Bertelsmann
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LITHIUM RISING

THE RACE FOR CRITICAL MINERALS

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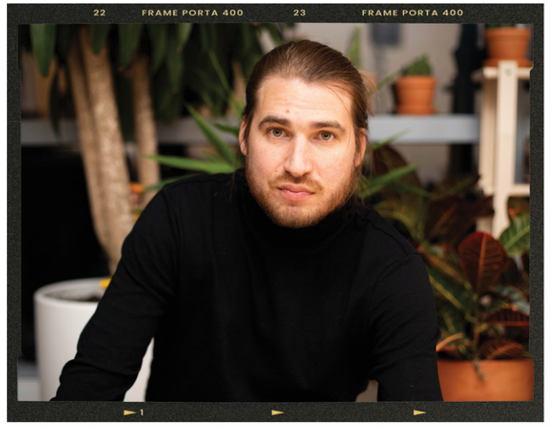

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FOREWORD

Throughout the 20th century, hydrocarbons powered large swaths of the world's economic, military and social development. That this era coincided with the rise of the United States as a global superpower is no coincidence. As a leading oil producer and a nation that made access to oil a core component of its foreign policy, the United States embedded energy strategy into its geopolitical playbook.

The era of oil is far from over. But in the last decade, a new front in the race for energy security has emerged. The demand for lithium-ion batteries—and the minerals that go in one—has skyrocketed. Accessing the needed lithium, nickel and cobalt—raw and refined—for the batteries has emerged, therefore, as a geopolitical imperative.

In this race, however, the United States and Europe find themselves behind the curve.

The Bertelsmann Foundation has identified three interconnected consequences of this lag. First, access to critical minerals is essential for US and European economic and security independence. Second, China dominates the critical minerals supply chain. Third, China is increasingly viewed in Washington and Brussels as a competitor and an adversary.

Yet this touches only the surface of the salt flat (under which much lithium lies). To explore the global competition for critical mineral access, we traveled to the (often poor) countries where these elements are extracted. There, we found dreams of resource development alongside serious environmental challenges tied to the so-called green-energy revolution.

What emerged from our journey is a discovery of a complex international ecosystem, with powerful nations maneuvering for control of supply chains and developing countries striving to turn natural wealth into a national opportunity.

This publication, "Lithium Rising", is a first step towards understanding the global stakes in the competition for critical minerals.

Irene Braam

EXECUTIVE DIRECTOR

BERTELSMANN FOUNDATION

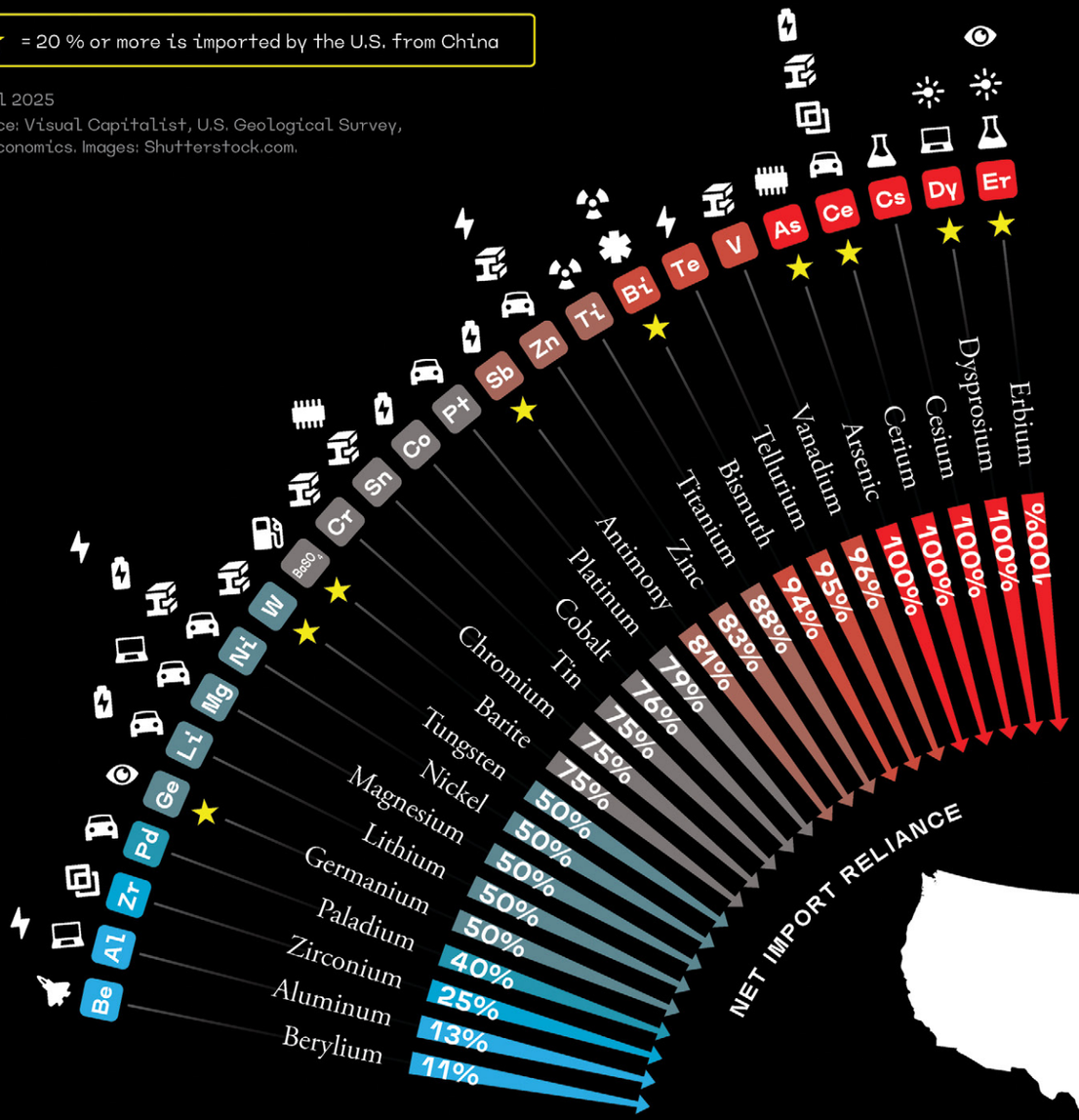
U.S. CRITICAL MINERAL RELIANCE

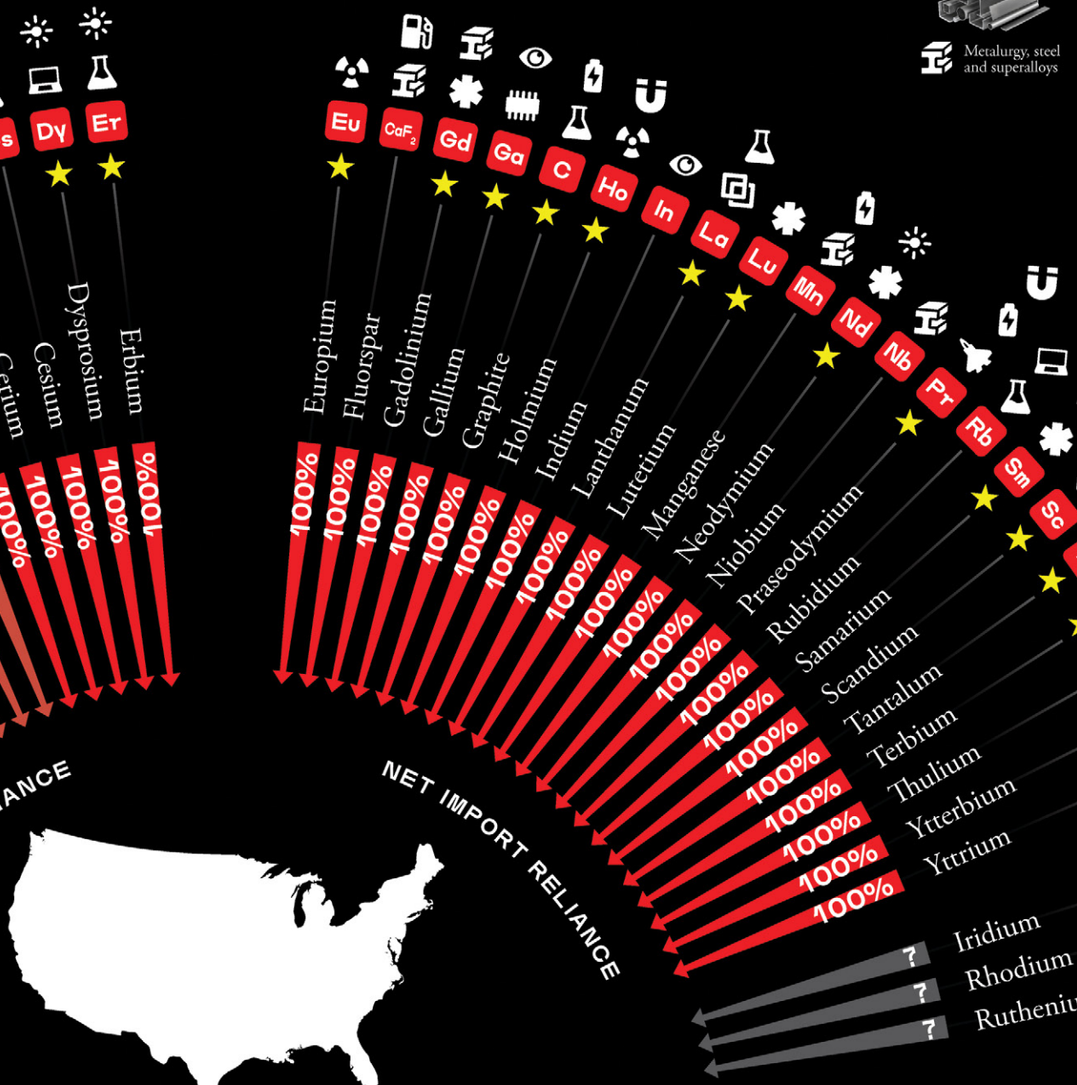
Access to critical minerals is of fundamental importance to American economic and security independence. Yet the US relies overwhelmingly on imports of these minerals via a supply chain dominated by China.

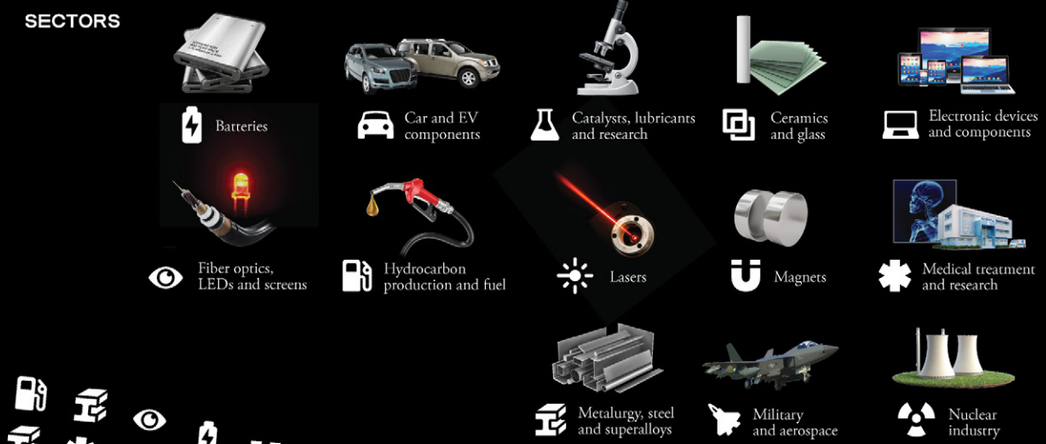
★ = 20 % or more is imported by the U.S. from China

April 2025

Source: Visual Capitalist, U.S. Geological Survey, TD Economics. Images: Shutterstock.com.







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THE RACE IS ON

Nickel mining in Indonesia. (Photo: Kasan Kurdi)

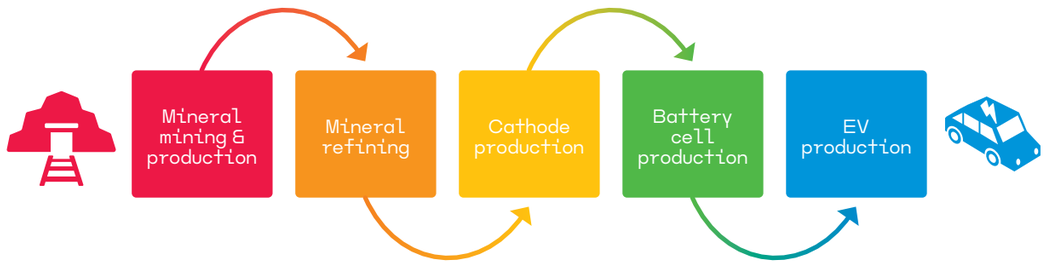
From the moment the smartphone alarm awakens us in the morning, we begin our day relying on the lithium-ion battery. The toothbrush, e-bike, laptop, tablet, camera, hearing aid, smartwatch, weedwacker and pacemaker: From the mundane to the lifesaving, lithium powered devices get us through every day.

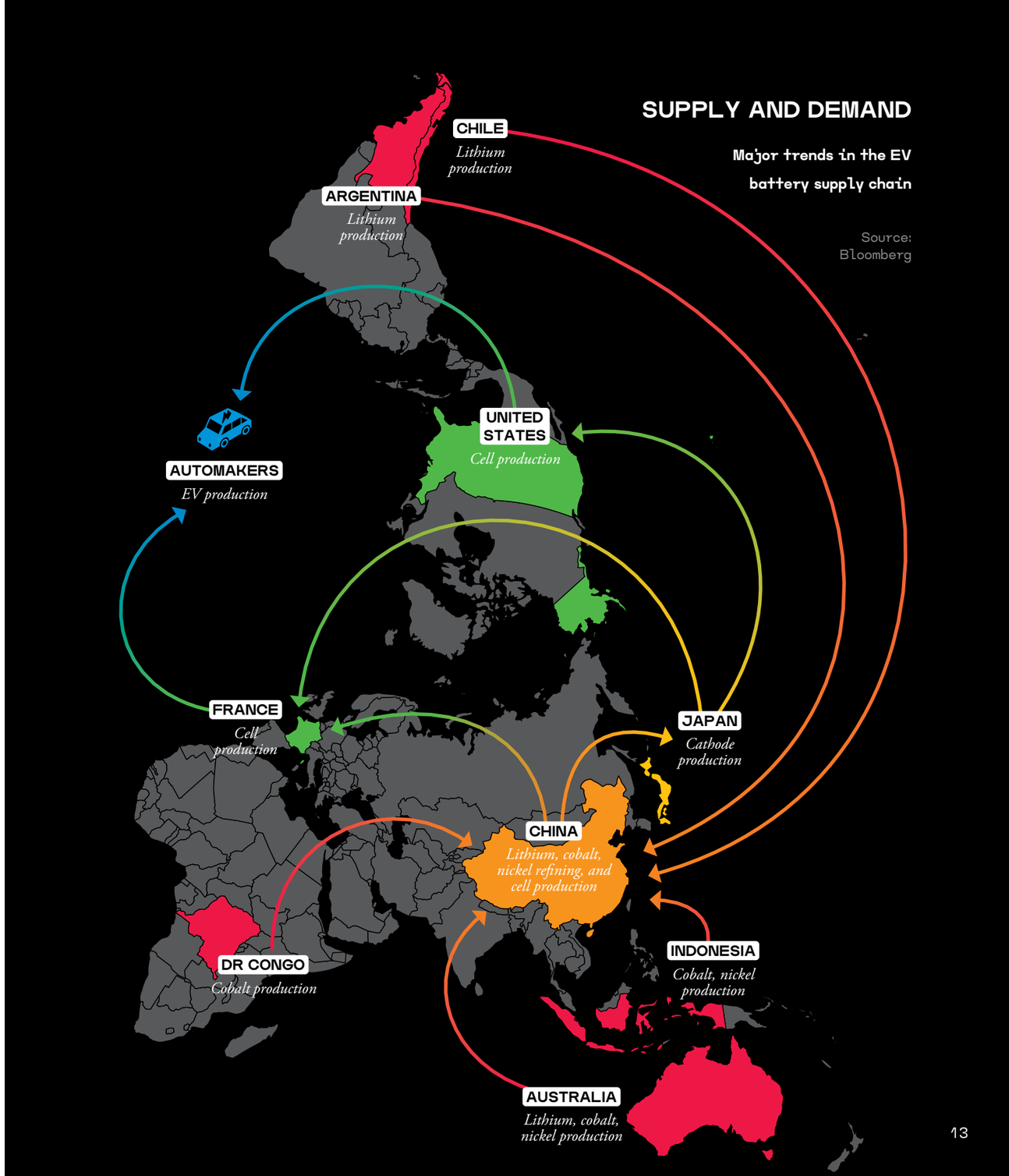
This is a new development, and the demand for lithium batteries has skyrocketed as a result. Between 2000 and 2010, "lithium consumption in batteries increased by 20% on average every year."[1] It was a warm-up act. That figure jumped over the next decade to 107%.[2]

The trend is forecast to accelerate further with the global transition to electric vehicles (EVs). Already, battery-powered cars, school buses and municipal trucks are common on the streets of the United States, China and Europe. The lithium-ion battery currently stands as the most likely energy source to replace the internal combustion engine, should humanity finally decide to make a transition.

