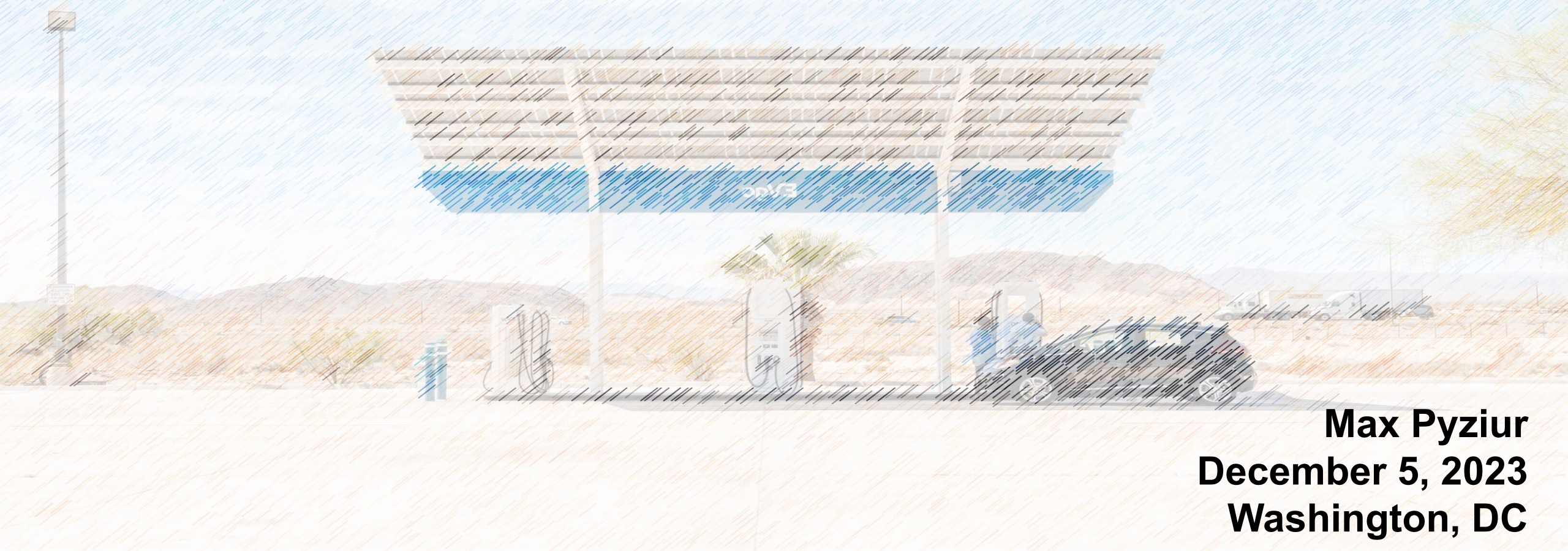


Pathways to Net Zero

Understanding Electrification Challenges

Panel 2: EVs and Electricity Demand Considerations



Max Pyziur
December 5, 2023
Washington, DC

Briefings (with attendant presentations, roundtables, and Congressional hearings):

- ***Biofuel Mandate: Technical Constraints and Cost Risks (November 2015)***
- ***CAFE, Gasoline Prices, and the Law of Diminishing Returns: A New Agenda for the Midterm Evaluation (March 2016)***
- ***Understanding California's High Transportation Fuel Prices (November 2016)***
- ***Octane: Pathway to a Compromise (February 2019)***

ESG: A PRIMER

July 6, 2023

Introduction

In recent years, there has been increasing emphasis on companies' and related entities' environment, social, and governance practices. The basic premise is that investors should evaluate firms based not just on their commercial performance but also on these attributes, hopefully through a system of tractable metrics.

Dubbed "ESG," momentum has been increasing as asset managers and capital providers are increasingly stressing these factors in their investment decisions. Relatedly, public-facing and capital-intensive practitioners, including but not limited to oil, natural gas, and coal concerns, are engaged in some combination of modifying their behaviors and accelerating reporting on their ESG worthiness.

A review of key historical developments and a summary of policy considerations.

While ESG is already causing strong shifts in capital allocations, branding, and credit-claiming, the movement seeks to aggregate a variety of objectives that lack coherent, uniform, and codified analytical and regulatory frameworks.

Furthermore, this lack of uniformity presents significant obstacles to the effectiveness of ESG criteria since currently it is difficult to precisely negotiate between ESG concerns and traditional financial metrics, and the various proposed systems can easily be gamed. Nevertheless, jurisdictions are adopting heterogeneous policies that vary both in terms of ambition and approach. With respect to the "E" (environment) some price carbon dioxide emissions, some subsidize green energy, some do both, but also, many do neither and instead choose other options.

