

THE MOVING WORLD REPORT 2024


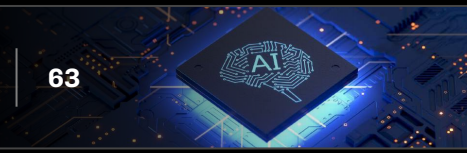
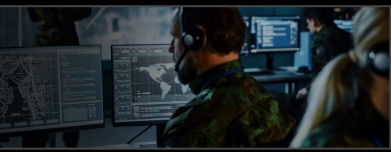





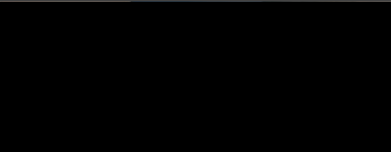

2024 Macro and Micro Trends in Mobility

For more information on UP.Partners, please visit our website at www.up.partners

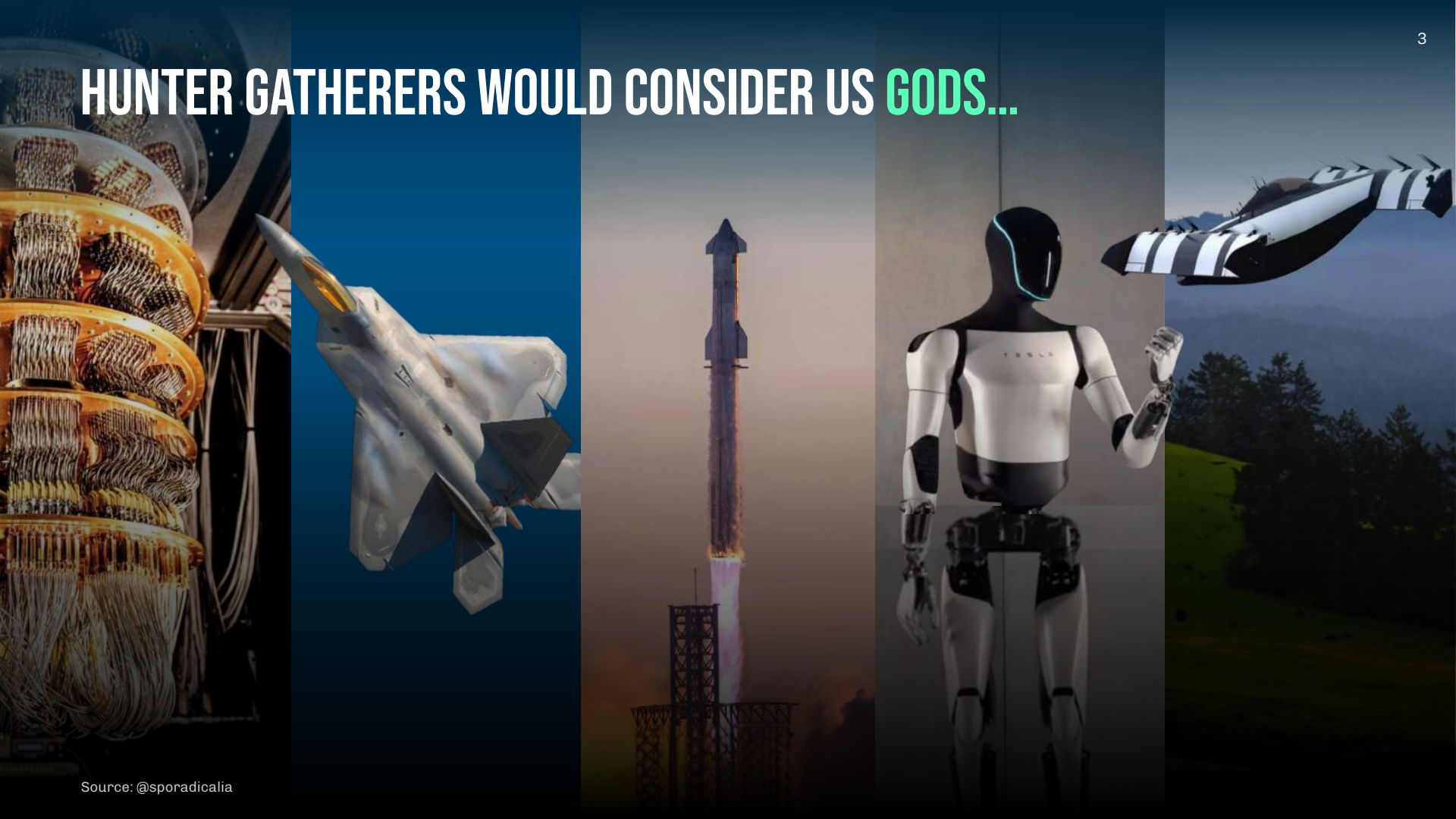
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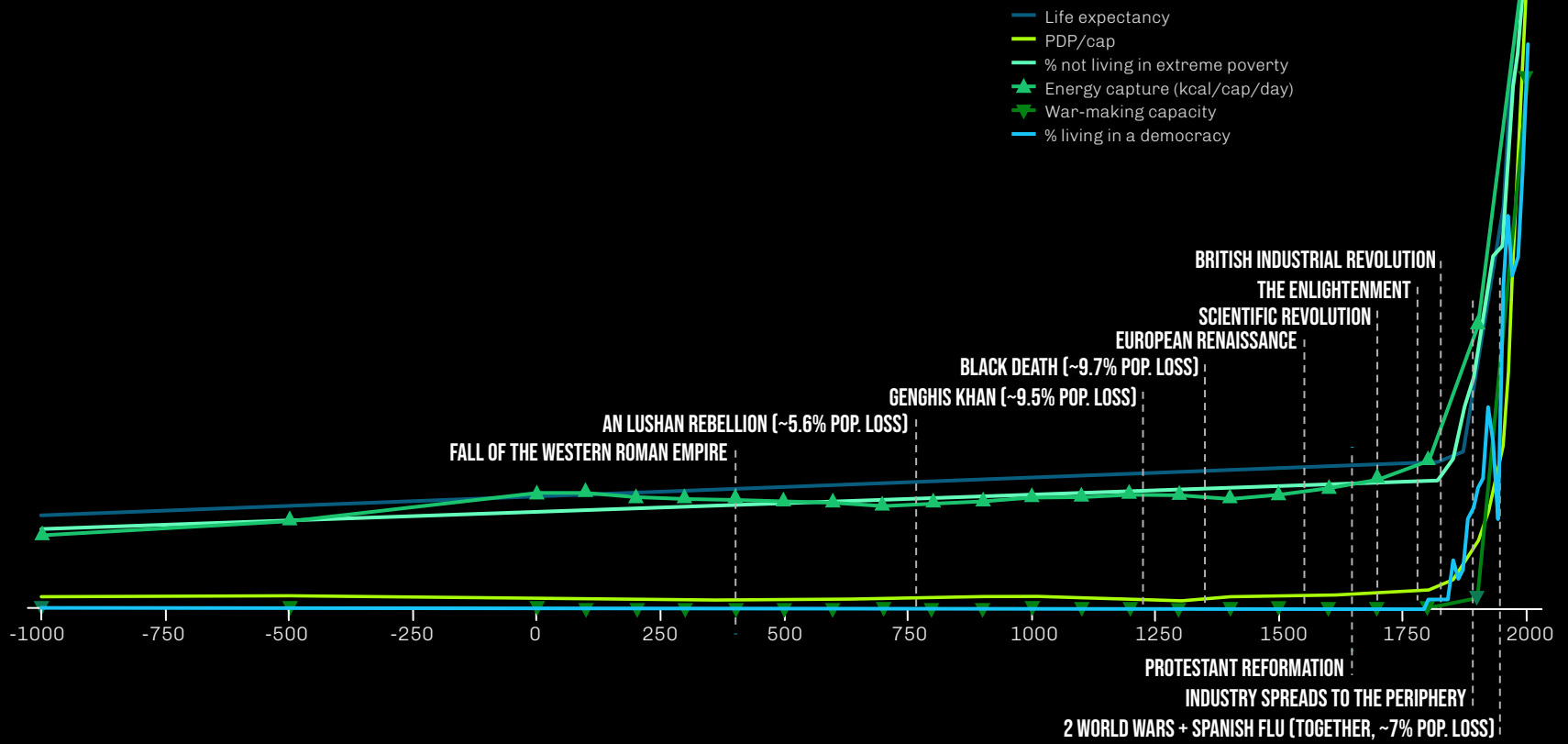


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HUNTER GATHERERS WOULD CONSIDER US GODS...



THINGS ARE RELATIVELY GOOD FOR US HUMANS

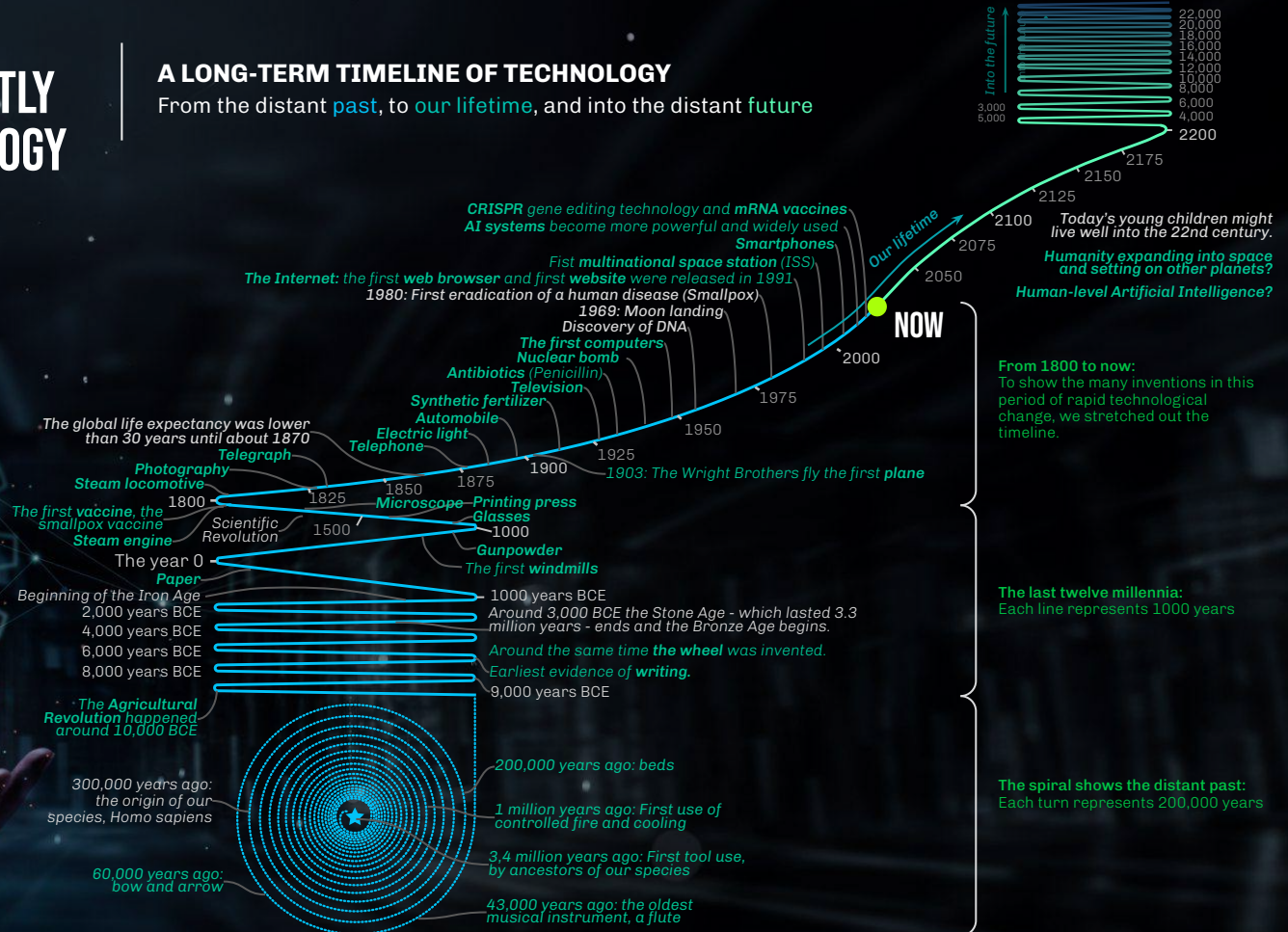


Source: Luke Muehlhauser

AND IT'S ACTUALLY GETTING BETTER MOSTLY BECAUSE OF TECHNOLOGY

A LONG-TERM TIMELINE OF TECHNOLOGY

From the distant past, to our lifetime, and into the distant future



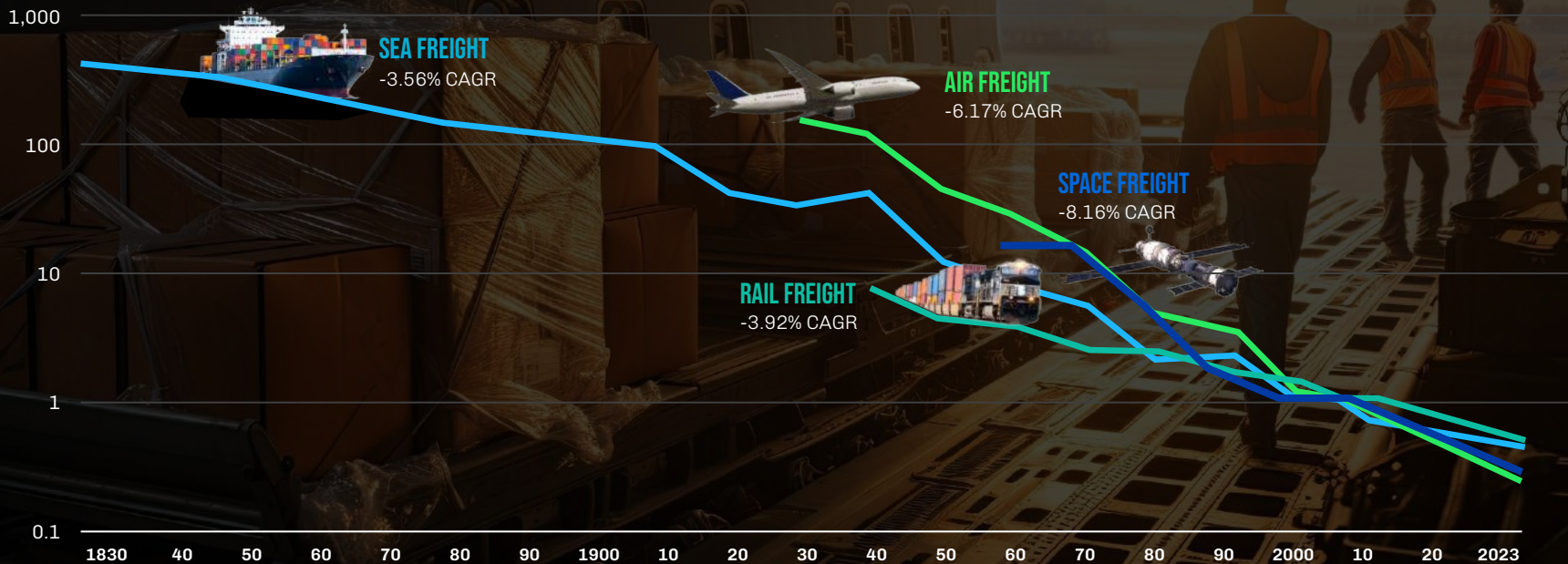
TECHNOLOGY HAS GIVEN
US MOBILITY SOLUTIONS
THAT OUR **ANCESTORS**
ONLY DREAMED OF