If the fate of global transportation and climate does not raise the stakes high enough, consider that the critical minerals that go into batteries are increasingly vital for modern defense and warfare.[3] Access to critical minerals has emerged as a geopolitical, economic and social frontline that will, in part, define the 21st century as access to hydrocarbons did the 20th. New groups of winners and losers will emerge from this, and the fate of nations will hang in the balance. Will a lithium-rich but otherwise poor country be able to leverage its bounty as the United Arab Emirates did with oil? Or will the minerals rush be but the latest chapter in a global history of resource exploitation that benefits the industrialized world, leaving source countries impoverished and dependent on their richer counterparts?

And who will control access to these minerals? The United States dominated a world order fueled by oil. But it is Beijing, not Washington, that has established a pole position in the emerging, battery-powered future. Can the West and its allies catch up? If not, what vulnerabilities will it face from relying on China?





Chile's Atacama Desert, the driest place on Earth.

Lithium mining in the Atacama desert – a water intensive process. (Photo: Samuel George)

WHAT IS A CRITICAL MINERAL?

The Energy Act of 2020, as passed by the U.S. Congress, defines critical minerals as those: (i) essential to the economic or national security of the United States; (ii) the supply chain of which is vulnerable to disruptions (including restrictions associated with foreign political risk, abrupt demand growth, military conflict, violent unrest, anti-competitive or protectionist behaviors, and other risks throughout the supply chain); and (iii) that serve an essential function in the manufacturing of a product (including energy technology-, defense-, currency-, agriculture-, consumer electronics-, and health care-related applications), the absence of which would have significant consequences for the economic or national security of the United States.[4]

In other words, a critical mineral is a naturally occurring resource often used to produce cutting-edge technologies. "Critical" does not reference any specific scientific characteristic or even global scarcity. Rather, it means that governments and industries have recognized the minerals' importance, and that losing access to them would be broadly detrimental.

By 2022, the U.S. government had identified 50 critical minerals: aluminum, antimony, arsenic, barite, beryllium, bismuth, cerium, cesium, chromium, cobalt, dysprosium, erbium, europium, fluorspar, gadolinium, gallium, germanium, graphite, hafnium, holmium, indium, iridium, lanthanum, lithium, lutetium, magnesium, manganese, neodymium, nickel, niobium, palladium, platinum, praseodymium, rhodium, rubidium, ruthenium, samarium, scandium, tantalum, tellurium, terbium, thulium, tin, titanium, tungsten, vanadium, ytterbium, yttrium, zinc and zirconium.

The lithium-ion battery typically requires at least six of these: lithium, cobalt, nickel, aluminum, manganese and graphite.[5] This text focuses on three of these elements: lithium, cobalt and nickel. This trio is integral in the battery cell's performance.[6]

To charge a battery, lithium ions move from the cathode side of a cell to the anode side. During the discharge, the ions retrace the process, moving from the anode back to the cathode, generating an electric current that powers devices. The nickel helps boost capacity in the cathode material, which means a battery can store more charge. This makes the element especially crucial for EV batteries. Cobalt stabilizes the cathode material, which increases battery capacity and lifespan. Cobalt also has high energy density, which helps a battery store more energy relative to its size. This makes cobalt of acute importance in smaller devices, such as cell phones.

CRITICAL NECESSITY

The 50 minerals deemed critical to U.S. security according to the 2020 Energy Act

Source: Visual Capitalist

U.S. NET EXPORTER

E

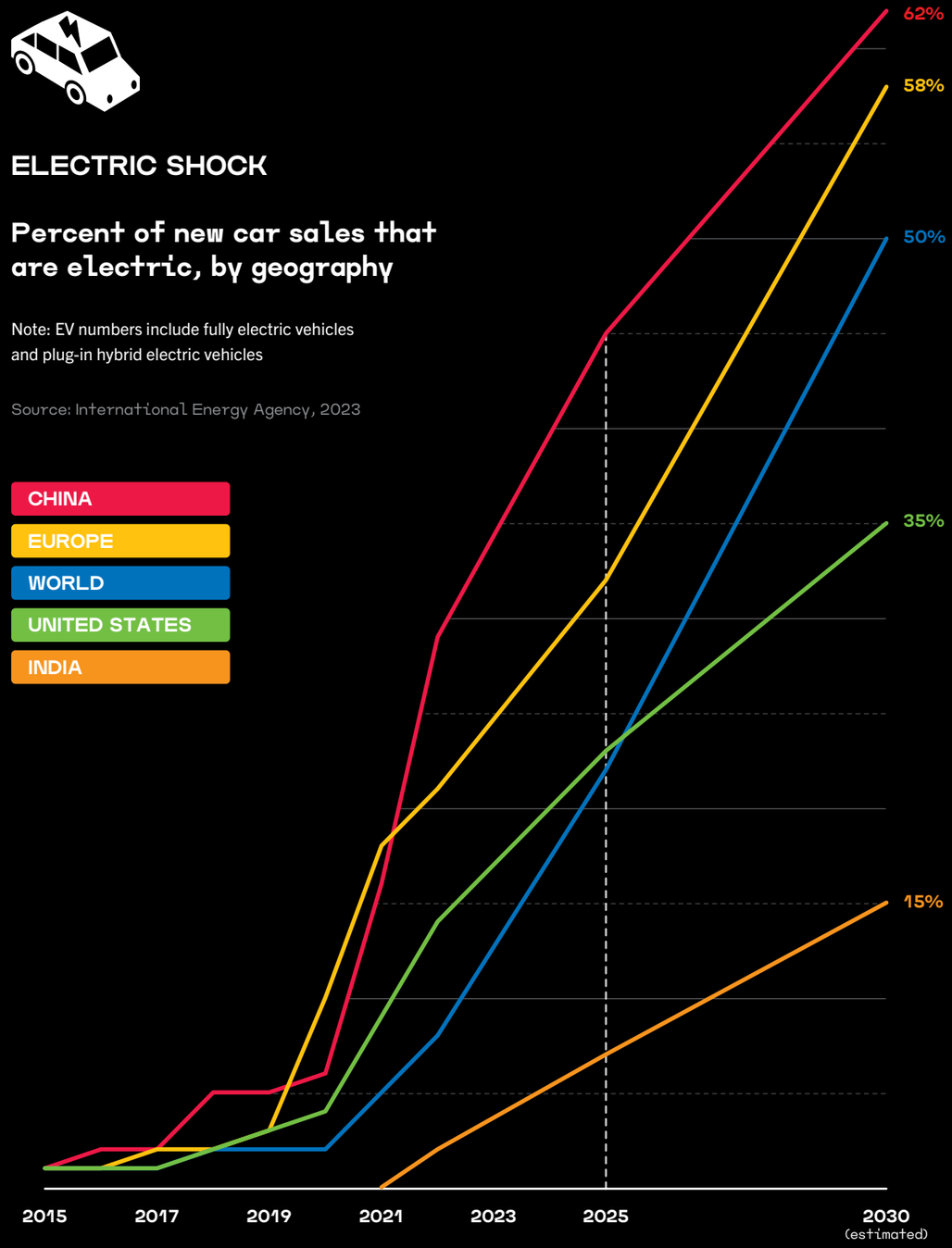
U.S. NET IMPORT RELIANCE

10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

? = No data available

H Hydrogen																	He Helium
Li 50% Lithium EV rechargeable batteries	Be 11% Beryllium Aerospace and defense industries											B Boron	C 100% Carbon (Graphite) Batteries	N Nitrogen	O Oxygen	F 100% Fluorine (Fluorspar) Steel, gasoline	Ne Neon
Na Sodium	Mg 50% Magnesium Car seats, luggage and laptops											Al 13% Alluminium Power lines, electronics	Si Silicon	P Phosphorus	S Sulfur	Cl Chlorine	Ar Argon
K Potassium	Ca Calcium	Sc 100% Scandium Alloys, ceramics and fuel cells	Ti 88% Titanium Metal alloys	V 96% Vanadium Alloying agent for iron and steel	Cr 75% Chromium Stainless steel	Mn 100% Manganese Steelmaking and batteries	Fe Iron	Co 76% Cobalt Rechargeable batteries	Ni 50% Nickel Rechargeable batteries	Cu Copper	Zn 83% Zinc Metallurgy, galvanized steel	Ga 100% Gallium Integrated circuits, LEDs	Ge 50% Germanium Fiber optics, night vision applications	As 100% Arsenic Semi-conductors, pesticides	Se Selenium	Br Bromine	Kr Krypton
Rb 100% Rubidium EV rechargeable batteries	Sr Stronium	Y 100% Yttrium Lasers, metallurgy and phosphors	Zr 25% Zirconium High-temperature ceramics	Nb 100% Niobium Steel and superalloys	Mo Molybdenum	Tc Technetium	Ru ? Ruthenium Electrical contacts and chips	Rh ? Rhodium Electrical components	Pd 40% Palladium Catalytic converters	Ag Silver	Cd Cadmium	In 100% Indium Liquid crystal display screens	Sn 75% Tin Alloys for steel, semi-conductors	Sb 81% Antimony Lead-acid batteries	Te 95% Tellurium Thermoelectric devices, solar cells	I Iodine	Xe Xenon
Cs 100% Cesium Research and development	Ba 75% Barium (Barite) Hydrocarbon sector	Lanthanides	Hf E Hafnium Nuclear control rods and alloys	Ta 100% Tantalum Electronic components	W 50% Tungsten Wear-resistant metals	Re Rhenium	Os Osmium	Ir ? Iridium Electrochemical processes	Pt 79% Platinum Catalytic converters	Au Gold	Hg Mercury	Tl Thallium	Pb Lead	Bi 94% Bismuth Medical, atomic research	Po Polonium	At Astatine	Rn Radon
Fr Francium	Ra Radium	Actinides	Rf Ruther-fordium	Db Dubnium	Sg Seaborgium	Bh Bohrium	Hs Hassium	Mt Meitnerium	Ds Darmstadtium	Rg Roentgenium	Cn Copernicium	Nh Nihonium	Fl Flerovium	Mc Moscovium	Lv Livermorium	Ts Tennessine	Og Oganesson

La 100% Lanthanum Catalysts, ceramics, glass	Ce 100% Cerium Batteries, ceramics, glass	Pr 100% Praseodymium Magnets, batteries, aerospace alloys	Nd 100% Neodymium Medical, industrial lasers	Pm Promethium	Sm 100% Samarium Absorber in nuclear reactors	Eu 100% Europium Phosphors, nuclear control rods	Gd 100% Gadolinium Medical imaging, steelmaking	Tb 100% Terbium Metal alloys, lasers	Dy 100% Dysprosium Data storage devices, lasers	Ho 100% Holmium Magnets, nuclear control rods	Er 100% Erbium Fiber optics, lasers, optical amplifiers	Tm 100% Thulium Metal alloys, lasers	Yb 100% Ytterbium Catalysts, lasers, metallurgy	Lu 100% Lutetium Medical imaging, cancer therapies
Ac Actinium	Th Thorium	Pa Protactinium	U Neptunium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium



ELECTRIC SHOCK

Percent of new car sales that are electric, by geography

Note: EV numbers include fully electric vehicles and plug-in hybrid electric vehicles

Source: International Energy Agency, 2023

THE RACE IS ON

In countries rich in critical minerals, the race is on to access and get them to market, to establish a first mover's advantage before others can get their operations online. This effort often puts governments and mining companies at odds with local communities and environmentalists.

Global powers are striving to control access to the minerals and to battery technology. The United States has deemed it untenable to rely on China for critical inputs to American defense, transportation and computing. Yet this is the case now. Accross the globe, scientists are scrambling to find new sources of power that can sustain modern lifestyles without torching the planet. Without a dramatic decline in carbon emissions, the U.N. Intergovernmental Panel on Climate Change has concluded that the world will heat to a point of no return in the early 2030s. At that time, "climate disasters will become so extreme that people will not be able to adapt," according to The Washington Post.[7]

The race is on to answer pressing moral questions. Should cobalt from the Democratic Republic of Congo (DRC) be avoided due to poor working conditions and child labor? Or would eschewing the country's minerals only punish one of the DRC's few reliable labor sectors? Is exhausting the water supply of a few indigenous communities in the deserts of Chile justifiable if that water can be used to mine lithium that could save the planet? Can we mine our way out of a climate crisis? Or are modern capitalists hiding behind green buzzwords to strike it rich?

From 2023 through 2025, I explored these questions for the Bertelsmann Foundation documentary "Lithium Rising". On five continents, my colleagues and I conducted more than 100 interviews with people ranging from cobalt miners in the DRC to power players in the upper echelons of the U.S. State Department. I met with industrialists zeroing in on epic paydays and the environmentalists trying to shut them down. I met with labor organizers fighting for unions at EV plants deep in the American South and with indigenous leaders fighting for job opportunities in the Bolivian highlands. Along the way, I collected a huge amount of original research, the overwhelming majority of which would not make it into the documentary.

This book dives deeper into that reservoir of research. The text does not pretend to be a comprehensive survey of global mineral dynamics. That topic is too large, too sprawling and too fluid for this effort. This text instead selects some key critical-minerals case studies and attempts to provide insight into how they are playing out and why the process matters.

Together, these chapters offer an overview of the lithium-ion battery, from extracting minerals from the earth to doing the same from exhausted batteries for recycling, and of the people, communities and governments adapting to a radical energy revolution.

CHAPTER

02

WHITE GOLD

THE LITHIUM OF SOUTH AMERICA

The Bolivian salt flats of Uyuni - the site of massive lithium deposits. (Photo: S. George)

The lithium-ion battery is an energy-conserving unit that requires globally sourced minerals, metals, machinery, logistics and labor. Its story could begin in many places. But there is arguably no better starting point than the Salar de Uyuni, the vast, bright white salt flats of the Bolivian altiplano.

The expansive flats stretch to the horizon. Distant mountains lurk in some directions, but no frame of reference helps determine their distance. The views in other directions offer only endless white. It takes days to traverse the flats in a 4x4, but doing so is a bad idea unless you know them well. There are no roads, and it is easy to get lost. Once lost, it is difficult to be found.

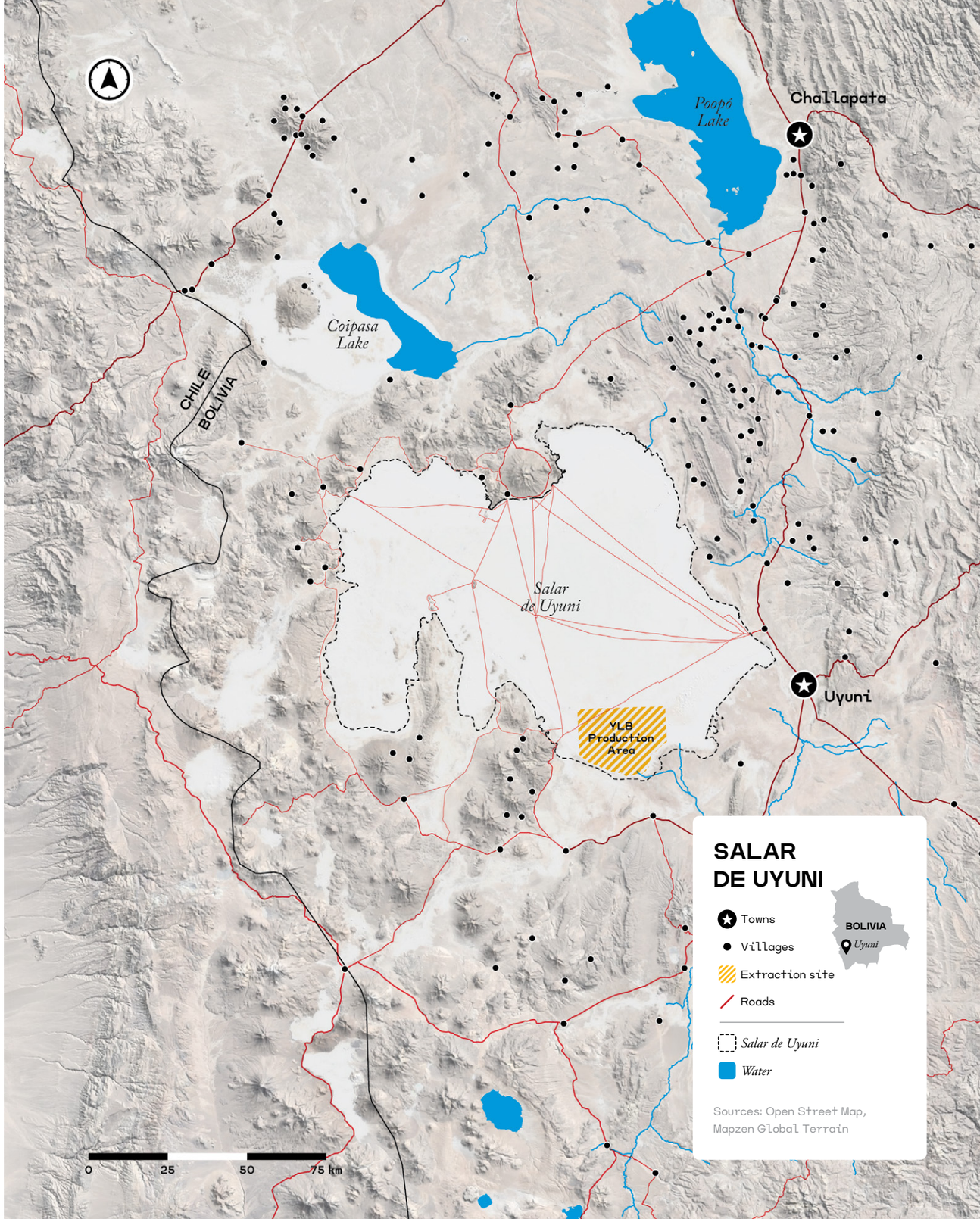
About 100 meters beneath the layers of salt and mud sits perhaps the world's biggest lithium deposit. A quarter of the Earth's known lithium is located over 4,000 square miles here. It is like white gold.