ESG, Net Zero, and Stranded Assets: Origins and Intent

ESG's origins can be traced to a few key predicates. By the mid-1990s, niche investment companies and other groups were offering "socially responsible investment (SRI)" management. One example of SRI priorities was the exclusion of weapons manufacturers from investment vehicles. But in terms of a percentage of AUM (assets under management), these SRIs were tiny.

In the early 2000s, staffers at the United Nations [Environment Programme Finance Initiative \(UNEP FI or The Finance Initiative\)](#) wanted to have the investment goals of large institutional money managers aligned with

its own mission. Specifically, UNEP FI sought ways to show that investments that positively affected biodiversity, human rights abuses, and GHG emissions were beneficial to investors' total returns. Critically, it was also important not to ignore companies' supply chains, labor policies, and environmental practices.

Seeking ways to gain traction, UNEP FI sought ways to demonstrate that considering these factors in investing decisions did not violate financial institutions' fiduciary responsibility. To that end, it commissioned two research works from (1) financial and (2) legal practitioners.

In a definitive report commissioned by UNEP FI and involving twelve large asset management organizations, (including BNP Paribas and ABN AMRO), industry sector analysts held "... that long-term shareholder value rests upon rigorous integration of environmental, social and corporate governance issues in the valuation process." (Some consider that this was the first use of the three words associated with ESG in a UN publication). The report was published in 2004, titled "[The Materiality of Social, Environmental, and Corporate Governance Issues to Equity Pricing](#)."

Furthermore, UNEP FI asked renowned multinational law firm Freshfields Bruckhaus Deringer (FBD) to consider the legal ramifications of utilizing ESG criteria in light of "the modern prudent investor rule." While acknowledging the primary wealth maximization responsibility of investment managers, FBD determined that investment decision-making has latitude to use a wide-range of investment strategies, concluding, "a decision-maker may integrate ESG considerations into an investment decision to give effect to the views of the beneficiaries in relation to matters beyond financial return." FBD's report was published in 2005 with the title "[A Legal Framework for the Integration of Environmental, Social and Governance Issues into Institutional Investment](#)."

Net Zero

Explicit first use of the term "net zero" is difficult to date. However, beginning with the [October 2014 IPCC \(Intergovernmental Panel on Climate Change\) Fifth Assessment Report](#), language such as this was used: "... net anthropogenic additions of CO2 into the atmosphere *have to reach zero*..." In December 2015, Article 4.1 of the Paris Accords stipulated that "...Parties aim to reach global peaking of greenhouse gas emissions as soon as possible ... so as to achieve a *balance between anthropogenic emissions and removals*..." Building on these precedents of the mid-2010s, several countries, including Sweden and

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EV Electricity Requirements and EPA's Challenging Rules



Can the U.S. Power Grid Manage An Immediate Switch to Electric Vehicles?				
			Factor	Formula
A	U.S. Total Miles On-Highway Driven (VMT)	3.2	Trillion	
B	Number of Light Duty Vehicles (LDVs) (90% of VMT)	249.0	Million	
C	Number of Heavy Duty Vehicles (HDVs) (10% of VMT)	13.2	Million	
D	LDVs VMT	2.9	Trillion	90% * A
E	HDVs VMT	0.3	Trillion	10% * A
F	MPG-Equivalent LD Electric Vehicle	100.0	One	
G	MPG-Equivalent HD Electric Vehicle	30.0	One	
H	LDV Fuel – Gasoline KWH/Gallon	35.3		
I	HDV Fuel – Diesel KWH/Gallon	40.3		
J	LDV EV Annual Electricity Requirement	1.015	Trillion KiloWatt Hours	(D + F) * H
K	HDV EV Annual Electricity Requirement	0.4	Trillion KiloWatt Hours	(E + G) * I
L	Total EV Annual Electricity Requirement	1.4	Trillion KiloWatt Hours	J + K
M	U.S. Total Electricity Generation	4.2	Trillion KiloWatt Hours	
N	10 year Annualized Growth Rate	0.4%		
O	Years Required of Growth in Electricity Generation	79.8		$(\ln(L+M) \div M) \div N$
Analysis based on EIA & DOE Data			EPRINC	

