# Roadmap to E-mobility for the State of Chihuahua, Mexico



SECRETARÍA **DE INNOVACIÓN** Y DESARROLLO ECONÓMICO **I<sup>2</sup>C** INSTITUTO DE INNOVACIÓN Y COMPETITIVIDAD

WILLIAM DAVIDSON INSTITUTE

AT THE UNIVERSITY OF MICHIGAN

INADET INSTITUTO DE APOYO AL DESARROLLO TECNOLÓGICO



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# **OVERVIEW**



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This report is a roadmap for supporting the transition to electric mobility (e-mobility) in the state of Chihuahua.

**Roadmap**: a high-level strategic plan that defines the what and why - it is a bridge between strategy and execution intended to clearly define the path to follow.

This work was made possible through a partnership between the William Davidson Institute and the Secretaría de Innovación y Desarrollo Económico de Chihuahua (SIDE), the Instituto de Innovación y Competitividad, and the Instituto de Apoyo al Desarrollo Tecnológico.



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## E-mobility is here to stay...



The transport sector is a major contributor to greenhouse gas emissions (GHG) and therefore a critical sector where electrification can have a big impact in supporting climate goals.



Largely motivated by policy shifts, OEMs are setting goals to electrify their product offerings over the next 5-10 years. That is tomorrow in automotive terms.



This is a major shift for vehicle production and impacts the entire supply chain: new additions to the value chain, new players, new opportunities.



The transition involves risk and phase-outs for ICE-specific parts of the value chain, and implications for sectors beyond automotive.



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# NORTH AMERICAN CONTEXT

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## The transition to e-mobility is a core issue for North America

The recent North American Leaders Summit (NALS) highlighted the need for the U.S., Canada and Mexico to work together to promote investment and reinforce competitiveness, innovation and resilience in the following areas:

- 1. Semiconductors
- 2. Critical minerals
- 3. EV charging infrastructure and transit electrification
- 4. Hydrogen
- 5. Workforce

Each of the three countries is taking action to address these priorities as discussed in the following slides.



In the **United States**, historic investments have been made to prepare the economy for a clean energy future and encourage domestic production in critical supply chains, including:

- The 2021 Bipartisan Infrastructure Law (BIL), which supports investments in transportation (roads and bridges, rail, transit, EVs, among others) and core infrastructure (power grid, broadband, environment)
- The 2022 CHIPS Act, which promotes cutting edge R&D to accelerate innovation in and commercialization of clean energy technologies, encourages semiconductor manufacturing and R&D, and supports a broader high-tech workforce
- The 2022 Inflation Reduction Act (IRA), which promotes domestic manufacturing capacity, encourages procurement of critical supplies domestically or from free-trade partners, and jump-starts R&D and commercialization of leading-edge technologies

These three pieces of legislation are poised to strengthen all parts of the EV value chain and will contribute to market expansion throughout this decade.

Sources: White House, "Reinvesting in America" by McKinsey, and "Congress's Climate Triple Whammy" by RMI, 2022.



The government of **Canada** is also making moves to develop a strong domestic EV ecosystem, leveraging its mineral reserves and raw materials.

- In early 2022, Canada launched the \$8B "Net Zero Accelerator" to support clean tech, domestic battery supply chain and decarbonization of high-emitting sectors through collaborations with the private sector
- In December 2022, Canada launched its Critical Minerals Strategy and earmarked funding to support the entire critical minerals supply chain, from geoscience and exploration to mineral processing, manufacturing, and recycling applications, including support for research, development, and technological deployment
- Canada is also making investments in battery component manufacturing, electric vehicle production, and the country's first gigafactory, which will be operational in 2025
- To spur domestic adoption, the country has proposed regulations that will require that at least 20% of new vehicles sold will be zero emission by 2026, at least 60% by 2030, and 100% by 2035



Momentum behind e-mobility has been building in **Mexico** recently, with encouraging developments and additional actions expected in 2023:

- In early 2022, a binational US-Mexico Task Force for the Electrification of Transport was established with the U.S. to support the transition of the automotive industries in both countries to produce EVs; the resulting roadmap is expected in April 2023
- The U.S. and Mexico are also collaborating through the Supply Chain Working Group, geared towards strengthening the semiconductors and information and communications technology (ICT) ecosystems to facilitate emerging technologies and workforce development in Mexico
- Mexico's government nationalized the country's lithium reserves in April 2022 and set up a public entity (LitioMx) to manage the exploration, mining exploitation, and refining of lithium throughout the country
- Plan Sonora, launched in late 2022, is a government-supported initiative to create a clean energy hub along the border of the northern state of Sonora
- The national e-mobility strategy is scheduled to be finalized this year



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## A window of opportunity

Decisions and investments made in the next few years will determine what the global EV ecosystem looks like in terms of production; ambitious goals by many players underscore the size of the opportunity that the EV value chain brings.



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# CHIHUAHUA & THE EV VALUE CHAIN



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## Chihuahua leading the way

The State of Chihuahua is embracing the transition to e-mobility in the automotive industry by developing a statewide strategy to increase its competitiveness and identify key capabilities needed to take advantage of current and future business opportunities in this changing sector.

For most of 2022, the William Davidson Institute, the Secretaría de Innovación y Desarrollo Económico, the Instituto de Innovación y Competitividad, and the Instituto de Apoyo al Desarrollo Tecnológico worked together to develop this roadmap for the transition to e-mobility\*.

Along the way, we have engaged with multiple stakeholders from different sectors across the state.

\*For more information about this project and our methodology, see Appendices.



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## A wide range of players poised to strengthen the e-mobility ecosystem

A diverse and connected set of players is important to advance state- and industry-wide goals. While there are opportunities to strengthen the players and linkages in this web in Chihuahua, many of them are already engaged or are poised to play a role in supporting the e-mobility transition.

The organizations represented here are indicative of existing assets in the state, but this set is not meant to be exhaustive.





## A time of transition...

For companies interested in capturing market share, the transition to electrification requires a high degree of agility and flexibility. New and established companies can compete all along the EV value chain.

Identifying areas of potential growth and clear pathways to capture them can provide a competitive edge for companies in Chihuahua.

But first we need to know where we stand. Let's take a look at the EV value chain and examine in more detail where the automotive industry is now - and where it is going.



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## A new value chain: the electric vehicle





### Chihuahua has a long and robust history with the automotive industry

Overview

The automotive industry is of foremost importance to the state, representing 35% of its manufacturing production value. Chihuahua is a major recipient of foreign direct investment from the automotive industry, the sixth highest recipient in the country.

Auto-related companies in Chihuahua are primarily export-oriented and integral to North America's automotive supply chain.

Next we take a closer look at the automotive industry in Chihuahua relative to the transition to electrification to understand where it currently stands and its future directions.

Source: CIES Perfil Automotriz 2021



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## Companies in Chihuahua's automotive industry

The visual to the right features companies in Chihuahua that are T1, T2 and T3 suppliers in the automotive industry.

Nearly 100% of these companies are headquartered outside of Mexico.

Source: CIES Perfil Automotriz 2021





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## **Existing EV capacity in Chihuahua**

Chihuahua has a deep foundation from which to build, with companies actively engaged in different parts of the EV value chain. Our research shows that there are also opportunities that have not been captured yet.



This analysis was developed based on existing state data as provided by CIES and the results of an electronic industry survey that WDI implemented with companies in the automotive value chain in Chihuahua. For more information about the survey and our data collection methodology, see Appendices.



## Taking action to capture EV-related opportunities

Automotive-related companies along the value chain in Chihuahua may experience positive, negative, or neutral impact from the transition to e-mobility. At this point, the type of impact is not guaranteed. Each company will be faced with a different set of decisions to take advantage of new opportunities and mitigate new challenges.

And companies in Chihuahua are already taking action - our research revealed their current and planned engagement in the EV value chain and underscored that there are many opportunities ahead.



### Along with industry engagement, an enabling ecosystem is needed

An enabling environment is needed to capitalize upon the opportunities that e-mobility brings, and for companies to successfully execute their plans.