A soft, silvery alkali metal, lithium is a fundamental component in rechargeable batteries that power modern gadgets. For Bolivia, South America's poorest country, the bounty beneath the salt flats represents a potential windfall that could fund much development. With lithium prices at $85,000 per ton in early 2023, and Bolivia's potential reserves at more than 21 million tons, the economic potential is staggering. Could Bolivia be the 21st century's Saudi Arabia and leverage lithium as the kingdom did oil?

Perhaps. But it hasn't happened yet, and the country may miss its moment. Discoveries of lithium deposits are becoming more common than expected. Bolivia boasts many, but so do Chile, Argentina and Australia. Deposits—some of tremendous size—have also been discovered elsewhere, such as in Serbia, Zimbabwe and the United States. In addition, lithium is a critical component of the current industry standard for a battery. But the standard could change. A new one may emerge, perhaps one that does not even require lithium.

Bolivia is, then, in a precarious position. A potentially short window of opportunity exists for the country to emerge as a frontrunner of the battery era.

Thus far, Bolivia's efforts to access its lithium have been stuck in the salt. Some 17 years since then-President Evo Morales declared that the country would begin to industrialize the mineral, exports of it are negligible. Despite significant state investment, the lithium remains deep underground. The lack of production stands in stark contrast to the activity in neighboring Chile and Argentina, the globe's second- and fourth-largest lithium producers.[1] Bolivia's inability to capitalize on its opportunity reveals critical fault lines of history, economic development and resource extraction that are shaping the emerging landscape of critical minerals.



THE TRAGEDY OF EXTRACTION

Bolivia's effort to industrialize lithium is the latest chapter in the country's long history of resource extraction, which has benefited primarily developed nations and left the majority of Bolivians in poverty. Bolivian visions of a lithium-powered future now collide with a democratic will that demands no repeat of past mistakes. The conflict has paralyzed progress.

Journalist Fernando Molina in La Paz, the Bolivian capital, understands the public's wariness. "Here we say natural resources are today's bread and tomorrow's hunger," he noted. "Bolivia has always lived of off natural-resource extraction. From silver to tin to rubber to oil and gas. And now it's lithium. It's always the same story. In the end, the resources get used up, and the country is left with broken dreams."

The Salar de Uyuni is located in the department of Potosí, which is not dealing with extraction for the first time. Legend has it that, in 1545, an indigenous man, Diego Gualpa, led the Spanish conquistadores to a large, green mountain just outside the present-day city of Potosí. The mountain's silver veins were bursting through the surface.

Over the next 300 years, nearly a third of the globe's silver came from the Cerro Rico, or "Rich Mountain", of Potosí.[2] The haul funded European development, but the indigenous and enslaved African miners remained indigent and died by the millions in appalling work conditions.[3] Meanwhile, the once green mountain turned a stark, barren red. The silver was a harbinger for the booms and busts to come. Potosí is today a top global producer of tin and zinc, yet it remains the poorest department in a poor country.

Hundreds of Cerro Rico miners push still deeper in search of remaining scraps of silver. Over the last half millennium, the "mountain that eats men" has been hollowed out like a brick of Swiss cheese. The miners fear an imminent and entire collapse.

"The life of a silver miner isn't a long one," Germán Soliz, who works the mountain, said as he headed in with me in tow. "You can die in there at any moment." Inside, I immediately felt claustrophobic, unable to stand straight or see beyond the dim light thrown by our headlamps. The pathway was just big enough for exiting miners to pass us on their way out. "Alcohol, cigarettes and coca leaves," Soliz admitted, "that's how we survive on the inside."

Outside, survival is not much easier. The mine's entrance is visible from Soliz's cinder block house, where he lives with his wife and six children. His home has two rooms with three cots. "I make about $15 a day," he said. In a nod to a potential future with lithium, he added, "I don't want this for my children. I don't want them buried in the dust."

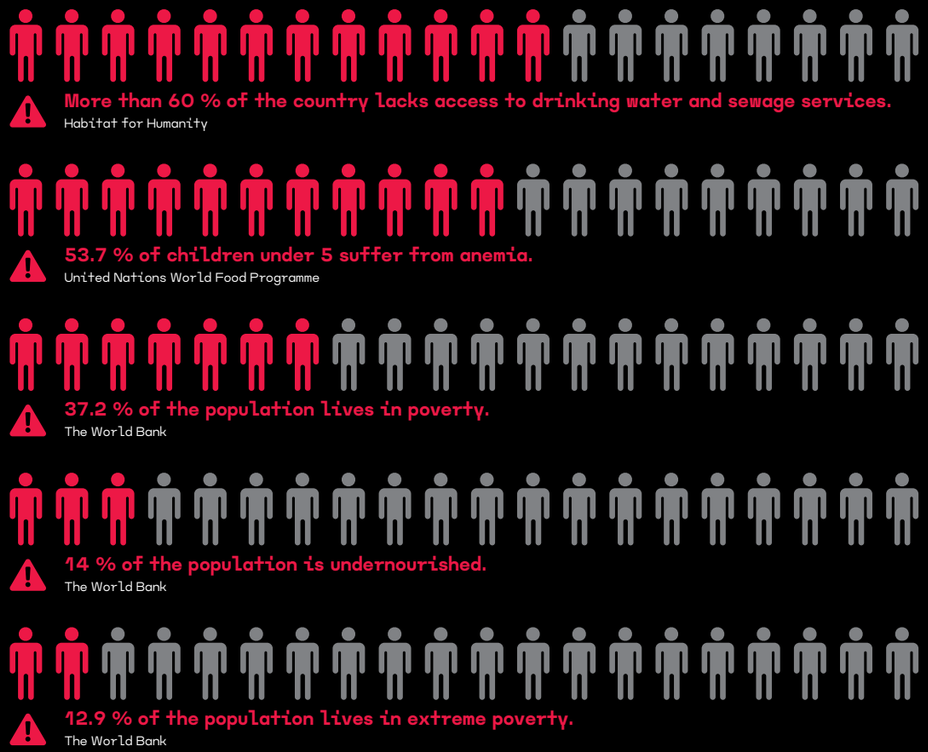
The people of Potosí are suspicious of the latest resource boom, and their history justifies the concern. They want to ensure that some of the riches stay local if lithium is extracted from the department.

"We look at lithium as an opportunity that we will not let slip through our hands," Rocio Veronica Velarde of the Potosí NGO Proyecto Intersol insisted. "The lithium is for Potosí. It's for the families of Potosí. It's for the development of Potosí. It's for our future generations."

"In the past, the people of Potosí have blocked international lithium negotiations," Molina, the journalist, explained. "They have made deals impossible." In 1992, the Bolivian government attempted to finalize an agreement with an American company to extract lithium, but local protests forced an end to the negotiations. In 2018, Morales—a leftist and indigenous leader—announced a $1.3 billion investment from ACI Systems, a German company, to produce lithium in Uyuni.[4] To many in Potosí, the deal seemed to be just the latest example of a European power looting the region's resources. Violent protest ensued. The deal was canceled, and Morales, once one of Bolivia's most popular political figures, abandoned the presidency and then the country.[5] The lithium remains underground.

BOLIVIA POVERTY FACTS

Source: Food for the Poor



Bolivian natural resources have made the world rich while Bolivians remain poor. Will it be different with lithium?

Cerro Rico de Potosí: The Mountain that Eats Men. (Photos: S. George)

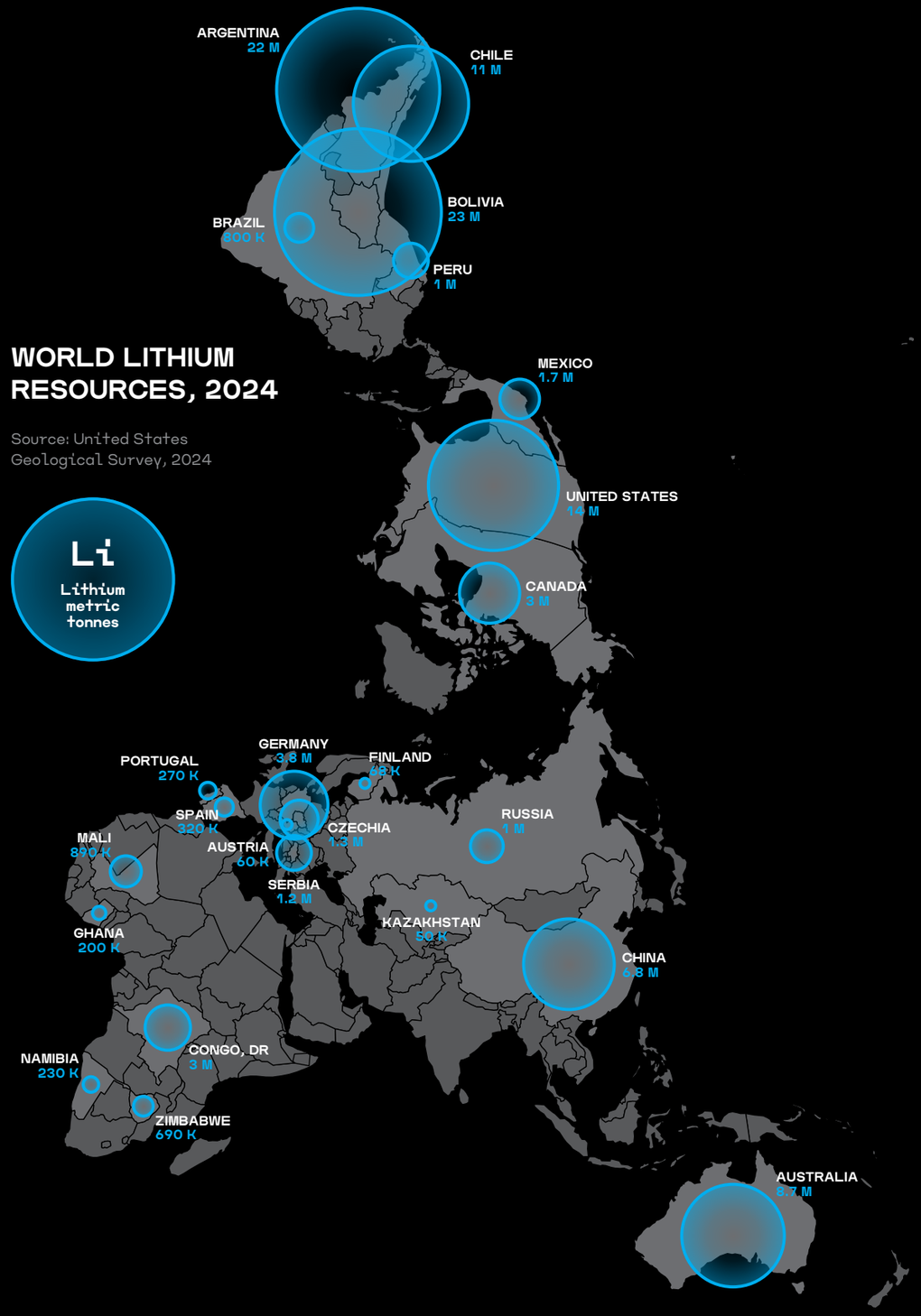
DO IT OURSELVES

Unable to work with international partners to extract lithium, La Paz pivoted to a domestic strategy. Bolivians would mine the mineral, process it, and export a refined product or build batteries domestically. The 2014 Mining Law and the 2017 Law for the Creation of Bolivian Lithium Deposits ensured that lithium extraction and industrialization would remain in the hands of the state.[6] The legislation also established the Yacimientos de Litio Bolivianos (YLB), a government institution "responsible for the development of the lithium sector in Bolivia".[7]

It was a fine plan, in theory, and it played into the population's prevailing nationalist sentiment. In practice, the plan was costly and difficult to execute. In neighboring Chile, the lithium deposits are in some of the planet's driest territory, where a straightforward evaporation process can help mine the mineral. Bolivians learned the hard way that this would not work in their altiplano, where a rainy season runs from December to April. The high magnesium content of the Bolivian salt brine also complicated the process.[8] Perhaps most damning, the country simply did not have the technical know-how to industrialize its lithium.

Wilson Caral, an environmental engineer from Potosí, worked for seven years at the Bolivian state-owned lithium plant in Uyuni. "We always said, as Bolivians, we know we can do this," he asserted. "We will succeed! And we worked together, doing everything we could to make that happen. We worked long hours together under very difficult conditions."

Over the last decade, the Bolivian state invested tens of millions of dollars into industrializing lithium, no small sum for a country with many pressing needs. The effort still did not bear fruit. "Now, from the outside looking back, I realize that we need help," Caral admitted. "Especially in terms of technology."



A LITTLE HELP FROM NEW FRIENDS

In 2021, President Luis Arce, also of Morales' MAS party but considered his chief rival, announced that Bolivia would again entertain offers for international partnerships to mine lithium. Two years later, the government signed three new international extraction agreements. One was a $450 million deal with a state-owned Russian firm. The other two, worth $1.4 billion, were concluded with Chinese companies. If all three play out as planned, Bolivia could become the world's largest lithium producer.

"In Bolivia, we are still living in the Cold War," Jack Matijasevic, a historian of extraction in Bolivia, said. "And the truth is, we are in fact still in a cold war. But this cold war is a fight for natural resources." In this reimagined conflict, La Paz finds it politically more palatable to make deals with Moscow and Beijing than with Washington. "The United States is viewed as imperialistic in its dealings with Latin America," Molina, the journalist, noted. "So, for this government, the more anti-American something is, the better."

China and Russia could be big winners in Potosí. It is unclear if Bolivians may be, too. The details of the agreements are shrouded in mystery,[9] and La Paz still needs to update the existing lithium mining laws to legitimize the international participation. Given the opaque nature of the proceedings, there is ample room for corruption and environmental degradation.[10] Meanwhile, the lithium remains underground.

***

One afternoon in Uyuni I joined a driver named Mateo for a ride in his eight-wheel truck on the periphery of the YBL plant. The lithium industry has created little employment for locals, but nearby villagers have had some luck getting transportation jobs for the plant. "There it is," he said pointing over a fence, "that's the lithium plant."

"We transport the salt from the evaporation pools," Mateo explained. "We call that the harvest, but we don't actually work in the plant. We work around it. Inside it's the technical people. Mostly they are Chinese."

This is a problem for Tomás Colque Lopez, leader of the Lipez indigenous group that lives in the area. He supports the exploitation of lithium as long as it benefits his community, but he has yet to see any such benefit. "Lithium hasn't brought us jobs," he said in his office in the dusty outpost town of Uyuni. "I went to the Labor Planning Office in La Paz and asked them how many jobs will this create for our people, and they didn't tell me anything. We want job opportunities for our people. And if we don't get them, we are going to have to take other measures."

"What other measures?" I asked.

Tomás gave a sly smile. "Well, we will go and block the entire lithium plant."

***

DESERT LITHIUM

It is a 10-hour drive from Bolivia's salt flats to the heart of the Atacama Desert in northern Chile. Ten hours through the altiplano and the rugged Andean mountains, past packs of llamas and abandoned mines—the scars of the open veins of Latin America.

Making a lithium-ion battery requires the Atacama. Only Australia produces more lithium than Chile, and the element is in this desert. A fortune worth billions of dollars is buried beneath the glaring Andean sun.

Some estimates hold that the salt water beneath the Atacama holds about 40% of the world's lithium reserves.[11] Mining conditions here are optimal. The brine is highly concentrated and has few contaminants.[12] The lack of rainfall and high solar radiation facilitate the evaporation process.