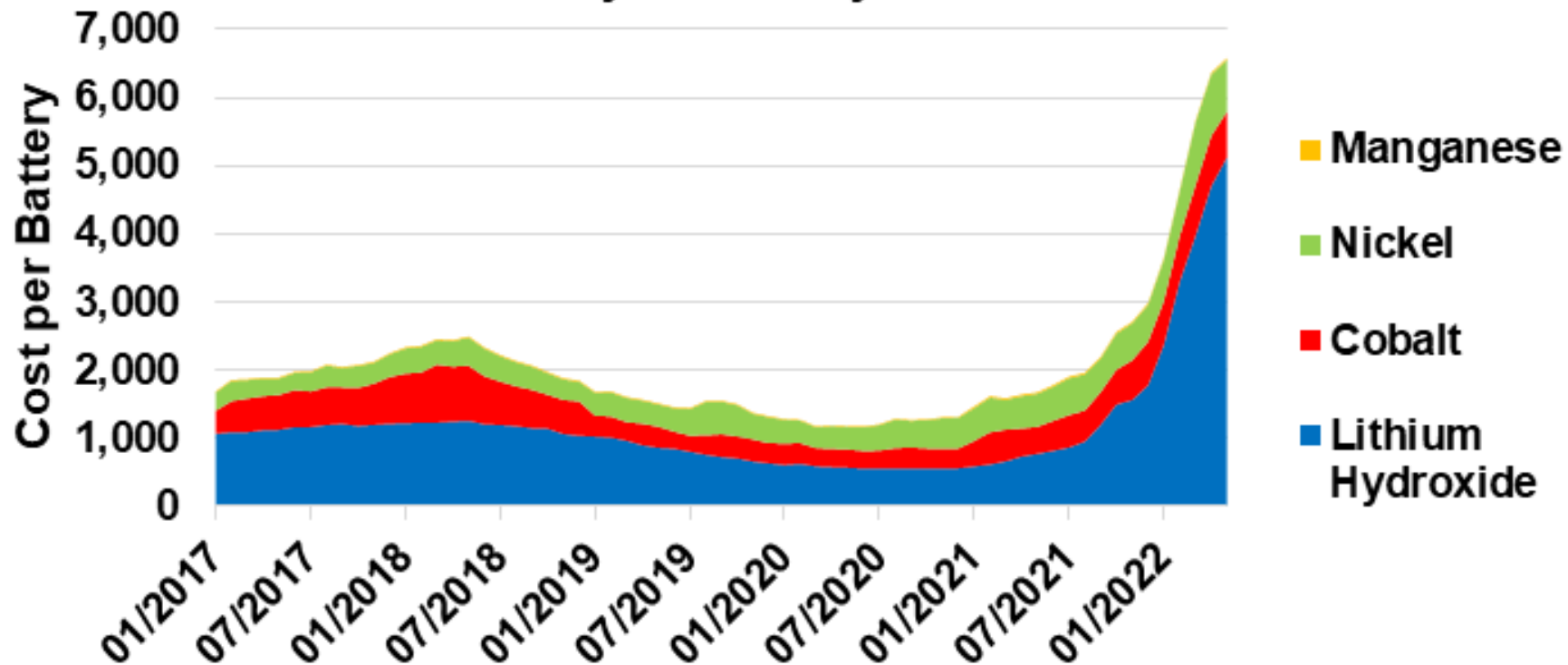
In order to accommodate a full fleet of electric vehicles, the U.S. Grid would need to generate 33%, or 1.4 Trillion KWHs, more of electricity.

U.S. Electricity Generation grew at an annualized 0.4% growth rate during the last ten years.

At that rate, it would require 79.8 years to accommodate a full EV transition of the U.S. fleet.