WE'RE DOING A HECK OF JOB OF DEMOCRATIZING THE COST OF MOBILITY

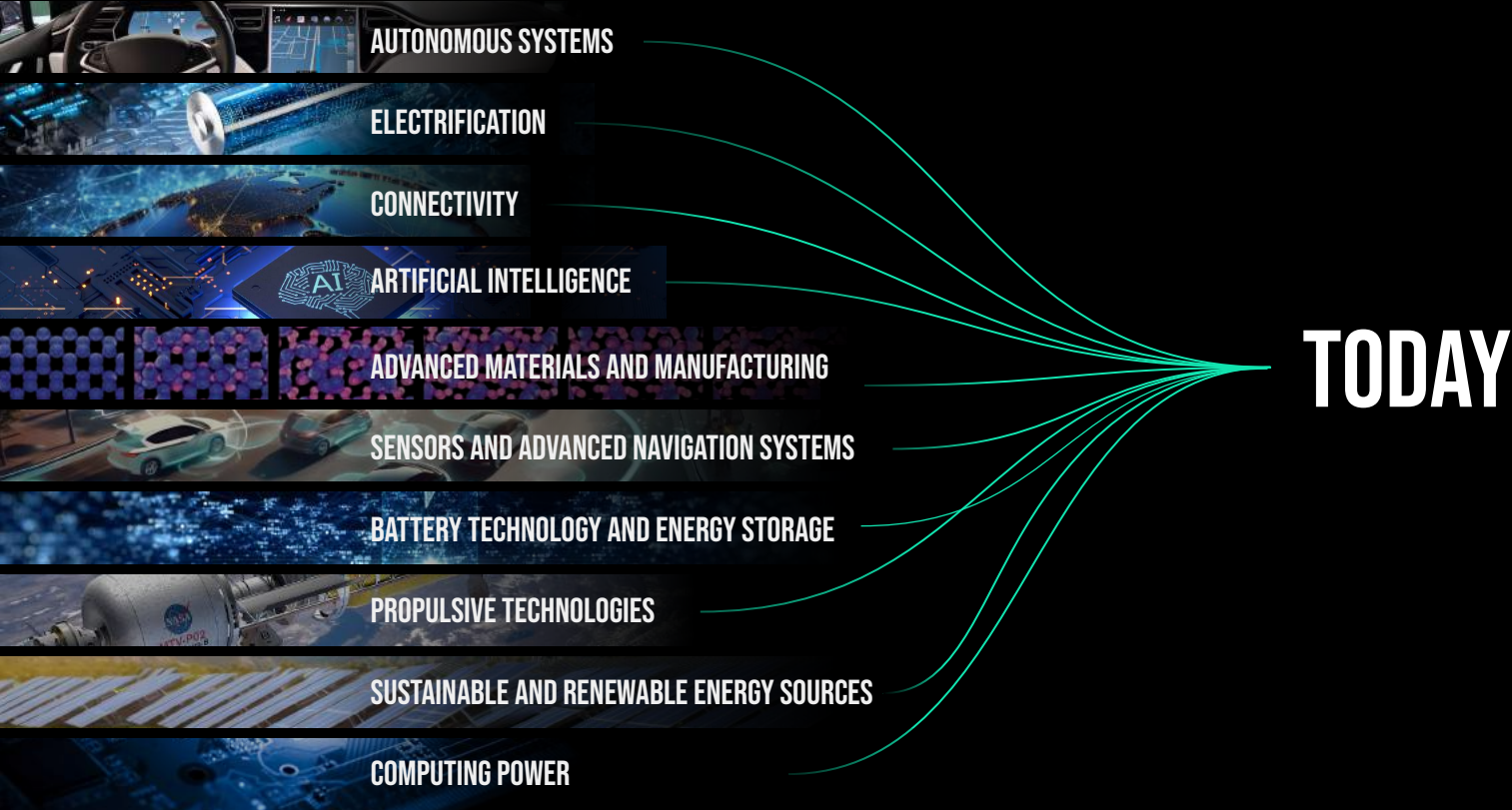
DEVELOPMENT OF TRANSPORT COSTS AT REAL RATES

Cost in 2005 indexed to 1

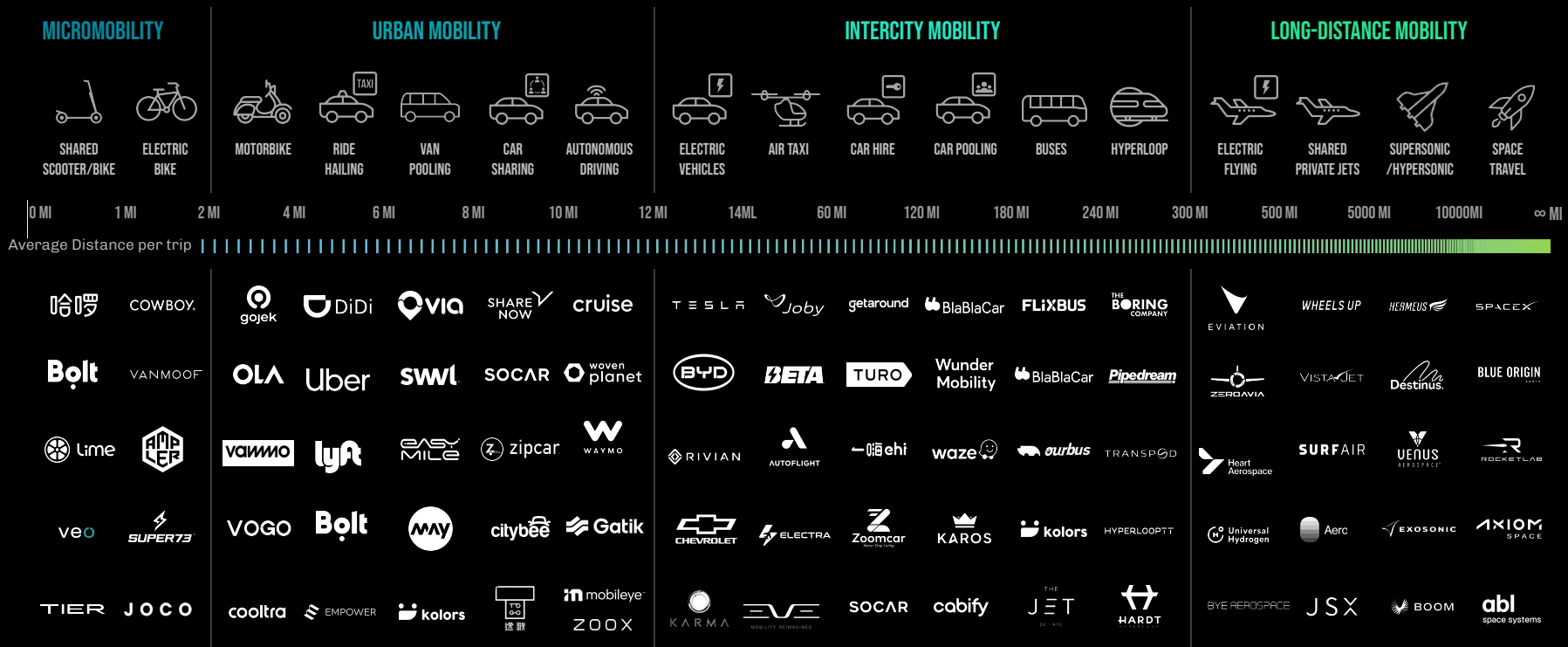


Source: UP.Partners analysis including data from McKinsey and the Center for Strategic and International Studies

PROGRESS IS ACCELERATING DUE TO THESE CONVERGING EXPONENTIAL TECHNOLOGIES



AS A RESULT – MOBILITY IS CHANGING EVERYTHING, EVERYWHERE, ALL AT ONCE



Source: UP.Partners analysis based on original mapping from Lufthansa Innovation Hub's TNMT.com



THE MOVING
WORLD REPORT 2024

CHANGING WORLD ORDER



“In 1945, we began a new world order. There’s always some kind of conflict at the beginning, and the system changes. New folks are in charge, and they set the rules.”

- Ray Dalio

THE SINGLE **LARGEST**
CUSTOMER OF MOBILITY
RELATED TECHNOLOGIES IS THE
U.S. DEPARTMENT OF DEFENSE



LET US REMEMBER HOW THE DOD HAS CATALYZED SOME OF OUR MOST PRIZED INVENTIONS/INVENTORS

HYDRAULIC BRAKES



Malcolm Lockheed invented hydraulic brakes, revolutionizing braking systems.

RADAR AND ANTI-RADAR

Developed during WWII, this technology enabled countries to identify and track enemy aircraft and missiles.

SILICON VALLEY



Frederick Terman ran radio research for the DOD, then became the "Father of Silicon Valley."

POLAROID



Edwin Land developed the spy cameras for the U2 and was the personal hero of Steve Jobs.

MICROWAVE OVEN



Percy Spencer, a Raytheon engineer, accidentally discovered microwave heating in 1945, leading to the invention of the microwave oven.

APPLE



Steve Wozniak's father moved to Silicon Valley to work for Lockheed.

DIGITAL PHOTOGRAPHY

NASA and defense agency research greatly advanced space reconnaissance technology.

THE INTERNET



The ARPANET project, backed by the US Department of Defense to link research institutions, evolved into today's internet.

GPS TECHNOLOGY

GPS technology created to track Soviet submarines.

3D GRAPHIC BOARDS

Lockheed's partnership with Sega (Real3D) led to the development of graphic boards for 3D rendering, significantly impacting modern design in multiple industries.

THANK YOU UNCLE SAM FOR MY **IPHONE**

FIRST GENERATION IPOD (2001)



DRAM CACHE
DARPA

MICROPROCESSOR
DARPA

MICRO HARD DRIVE
DoE/DARPA

LITHIUM-ION BATTERIES
DoE

LIQUID-CRYSTAL DISPLAY
NIH, NSF, DoD

CLICK-WHEEL
RRE, CERN,

SIGNAL COMPRESSION
Army Research Office

IPHONE (2007)

CELLULAR TECHNOLOGY
US Military

MULTI-TOUCH SCREEN
DoE, CIA/NSF DoD

NAVSTAR-GPS
DoE, NAVY

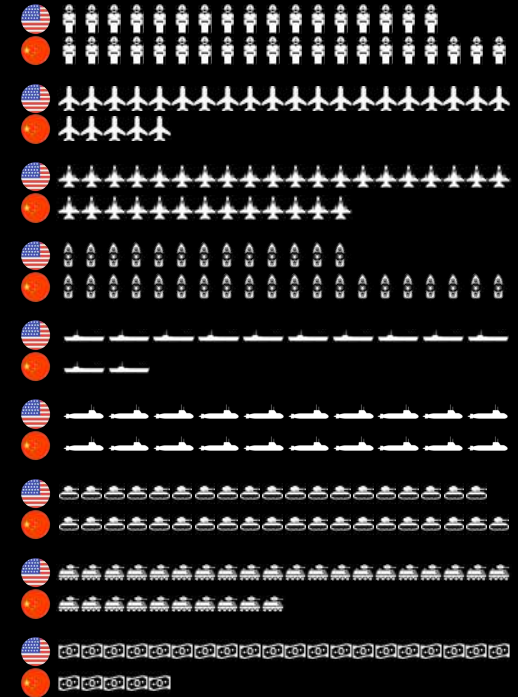
HTTP/HTML
CERN

SIRI
DARPA



WORLD'S 2ND LARGEST MILITARY IS THE CHINESE PEOPLE'S LIBERATION ARMY

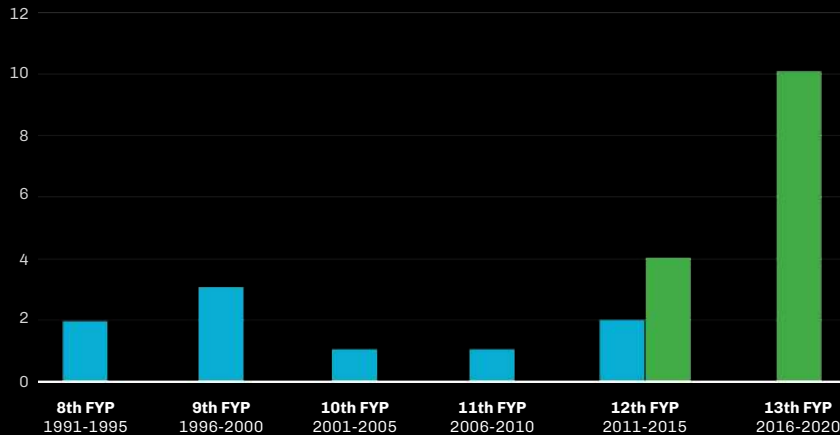
MILITARY ASPECT	 UNITED STATES	 CHINA
Military Personnel (Active & Reserve)	2,217,500	2,545,000 
Total Aircraft Strength	13,209 	3,304
Fighter Aircraft	1,854 	1,207
Fleet Strength	472	730 
Aircraft Carriers	11 	2
Submarines	64 	61
Tanks	4,657	5,000 
Armored Vehicles	360,069 	174,300
Defense Budget	\$831,781,000,000	\$227,000,000,000



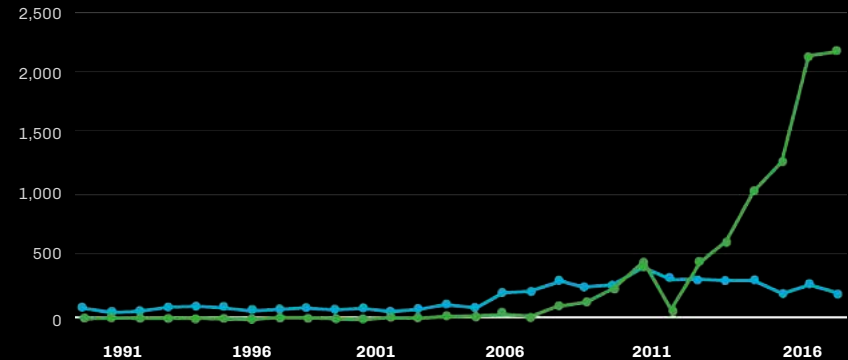
CHINESE MILITARY CIVIL FUSION (MCF) NATIONAL POLICY IS **WORKING** — FAST

MCF can be defined as a strategy that strives to reinforce the PRC's ability to build the country into an economic, technological, and military superpower by fusing the country's military and civilian industrial and science and technology resources.