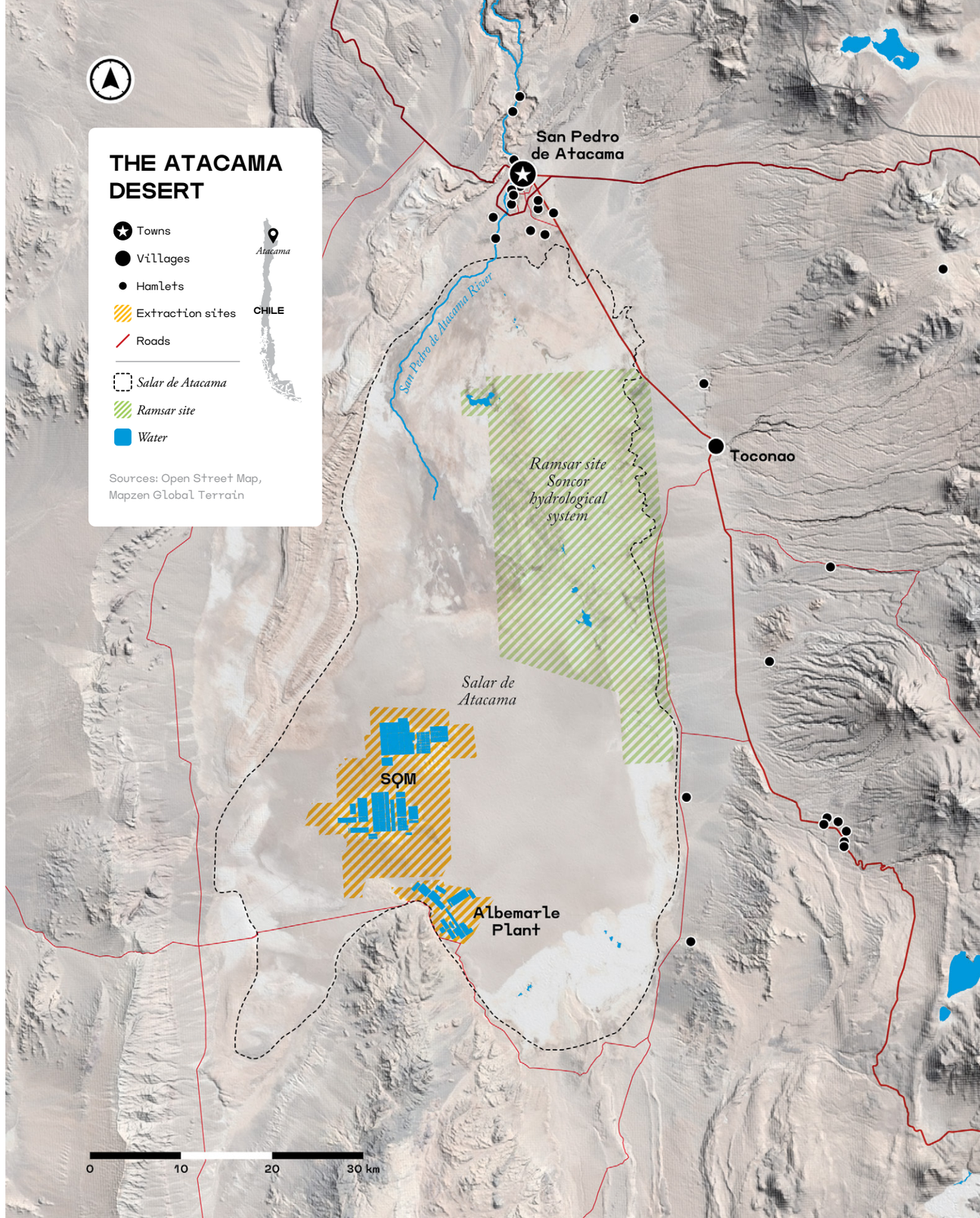
Two major lithium mining companies operate in the Atacama. One, Albemarle, represents American capital. The other, the much larger Sociedad Química y Minera (SQM), is Chilean, although Tianqi, a Chinese company, owns a 24% share.[13]

"We do it through a process of evaporation," mine superintendent Sebastian Parada explained as we looked out from the SQM campus over colossal pools of brine expanding across the flat desert. "The brine passes through the pools for between 12 and 14 months, becoming more concentrated along the way." During that period, exposed to the desert sun, water and unwanted salts evaporate, leaving an increasingly concentrated lithium solution.[14] "The brine starts at a concentration of 0.17% lithium," Parada noted. "By the end, it is between 4.7 and 6%." SQM currently exports 200,000 metric tons annually and expects to produce 280,000 to 300,000 metric tons of lithium carbonate by 2060.[15]

In a sense, Chile is living Bolivia's dream. Lithium could represent a multigenerational windfall, a source for funding schools, health care and infrastructure, all while helping the planet avert climate catastrophe. Current Chilean President, Gabriel Boric, has led an effort to develop a strategy to "maximize [lithium] revenue streams for the State in a sustainable way and to achieve the highest possible amount of public revenue in the current lithium price cycle".[16]

The resulting 2023 National Lithium Strategy begins with a proclamation: "Chile has a historic opportunity. Chile has lithium. Chile has a better future for families. The goal of this National Strategy is to increase wealth for the country, developing a key industry as a fundamental step to link Chile's economic development with the shift towards a global green economy."

The Chilean government is seeking public-private partnerships to break ground on an additional three to four mines in the Atacama and has identified 69 additional salt flats nationwide for lithium extraction.[17] But there is a catch.



CHILEAN LITHIUM MODEL

Source: SQM

The entire extraction process is completed after about 13 to 16 months.

Lithium extraction requires a multi-stage evaporation and purification process, which is controlled by advanced modelling of the thermodynamic conditions.

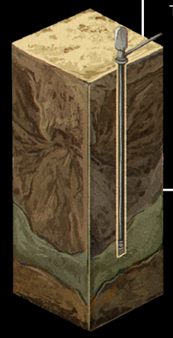
This is achieved solely under natural physical conditions, without the addition or use of any chemicals.

Brine wells extraction

Halite ponds

Sylvinite ponds

Carnalite ponds



To extract the lithium, the extremely saline brine is pumped from depths of 1.5 to 150 meters below surface through a pipeline system into the extraction basins.

The extraction basins are built with the salts left over from potassium and lithium production and lined with foil. Hence no cement or concrete are required for this.

The brine is pumped into the neighboring basin after a defined time.

Waste

Lithium ponds

High boron-LiCl solutions

What remains is a highly concentrated brine containing up to 6% lithium or 30%-35% lithium cloride.

WATER IN THE DESERT

Lithium mining via evaporation requires huge amounts of water. From China to Zimbabwe to Argentina, the water requirements for lithium production have strained local communities. It is an especially difficult challenge in northern Chile. In the Atacama, one ton of lithium carbonate requires the evaporation of 200 tons of water.[18] The evaporation ponds needed for such production require, according to Euronews, around 21 million liters of water per day.[19] SQM maintains 49 million square meters of evaporation pools in a region where water is a scarce and treasured resource for nearby indigenous communities.

"Look, part of the Chilean mentality is to have these sacrificial zones," Christian Ortiz said. He has lived in the Atacama for 40 years and has seen it transition from a remote desert to a tourist destination to a hub of lithium mining. "Look how they sacrificed all of Antofagasta and Calama for copper," he added, referring to two regional cities.

For the last century, copper has been an integral part of the Chilean economy. The country is the world's leading producer of the metal, which contributes about 10% of GDP and frequently accounts for more than 50% of exports.[20] But copper mining has left its mark. "Calama is now the most polluted city in Chile," Ortiz noted. "Now we have lithium, and this is a dance worth billions of dollars. And they are not going to leave the lithium underground just so some people don't lose their water."

The Atacama Desert may look, in some places, like an abandoned lunar landscape. But people live there. A series of indigenous communities dot the landscape. I met a young woman and her father next to their community's water reserve. It was shaped like one of SQM's lithium pools, but it was much smaller and stood alone in the otherwise bone-dry terrain. "This is our water," she said. "And we take care of it. We collect it from underground and use it for the next year's harvest. The mines are now sucking out that water from below ground. And our pools don't fill up anymore."

The young woman produced a glass bottle about one-third full of a grayish liquid. "This is lithium concentrate. This is what they export. For them, this is dollars. But for us, it's our water."

"When we try to talk to them, they just laugh at us," the woman's father added while becoming increasingly agitated. "But if our valley completely dries out, what are we supposed to do then? Maybe we should go to the city and show up at their houses."

"We are producing lithium for batteries that will go in electric cars in Europe and the United States at the expense of the communities that live here," said Orlando Cortes, a local political figure. Local farmers are feeling the pinch. "We can't irrigate here anymore," one lamented. "We used to be able to pull water from a communal tank. Not anymore."

"These are my ancestors' lands," another said. "And we used to cultivate wheat and corn. Now it's dry. There's just not enough water. I know that is not convenient for the state to hear because the lithium is supposed to be Chile's paycheck."

No longer able to farm, many who lived on the outskirts of towns now live in them. Community members fear that soon they will not be able to live in the Atacama at all. "We are not natives in a museum," the young woman by the water reserve protested, the bottle of lithium concentrate still in her left hand. "We're still here! And now we can't farm. We can't raise animals here."

PAY TO PLAY

SQM and Albermarle pay royalties to the local communities. 2016 agreements between the latter and the surrounding neighborhoods provide for an annual payment of about 3% of mineral sales.[21] SQM's Parada said that his company also pays nearby communities between $15 million and $18 million annually.

With Albemarle, individual communities needed to sign community benefits agreements to receive payments. The Chilean government is not party to the accords; communities make them with the company.

"Do you think they are trying to buy off the communities?" I asked Llerco Quezada, a local businessman and a pillar of the town of San Pedro de Atacama. "They already bought them off!" he immediately exclaimed.

Participating communities receive hundreds of thousands or even millions of dollars a year in royalty payments. There is little transparency in how these payments are made and spent, and members of several communities have come to loggerheads over allocating the money. Whispers of corruption abound. "It's a chunk of money for people with no experience managing that kind of cash," Diego, a local resident confided. "And they make mistakes. Huge amounts of money are misspent. There is bickering within the community."

"I have benefited from the payments," Diego admitted with a sigh of resignation. "A lot of people don't support the exploitation of the land. But they still take the benefits because it's the only thing they can do. They say, well, if they're going to destroy the planet, at least they can leave a little something for us."

CHAPTER

03

MADE IN CHINA

A chinese managed nickel smelter in Indonesia. (Photo: K. Kurdi)

Odds are high that the battery components of any lithium-powered device have passed through China. This is not because the country is particularly resource-rich: It does possess significant lithium, coal and rare earth metals, but it does not have other key minerals, such as nickel or cobalt. Those it gets from countries with which Beijing has built deep connections.

China, rather, has developed dominant global positions at critical junctures in the battery supply chain. It is, for example, unmatched in its critical-minerals processing capability. Chinese manufacturers of cost-effective, battery-powered machines also leave competitors in the dust.

This is not by accident. China's strategic positioning stems from two decades of government policy "at both the federal and provincial levels [that] has made EV competitiveness a national priority".[1] In the early 2000s, China's powerbrokers realized that the country was unlikely to ever compete with global leaders in internal combustion cars.[2] Meanwhile, a thick fog of pollution engulfed the country's urban centers, offering a sneak peek at what the future might hold if the world did not end its addiction to oil.

"China was actually a latecomer to green power," Wang Huiyao, president of the Beijing-based Center for China and Globalization noted. "And with the smog in Beijing, we started to get criticism from around the world." Chinese leaders concluded that electric energy would become increasingly important as the world faced changing climates. They also realized that by moving early and powerfully in that direction, they could steal a march on potential competitors. "China said, 'OK!'" Huiyao continued, "Let's have a paradigm shift. Let's develop green energy."

Chinese governance and economics work differently from that in the West. The United States president changes every four or eight years and its legislature every two. The American private sector functions largely independently from the state. The Chinese government, in contrast, has far less institutional turnover. The Chinese Communist Party rules uniformly, and President Xi Jinping has consolidated awesome power for an indefinite period of time. This enables Beijing to pursue long-term development projects and strategies that are elusive in the United States. The Chinese state maintains a heavy hand in industry and can push state-owned enterprises into long-term investments that may not be immediately (or ever) profitable. Priority goes to the country's strategic vision.

Urged on by government influence, China went early and heavy into battery production. It is now well positioned to dominate a lithium-powered century just as the West dominated the hydrocarbon era. So, how did China execute this strategy? And why does it cause the United States and Europe such concern?

CAN YOU DIG IT?

Over recent decades China has developed close economic ties with developing countries rich in critical minerals, principally those in Southeast Asia, Africa and Latin America. Beijing's efforts in this endeavor have emphasized neither improving global governance nor financial transparency. Rather, China has been more concerned with ensuring access to strategic inputs, and it has been willing to put a lot of money on the table to get it.

"China deals with governments and societies as it finds them," David Lampton, former director of China studies at the Johns Hopkins University of Advanced International Studies, said. "Much of [Western] commentary about China and its behavior in the world puts it in an ideological frame. I would say it's as least as much an issue of pragmatism."

"Meanwhile, small and poor countries want to get rich," Lampton continued. "And the operative question from their viewpoint is who is going to help us do that?" Loans and investment from the United States or the EU require financial transparency and, often, other measures related to governance and democracy. Developing-country leaders frequently prefer to avoid that kind of scrutiny.

Chinese investment, on the other hand, manifests as large sums of cash on the table, with fewer questions asked. "If the Chinese say they are going to build your country a road, a year later you will have a road," David Dollar told me in 2022, when he was an economist and China scholar at the Brookings Institution. "If a Western institution like the World Bank says they will build a road, maybe it takes ten years. Maybe it never happens."

Chinese state-owned enterprises may be happy to build a road, but the route will likely pass mineral deposits in which Chinese interests have been granted concessions. "In 2008, the DRC and China signed the Sicomines pact, which gives Chinese signatories mining rights to DRC's cobalt and copper in exchange for Chinese investments in Congolese infrastructure projects," Daniel Quiggin and Richard King of Chatham House wrote in a 2023 article.[3] Meanwhile, the Chinese state heavily subsidized Chinese foreign mining operations, which allowed enterprises to take more risks and set up in remote areas without the need to rapidly turn a profit.[4]

The resulting deep ties have paid off. The DRC produces about 70% of the world's cobalt, and Chinese companies own 80% of that output.[5] Reports of abysmal labor conditions and child exploitation in the mines persist.

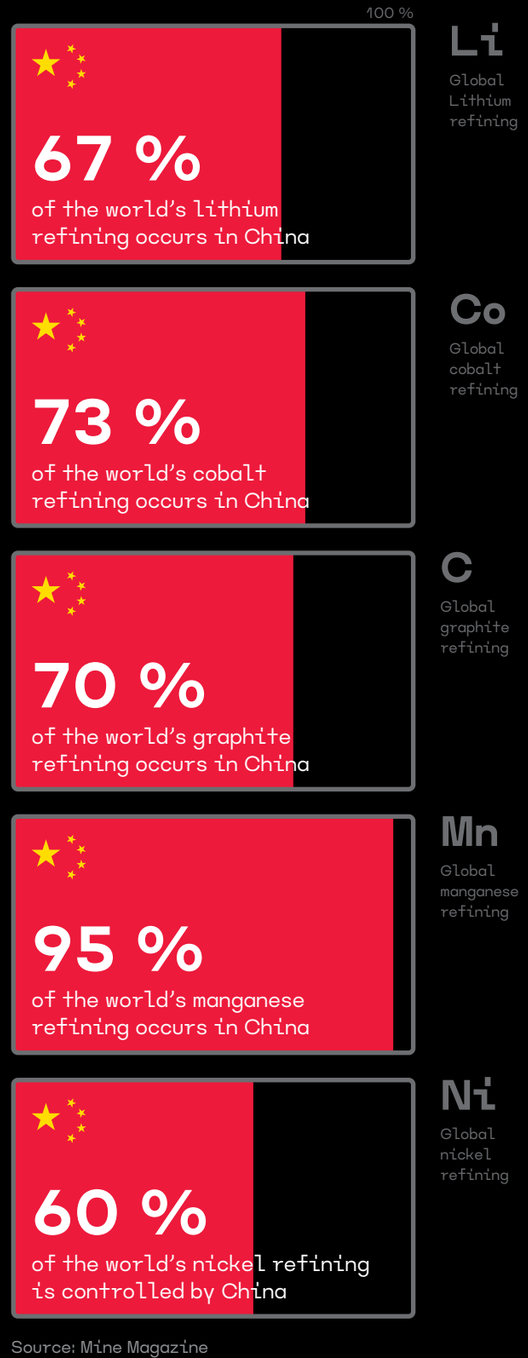
"China does not put a lot of preconditions on operations," Mvemba Phezo Dizolele, a Center for Strategic and International Studies scholar and Congolese national told me.

"They don't ask questions about human rights, they don't ask questions about freedom of speech, or all that other 'democracy talk'. Their model calls for taking resources, and the model calls for maximization of profit."

In a similar vein, China has established deep connections with Indonesia and has a dominant position in the country's nickel mining and smelting sector. Indonesia is the leading producer of the element, accounting for some 40% of its global production in 2023[6] due to billions of dollars of Chinese investment in mining and processing.[7] Nickel is critical for extending a lithium-ion battery's run time between charges.

"In Indonesia, President Joko Widodo came into office about a decade ago looking for investment in commodities," Prashanth Parameswaran of the Wilson Center explained. "And he saw China as the source for that investment." The resulting economic relationship did not stem from a preexisting natural allyship. Rather, it emerged because Beijing was interested in investing in critical minerals. "President Widodo said, well, if China is going to be the first mover, we owe it to ourselves to actually test that proposition. And that's exactly what has happened. Chinese companies have flooded into the Indonesia nickel space."