To assess the "readiness" of the Chihuahua ecosystem to successfully enable a transition to e-mobility across the areas of policy, infrastructure, workforce, and company engagement, we developed a new assessment tool.

Within each of these four areas, we identified several dimensions that are important for any location to enable such a transition, and then scored Chihuahua along each of those dimensions based on a variety of data sources, as noted in the Appendices.





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## Chihuahua E-mobility Readiness Assessment



#### Forward-Thinking Follower

Chihuahua is taking action to build its position as a leader on e-mobility in Mexico. Among its strengths, many companies are actively engaged in the EV value chain and/or planning to develop further capabilities. There is a wide range of players with deep knowledge of the automotive industry who are seeking to better understand and support this transition. The state also has many relevant assets that could be used to enable innovation, facilitate the reskilling of the workforce, and develop new talent. Chihuahua can leverage all of these strengths to bridge identified gaps.

More information about the tool, methodology and how the scoring was determined is included in the Appendices.



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## Charting their own futures

Many parts of Chihuahua's automotive industry are ready to capture the opportunities that EVs will bring. These companies will have to commit to investing in new infrastructure, workforce development, and capital investments, and will have to choose from many pathways to follow. Other companies may find their business opportunities shrinking, and may need to find new areas to move into - or customers in markets that will be slower to transition to e-mobility.

There are many ecosystem players well positioned to support these moves. The collective actions they take will be crucial for a successful transition.





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#### **Roadmap: A tool for decision making**

Narrowing down the possibilities associated with the transition to e-mobility can help better utilize existing resources and coordinate actions more effectively.

The roadmap we developed focuses on 10 opportunities and offers a variety of ways in which Chihuahua companies and stakeholders can move forward with this transition.

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# ROADMAP



# To develop this roadmap, we assessed the potential and relevance for Chihuahua of 30+ business opportunities along the EV value chain\*

Key Business Opportunities					
Raw Materials - Producing copper, aluminum, steel and magnesium - Manufacturing of SiC - Developing new materials - Recycling of materials	<b>Batteries</b> - Mining, refining, processing of raw materials - Battery manufacturing - Developing solutions for battery housing - Battery swapping services - Replacement services - Diagnostic systems - Developing second-life solutions - Battery thermal management systems - Developing reuse & recycle/e-waste management solutions	Parts & Components - Manufacturing of powertrain and electric components - Manufacturing of wire harnesses - Manufacturing of semiconductors - Developing and manufacturing of advanced braking systems - Thermal management systems - Developing ADAS and sensors - Developing and manufacturing x-by-wire technology	Charging - Manufacturing electric vehicle supply equipment (EVSE) - Installation of EVSE - Maintenance - Operators - Platform service providers - Innovative charging technologies	Sales & Aftermarket - Setting up EV service centers - E-conversion of vehicles - Developing solutions for reuse & recycle/e-waste management - Mobile service fleet	
Software					
		Recycling			



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# Sizing the opportunity

In our report, "<u>Mapping the e-mobility transition: Opportunities and Enablers</u>", we included details about these opportunities as well as relevant trends that we expect will continue to be in play as the transition to EVs moves ahead.

We later prioritized 10 key opportunities for Chihuahua, which are presented in the next slide, organized based on the level of investment needed to capture them, their expected market size in 2030, and the relevant capacity that already exists in the state.



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#### Legend

Here we plot specific business opportunities along three dimensions:

**Y-axis:** Degree to which companies are already engaged in this type or work, or infrastructure, workforce, or other assets that translate well to this opportunity.

**X-axis:** Amount of capital or other investment needed for companies to engage in each opportunity. This measure is not specific to the Chihuahua context. See appendix for more details.

**Size of circle:** Global market size anticipated for each opportunity by 2030. See appendix for more details.

**Color of circle:** Opportunity groupings (see following slide).

Dashed circle: Market size not applicable.

#### Example interpretation

#### Manufacturing of high voltage harnesses:

Chihuahua has high existing relevant capacity with some companies already engaged in this, and many more involved with producing low voltage harnesses, which involves some transferable skills and technology. There is a non-negligible amount of investment needed to produce these highly technical and specialized products. The global market size is anticipated to be \$33.3B in 2030.