Occurrence of MCF and CMI in Five Year Plan's (FYP) Documents















































Occurrence of MCF and CMI in Academic Publications



● Civil-Military Integration ● Military-Civilian Fusion

ACCORDING TO ASPI, CHINA'S GLOBAL LEAD EXTENDS TO 37 OUT OF 44 CRITICAL TECHNOLOGIES!

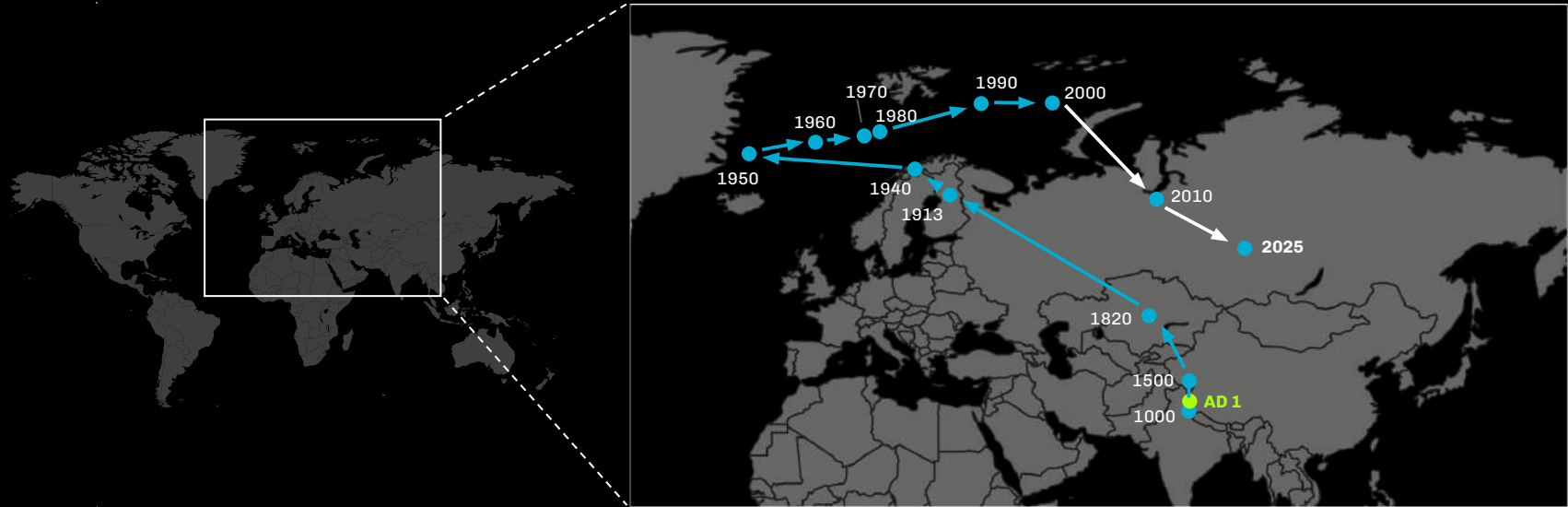
Artificial intelligence, computing, and communications	Advanced material and manufacturing	Energy and environment	Defense, space, robotics, and transportation
 High Performance Computing	 Nanoscale materials	 Hydrogen and ammonia	 CubeSats
 Circuit design	 Coatings	 Supercapacitors	 Space launch
 Natural Language Processing	 Smart materials	 Electric batteries	 Hypersonics
 Advanced RF communication	 Advanced composites	 Photovoltaics	 Drone swarming
 Advanced optical communication	 Novel metamaterials	 Nuclear waste management	 Advanced robotics
 AI	 High-specification machining	 Directed energy	 Autonomy
 Blockchain	 Advanced explosives	 Biofuels	Quantum
 Advanced data analytics	 Critical minerals extraction	 Nuclear energy	 Quantum computing
 Machine learning	 Superconductors	Biotechnology, gene technology, and vaccines	 Post-quantum cryptography
 Cybersecurity	 Advanced protection	 Vaccines	 Quantum communications
Sensing, timing, and navigation	 Chemical synthesis	 Biological manufacturing	 Quantum sensors
 Photonic sensors	 Additive manufacturing	 Synthetic biology	

THIS IS EMPIRE BUILDING. AGAIN.



BY FAR THE **MOST RAPID SHIFT** IN THE WORLD'S ECONOMIC CENTER OF GRAVITY HAPPENED IN 2000-10, REVERSING PREVIOUS DECADES OF DEVELOPMENT

Evolution of the earth's economic center of gravity¹
AD 1 to 2025



¹ Economic center of gravity is calculated by weighting locations by GDP in three dimensions and projects to the nearest point on the earth's surface. The surface projection of the center of gravity shifts north over the course of the century, reflecting the fact that in three-dimensional space America and Asia are not only "next" to each other, but also "across" from each other. Source: McKinsey Global Institute analysis using data from Angus Maddison; University of Groningen

THE WEST HAS A LONG TAIL, STRUCTURAL, EDUCATIONAL CHALLENGE

Do you know what most kids' dream job is today?



is social media influencer



is professional gamer



is YouTuber



Palmer Luckey @PalmerLuckey



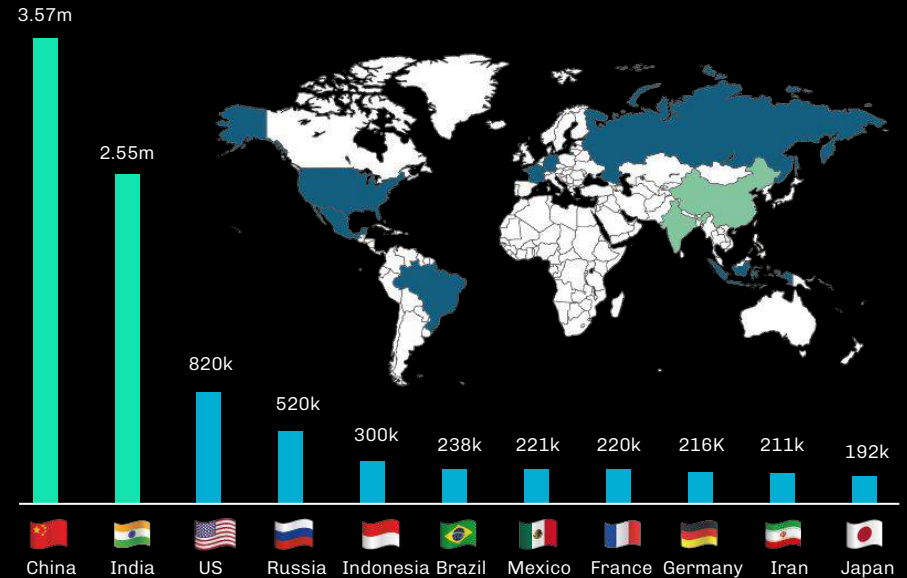
You can't tell kids to follow their dreams when their dreams suck.



Do you know what it was in 1971?

Astronaut 🚀🌙

Top countries by number of STEM Graduates
Graduates is Science, Technology, Engineering and Mathematics in 2020



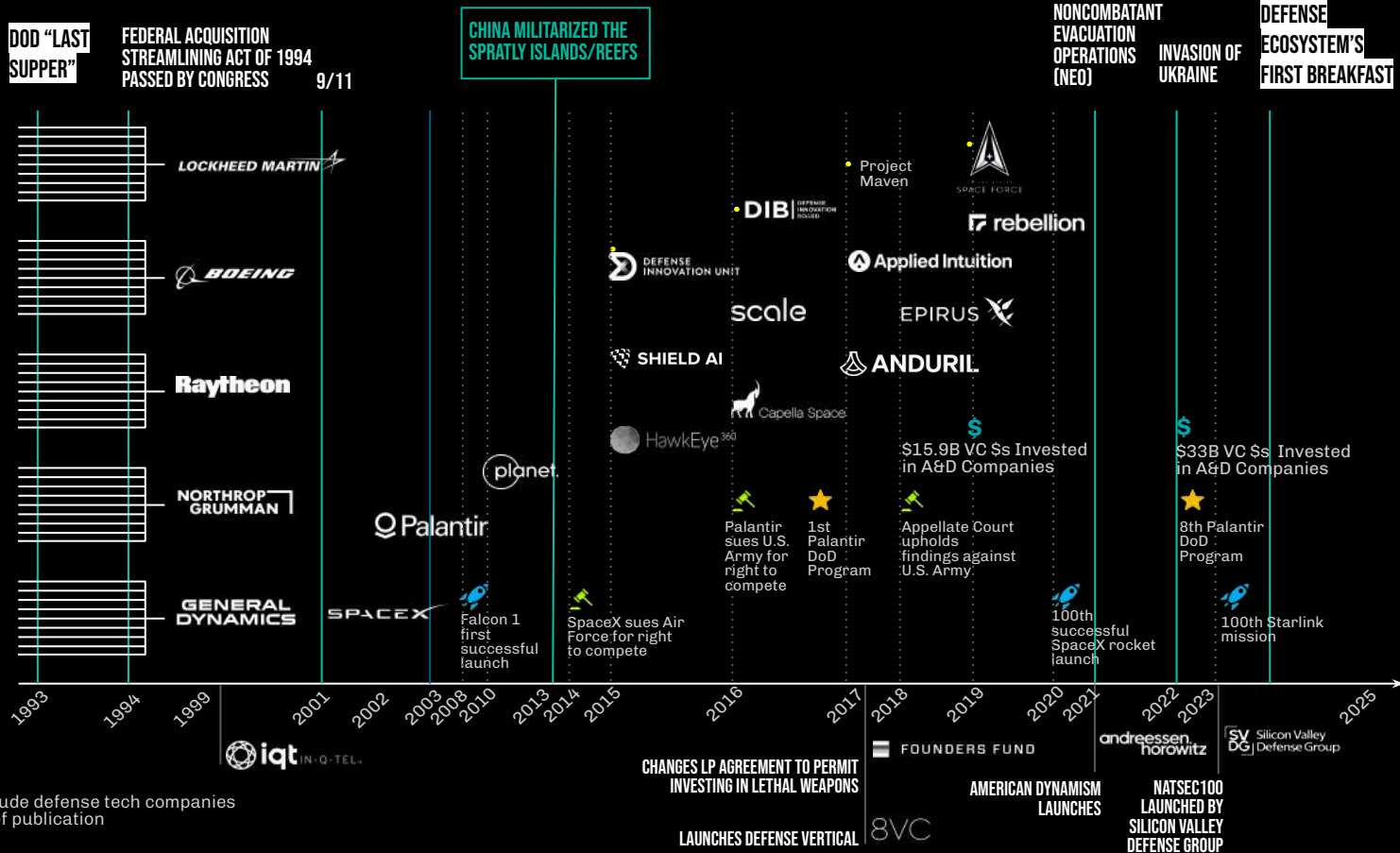
MEANWHILE, 2 BILLION PEOPLE IN 64 COUNTRIES REPRESENTING 40% OF GLOBAL GDP WILL HAVE NATIONAL ELECTIONS IN 2024

The results of these elections will have an impact on the future of mobility (Net zero? War? Repealing of IRA? Nuclear? Etc.)



FROM 51 DEFENSE COMPANIES, TO 5, TO A RESURGENCE OF NEW NAMES

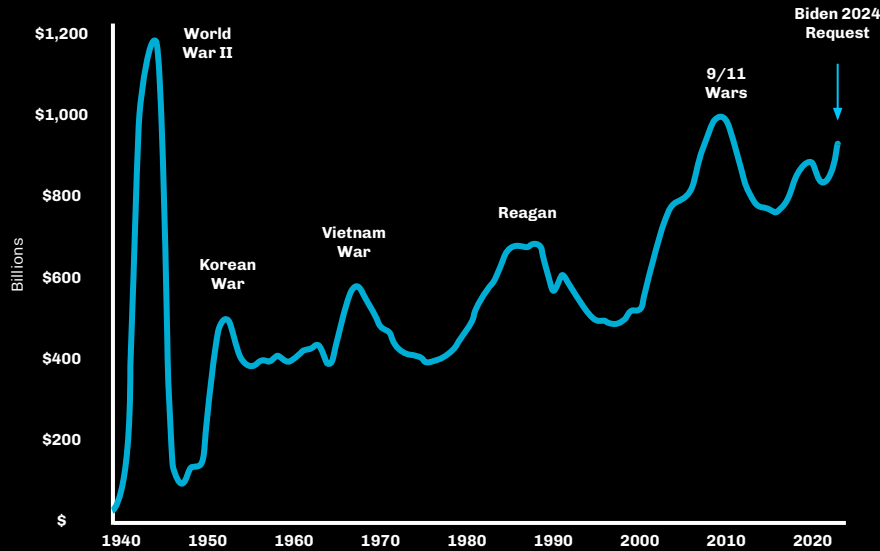
"The Last Supper" refers to a pivotal 1993 meeting held by then-U.S. Secretary of Defense Aspin and Deputy Secretary Perry with leaders of major defense contractors. This event marked a significant moment in the consolidation of the defense industry. 51 companies consolidated into 5.



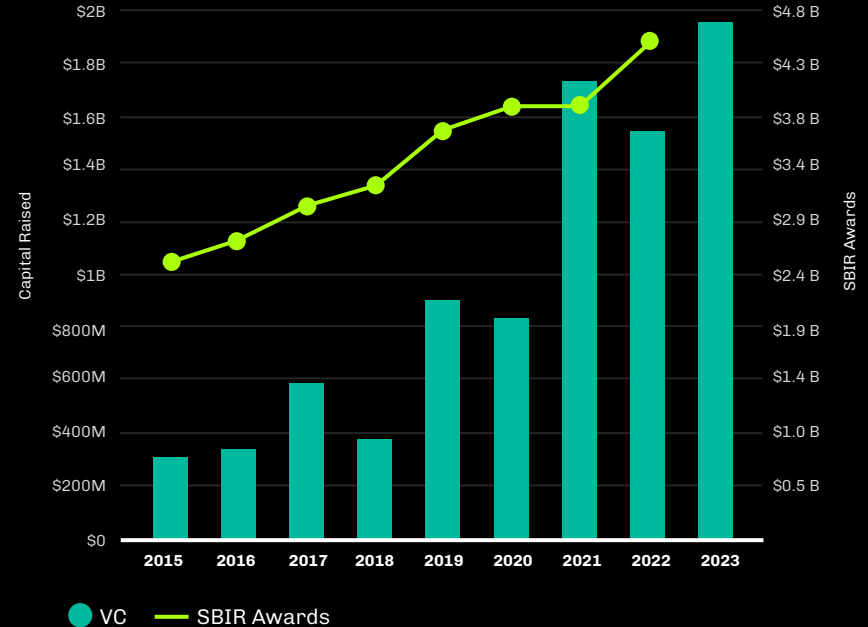
1- Logos included above only include defense tech companies with a ≥1B valuation at the time of publication

DOD BUDGET RISES WITH CONFLICT → ATTRACTS VC INVESTMENT

U.S Military Spending Is Approaching \$1 Trillion



VC Investment into Defense Rises in Lockstep with SBIR Awards



DEFENSE TECHNOLOGY IS GETTING VC ATTENTION

A shift from the deployment of purely “patriotic capital” to the deployment of “momentum capital.”