More than 90% of Indonesian nickel went to China by 2019, when Jakarta banned the element's export in an effort to promote domestic smelters and processing.[8] China responded by investing more than $30 billion in smelters in Indonesia. They continue to ensure that China receives the lion's share of Indonesian nickel.[9]



Source: Mine Magazine

THE WORLD'S MINERAL MIDDLEMAN

Accessing minerals is only the first stage of building a lithium-ion battery. Just as crude oil cannot power a car, minerals must be processed and refined into battery-grade metals. This critical middle step in the supply chain occurs overwhelmingly in China. According to Mine Magazine, "67% of global lithium supply is processed by China, along with 73% of cobalt, 70% of graphite and 95% of manganese."[10] In other words, any country mining lithium is still likely to export it to China for refining. Any country invested in developing its own battery manufacturing plant is still likely to import the processed materials for production from China.

"This dynamic emerged when all the consumer electronics left the Western world for China," explained Wolfgang Bernhard of Roland Berger, a consulting firm. "The industry started out there, and the demand for the refined materials began in China. And they built up the industry."

According to a White House study, between 2009 and 2019 the Chinese government supported mineral processing with upwards of $100 billion in subsidies, incentives and tax exemptions.[11] This supercharged the sector at a time when the rest of the world appeared to not grasp its potential.

Meanwhile, Western refining capacity atrophied. The Brookings Institution found that by 2022 "the only notable mineral processing capacity outside of China is in Europe, but this is mostly limited to cobalt processing, mainly at plants in Finland."[12] It is not an easy sector to kick-start. Critical-mineral refining is a complex process that requires significant knowledge, infrastructure and investment. The Oxford Institute for Energy Studies found that that "the costs of building a lithium refinery outside of China are three to four times higher than building one within the country."[13]

Even for countries that might have the financial firepower to pursue such projects, the prospect of competing with Chinese processors at this point is daunting. Many developed-world mineral producers have decided it is not worth the effort. Australia, for example, continues to export lithium concentrate to China for processing.[14]

"It's not that China was smarter than everyone else," the Center for China and Globalization's Huiyao said. "Many Western countries abandoned the refining industry years ago. They think it is very polluted. So, while they were leaving the industry, China gained years and years of a head start."

DOWNSTREAM DOMINANCE

Chinese dominance extends downstream into battery and car production. The country produces three-quarters of the world's EV batteries.[15] As they are the most expensive component of an electric car, it is perhaps unsurprising that China has emerged as a leader in EV production as well. Chinese automakers sold 6.8 million EVs domestically in 2022, more than eight times the number of EVs sold in the U.S.[16] All told, China produces more than 60% of the world's EVs.[17]

Chinese EVs continue to penetrate the international market. The Information Technology and Innovation Foundation found that "from 2020 to 2023, China's global EV exports increased by 851%, with the largest share of those exports (nearly 40%) going to Europe."[18] Thanks to stiff tariffs, Chinese EVs are not yet common in the U.S., but American car manufacturers are spooked by the ability of Chinese competitors to develop high-quality EVs at a fraction of the price of American options. A Chinese EV costs about $34,400 on average, far less than the $55,242 for an American-made car.[19] The implications of Wuling Hongguang's Mini EV hitting the U.S. market with a base price as low as $5,000 are significant.[20]

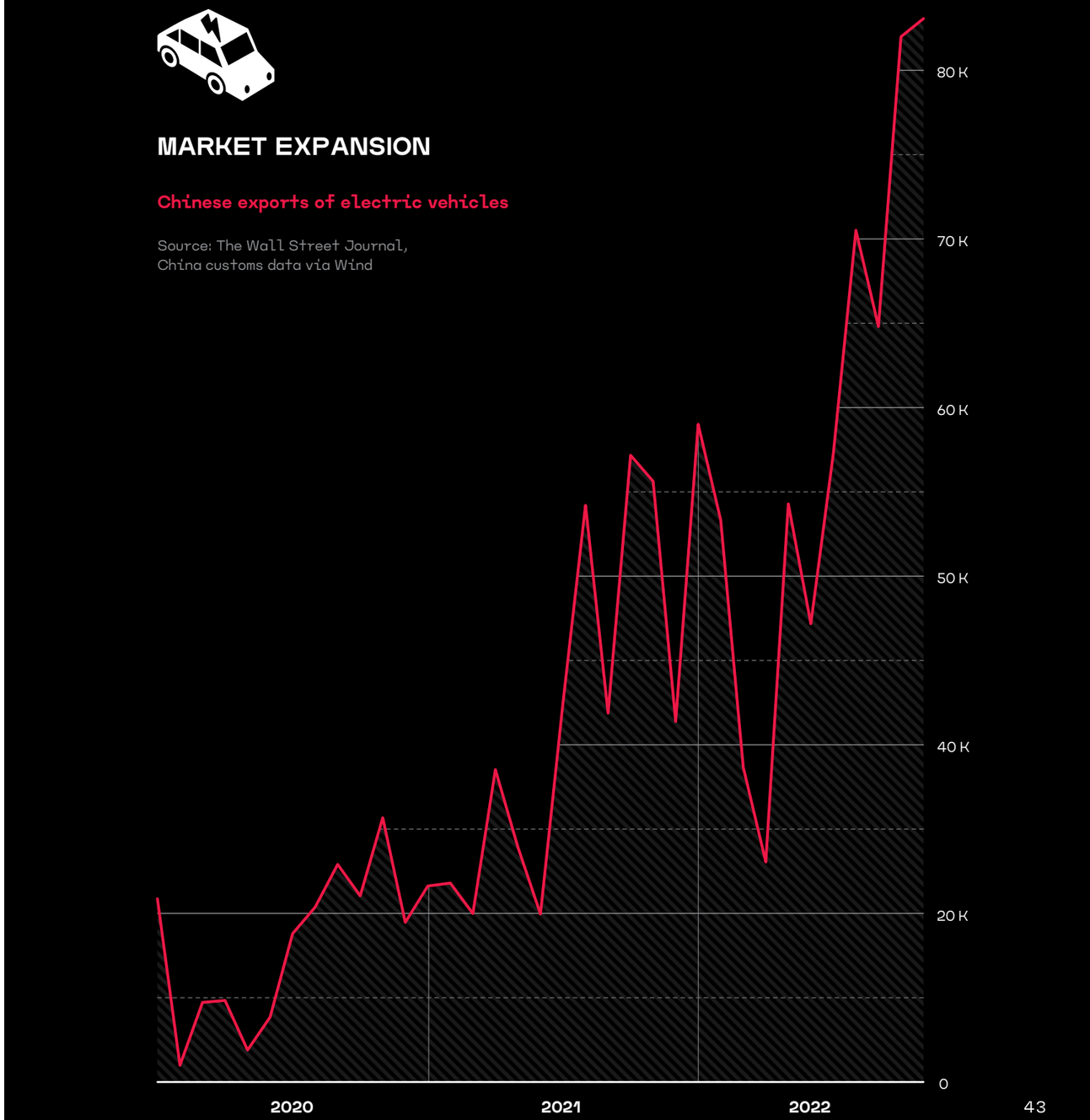
Again, China's strong position stems from years of planning and investment. Battery and car producers received the equivalent of billions of dollars in state subsidies and research and development investment. China was also able to import considerable know-how from Western companies as part of the price they had—and were willing—to pay for access to the country's massive market.

Beijing has also offered consumers incentives to purchase EVs since 2009. National subsidies for buyers were often augmented by additional local ones.[21] EV purchasers enjoyed other benefits as well, such as access to bus and HOV lanes, a significant benefit in China's traffic-congested cities. But the biggest perk was an exemption for EV purchasers in the capital, for example, from having to win a lottery for a license plate that every new vehicle, since 2011, must have. By 2018, the odds of winning that lottery were 1 in 2,031.[22]

Such benefits played a key role in Chinese citizens' early adoption of EVs.[23] But the subsidies and perks, calculated to have cost the state $230 billion between 2009 and 2023,[24] applied only to Chinese-made EVs.

This state-led push for EVs gave China's industry an impulse and a market that added up to a first mover's advantage. While Western EV development and adoption stalled, Chinese manufacturers developed expertise that led to profits and reinvestment as more Chinese consumers opted for EVs. In 2024, a World Economic Forum study found that a whopping 97% of surveyed Chinese expected their next car to be electric, dwarfing 35% for American and 43% for European respondents.[25]

A perceived lack of quality among Chinese EVs meant that they were initially of no great concern to global automakers. But by 2024, Chinese models could no longer be overlooked. Western analysts, perhaps begrudgingly, became impressed with the "energy intensity, range and reliability of Chinese EV batteries".[26] The vehicles would now likely overwhelm the American market if they had open access to it.



WASHINGTON RESPONDS

"China saw the opportunity, and they benefited from it," Jose W. Fernandez, Under Secretary for Economic Growth, Energy, and the Environment in the U.S. State Department during the Biden Administration admitted. "So, we have to catch up."

Beijing's strong position throughout the lithium-ion battery supply chain has Washington deeply concerned. But why? After all, the precepts of comparative advantage dictate that the most efficient economic strategy is to let players exploit their strengths. If China can produce a battery better, cheaper and faster than anyone else, why not just let the country supply the world? American businesses were more than happy to offload manufacturing duties to China in the 1990s and 2000s when the country's producers demonstrated that they could lower costs for manufacturers and consumers. What has changed?

American officials often point to the supply chain disruptions that occurred during the COVID-19 pandemic, which laid bare the risks of relying on external partners for critical goods. But U.S. officials clearly have specific concerns about relying on China for critical minerals and batteries.

"The United States is going to need 42 times the amount of lithium we have today by 2040 to 2050," Under Secretary Fernandez said. "We are going to need 25 times the amount of manganese that we have today. Same with cobalt. Most of those minerals are either controlled by [Chinese] mines, or are processed in China. That is a vulnerability. And we have seen China use its dominance of certain products as a tool for economic coercion."

He is right. In summer 2023, China began restricting exports of gallium and germanium. These two minerals, of which China is the globe's leading producer, are important to the semiconductor industry. In October that year, China limited exports of graphite, the largest per mass mineral in a lithium-ion battery. Finally, two months later, China took steps to ban the export of technology required to extract and separate rare earth minerals.[27]

From Beijing's perspective, these restrictions were not unilaterally aggressive moves. Rather, they were responses to trade provocations from the United States, such as a tightening of artificial intelligence-related exports to China.[28] It can be difficult to determine who started the protectionist race, and the answer is rapidly losing relevance anyway. The bottom line is that the United States and China are in a tit-for-tat trade conflict that represents part of

Policymakers in Washington feel increased pressure to close the gap with China on critical minerals. (Photo: S. George)

a broader competition between the two that is likely to persist for decades. This, coupled with the emerging importance of access to lithium batteries, renders the West's reliance on China a glaring vulnerability.

The United States is gambling that it will be able to catch up to China by piquing private-sector interest. As former Under Secretary Fernandez explained, "China has tools that a capitalistic society does not have. We can't force our companies to invest. What is our competitive advantage? We have a private sector that is the envy of the world. And if we can get our private sector involved, then we can meet this demand signal."

Will it work? The answer may be in a remote corner of Nevada, where the U.S. government is supporting a private enterprise that is trying to build one of the world's biggest lithium mines.

CHAPTER

04

THACKER PASS, USA

Could Northern Nevada provide America's lithium? (Photo: S. George)

From the State Department to the private sector, many centers of power in the United States would like to make a lithium-ion battery with domestically mined lithium. It may be possible. An increasing body of evidence indicates that the country is rich in the mineral.

In the Northeast, hikers stumbled upon a massive deposit in Maine in 2018.[1] In the South, geologists have discovered lithium-rich salt brines near former oil towns in Arkansas.[2] Scientists believe they can eventually extract the mineral from the Salton Sea, a shrinking landlocked body of water in Southern California that is leaving salt flats in its wake. But there is one site in particular that is poised to provide the United States with the lithium it so badly needs. West of the Rocky Mountains, just south of the Oregon badlands, beneath the sagebrush deserts of northern Nevada sits Thacker Pass, home to one of the world's largest lithium deposits.

Lithium Americas, a Canadian company, has broken ground on the site for a massive open pit mine. When completed, it could "produce enough lithium carbonate to support the production of batteries for up to 800,000 electric vehicles annually — [eliminating] the equivalent of 317 million gallons of gasoline consumption per year, according to the Department of Energy".[3]

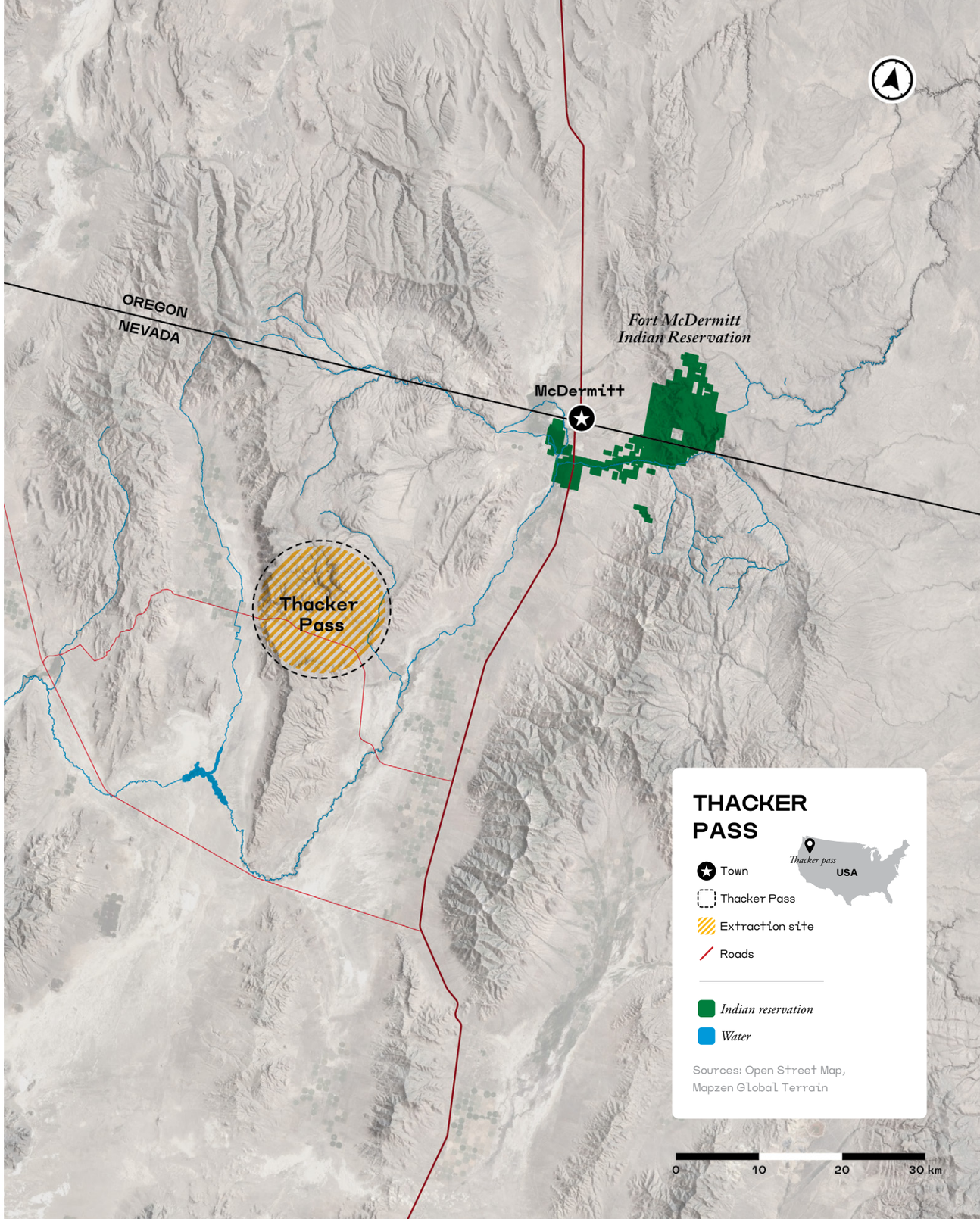
The U.S. government supports the mine and has provided a $2.26 billion loan with favorable conditions to build it.[4] Meanwhile, General Motors has invested $650 million in the project, and the lithium from Thacker Pass would go directly into batteries for the vehicles that the company makes.[5] This is exactly what many in the United States have been clamoring for: American lithium for American batteries for American cars.

"Typically, lithium is extracted in Australia or South America," Tim Crowley, Lithium Americas vice president explained. "Then they send that material in a concentrate elsewhere, typically to China, to get processed. We're changing that. And we're changing that right here in Thacker Pass."

The mine was in the early stages of development at the end of 2023. Heavy-duty trucks softened and removed soil, crisscrossing the dusty reddish-brown terrain. Billions of dollars' worth of lithium lie beneath.

"The United States is way behind in battery development," Crowley said. "Currently, the United States produces about 5,000 tons of lithium carbonate per year. We're going to start by producing 40,000 tons, and we'll double that once we double the size of our plant."

If Lithium Americas can hit that upper number, it will surpass the initial estimates and supply lithium for nearly 2 million electric cars annually. "We need to produce these things in the United States. And that's what we are doing."