Implied Tesla Battery Cost Based on Primary Input Spot Prices

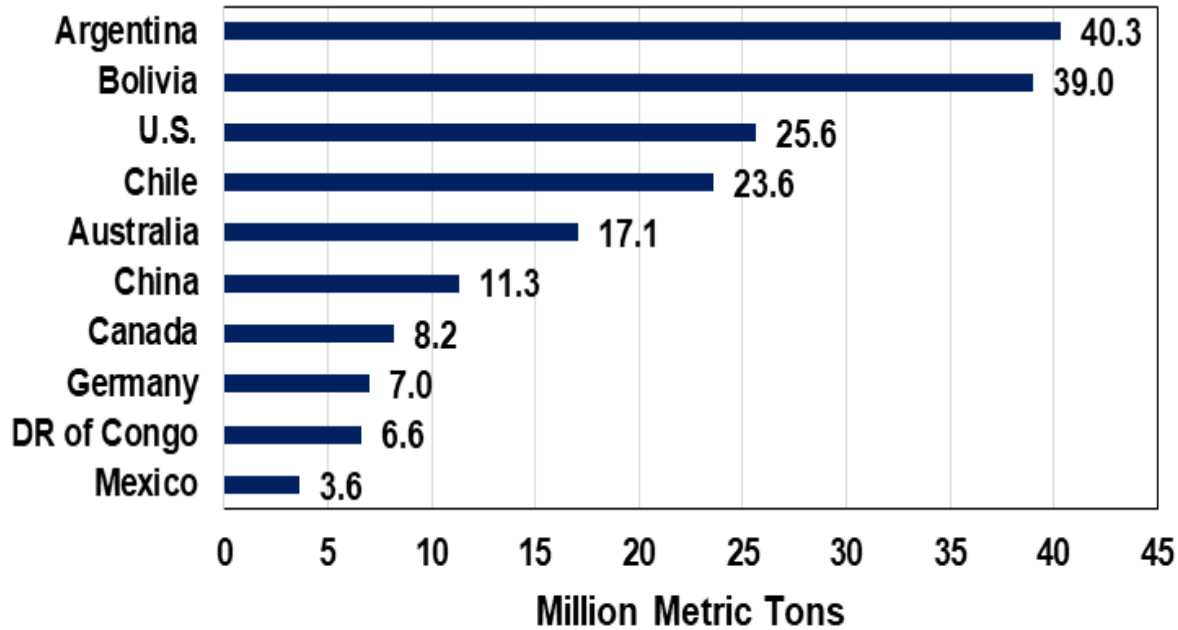
January 2017 - May 2022



Analysis Based on LME Monthly Data

EPRINC

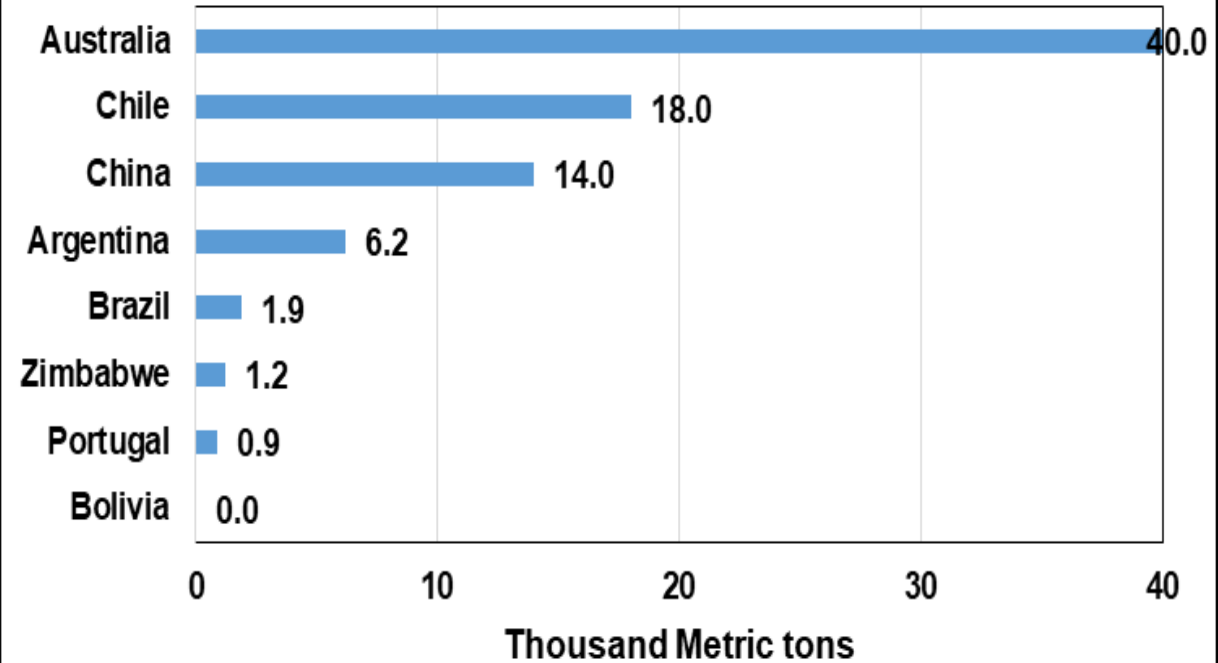
Top Countries by Lithium Reserves/Resources as of Q42020