HIVE MIND SWARMING

Last year at Defense Ventures Summit there were <200 attendees. This year there were 700 and the event was oversubscribed. There were 100+ VC firms in attendance investing in defense.



announced that it's raising an additional \$400-500M, less than a year after its \$1.5B Series E at a \$8.5B post-money valuation



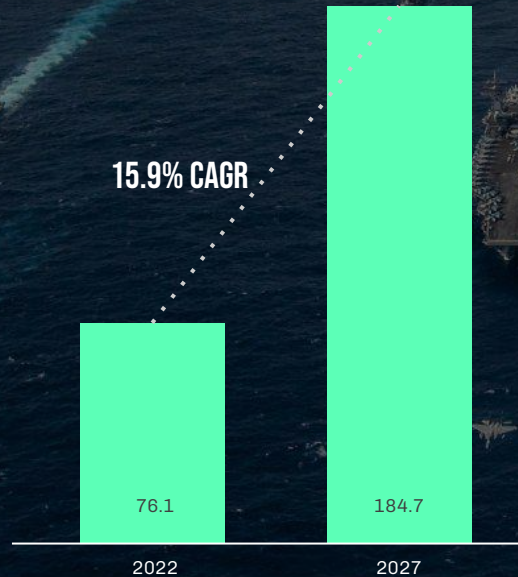
announced an incremental \$300M raise to its Series F, reaching a \$2.7B valuation



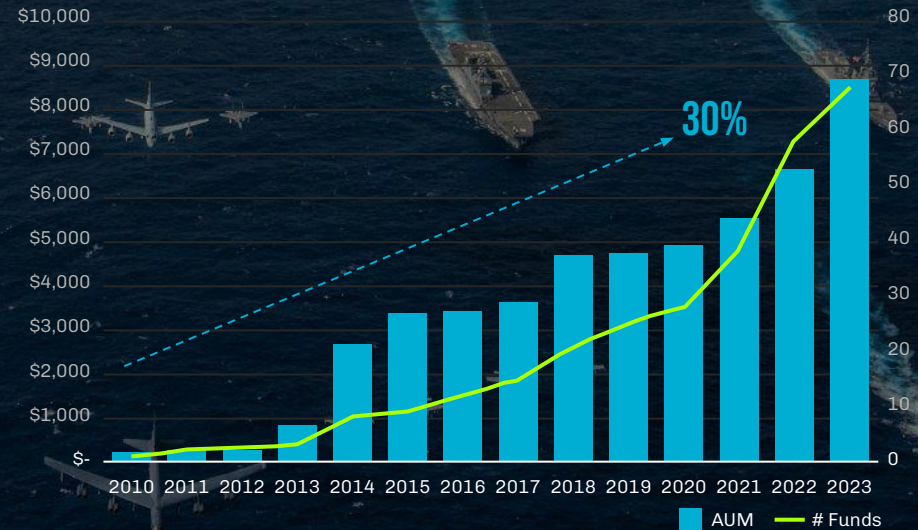
announced a \$79M raise at a \$335M valuation, just four months after its \$5.7M seed round

MARKET SIZE AND NUMBER OF VCS FOCUSED ON DEFENSE SECTOR ARE **GROWING** RAPIDLY

Defense Tech Market Size Estimate (\$B)



The number of VC funds investing in Defense Tech is growing faster than the Defense Tech market itself



PUBLIC SENTIMENT FOR DEFENSE TECHNOLOGY HAS FLIPPED

The younger generation is energized and enthusiastic about defense technology

FROM:

Googlers protesting and signing petition to shut down Project Maven (2018)

Sign this letter

Dear Sundar,

We believe that Google should not be in the business of war. Therefore we ask that Project Maven be cancelled, and that Google draft, publicize and enforce a clear policy stating that neither Google nor its contractors will ever build warfare technology.

TO:

34%

of US tech workers more likely than last year to apply skills to military project (2023)





THE MOVING
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SPACE



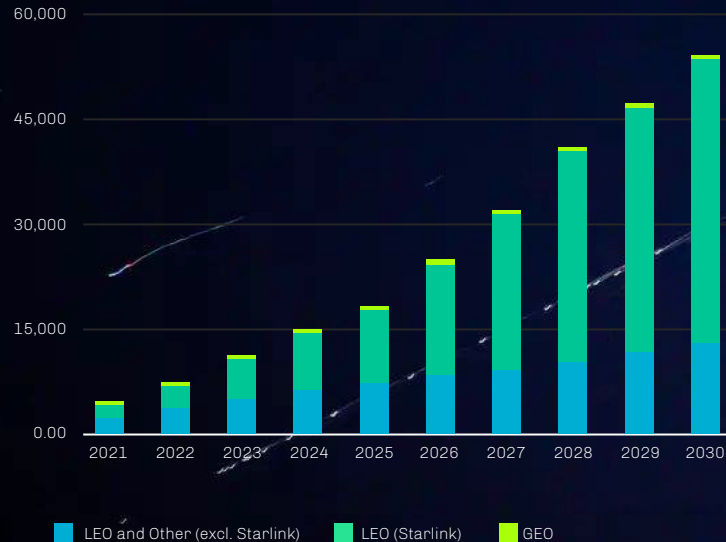
“It doesn’t matter what country or what political system you are from. Space brings you together.”

- Valentina Tereshkova, Soviet Cosmonaut and Youngest Woman in Space

CONSTELLATIONS, UP 10X IN 4 YEARS — DOLLARS SPENT, UP 3X IN 10 YEARS

Projected total number of satellites in orbit

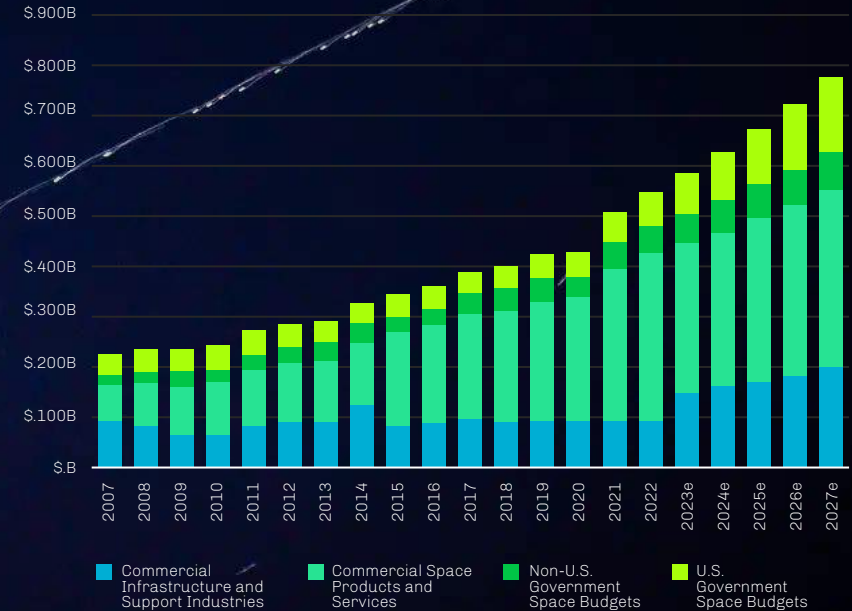
Projected number of satellites in GEO and non-GEO orbits, 2021-2030. Increasing rate of launch will lead to increased congestion, especially in LEO.



GEO: Geostationary Satellites
LEO: Low Earth Orbit

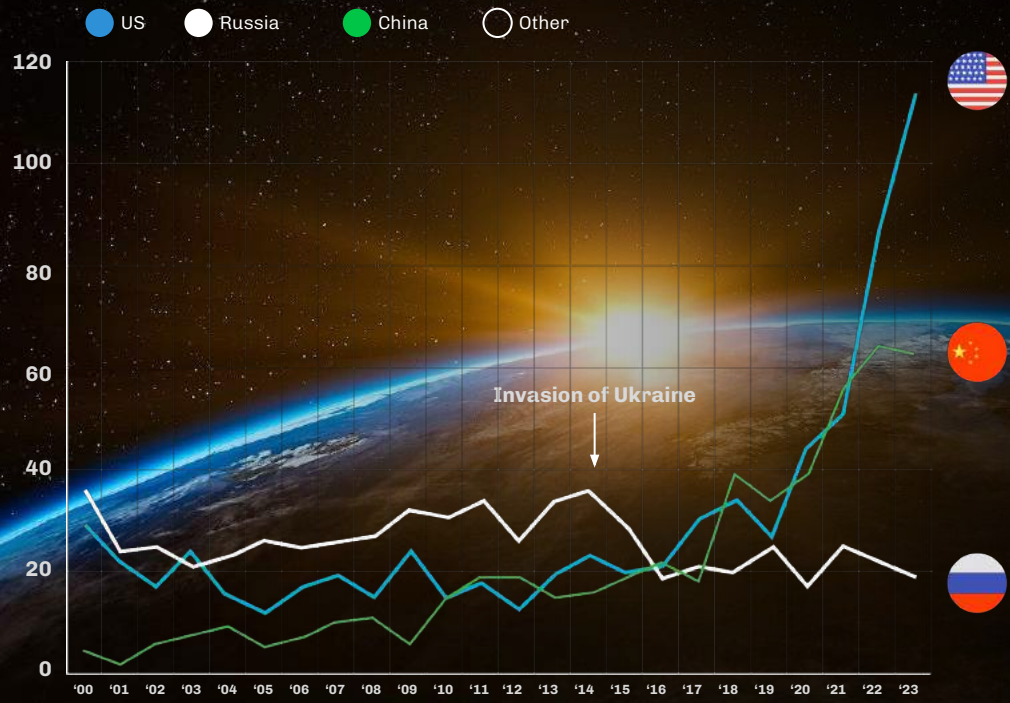
Source: AXA, XL, NSR. Spacenews graphic by Robin McDowall

Global space activity by category, 2007-2027



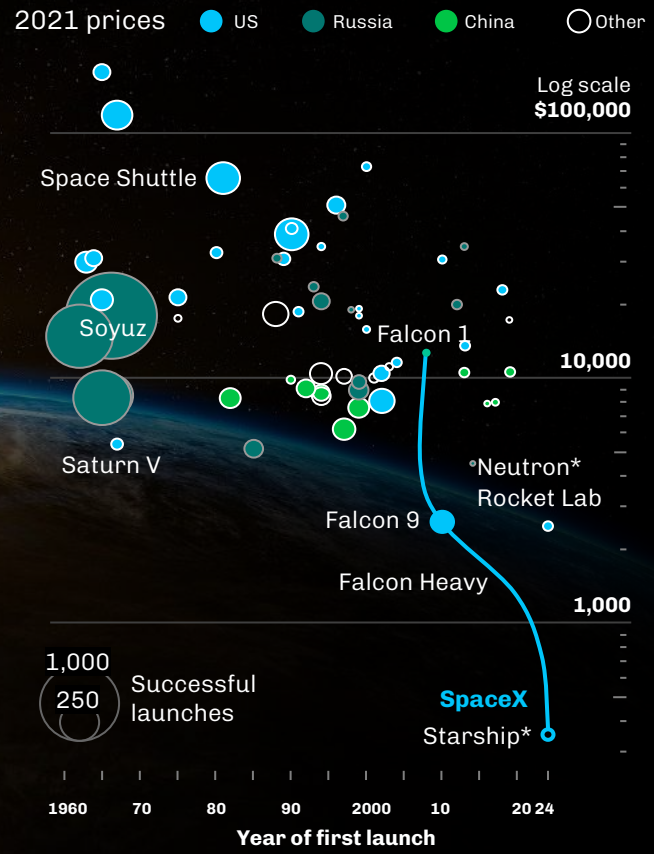
Source: The Space Foundation

ORBITAL LAUNCH ATTEMPTS 2000-2023



Source: RussianSpaceWeb

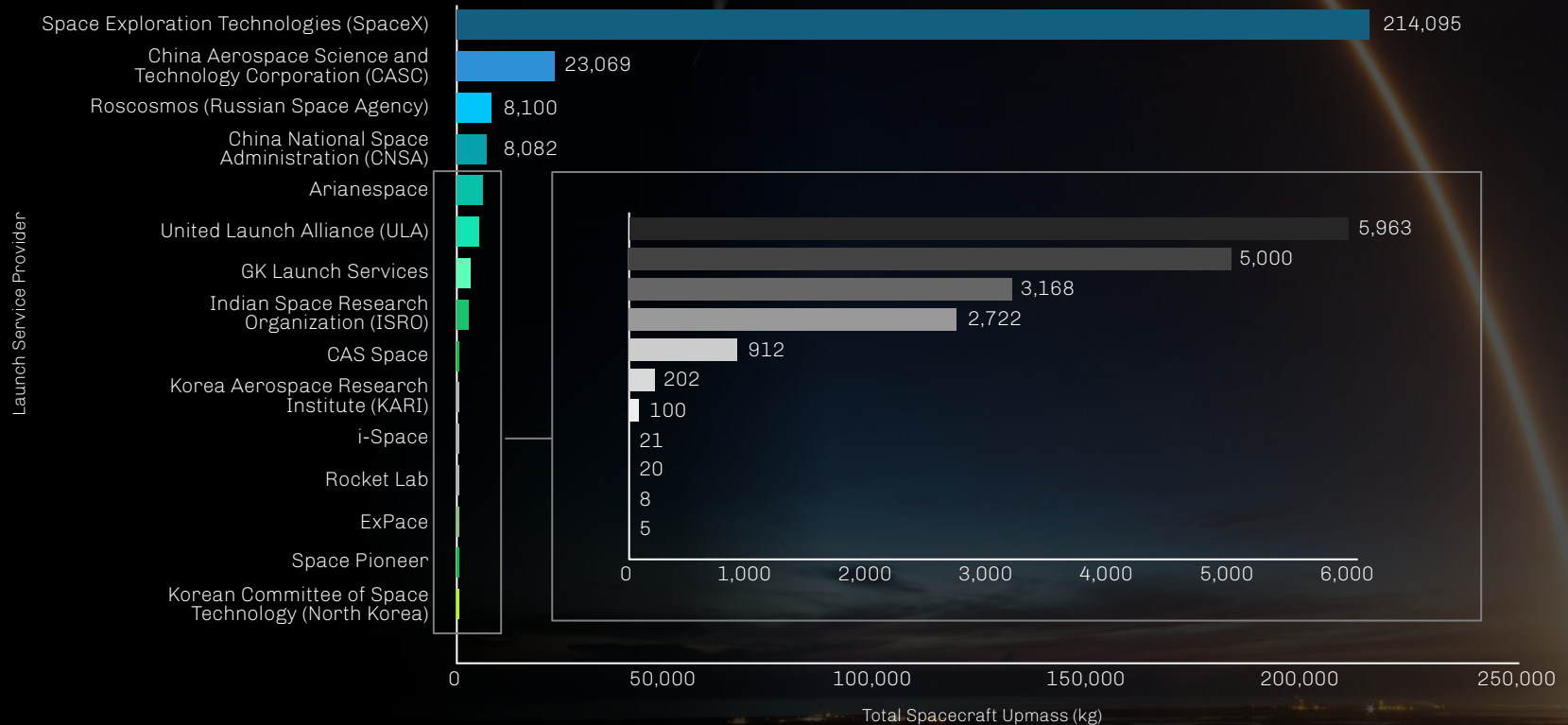
COST TO LOW-EARTH ORBIT PER KG



Source: The Economist estimates

SPACECRAFT UPMASS CARRIED BY LAUNCH PROVIDER

SpaceX launched about 214,095kg of spacecraft upmass in Q2 of 2023, followed by CASC with about 23,069 kg



Source: UP.Partners research and Bryce Tech. Includes estimates of spacecraft mass when not publicly disclosed.