Arlo Crutcher herding cattle.

The lithium project has divided the tribe. (Photos: S. George)

A TORTURED HISTORY

This would seem to be a clear-cut win for the United States. But as in Chile, there is a catch. Access to this lithium also requires mining through complicated chapters of history.

The mine site sits along the border of the Fort McDermitt Reservation, home to members of the Paiute and Shoshone tribes. The fort had been an army post from 1865 to 1889, and Native people had been subsequently relocated onto the surrounding area as part of America's insatiable push west.

The land itself is soaked red in indigenous blood. The Pauite and Shoshone people contend that a brutal 19th-century massacre of their ancestors by the U.S. Cavalry occurred at Nipple Rock, which sits along the lithium deposit. The Owyhee Avalanche newspaper covered the event in 1865, reporting that "the Indians discovered their danger when the captain ordered Lt. Littlefield and nine men to advance between the mountain and the camp. A charge was ordered, and each officer and man went for scalps, and fought the scattering devils over miles, at which time all were killed."

To this day, tribal members regularly return to the site to mark the past.[6] "America has been committing these crimes for hundreds of years, but it seems like it's OK when it happens against indigenous people," tribe member Day Hinkay said. Hinkay opposes construction of the mine for two reasons. He views it as a desecration of a sacred space and believes the resulting pollution and environmental degradation will harm his people.

"Why do extraction companies get to contaminate groundwater, land, and air call it green?" Hinkay wondered. He is not alone.

Gary McKinney, a member of the Duck Valley Shoshone Paiute Tribe, explained his concern that the impoverished tribes were losing out on an economic bonanza. "These are foreign companies coming into our ancestral land, making claim to it, and walking out millionaires. They're not in it to fix anything; they're in it to make money. They're in it to get the United States ahead of China."

Northern Nevada is pockmarked with abandoned gold and silver mines, hinting at the region's long history of natural resource booms and busts. "For me, that's kind of a red flag for lithium," McKinney said.

Tribal members against the mine united under the banner of "The People of the Red Mountain", forming "a committee of traditional knowledge keepers and descendants of the Fort McDermitt Paiute, Shoshone and Bannock Tribes working in coalition with allies to protect our ancestral homelands".[7] They challenged the project in court, resulting in years of legal delays. During that time, the group garnered sympathetic media coverage from The New York Times, the BBC and The Guardian. A narrative emerged that natives had been bullied off land that they had previously been herded onto, and that they now faced the prospect of a poisoned environment.

A TRIBE DIVIDED

Fort McDermitt is about 250 miles northwest of Reno. The nearest city is Winnemucca, about an hour's drive south. The desert terrain is rough with patches of sagebrush in valleys surrounded by spiking mountains, and the reservation is next to the so-called town of McDermitt. But that status is an exaggeration. McDermitt consists of a couple of gas stations, a pair of withered strip motels, and a small, depressed casino that smells of stale cigarettes and serves bar food. A gas station next to the turn-off to Thacker Pass serves burgers. A convenience store has frozen food and prepackaged sandwiches. These are the food options in the area.

On the reservation, residents live mainly along two winding roads that cross the valley, North Street and South Street. Curiously, they intersect at a right angle. Small, ranch-style houses at varying levels of decomposition dot the landscape. The views of the surrounding mountains are breathtaking.

Myron Smart, a middle-aged man with a herd of cattle, echoed concerns about the mine. "They're supposed to be building three big incinerators out there. … With all the chemicals they are going to be mixing together, it is going to contaminate our water."

Elvida, an older woman, agreed. "If they start that mine up, the wind will blow all that polluted air over our reservation. I have grandsons. What are they going to think when they grow up and this land is all dried up, and the water of life is going to be gone?"

But these concerns were not unanimous among members of the tribe. In fact, the Fort McDermitt Tribal Council supports the mining project. The legal challenges to the Thacker Pass project were not coming from tribal leadership.

Smart sighed when asked about that. "I really don't understand that part," he acknowledged, before sharing a perspective common among tribe members who oppose the project. They believe the leadership has been bought off, either with bribes or with cheap promises of concessions to the reservation. "If you show them a little bit of money, and you promise that you are going to give us this, or build us that, then right away they are all for it," he said.

Elvida and her son Bert make traditional crafts out of hides in a makeshift workshop behind their house. Bert also felt leadership had sold out the tribe. "Did they help certain people? Yeah! Did they help themselves? You damn right they did!"

Across the reservation, handmade signs reflect the protest against the lithium mine. From the highway, a large billboard purchased by The People of Red Mountain proclaims "Life over Lithium".

The reservation is not large. Everybody knows everybody, and families have lived here for decades. The mine clearly divides residents.

IT'S HERE

Arranging a meeting with Arlo Crutcher, the Fort McDermitt tribal chairman, took time and patience. It involved a series of phone conversations during which his frustrations with the media became clear. Numerous articles and television segments, he claimed, used him for quotes supporting the mine, implying that he was a major backer of the project. He was aware of the rumors circulating in his community, shared by people he had known for decades, that he had been paid off. The weight of a divided tribe seemed to rest heavy on his shoulders.

He eventually granted me an interview, breaking his self-imposed vow not to speak on the record. This was for a research project, he reasoned, not a news piece. But perhaps he just wanted to talk. One interview became two, and two became three. The long, winding conversations covered everything from the tribe's history to its economic future. His perspective on the lithium mine was clear. The tribe faced certain realities, and all they could do was try to make the best out of them.

"We don't own anything. We don't own this land. We have access to the land," he said. "But the natural resources don't belong to us. They belong to the United States government. That's just how it is. So, people can keep fighting lithium, but it's here."

As Crutcher quickly noted, the Donald Trump and Joe Biden administrations supported the Thacker Pass lithium mine, making it one of the few policy issues on which the two agreed. "Sitting in this position here as tribal chairman, what do you do for your people? What's best for your community? Because the mines are here. And they aren't going anywhere."

Local employment opportunities are limited, and many young tribe members are forced to leave the area to find work. Crutcher sees the mine as a source of jobs just minutes from the reservation. The need is great.

"I needed some income," a man named Jason declared. "And jobs are hard to find out here. And the benefits are pretty good at the mine—you know, medical and retirement." Shania, a young woman who works on the site, said that the opportunity had been life-changing. "A lot of my family doesn't like it. They say we are destroying a sacred site. But they don't pay my bills."

As part of a community benefits agreement the tribe signed with Lithium Americas, the mining company is building a multimillion-dollar community, daycare and cultural center. The existing one is tiny and rodent-infested. "We asked them to include a computer lab for us as well," Crutcher said. "And they agreed. That might not sound like much. But it's a lot for our tribe. Because we don't have the money for that stuff."

"Some of the people who protest the mine think that, with lithium, we are allowing white people to use us," he continued. "I won't argue that. How else would we get these things done?"

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In 2023, after years of legal proceedings, the 9th U.S. Circuit Court of Appeals upheld a lower court's ruling that Lithium Americas could proceed with the Thacker Pass mine. The company is now removing topsoil from the site and expects to begin producing by 2026.[8] Meanwhile, recent studies suggest the lithium deposit at Thacker Pass may just be the tip of the iceberg. The broader McDermitt caldera that stretches from Nevada to Oregon may have up to 40 million metric tons of the mineral— "more than double the concentration of lithium than any other bed of clay globally".[9] That means more mines could be on the way soon.

As the United States fights to establish lithium independence, it will continue to face challenges from communities that feel disadvantaged by new projects. These communities themselves may become divided and be forced to weigh economic advantages against environmental concerns. Meanwhile, the American government and private sector, and public opinion, will have to make similar calculations. Lithium access may be a vital national security issue, and it may represent an economic bonanza for U.S. producers, but what if it requires running roughshod over communities that have already been punished for centuries?

On the reservation, some feel that they already know what the resolution will be. "Who out there gives a shit about a bunch of Fort McDermitt Indians anyway?" Bert said. His mother nodded in pained agreement and continued working on the hides.

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Construction of the Thacker Pass Lithium Mine is now underway. (Photo: S. George)

CHAPTER

05

COBALT: A BLOOD MINERAL?

Most of the world's cobalt comes from the Democratic Republic of the Congo. (Photo: Robert Carruba)

Many lithium batteries use cobalt to boost energy density.[1] It reduces overheating in EV batteries and extends their run time on a given charge.[2] But cobalt is expensive and scarce. And most of it comes from the Democratic Republic of the Congo. An estimated 70% of the world's supply originates in the country, which faces dire challenges of poverty, conflict and failed government institutions.[3]

Most cobalt in the DRC is mined in and around the southern city of Kolwezi. There, be it at small makeshift operations or in massive open-pit mines, men (and some women) dig into the red earth in search of the mineral. The process is labor intensive, dangerous and poorly monitored. Reports of child labor and appalling working conditions plague the industry.[4] This has led critics to liken the DRC's cobalt extraction to that of "blood diamonds", which are mined in African conflict zones under oppressive conditions.

Chinese traders dominate the DRC's cobalt industry. According to a US congressional commission, "80% of the DRC's cobalt output is owned by Chinese companies, refined in China, and then sold to battery makers around the world."[5]

Given the human rights complications around cobalt, some battery scientists are working on cell technology that does not require the mineral. This effort is in part because producers want to avoid the moral dilemmas associated with cobalt production.

But eschewing Congolese cobalt creates other moral dilemmas. Brutal as the process may be, the mining offers one of the region's few employment opportunities. Should more batteries be produced without cobalt, that could doom a sector that has reduced poverty and generated state revenue.[6]

The problem defies easy resolution. A best-case outcome would be to professionalize and reform the DRC's cobalt industry. But that is much easier said than done in a country whose national government struggles to exert control over its massive territory.

To better understand the complexities of the cobalt industry in Kolwezi, we interviewed local miners. We asked why they started mining, what the process was like, how the business worked, how they succeeded or failed, and what their work meant for their personal lives. Their words follow.

My name is Jean de Dieu Kabala Bewa Muteba, and I am a cobalt miner. But I wasn't supposed to be a miner. I was studying. I should have been a teacher. The problem was there was no job available. I had to think, how can I make money in the Democratic Republic of Congo?

I am a miner. My work is digging. I know the cobalt helps make phones. Televisions, too. And many other things. Probably some that I don't even know about. After finishing my studies, I couldn't find another job besides digging. If there was another job, I would do it! But apart from digging, I don't have another option.

When this all started, people would dig mine shafts in residential houses. There were people digging eight meters deep inside their own houses! That's when life changed. And there was no other employment. So I said, fine, let me dig, too!

There are different jobs. Someone holds the bag, another one has the spade. Another works the board. But once you get inside the mine shaft, you don't want too many people. Four or five guys, usually.

First, we remove the waste rock. Then we start going deeper and deeper down.

Before you reach anything, you must suffer. We start with a team of around six, but all of them will not make it. Some will run away.

(Photos: R. Carruba)

(Photos: R. Carruba)

There are landslides. If not landslides, you can die from contamination. That happens a lot if you work in a mine shaft without good security measures.

If you're cutting and the team becomes disorganized under there, you could damage the mine shaft. If that happens, it will collapse.

As we keep digging lower, the mine shaft becomes very deep. It gets hard to breathe. We try to use generators and blowers to help us get air down there.

Once you are 25 meters deep, you look up and you don't see anyone anymore. We call that being in the chimney. All you can do at that point is look for traces of cobalt.

The fear is at the beginning, when you first start. Now I am used to it. I can go 50 meters deep without fear.

It's like a grave down there. It's like getting your heart pulled out. When you go that deep, you are on the edge of life and death. It becomes a habit. You go down and come back. You go down and come back. But one day, you go down, and you will not come back.

Miners die frequently because of landslides. When it happens, all we can do is try to help by removing the soil. Some [victims] become disabled. They lose a leg in a landslide. That's the reality.

I was once covered in a landslide. I was very scared. But we were saved. Then, after a few days, I told myself that this happens, and I needed to get over it. And I went back underground.

It can take years to hit cobalt. And sometimes, after digging for a long time, you find nothing. When that happens, I feel like my work has been lost in a vacuum.

But when you find it ... once you reach that layer, everybody is overjoyed!

The day I find cobalt, when I see it with that black color, I immediately feel happy. It is a tremendous joy. And when I go home to my wife and my children, it will be pure joy.

Joy! You have found wealth. You know that everything will be OK. The suffering that you endured while digging, well, it is over.

(Photos: R. Carruba)

Cobalt extraction in the Democratic Republic of the Congo. (Photos: The University of Bath)

(Photos: R. Carruba)

After finding the cobalt, the first thing we do is take a sample for testing to learn the grade. That happens at the buying house.

We get paid based on the grade of the cobalt. That means I might have 100 kilograms of cobalt. At the buying house, maybe I can sell the 100 kilograms for $20. But I can also have 100 kilograms of cobalt, and I can sell it for $1,000. It just depends on the grade of the cobalt.

If production is good, and the cobalt has a good grade, I can make $800 a week. If it's not good, I earn like $30.

Most of the traders are Chinese. And the Chinese know how to negotiate. But where else can we go? I can't go directly to the processing plants to sell. I need to go through the Chinese. And when they measure it, they leave us outside. They pay the Chinese trader. And then he pays me.

Sometimes it feels like they are taking it for free. We work a lot, but we get little money.

We have no direct contact with the factories. We are limited because we have to give our product to a Chinese trader who takes it to the factory. They calculate a price based on a coefficient. What is a coefficient? We don't know what it is. We've found the cobalt, and now they talk about the coefficient. It's like they are trying to confuse us.

But mining has transformed my life. When I started, I was single. With digging, I got married. With digging, I have children. With digging, I pay for my kid's schooling. With digging, I have bought a house. That is life!

If you come to my house, you will see I have chairs. I have a television. I have a wife, and I have children who are going to school. Mining helped me have a stable life.

I bought a bed and my clothes, and paid an advance for a rental house. It is good work because it brings money. Any activity that produces money is a good activity.

Some of my friends died in the mine shaft. But I am alive. I have been working, and I got married. This work is my business.

(Photos: R. Carruba)

CHAPTER

06

BATTERY VALLEY, EUROPE

Universities in Northern France are betting on battery science. (Photo: S. George)

Metal cylinders poked into the sky, some billowing thick white smoke. Others belched a thinner, black fog. Faded, beige, windowless structures, five or six stories high, connected long metal passages across a landscape scarred by rusted pipes. Piles of coal sat on the side of the road, abandoned in a previous era.

The port of Dunkirk is not what most people imagine when they think of France.

Daniel Deschodt is the port's chief commercial officer, a man with an affable smile. "I'll tell you why I'm excited personally," he said in impeccable English marked by a heavy British accent as the port's mechanized gates creaked open. Inside, a massive, sprawling industrial complex unfolded before us. "I was born and raised here in Dunkirk, and my father worked here on the shipyard. We've lived through the rough years."

We drove passed colossal, rusted industrial equipment. Some of it seemed still in operation, and some looked long abandoned. "In the 1980s, the shipyard closed down," Deschodt continued. We all had to leave this area. By the time the last refinery closed, we had lost tens of thousands of jobs."

His experience is not unique. Across northern France, the country's manufacturing, mining and industrial heartland, boom-and-bust cycles affected generations of workers. Coal towns such as Douai, Lens and Hénin-Beaumont have faced high unemployment in the 21st century as mines closed and industries left. The local economies adrift, shops, salons and restaurants shuttered shortly thereafter.[1]

For much of this century thus far, French unemployment has hovered between 8% and 10%.[2] The northern Hauts-de-France region has averaged more than 11% since 2010. "There were factories that employed between 8,000 and 10,000 people," Stéphanie Maurice, northern France correspondent for Libération said. "Now entire towns are unemployed."[3]

"When you've been here for 30 years like me, you've seen a lot of plants close down," Maurice added. "This is a working-class region. It gets a bad reputation in France. It seems gray and sad. A lot has been said about unemployment, deindustrialization, industrial wastelands, factory closures, the end of coal. Practically all the factories have closed. There's nothing left."