Analysis Based on S&P Data

@EPRINC_DC

Top Lithium Producing Countries as of Q42020

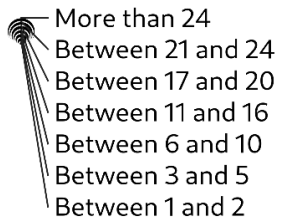


Analysis Based on USGS and Other Data

@EPRINC_DC

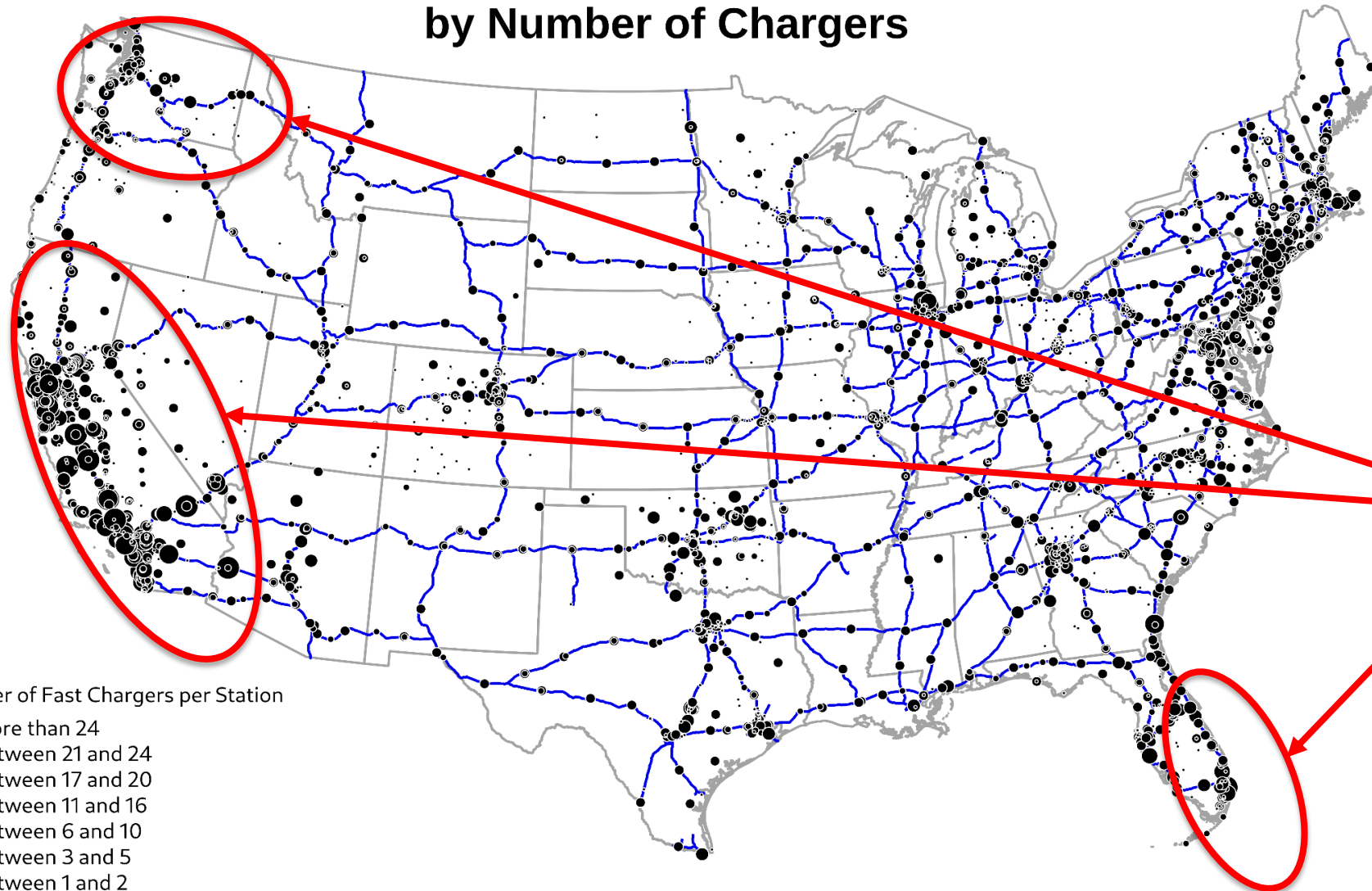
Electric Vehicle Fast Charging Stations by Number of Chargers

Number of Fast Chargers per Station



U.S. Highways

— U.S. Interstates



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Analysis based on Census and DoE/AFDC Data

EV charging infrastructure by number of stations and fast chargers is concentrated in states such as California, Florida, and Washington

Thank you.