CHINA IS GOING ALL IN ON SPACE

Elon Musk replied



Chris Hadfield  @Cmdr_Hadfield

"By 2030, the Chinese people will definitely be able to set foot on the Moon. That's not a problem," Wu, chief designer of the lunar exploration program, said.

Read: <https://shorturl.at/kmwPV>



Elon Musk  @elonmusk

The China space program is far more advanced than most people realize



CHINA IS LANDING REUSABLE ROCKETS

THE CHINESE COMPETITORS — THERE ARE MANY OF THEM!



SPACE PIONEER



DEEP BLUE



ISPACE



CAS SPACE



ORIENSACE



GALACTIC ENERGY

NON-CHINESE COMPETITIVE LANDSCAPE

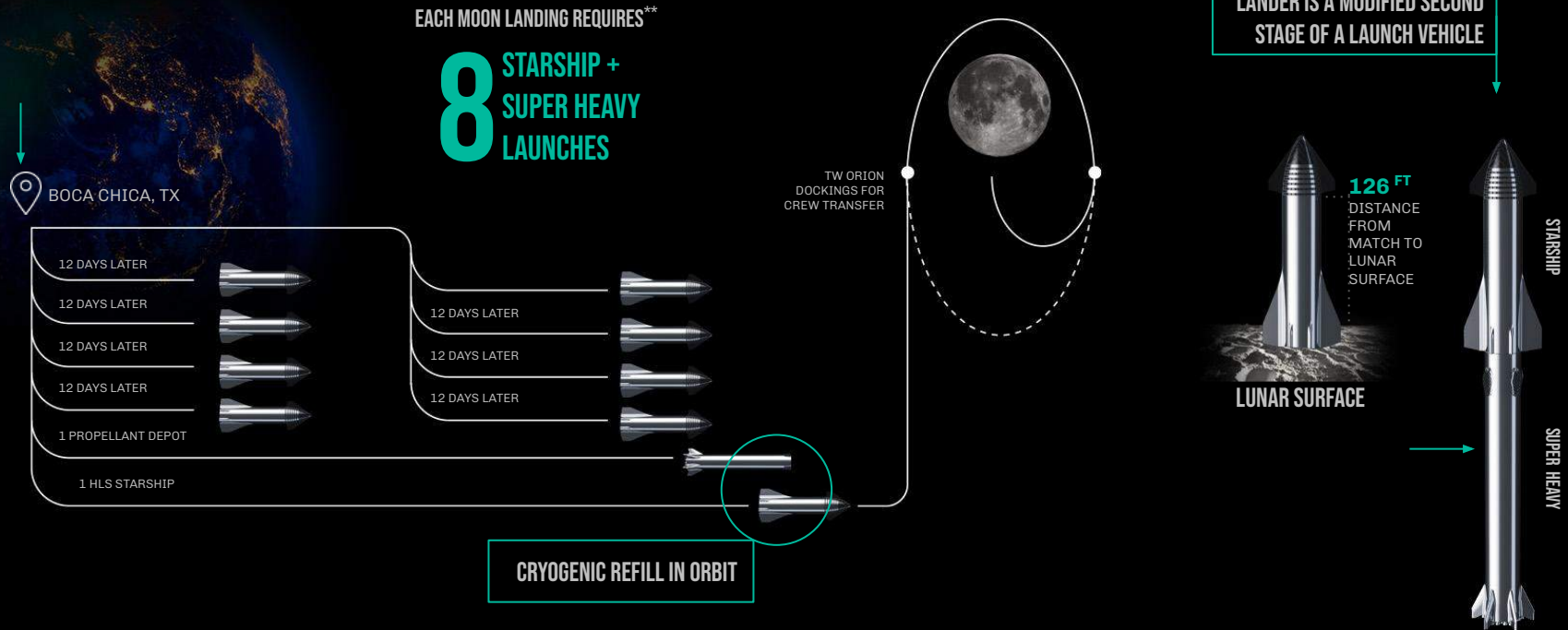
	NEW SPACE								OL' RELIABLES						
	ASTRA	ROCKET LAB	BLUE ORIGIN	FIREFLY	RELATIVITY	SPINLAUNCH	ABL	STOKE	SPACE X STARSHIP	NORTHROP MINOTAUR	ESA VEGA	ULA ATLAS V	SPACE X FALCON 9	SPACE X TRANSPORTER	ULA VULCAN
YEAR FOUNDED	2016	2006	2000	2017	2015	2014	2017	2019	2002	2000	2012	2002	2010	2021	2024
ORBIT	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO	LEO/GTO
\$/KG	\$13,167	\$16,333	-	\$15,000	\$8,113	\$5,000	\$8,889	\$250	\$100	\$30,500	\$25,517	\$8,100	\$2,700	\$6,000	\$4,044
SUCCESSFUL ORBITAL FLIGHTS	2	36	24	0	1	0	0	0	0	19	20	99	282	9	1
FUNDING	Public	Public	~\$1b/year	\$226m	\$1.33b	\$179m	\$481m	\$175m	\$9.4b	Public	Public	JV	\$9.4b	\$9.4b	JV



*Roughly scaled proportional to height. Proportionate to illustrations, SpaceX Starship still significantly larger than how it is represented vs other products, due to formatting.

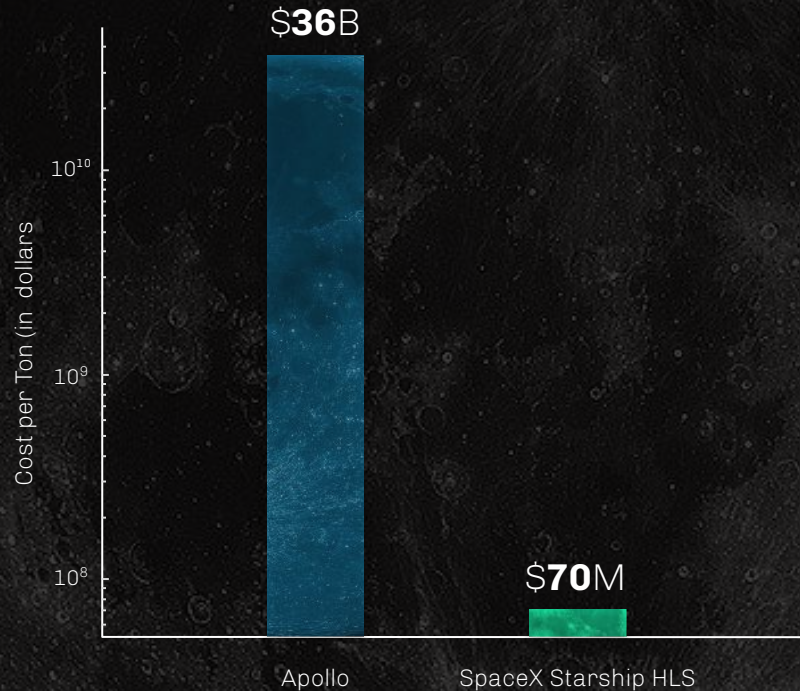
Source: UP.Partners research

NASA ARTEMIS MISSION IS PRETTY DARN **COMPLEX** TO GET TO THE MOON AND BACK, AGAIN

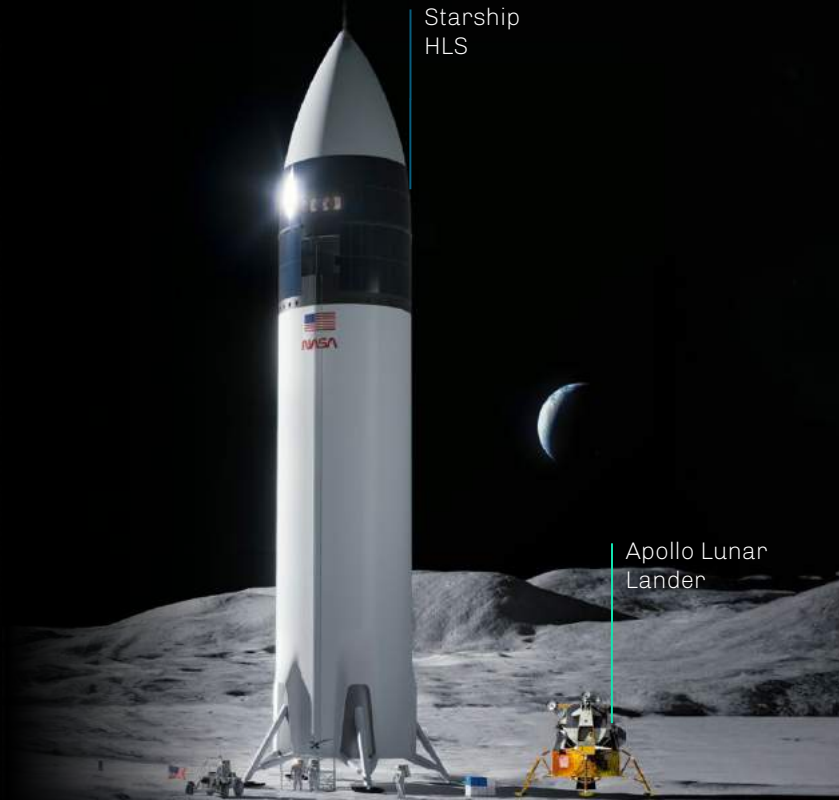


ASSUMING THIS WORKS, APOLLO = ~\$36B/TON TO THE MOON VS. SPACEX = ~\$70M/TON TO THE MOON

Cost per ton of payload to the moon: Apollo vs. Space X starship HLS

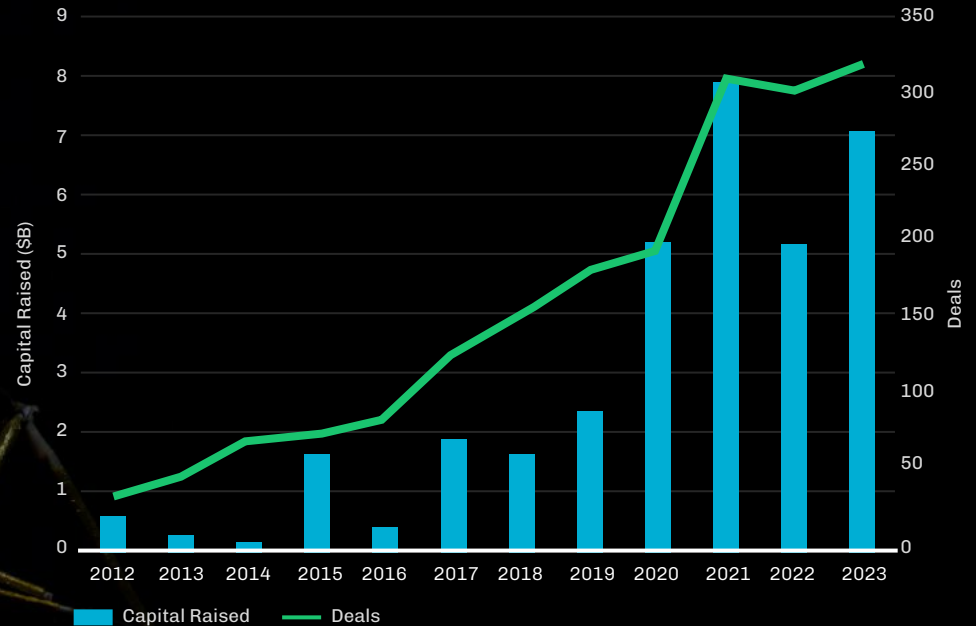


Source: UP.Partners research. Approximate estimates.