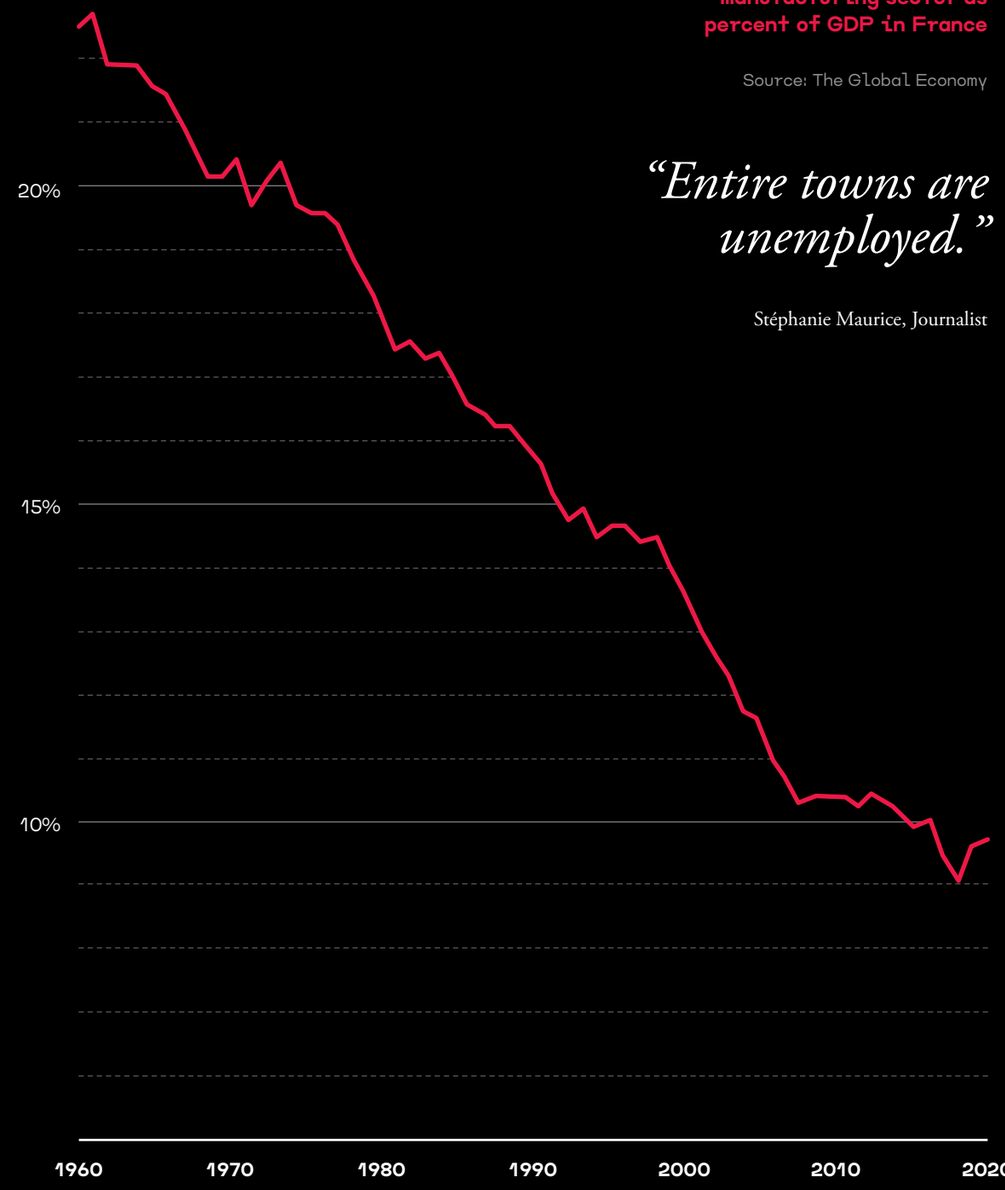
This deflating trend left many locals frustrated and pessimistic about the future. At the Thursday market in Hénin-Beaumont, residents pointed to the evidence around town. "Do you realize everything around here is closed?" one fruit vendor asked contemptuously. "The town center is dead. We have only one café that is open, and that's just because they sell lottery tickets." Fully 60% of the town's residents earn so little that they do not pay taxes.[4]

Another vendor displayed used clothes for sale. "I worked in the metal industry before doing this," he said. "We sold to all the factories here. But when they all closed, we had to close, too."

DEINDUSTRIALIZATION IN FRANCE

Value added by the manufacturing sector as percent of GDP in France

Source: The Global Economy



"Entire towns are unemployed."

Stéphanie Maurice, Journalist

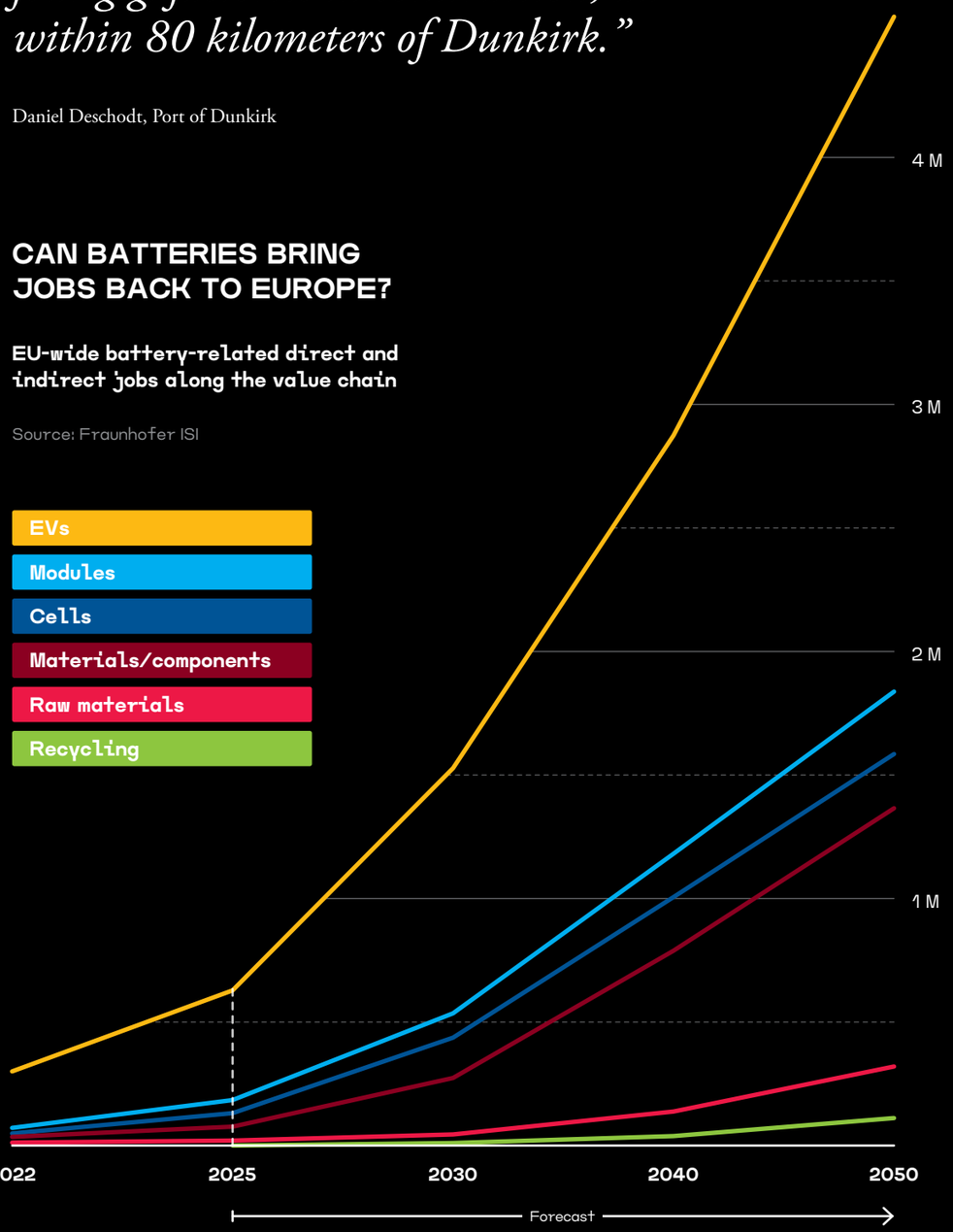
“Here in northern France, we have four gigafactories in construction, all within 80 kilometers of Dunkirk.”

Daniel Deschodt, Port of Dunkirk

CAN BATTERIES BRING JOBS BACK TO EUROPE?

EU-wide battery-related direct and indirect jobs along the value chain

Source: Fraunhofer ISI



The region, with its history of organized labor, was politically left-leaning. Even as recently as 2012, Socialist presidential candidate François Hollande secured well over 50% of the Haute-de-France vote.[5] But since then, populist and right-wing candidates have made major gains. Marine Le Pen, the National Front stalwart, invested significant time in Hénin-Beaumont and the surrounding region. Steeve Briois, the town’s mayor since 2014, is a leading figure in Le Pen’s movement. In 2024 legislative elections, the National Front performed strongly in the region, even as it suffered setbacks elsewhere around the country.

“In the north, the right-wing vote isn’t driven by concerns over immigration or racism as it might be in the south,” Maurice noted. “It’s really a feeling of being forgotten and abandoned by the state. The National Front exploited that feeling of decline and abandonment.”

A process of deindustrialization, economic stagnation and voters swinging right may sound familiar to an American audience. But the link to lithium batteries is evident upon a return to the port. After passing a football field’s worth of heavy industry, one sees modern buildings. They are large white facilities that resemble massive storage units or, perhaps, indoor sports arenas.

“This is Battery Valley,” Deschodt announced. “Here in northern France, we have four gigafactories in construction, all within 80 kilometers of Dunkirk.” A gigafactory is a lithium-ion battery concern with a footprint of more than 100 hectares with more than 1,000 employees and requiring more than €1 billion in investment.

France’s emerging “Battery Valley” is part of an attempt to reindustrialize the region. According to Deschodt, Dunkirk’s effort dates back to 2010, when the port’s leaders realized they needed something new. “We didn’t really have the idea of becoming part of Battery Valley at that point. But we were looking for a new industry. And we found this entire new ecosystem. And we have built it in just a few years.”

A colossal building under construction featured what looked like massive white concrete slabs. This was the Verkor gigafactory; a lithium-ion battery plant that, when complete, will produce 300,000 EV battery cells annually.[6] It is a key component of northern France’s gambit to become Europe’s heartland for all things EV, to reduce battery dependency on China, and to help the EU meet its self-imposed requirement to end the sale of gasoline-powered vehicles by 2035. And if that is not optimistic enough, the region is hoping the effort will bring mass employment back to the country. Deschodt pointed towards the construction with a glint in his eyes. “This is new business!”

Inside the ACC battery plant in Northern France. (Photos: S. George)

PLAYING CATCH-UP

EU leaders, like their counterparts in the United States, fret that they are behind the curve on developing a domestic supply of critical minerals and batteries. The transatlantic partners currently rely on China for both.

The EU learned a harsh lesson about reliance in 2022, when the Kremlin chose to invade Ukraine. At the time, the bloc imported nearly 50% of its natural gas from Russia.[7] The outbreak of conflict resulted in a diplomatic rupture that led Russia to "[respond] to the EU's unequivocal support for Ukraine by weaponizing its gas supplies to the bloc".[8] Gas exports to Europe were cut, resulting in shortages, exacerbated inflation and the specter of energy rationing through the approaching winter.

The effort to develop Battery Valley is part of a broader EU strategy to pursue energy independence. But building the needed ecosystem for that takes more than money.

"We are creating an industry that does not exist in Europe," explained Matthieu Hubert, the general secretary of the ACC battery gigafactory, which is a 20-minute drive northwest of Hénin-Beaumont. "We're finally asking what do we have to do to build, develop and design batteries for Europe, in Europe. But it is 10 or 15 years after we should have. We are trying to catch up. We are late."

A MANUFACTURING RENAISSANCE?

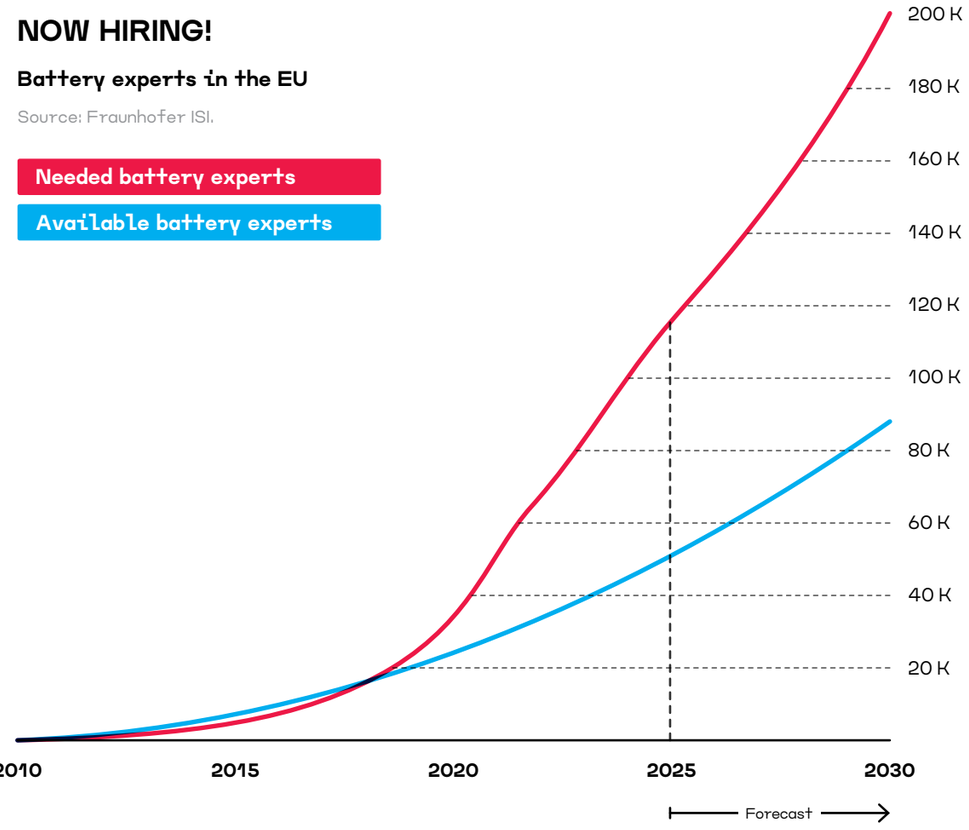
The biggest bottleneck is perhaps neither money nor technology but a lack of workforce training. European battery companies already need approximately 60,000 skilled laborers. Experts forecast that figure to spike to 200,000 by 2030.[9] The broader demand for workers will be even higher. Fraunhofer ISI found that "looking at the entire value chain (including battery system integration in electric cars/applications) as well as indirect employment effects, up to 800,000 jobs across the EU will be linked to the battery value chain by 2025".[10] The research institute also concluded that the bloc currently has about 40% of the battery specialists it requires. The analysis suggests that the shortage will persist over the next decade.

The EU must increase workforce capacity, which is happening across northern France. Just a five-minute drive from the port of Dunkirk sits a Université du Littoral Côte d'Opale

NOW HIRING!

Battery experts in the EU

Source: Fraunhofer ISI.



campus, where curricula are being redeveloped to prepare students for careers in battery production and related fields.

Devon and Lucy are already at it, assisting a professor with a computer tucked into a small lab in a university basement. Various machines cluttered the space, and the students stood at the computer the size of a small refrigerator. "We're working on a fuel cell," Devon explained. "It's a cell that uses hydrogen and oxygen to produce electricity which we can then store in batteries for different uses."

"This is a great opportunity for young people," Lucy said. "This is the best sector to be in because it's the sector where we will have the most work."

"What you see here is our investment in technology platforms," Franck Giuliani, a university administrator, added. "So that young people can be prepared. We want to be ready for technologies that we don't even know about yet."

The training is not just for young people. Across France—and especially in the north of the country—government-subsidized battery training centers are popping up in the vicinity of gigafactories. They are part of an effort to create a pipeline to fill new jobs. At one center near Hénin-Beaumont, apprentices rotated from classrooms to bespoke laboratories designed as resemble those across the street at the ACC plant. Inside, they practiced while sporting white attire and personal protective equipment, just as if they were in a gigafactory.

The success of these training centers is critical to Europe's economic future. Ramping up the domestic capacity is vital for the EU to meet its ambitious 2035 goal to end sales of gasoline-powered vehicles. As Forbes Senior Contributor Niel Winton wrote, "European Union auto manufacturers haven't the capacity to reach [this target], but the Chinese do."[11] As of now, the goal is achievable only if more consumers buy cheaper Chinese EVs. But that would "deal an existential blow to European automakers".[12]

The ACC plant features a seemingly endless series of hermetically sealed labs, each manned by specialists covered head to toe in white coats, lab hoods and facemasks. In another area, cavernous rooms the size of theaters are filled with machinery and tubes. Mechanized claws in one grabbed finished batteries, each with a clean sheet of metal covering the complicated internal amalgam of lithium, cobalt, and nickel, among other minerals.

Here was the culmination of investment and labor collected worldwide. Here, one by one, coming off the production line, was the hope for a cleaner Europe and a greener future.

Quentin, a 26-year-old who transitioned from working on fuel engines to the ACC gigafactory, summed up the challenge. "A battery is very difficult to manufacture. I had to go to the training center for one year to learn how to work the new machines. But thanks to that, I changed from something very old to something very new."

