 11403. Carbon reduction program - \$7B; IIJA: Title VIII National Electric Vehicle Formula Program - \$5b

2. Sec. 40207. Battery processing and manufacturing - \$6.13B Sec. 40208. Electric drive vehicle battery recycling and second-life applications program - \$.2B

Source: DOE, IIJA, BCG Analysis

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