OVERALL INVESTMENT NEEDED

HIGH

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#### We organized these opportunities into three groups which representing different business strategies:



#### High investment / low capacity opportunities

- EV assembly
- Battery manufacturing
- Semiconductors



Moving up the value chain

Medium investment / medium to high capacity opportunities

- EV powertrain
- Manufacturing of high voltage harnesses
- EVSE manufacturing
- Testing of EV components



Capturing lowhanging fruit

Low to medium investment / medium capacity opportunities

- EV training
- Recycling
- E-conversion



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## Seizing the opportunity

For each of these opportunities, we developed capture strategies and recommendations for Chihuahua stakeholders, as well as policy, infrastructure and workforce recommendations to strengthen elements of the local ecosystem that are relevant to each opportunity. We also listed local players and organizations that can support implementation of these recommendations given their capabilities and interests.



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### From strategy to tactics

Our recommendations are designed to help Chihuahua secure high-value anchor investments, help companies move up the value chain, and capture low hanging fruit as it relates to the EV opportunity. Here are a few examples.

#### Policy

- Formally incorporate e-mobility as a vertical within the newly created energy agency
- Develop comprehensive EV policy with incentives for production and adoption
- Develop comprehensive regulation focused on circular economy goals

#### Infrastructure

- Develop comprehensive EV value chain asset map
- Establish a mobility innovation hub to support local entrepreneurs
- Establish an innovation fund or platform focused on advanced mobility/ e-mobility solutions

#### Workforce

- Support training institutions to design an EV credential covering critical skills
- Explore a mobility collaborative convening EV related companies and workforce development organizations
- Engage partners to identify viable business models for EV trainings



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## Up next: 2023 and beyond

The insights and recommendations included in this roadmap point to several possible directions for Chihuahua to cement its position in the EV value chain and strengthen its enabling ecosystem to fully take advantage of the opportunities that this transition brings.

2023 promises to be a year of continued growth for the clean energy economy around the globe, and certainly in North America, from semiconductors and critical minerals to wind and solar, EV charging infrastructure and the anticipated potential of hydrogen.

We expect more infrastructure investments to be announced this year, the rollout of new and more responsive policies to foster this growth at all levels, and increased emphasis on developing the talent pipeline needed to power this transformation.

This sea change calls for decisive action for those looking to capitalize on such a wealth of opportunities and lead the way forward.



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# Chihuahua E-mobility Readiness Assessment Methodology and Scoring Rationale



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# E-mobility Transition Readiness Assessment Methodology

#### About the tool

WDI developed a tool to assess Chihuahua's overall "readiness" to manage the transition to e-mobility, with a focus on production – not adoption – of light-duty EVs. By articulating various categories (e.g. policy, infrastructure, workforce, company engagement in EVs) and dimensions within each category we aim to shed light on the different aspects of an ecosystem that are necessary to support such a transition, and the relative importance of each. In the following slides we have noted the data sources that provide the basis for the scores: much of our assessment is driven by qualitative fieldwork interviews. We acknowledge that this index is not entirely objective, nor is it exhaustive. Rather, it is intended to serve as a tool to help local stakeholders and decision makers make sense of the assets and gaps in their ecosystem in a more systematic way, identify where more or better data may be needed, and support conversations about where to focus attention and resources.

#### About the scoring

Each dimension was assigned a weight to indicate its relative importance in supporting the e-mobility transition (high=3, medium=2, low=1). Each dimension has also been assigned a score (green=3, yellow=2, red=1) to indicate how strong Chihuahua is in that regard. Each dimension then has a weighted score (score \* weight) and each category has an overall score (sum of the weighted scores of each dimension). While each category has a different number of dimensions, we believe they are all more-or-less equally important to the ecosystem's overall readiness, so each category has an equal weight in the ecosystem's overall score.