CHAPTER

07

MOTOWN SOUTH

The Ascend Elements battery recycling plant in Covington, Georgia. (Photo: S. George)

The recent history of American blue-collar industry has been marked by job losses, factory closures and rust. The statistics reflect the grim picture. From 1964 to 1991, manufacturing employment held relatively steady at around 17 million jobs. The country has since hemorrhaged anywhere from a quarter to one-third of them, many to overseas competitors.[1] Critically, these were positions that often did not require advanced degrees but were dependable and well-paying enough to offer families a pathway to financial stability. The loss of these opportunities is intimately linked to a shrinking American middle class.[2]

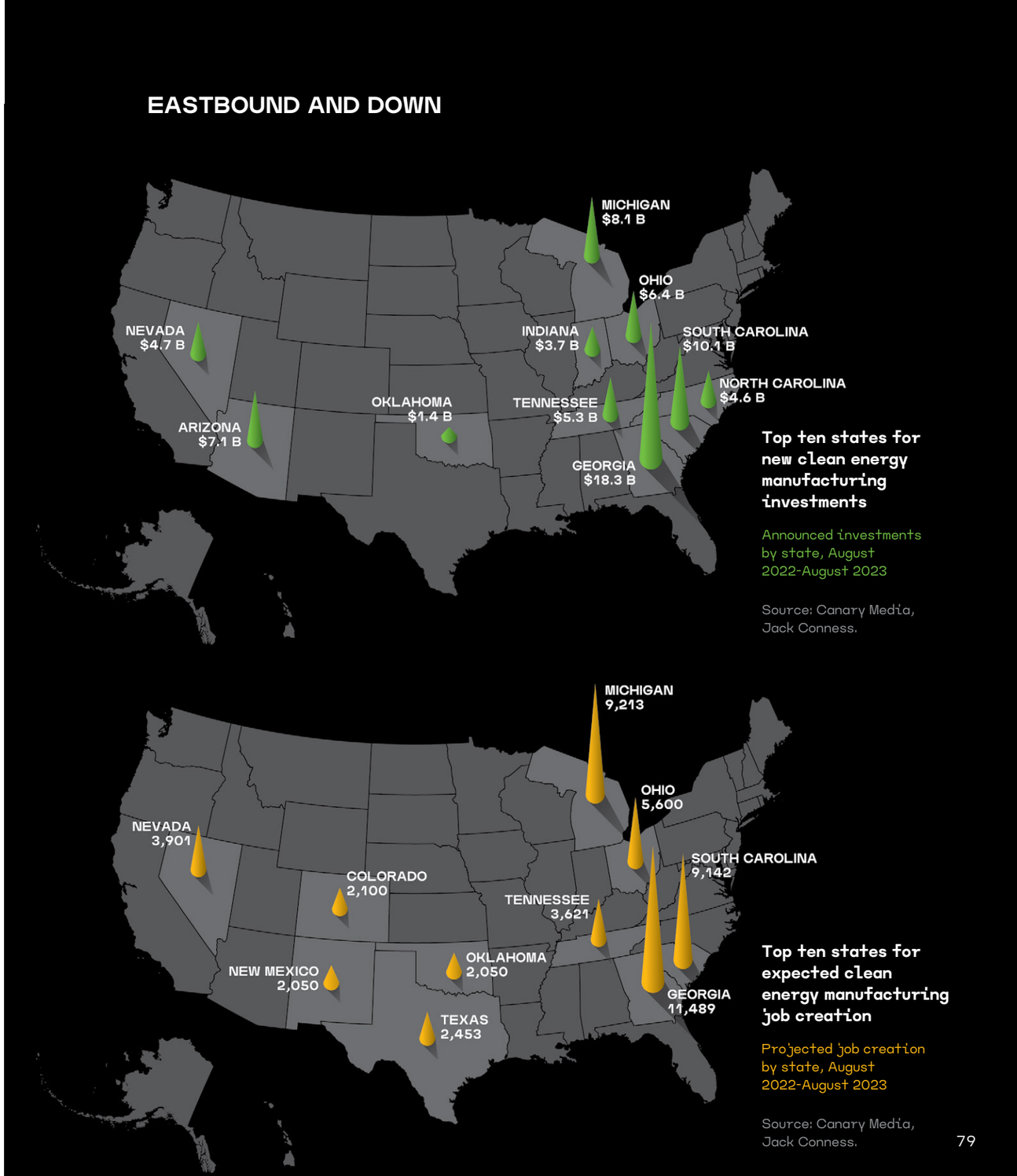
Economists can offer logical explanations for the manufacturing exodus. Following the precepts of comparative advantage, employers offloaded jobs to countries whose workers can do them more efficiently or, in other words, more cheaply. Theory posits that this allows American workers to focus on what they do best: innovation, new apps, think tank papers. Americans would rather work in air-conditioned consulting firms than on a manufacturing lines anyway, right?

The problem is, while the United States has shed blue-collar jobs, it has been unable to develop new mass employment opportunities. As a result, underemployment—which includes people working part time who wish to work full time, or working two jobs to pay for the basics, and those working below their level of qualifications—remains a persistent challenge.[3] But as in France, the transition to battery-powered vehicles offers the United States a rare opportunity to recharge domestic manufacturing.

AMERICA'S BATTERY BELT

EVs tend to be associated with wealthy liberals—people who, in general, may care about the environment and can afford new technology. They contrast with the stereotype of conservatives who drive trucks using internal-combustion engines and are suspicious of climate change and any initiative from Washington that may impact a current way of life.

Political party leadership reflects a similar contrast. President Biden and congressional Democrats included incentives for EV purchases as a key component of the Inflation Reduction Act (IRA) of 2022. President Trump, however, "is crystal clear about his disdain for electric vehicles".[4] It may be unsurprising, therefore, if the EV industrial heartland were a liberal enclave.



But the EV manufacturing boom in the United States is not occurring on one of the liberal coasts. It is not entirely occurring in Michigan, which, for most of the 20th century, was home to "the big three" American automobile manufacturers—Ford, General Motors and Chrysler. Instead, the "Battery Belt" is emerging deep in the American South, in traditionally conservative states. Between August 2022 and August 2023, the first year in which the IRA was in effect, $80 billion in new battery-related investments was made in 100 facilities, nearly half of which are in Georgia, South Carolina, Tennessee and North Carolina.[5] They include a lithium mine, a battery factory, a battery recycling center and automobile production plants. Such investments come with predictions of tens of thousands of well-paid, long-term jobs.[6]

Georgia alone attracted nearly $20 billion in investment, including $7.5 billion for a Hyundai plant near Savannah and $5 billion for a Rivian plant at Stanton Springs. Funds also flowed into an SK Battery plant in Commerce, which employes 2,600 people, "about a third of the town's population".[7] Ascend Elements, which is gearing up to recycle 70,000 EV batteries annually, is also a beneficiary.[8]

"These companies have recognized that they can make money building here," Georgia Public Service Commissioner Tim Echols said. "It seems like everything EV is now being built in Alabama, South Carolina and Georgia. The South has become the new Detroit."

The excitement was palpable at the Hyundai construction site. More than 4,000 workers buzzed through the massive campus, which is slated to employ 8,500 people and deliver between 300,000 and 500,000 EVs annually once operational. For Eric Johnson, Georgia's project director at the site, the impact will be "generational". "We're talking about a $500 million payroll being added to the local economy," he touted.

But why is investment pouring into the South? "The reason all these companies are coming is because they feel that people here are not educated on the benefits of having a union," explained Alex Perkins, a United Steelworkers organizer for a region including parts of Georgia and Alabama. "Certainly not as much as the people up North that have had unions for years and years. They come down here to take advantage of an uneducated workforce."

Organized labor has an underwhelming record in the region. As of 2020, "union membership in the American South is half that of the national average ... [and] only five percent of Southern workers belong to a union."[9] In Georgia, that figure is closer to 3%.

This has historical antecedents. American labor victories occurred in the Northern industrial belts while Southern agricultural leaders successfully warded off union advances, in part out of fear of empowering "a completely subjugated, and overwhelmingly African American, workforce".[10]

By the 21st century, Southern states openly advertised a lack of union penetration as evidence that they were "open for business". When Boeing workers attempted to organize in South Carolina in 2014, then-Governor Nikki Haley stated that "we discourage any companies that have unions from wanting to come to South Carolina because we don't want to taint the water."[11]

Southern states have blunted the impact of unions with "right to work" laws, which "designate that payment of union dues or fees cannot be a requirement for employment".[12] The result is small unions with marginal bargaining power. In this environment, the South was a destination for international automakers even before the EV boom.[13] As Commissioner Echols acknowledged, "the car manufacturers have said that it's easier to produce cars here because it's not union labor. That does seem to be something that is very important to them."

For Savannah's Democratic Mayor Van Johnson, this is concerning. "These manufacturers don't have to engage in collective bargaining or face the dangers of a strike," he said. "Historically, wages have been less here than what they are in Northern states. And that is because there is a lack of union representation."

Whether the South's approach is right or wrong is a matter of opinion and debate. Some, such as Georgia's Republican Governor Brian Kemp, have argued that his state's recent success comes precisely because it is a right-to-work state. Would it to be more unionized, he has claimed, the EV investment would not have come.

Labor leaders, on the other hand, believe the legal environment exploits workers. They cite as an example of this the Department of Labor's fining SK Battery $77,200 for "failing in their responsibility to meet required federal standards designed to help every worker end their shift safely … on multiple occasions".[14]

What is not debatable, however, is that union organizers are taking their fight into Southern states, a new frontier, in their view, for labor rights. In turn, workforces there are learning more about unions, and committees in numerous plants are pushing for unionization. The outcome will be integral to the future of America's Battery Belt.

Blue Bird Corporation employees. Clockwise from top left: Darvin Yates, Jontae Lockett, Craig Corbin and Ciera McClinton. (Photos: S. George)

FLIPPING THE BIRD

The story of the Blue Bird Corporation may be a precursor to the labor fights to come in the EV shops of the American South. Blue Bird is not a Johnny-come-lately to Georgia's industrial scene. The firm has been based in the rural town of Fort Valley since 1932 and has long been the nation's leader in the production of the iconic yellow school buses.

The company's production of EVs, which ramped up in 2023, is, however, new, as is a facility "designed to increase the company's production of electric school buses from 100 per year to 5,000".[15] The bet on these buses makes sense. The daily route of such a vehicle is fixed, predictable and usually not too long, a perfect fit for a battery-powered vehicle. The break between school drop-off and pickup affords an opportunity to recharge. Moreover, the electric buses replace diesel engine versions that can be particularly noxious for the environment and children on board.[16]

Yet, while Blue Bird's revised output reflected changing times, its approach to labor did not. It had always been a non-union shop. In the small, majority African American town of Fort Valley, the company had long been a principal employer. Many of its staff worked for Blue Bird for decades, and their parents or grandparents did the same. But as EV orders spiked, so did concerns about working conditions.

A number of personnel claim that favoritism and friendships impacted the best shift assignments and opportunities to work overtime. "They just kept passing me by," Craig Corbin, a Blue Bird employee said, "but I was a good worker!" Others were concerned about wages. "We didn't get a raise for three years," Patrick Watkins, a 17-year Blue Bird veteran grumbled. For still others, frustrations stemmed from poor health insurance. "The premium would go up, but the coverage would drop," Ciera McClinton explained. For Jontae Lockett, the arbitrary nature of the employment was a chief concern. "People would just get fired for no reason," he asserted.

The situation caught the attention of Perkins, the United Steelworkers organizer. "I starting meeting with the workers. And I'm listening to all these issues. And I tell them, all of these issues could be addressed with a collective bargaining agreement!"

But the region's limited history of labor organization and innate suspicion of unions posed challenges. To overcome them, Perkins and his union colleague Wilhelmenia Hardy got to know Blue Bird workers over the course of years. They made an effort to embed themselves in the community, passing out water after work and talking up anyone willing to listen.

Watkins, the Blue Bird veteran, was one of the first to show interest. “I didn’t have any experience with unions,” he admitted. “But when I started doing my research, I realized we need a union in here!” Under Hardy’s guidance, Watkins formed an organizing committee of employees ready to explore unionizing and to encourage co-workers to join in.

This was no small task. “Down south, it’s hard to unionize,” Watkins conceded. “A lot of people are afraid." "I was terrified,” McClinton confessed, adding “a lot of us were afraid. We didn’t want to speak about [our concerns] because we were afraid to lose our jobs.” According to old timers, that fear was warranted. “Back in 2001, there was a campaign for a union to come in,” James Holderfield, another Blue Bird employee, recalled. “And I saw a lot of people lose their jobs.”

But the workers committee persevered. Members went door to door. They made phone calls. Those that went unanswered were made again the following week. “When they first called me, I didn’t answer,” Carolyn Allen admitted. “I was scared. But the second time I got the call, I was ready.”

More and more workers joined the workers committee, conversations on the topic became more comfortable, and planning intensified. “A lot of meetings,” Allen noted. “Lord knows we did a lot of meetings! But they were good meetings.”

“We spent a lot of time talking to each other, learning what the union was really about,” employee Wayne Walker said. “That helped us come together. We built a team,” Watkins added. “We built a great team. We built a family.”

The effort paid off. Over the course of two days in May 2023, Blue Bird employees voted to unionize. “I was the one who counted the votes,” Darvin Yates stated proudly. “And we kept hearing ‘yes’, ‘yes’, ‘yes’, and we just got more and more excited.” He flashed a smile. “It wasn’t close at all!”

The vote to unionize passed, 697–435. Cellphone footage from that afternoon shows Watkins, Yates, Corbin and others celebrating in the rain in front of the Blue Bird plant. “We were crying, jumping for joy,” Corbin said. “I was elated,” Holderfield added. “It was like a burden had been lifted off my shoulder. Granted, the fight has just begun.”

He is right. Simply having a union does not improve working conditions. Watkins, Yates, Corbin, Allen and the others are now leaders of their local chapter, and they are working with Perkins to bargain for a new contract.

Similar conversations, debates and votes are occurring in lithium-ion-battery related companies across the South, but their outcomes are far from predetermined. The Blue Bird vote was just one victory for organized labor; a similar campaign at a Mercedes EV plant in Alabama failed in May 2024. Union organizers now eye new massive plants, such as SK Battery’s, as potential targets. “I can’t tell you too much right now,” one organizer remarked. A sly smile crept across his face. “I’ll will say we are in touch with workers at SK.”

Blue Bird Corporation employees. Clockwise from top left: James Holderfield, Dee Thomas, Shawn Clint and Patrick Watkins. (Photos: S. George)

URBAN MINING

Across the globe, great powers jockey to access the critical minerals required for lithium batteries. Meanwhile, many countries—a number of them in the developing world—hope that their minerals will power an economic boom through the next century. But what would result if a linear supply chain that has lithium mined in Chile, refined in China, and built into a battery in France is replaced by a "closed loop" that sees critical minerals recovered from old batteries in the United States and put into new ones there, negating the need for imports or more domestic mining?

End-of-life is a critical issue for the battery sector. Without the ability to recycle them, expired battery cells must be disposed of, likely in landfills, allowing toxins to seep into the environment. This would undercut the technology's impact as a green alternative to hydrocarbons.[17]

An inability to recycle batteries would also lead to greater conflict for access to critical minerals and more mining worldwide, exponentially increasing some of the challenges outlined in this text. Competition would only get fiercer as demand increases and reserves dwindle.

Fortunately, the technology to recycle critical minerals exists and is rapidly scaling up. Consumers of electronic devices may find this surprising given their first-hand experience with diminishing battery quality, whether in a smartphone, computer, or other gadget. But the degradation occurs in the chemical reactions. The critical minerals themselves—the cobalt, the nickel, the lithium—maintain their purity and their value. Enterprising companies are offering proprietary approaches to extracting those minerals from old batteries.

Ascend Elements is one of them, with a facility an hour-and-a-half's drive south of the SK Battery factory in Georgia. Soon it plans to recycle "70,000 electric vehicle batteries per year [in a] process that can recover up to 98 percent of the critical metals used in those batteries".[18]

Ascend Elements battery recycling in Georgia. (Photos: S. George)

Source: Chemistry World.

"You use oil and gas once, and it's gone," Ascend Elements Senior Director Thomas Frey noted. "But with a lithium-ion battery, the metals don't degrade. The materials inside them are infinitely recyclable. You can use the lithium, nickel, and cobalt over and over again."

Inside the Ascend plant, workers covered head to toe in personal protective equipment deconstruct old batteries. "We destroy batteries that are no longer of use," Scott Plickert, the plant's manager, said. "We grind them up. And we recover everything out of the inside rather than send them down a waste stream that ends in a landfill."

The geopolitical and economic implications of recycling are tantalizing for countries such as the United States that currently rely on imports. "It doesn't matter if it's a battery that goes into a cellphone or a vehicle," Plickert noted. "They all have a lot of value. Those were materials that were mined out of the ground, that we had to buy from other entities. We have a lot of stock in the United States. We just need to find a way to recycle it instead of sending it to landfill."

A "closed loop" may be possible someday, but it is not guaranteed. The metals may be valuable, but recycling them is expensive. Companies such as Ascend are racing to be the first to develop extraction technology that is less expensive than mining for more minerals, even if recycling the current battery supply is insufficient to obviate the need for new mining. At best, the "loop" will not close for decades. "Maybe 50 years from now", posited Wolfgang Bernhart of Roland Berger, the consulting firm.

In the meantime, battery proponents are optimistic that the United States can locate and mine domestically the continually increasing amount of needed critical minerals, thereby weaning itself off tenuous global supply chains that involve international rivals.

On conveyer belts in the Ascend plant, old batteries disappear into the teeth of heavy machinery. They likely contain lithium from Chile, cobalt from the DRC and nickel from Indonesia, all of which were likely refined in China. Perhaps they were then shipped, via the port in Dunkirk, to facilities in northern France, where they were placed into the batteries' cells.

Their journey is not over. "This is not the end," Frey said. "It's the start of a new beginning."

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