NO WONDER SPACE TECH HAS SECURED ANOTHER **STRONG YEAR** OF VC INVESTMENTS

VC Investment in Space Tech



SPACE SPACS: ENORMOUS VALUE HAS BEEN DESTROYED

Companies

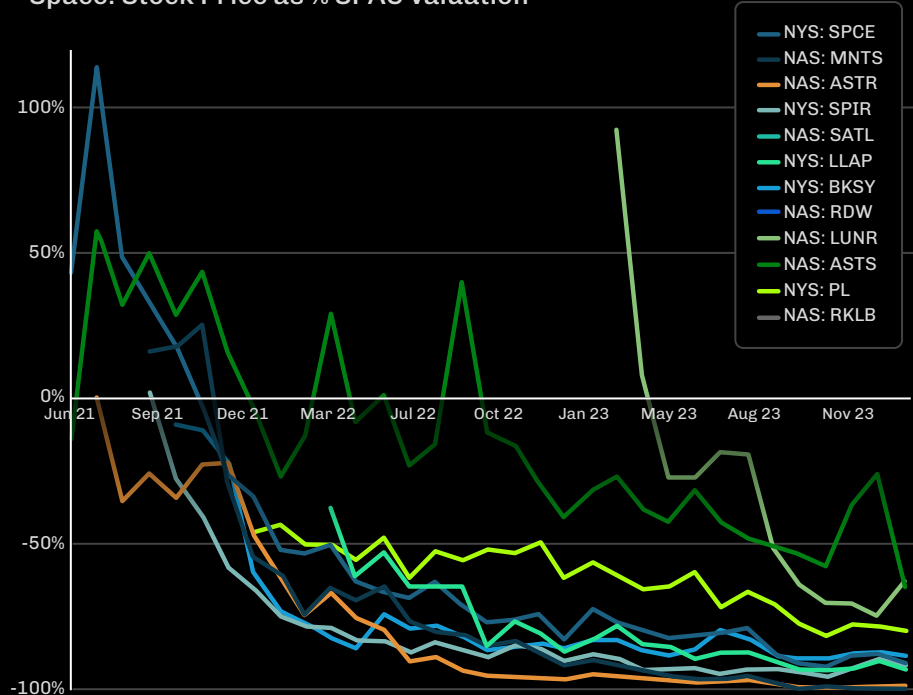
(Market Cap at time of SPAC)

Current Market Cap

As of Feb 8, 2024

Company	Current Market Cap	Market Cap at time of SPAC
Virgin Galactic (SPCE)	\$704M	\$2B
Momentus (MNTS)	\$8.5M	\$1.5B
Astra Space (NAS: ASTR)	\$44M	\$2.6B
Spire (NYS: SPIR)	\$177M	\$1.6B
Satellogic (NAS: SATL)	\$122M	\$1.1B
Terran Orbital (LLAP)	\$167M	\$1.8B
BlackSky (BKSJ)	\$203M	\$1.5B
Redwire (Jacksonville) (NYS: RDW)	\$193M	\$675M
Intuitive Machines (LUNR)	\$110M	\$1.2B
AST SpaceMobile (ASTS)	\$406M	\$1.8B
Planet Labs (PL)	\$636M	\$2.8B
Rocket Lab (RKTLB)	\$2.1B	\$4.8B

Space: Stock Price as % SPAC valuation



HARDWARE TO WATCH



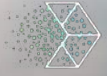
BLUE ORIGIN

Blue Origin New Glenn
expected to launch in 2024




STOKE

Stoke Space



THE MOVING
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FLYING THINGS

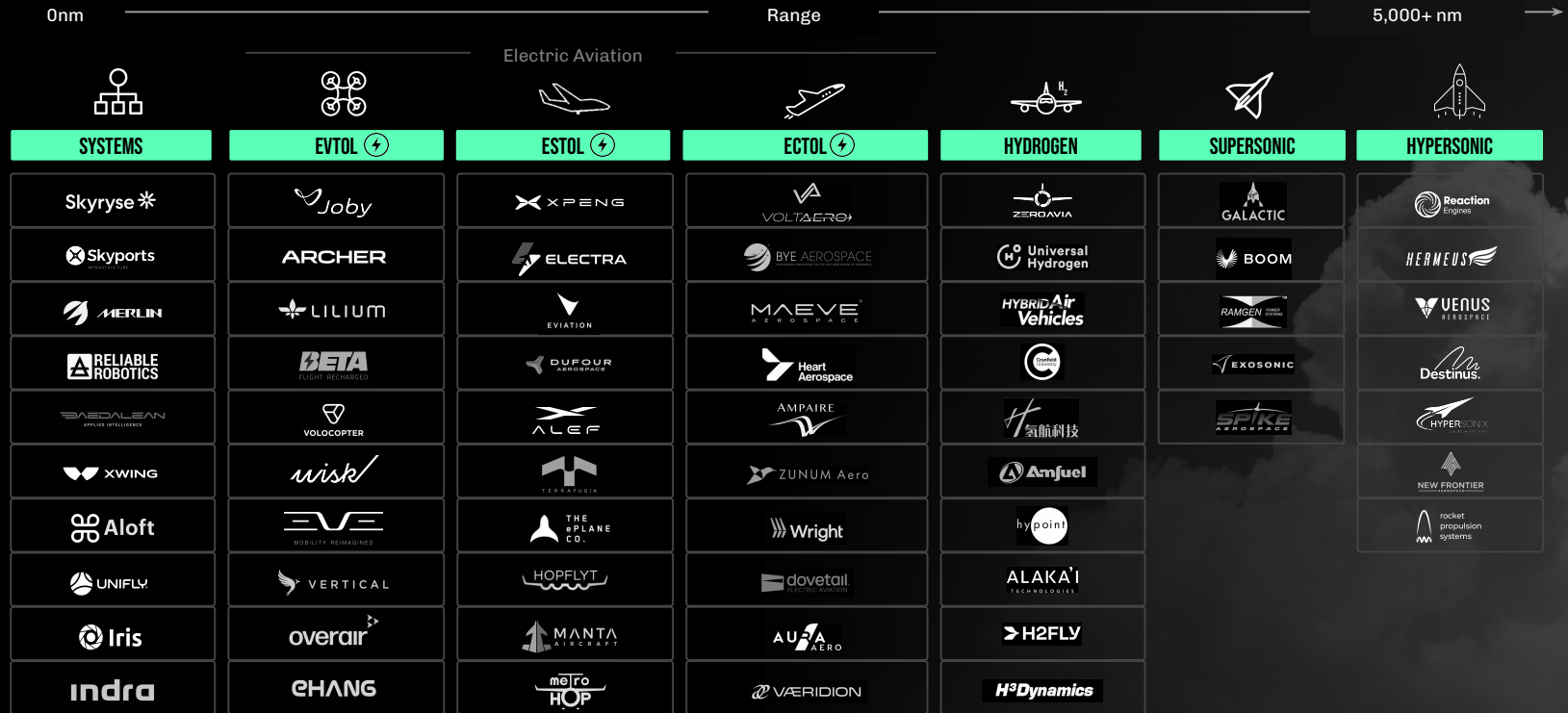


“80% of living humans
today have never flown
on an airplane.”

- Boeing

REACHING FOR THE STARS: THE 2023 NEW AIR TRAVEL LEADERBOARD

New air travel startups ranked by VC funding raised



Note: Includes scale-up firms that are usually not considered a "startup company" any longer

Source: UP.Partners research, Lufthansa Innovation Hub Analysis, TNMT.com, PitchBook Data Inc.

2ND ONLY TO THE WAR IN UKRAINE, **WALMART** IS THE BIGGEST DRIVER OF DRONE DEVELOPMENT IN THE WORLD

“...the **largest drone delivery expansion of any U.S. retailer**, bringing drone delivery to 1.8 million additional households in the Dallas-Fort-Worth area...”

- John Furner, Walmart U.S. CEO



Walmart

WALMART IS BEATING AMAZON IN THE RACE TO ESTABLISH ROUTINE DRONE DELIVERY

amazon

Announced Prime Air Concept video

Jeff Bezos predicts 85% Amazon delivery by drones in "4-5 years" on 60 Minutes

Receives FAA experimental airworthiness certificate

Receives FAA Part 125 Approval

100 Prime Air employees fired in UK

June: drone overheated, crashed, and started a 25-acre bushfire in OR

\$2B invested in 10 years

April: Bloomberg reports 5 drone crashes

Nov: 18601B exemption

Dec: Flubbed first commercial delivery

Jan: Amazon cuts 140 more Prime Air employees

Dec: first drone delivery

May: 100 deliveries

2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Walmart

Oct: Applies with FAA to test drone deliveries

Began testing drone delivery

Files for 94 drone patents, compared with Amazon's 54

Sept: Trialed delivery of COVID tests

First commercial drone delivery in U.S. (Arkansas), with Zipline

June: Invested in DroneUP

Nov: partnership with DroneUP, Flytrex

"hundreds of drone deliveries"

May: 4 million households eligible

6000 paid deliveries

Partnered w/ Wing

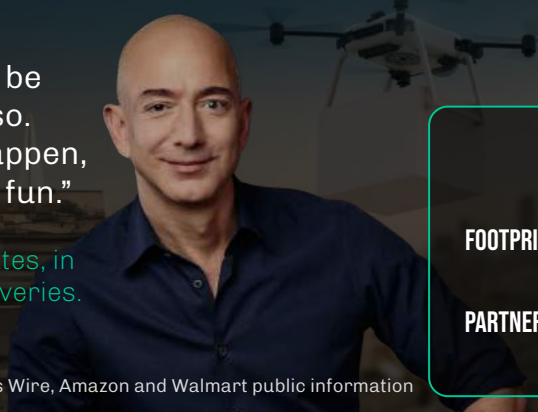
36 delivery hubs across 7 states (Arizona, Arkansas, Florida, North Carolina, Texas, Utah and Virginia.)

Adding 1.8M people to network across DFW

Completed over **20,000 deliveries** in last two years

"I'm an optimist. Could it be four, five years? I think so. It will work, and it will happen, and it's gonna be a lot of fun."

—Jeff Bezos on CBS's 60 minutes, in 2013, talking about drone deliveries.

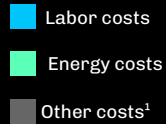


Source: UP.Partners research, Business Wire, Amazon and Walmart public information

	amazon	VS.	Walmart
FOOTPRINT	Amazon only has ~100 active FCs		Walmart has over 4,600 stores within 90% of the US population
PARTNERSHIPS	Amazon is vertically integrated		Walmart partners w/ leading drone OEMs

DRONES AREN'T JUST COOL — THEY'RE CHEAPER THAN GROUND DELIVERY

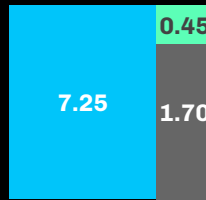
Delivery costs for
5-mile delivery of
a 216-cubic-inch
package (6 inches
per side), \$



Electric car
1 package, 1 driver



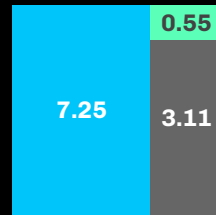
~9.40



Electric van
1 package, 1 driver



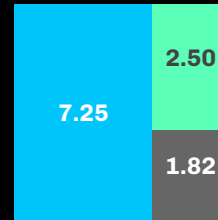
~11.00



**Internal combustion
engine (ICE) van**
1 package, 1 driver



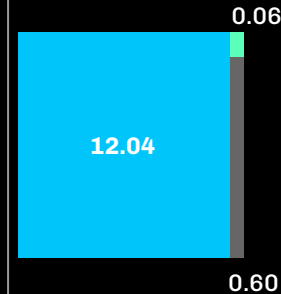
~11.60



Drone
1 package, 1 drone
per observer



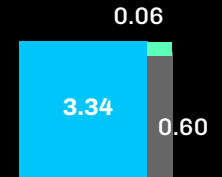
~12.70



Drone
1 package, 15 drones
per observer



~4.00



**Emissions,
kilograms CO²
equivalent²**

1.40

2.08

6.40

1.07

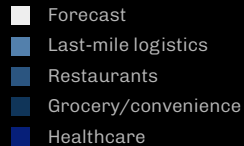
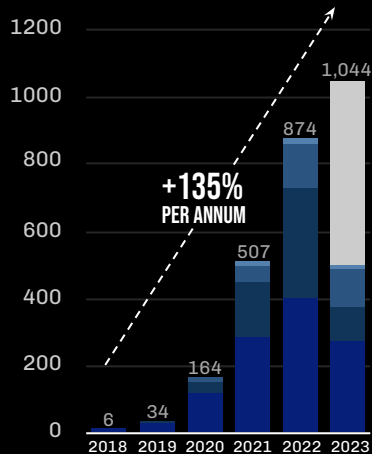
1.07

¹Other costs include
asset, maintenance,
and insurance costs.
²Scopes 2 and 3.

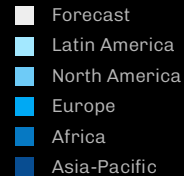
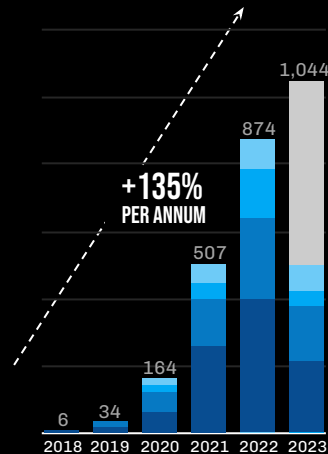
IN THE MEANTIME, THE BUSINESS OF UNMANNED CARGO DRONES IS ALREADY REAL AND BOOMING

COMMERCIAL DRONE DELIVERIES ARE PROJECTED TO EXCEED 1 MILLION IN 2023

Commercial drone deliveries by use case (thousand)



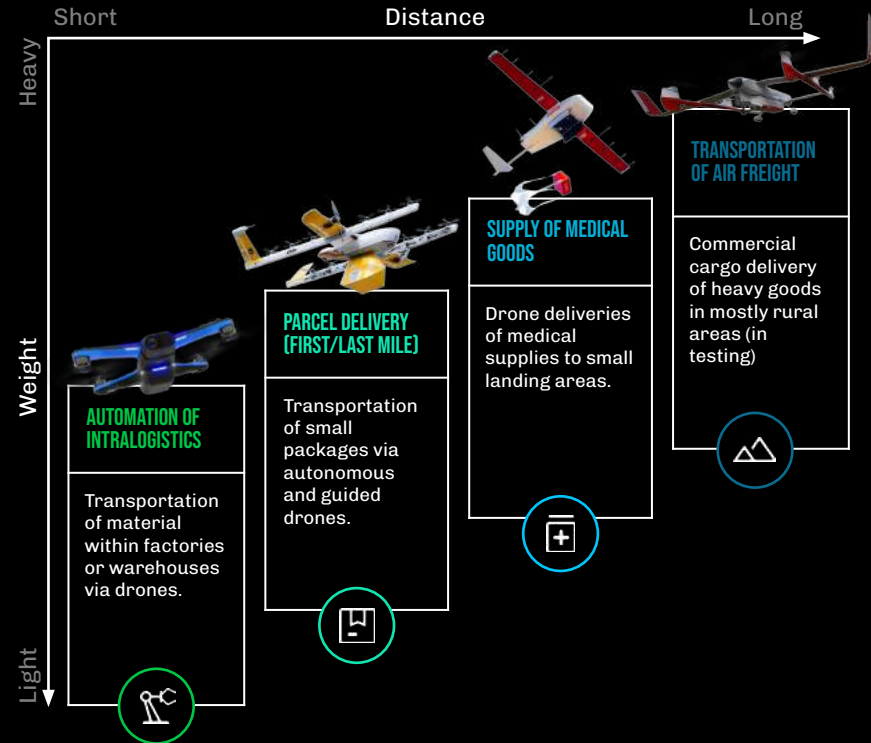
Commercial drone deliveries by region (thousand)



Note: Number of deliveries represents number of parcels delivered, not total number of items within the parcels.