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# **Readiness Assessment Dimensions**

Policy	Workforce
Existence of incentives for established companies to locate and operate in Chihuahua	Availability of workforce (labor force participation rate)
Existence of incentives for local entrepreneurship	Readiness of current workforce for areas related to e-mobility (education levels)
E-mobility identified as priority at state level	Pipeline of local students preparing for areas related to e-mobility in Chihuahua (skilled trade and higher education graduation rates)
Comprehensive e-mobility strategy or policy in place	Ability to attract talent from elsewhere in areas related to e-mobility
Existence of an advanced mobility dedicated entity that can coordinate efforts	Existence of education and training programs
Regulatory ease of setting up and operating a business (World Bank indicator)	Existence of training facilities with space and equipment related to e-mobility
Multi-agency and cross-sector collaboration related to e-mobility	Effectiveness of industry-academia alignment and feedback loops to advance topics related to e-mobility
Incentives linked to production of e-mobility-related products	Presence of entrepreneurial/intrapreneurial mindset
Corruption perception (Transparency International score)	



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# Readiness Assessment Dimensions (cont'd)

Infrastructure	Company Engagement in EVs
Availability of quality existing sites for new players or expansion into e-mobility	Existing companies with automotive sector expertise
Suitability of existing infrastructure (equipment, facilities, plants) to serve e-mobility space	Existing companies serving or planning to serve the EV market (survey results)
Availability of suitable greenfield sites for new construction related to e-mobility space	Existing channels for companies to work with startups (i.e. procurement, piloting, etc.)
Availability and accessibility of finance (World Bank indicator)	Existence of e-mobility startups
Logistics performance (World Bank logistics performance index)	Foreign direct investment in automotive sector (state data)
Cost and reliability of electricity (World Economic Forum data)	
Existence of platforms/interest groups for sharing information, making connections, etc.	
Effectiveness of platforms/interest groups for sharing information, making connections, etc.	
Presence of innovation centers and entrepreneurial support programs	
Presence of e-mobility-focused players beyond private sector	
Awareness and knowledge of e-mobility topics	
Focus on R&D (state data)	



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# Business Opportunity Prioritization Analysis and Data Sources



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**OVERALL INVESTMENT NEEDED** 

HIGH

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# Business opportunities: Global market size in 2030

Ranking	Industry	Market Size	Business Opportunity Category	Source
1	Semiconductors	\$1.6 Trillion	Attracting High-Level Anchor Investments	Fortune Business Insights
2	EV Assembly (using EV market size)	\$1.11 Trillion	Attracting High-Level Anchor Investments	<u>Global Newswire</u>
3	EV Powertrain	\$522 Billion	Moving up the Value Chain	Grand View Research
4	Batteries	\$449 Billion	Attracting High-Level Anchor Investments	Inkwood Research
5	Recycling	\$169 Billion	Capturing Low-Hanging Fruit	Market, <u>Newswire</u> , <u>Arizton</u>
6	E-Conversion	\$118 Billion	Capturing Low-Hanging Fruit	Precedence Research
7	EVSE Manufacturing	\$64.6 Billion	Moving up the Value Chain	Precedence Research
8	Manufacturing of HV Harnesses	\$33.3 Billion	Moving up the Value Chain	Markets and Markets
9	Testing of EV Components	\$19.1 Billion	Moving up the Value Chain	Markets and Markets
10	Training	N/A	Capturing Low-Hanging Fruit	N/A



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## **Business opportunities: Investment needed**

Ranking	Industry	Average Investment Size	Business Opportunity Category
1	Semiconductors	\$20.1 Billion	Attracting High-Level Anchor Investments
2	Batteries	\$3.62 Billion	Attracting High-Level Anchor Investments
3	EV Assembly	\$2.23 Billion	Attracting High-Level Anchor Investments
4	EV Powertrain	\$308 Million	Moving up the Value Chain
5	Testing of EV Components	Based on interviews	Moving up the Value Chain
6	Manufacturing of HV Harnesses	Based on interviews	Moving up the Value Chain
7	EVSE Manufacturing	\$27.7 Million	Moving up the Value Chain
8	Recycling	Based on interviews	Capturing Low-Hanging Fruit
9	E-Conversion	Based on interviews	Capturing Low-Hanging Fruit
10	Training	N/A	Capturing Low-Hanging Fruit



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# **Roadmap Development**



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# Methodology





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