Source: McKinsey Drone Delivery Tracker and Forecast

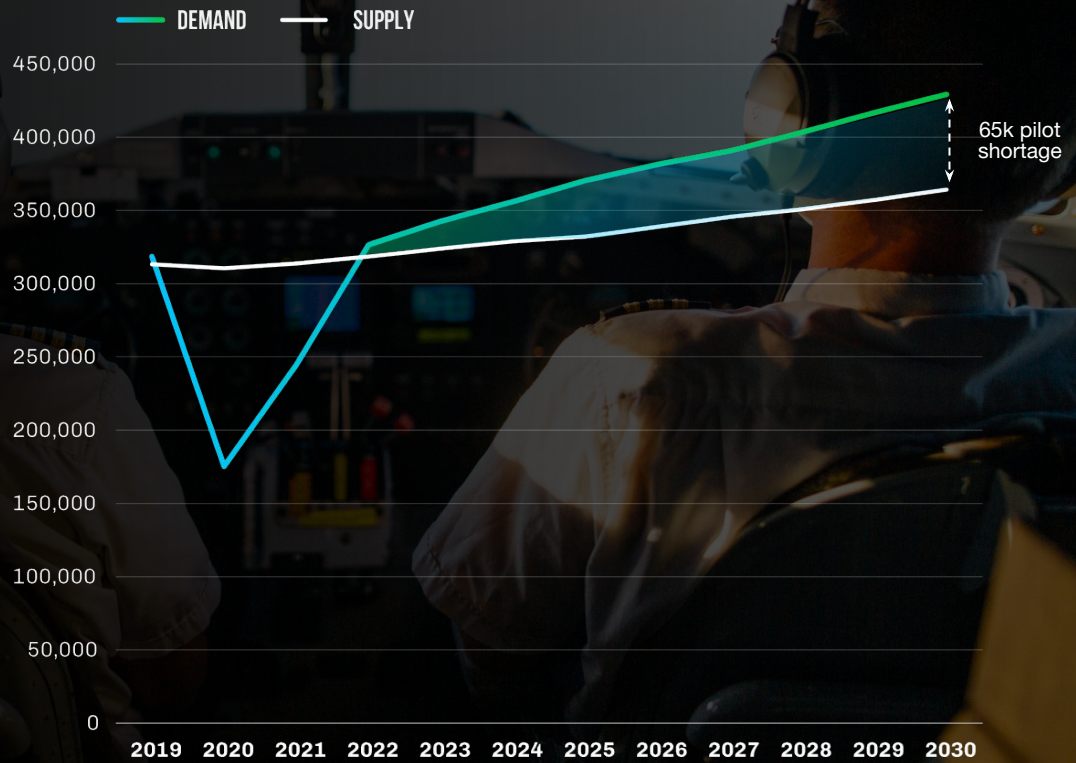
MAJOR USE CASES FOR CARGO DRONES



Source: UP.Partners research and Roland Berger

THE PILOT SHORTAGE WILL FURTHER PUSH AUTONOMOUS TECHNOLOGY ADVANCEMENTS

Global pilot demand versus supply
In number of pilots

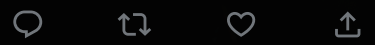


B Bloomberg 📌 @business

Hong Kong-based airline Cathay Pacific slashed the number of flying hours needed to become a captain by 25%, people familiar with the matter said, as a **pilot shortage** contributes to mass flight cancellations



From bloomberg.com



“WE WANTED **FLYING CARS**, INSTEAD WE GOT 140 CHARACTERS.” - PETER THIEL, 2013

Actually, Peter, it only took an extra 10 years, but we got us some flying cars!

Customer deliveries began in 2023

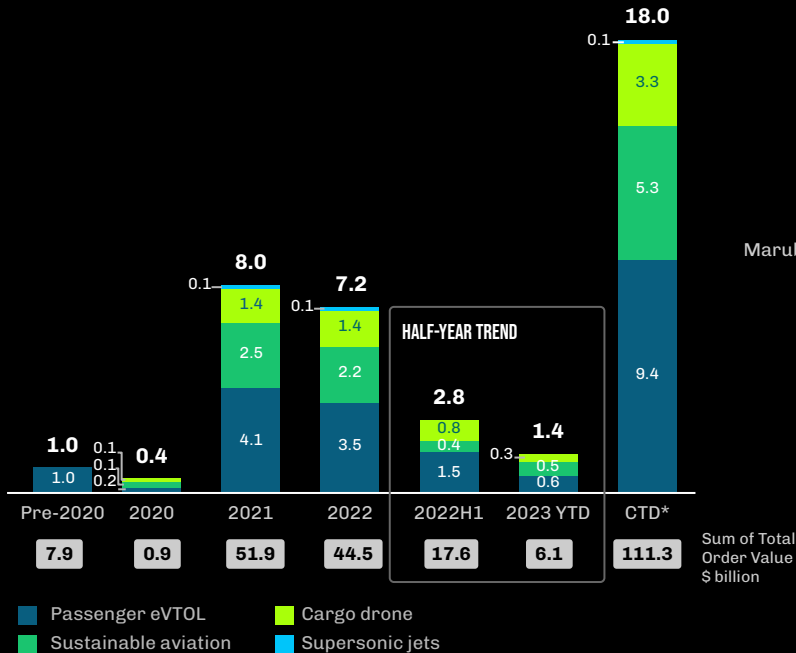
No pilot license required



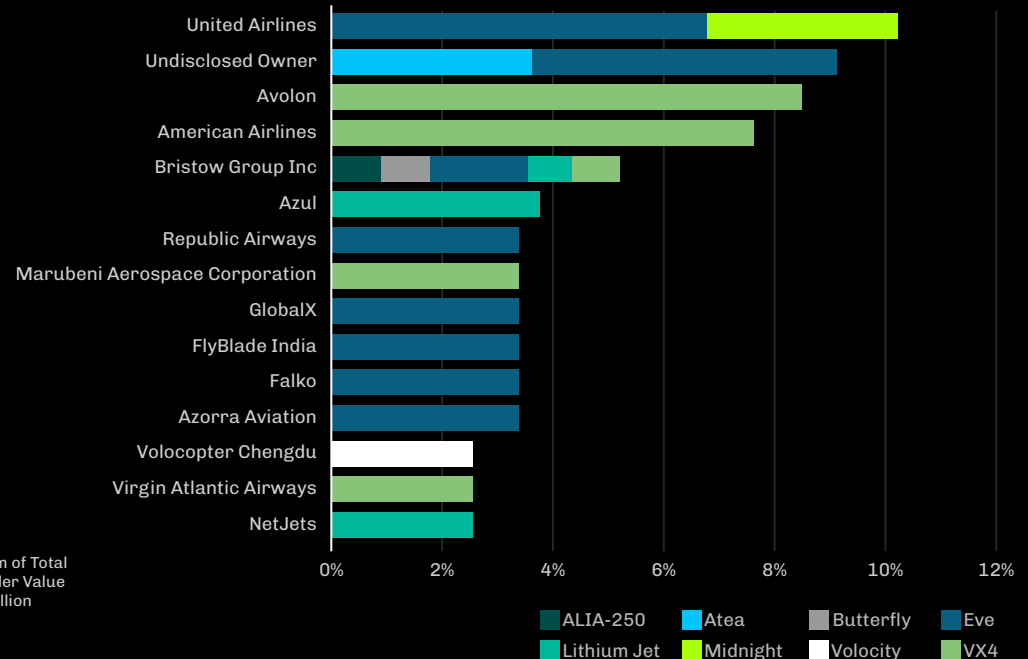
ELECTRIC VERTICAL TAKEOFF AND LANDING VEHICLES (EVTOLS) HAVE ATTRACTED SIGNIFICANT COMMERCIAL INTEREST

ORDERS CONTINUE TO FLOW IN, WITH A TOTAL BACKLOG OF 18,000 AIRCRAFT WORTH AN ESTIMATED \$111 BILLION.

Total publicly disclosed orders by time period, ¹ thousands



SHARE OF EVTOL COMMITMENTS BY COMPANY AND TYPE



¹As of June 9, 2023; figures may not sum, because of rounding.
 *CTD: Cumulative to Date
 Source: McKinsey & Company

Graph is showing commitments for those with a >3% share of the total number.
 Source: Cirium Fleets Analyzer as at 8th May 2023

YET, THE EVTOL MARKET IS STILL VERY VERY **CROWDED**; AAM REALITY INDEX

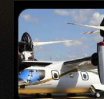
OEM (stock)	ARI	Funding (\$M)	Use Case	Vehicle Type	Propulsion	Operation	Vehicle	First Flight	EIS	Country	
Volocopter	↔	8.3	\$761.0*	Air Taxi	Multicopter / Lift + Cruise	Electric	Piloted	VoloCity / VoloRegion	2021 / 2022	2024 / 2026	Germany
Ehang (EH)	↔	8.0	\$185.0	Tourism, EMS, Firefighting, Air Taxi	Multicopter/Lift + Cruise	Electric	Autonomous	EH216-S / VT-30	2018 / 2021	2023 / -	China
Joby (JOBY)	↔	8.0	\$2,261.1	Air Taxi	Vectored Thrust	Electric	Piloted	-	2018	2025	USA
Beta	↔	8.0	\$985.0	Cargo, Regional, Air Taxi	Conventional / Lift + Cruise	Electric	Piloted	CX300 / Alia-250	2020 / 2022	2025 / 2026	USA
Archer (ACHR)	↔	7.9	\$1,096.3	Air Taxi	Vectored Thrust	Electric	Piloted	Midnight	2023	2025	USA
Wisk (Boeing)	↔	7.4	Corporate backed	Air Taxi	Vectored Thrust	Electric	Autonomous	Generation 6	-	-	USA
Eve (EVEX)	↔	7.2	\$377.4	Air Taxi	Lift + Cruise	Electric	Piloted	Eve	2024	2026	Brazil
Vertical (EVTL)	↔	7.1	\$347.8	Air Taxi, Cargo, EMS	Vectored Thrust	Electric	Piloted	VX4	2023	2027	UK
Lilium (LILM)	↑	7.0	\$1,342.3	Regional, Cargo, Biz Av	Vectored Thrust	Electric	Piloted	Jet	2024	2026	Germany
Pipistrel (Textron)	↔	7.0	Corporate backed	Cargo	Lift + Cruise	Hybrid	Autonomous	Nuuva V300	2024	2025	USA
AutoFlight	↔	6.9	\$200.0	Cargo, Air Taxi	Lift + Cruise	Electric	Autonomous / Piloted	CarryAll / Prosperity I	2023 / 2022	2024 / 2027	China
Airbus	↔	6.5	Corporate backed	EMS, Tourism, Air Taxi	Lift + Cruise	Electric	Piloted	CityAirbus NextGen	2024	-	France
Supernal	↔	6.5	Corporate backed	Air Taxi, Cargo	Vectored Thrust	Electric	Piloted	S-A1	2024	2028	South Korea

Source: UP.Partners research (<https://aamrealityindex.com/>)

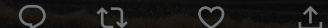


Charles Alcock
@AlcockNews

20 years after the aircraft's first flight and 11 years after @LDO_Helicopters applied for a type certificate for the #AW609 #tiltrotor, the @FAANews has launched a consultation over how it proposes to approve it. Patience is a virtue #eVTOL pioneers:



futureflight.aero
FAA Consults Over Long-Awaited Plans to Certify Leonardo:
The U.S. air safety regulators approach to certifying the Italian manufacturer's tiltrotor appears to be closely align...



HAS BETA WON THE EVTOL CHARGER WARS?



Paul Brinkmann @paulBrinkmann



Electric air taxi developer @Lilium cofounder Daniel Weigand says on investor call that the company's batteries will be chargeable with charging stations made by US company BETA Technologies, which use the automotive industry's CCS standard, along with @ArcherAviation.



Luke Fischer @FischerLukeM

So that makes Lilium, Archer, and obviously Beta using Beta chargers. Joby doing their own thing?



Paul Brinkmann @paulBrinkmann

Joby tells me they have others who want to use their charging system, and they will announce those soon, but they have not yet.

November 6, 2023 | Archer Aviation and BETA Technologies Collaborate to Accelerate the Adoption of an interoperable Charging System across the electric aviation industry



eHANG | 亿航

**CHINESE COMPANY E-HANG
RECEIVES FIRST OFFICIAL TYPE
CERTIFICATE, MAKES WORLD'S
FIRST COMMERCIAL ELECTRIC
AIR TAXI FLIGHT**



⁵²
**EH16-S 无人驾驶
型号合格证书**

中国
2024



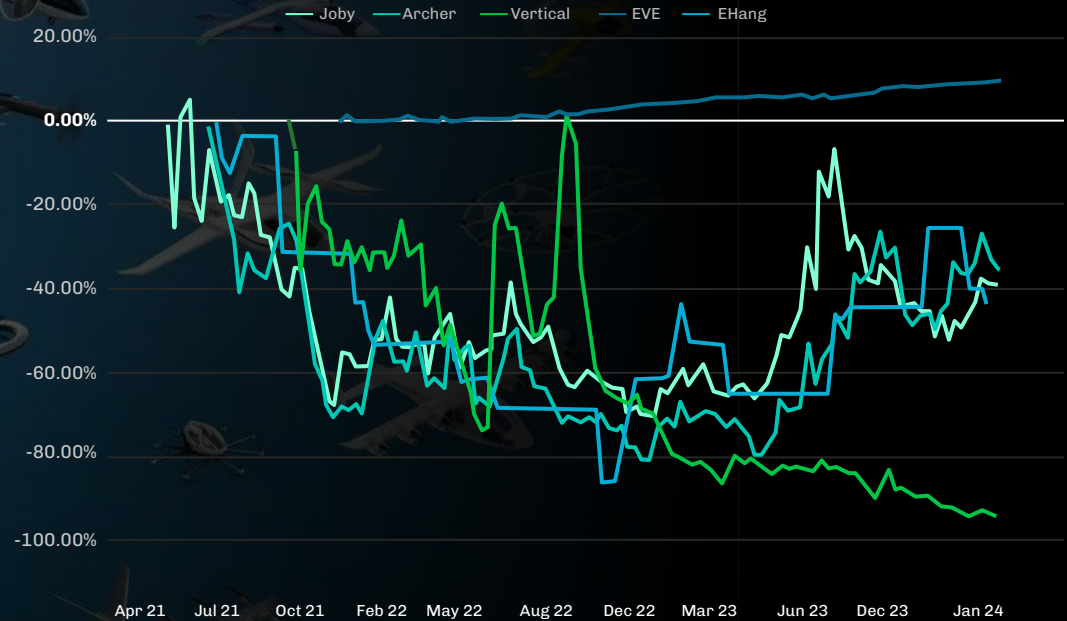
EVTOL FIRMS WILL HAVE TO WEATHER A **TOUGHER** INVESTOR CLIMATE

Companies

(Market Cap at time of SPAC)

Companies	Current Market Cap	Current Market Cap
(Market Cap at time of SPAC)	As of January 2024	As of January 2024
Joby	\$6.6B	\$4.3B
Archer	\$2.7B	\$1.6B
Vertical	\$2.2B	\$157M
EVE	\$2.4B	\$1.8B
EHang	\$590M	\$747M

STOCK PRICE PERFORMANCE OF MAJOR EVTOL COMPANIES IN 2023



MEANWHILE, WE HAVE AN INNOVATION PROBLEM IN COMMERCIAL AVIATION

1903



Wright Flyer

1964




737-100

2024



737-MAX8

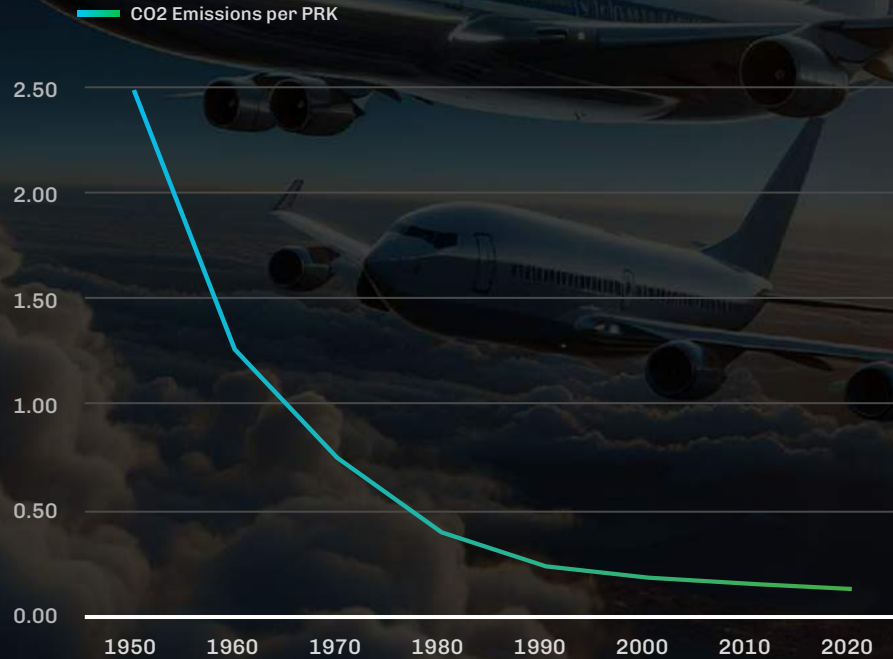


Patrick Collison  @patrickc

As of later this year (October 5, specifically), the commencement of the design of the Boeing 737 will be closer to the Wright brothers' Kitty Hawk flight than it will to the present day.

EFFICIENCY GAINS ARE LEVELING OFF

EFFICIENCY GAINS IN THE LAST 70 YEARS
CAME ALMOST ENTIRELY FROM ENGINES,
NOT AIRFRAME INNOVATION.



707
1950



737
2023

BLENDING WING BODY IS FIRST MAJOR AIRFRAME INNOVATION IN 70 YEARS **50% REDUCTION** IN FUEL BURN



USAF Awarded U.S. startup JetZero \$250MM to develop BWB demonstrator for air-to-air refueling.

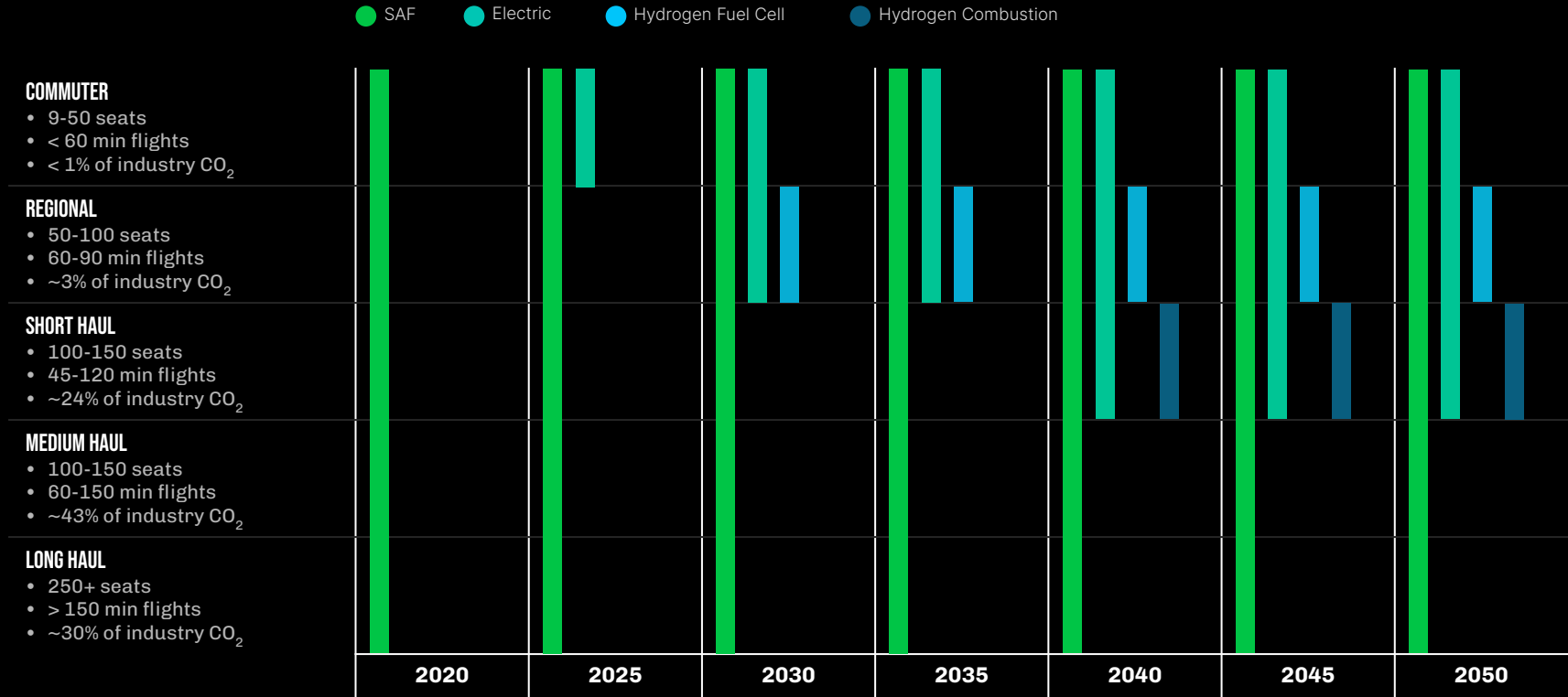
In 1954 USAF awarded Boeing contract to develop KC-135 air-to-air refueler, which ultimately created the 707 → 737 we're flying today — is this a repeat of history?



In 2020, Airbus released their concept for a BWB, the MAVERIC. No new news from Airbus on their plans to pursue the design — but it would not be a surprise to see it get accelerated in light of the JetZero success.

DECARBONIZING AVIATION IS REALLY REALLY HARD

Estimated reliance on electric vs. hydrogen vs. SAF for major aviation use cases



ELECTRIFYING OR SWITCHING TO HYDROGEN LIKELY HAS A LIMITED IMPACT, AT A HUGE COST



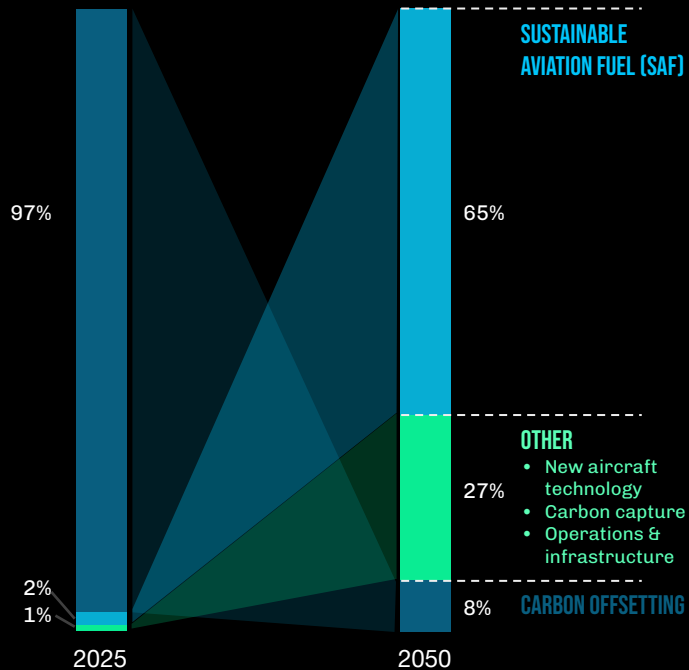
If we electrified every flight under two hours we would affect 28% of aviation's CO₂ emissions



Electrifying or using hydrogen for flights more than two hours is currently not technically or financially feasible, representing 72% of emissions

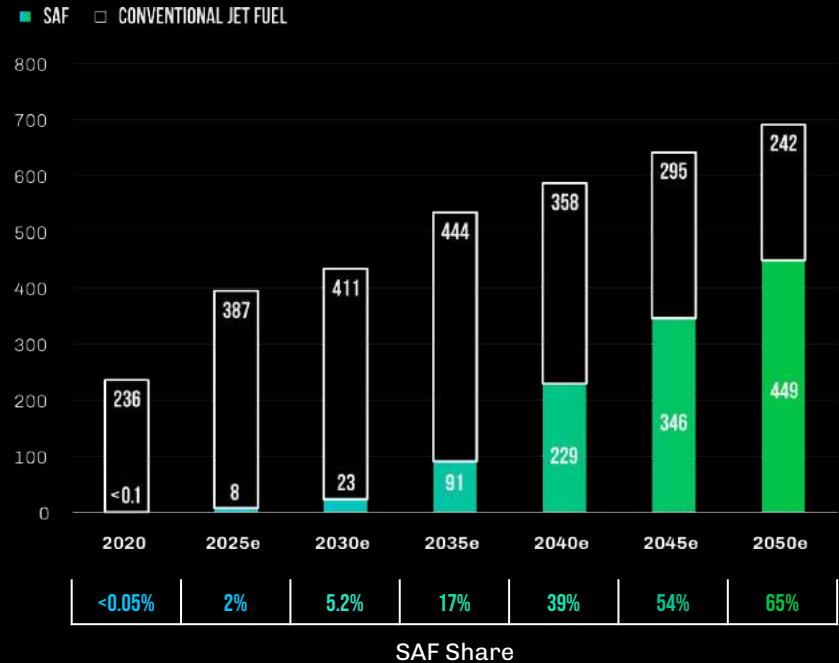
THE INDUSTRY DEPENDS ON SUSTAINABLE ALTERNATIVE FUEL (SAF) AS A BRIDGE TECHNOLOGY

IATA projections on the emissions reduction contributions by technology type for a net-zero future for aviation



Source: IATA, FlyNetZero

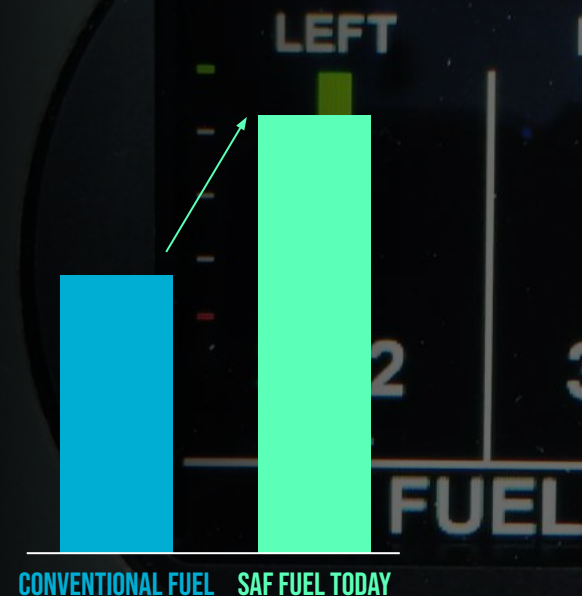
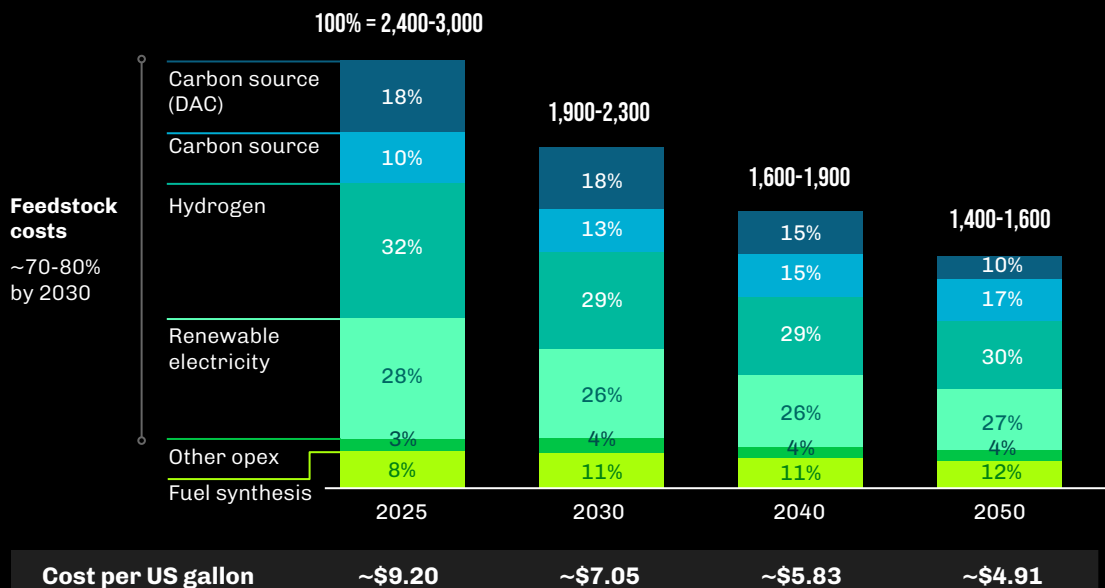
Projected fuel consumption of commercial airlines incl. share of SAF required to reach net-zero (in billion liters)



Source: Sustainable Aero Lab, IATA, Statista

HYDROGEN, CARBON, AND ENERGY COST INPUTS NEED TO BE REDUCED TO MAKE SAF COMPETITIVE; THIS MIGHT TAKE OVER A DECADE

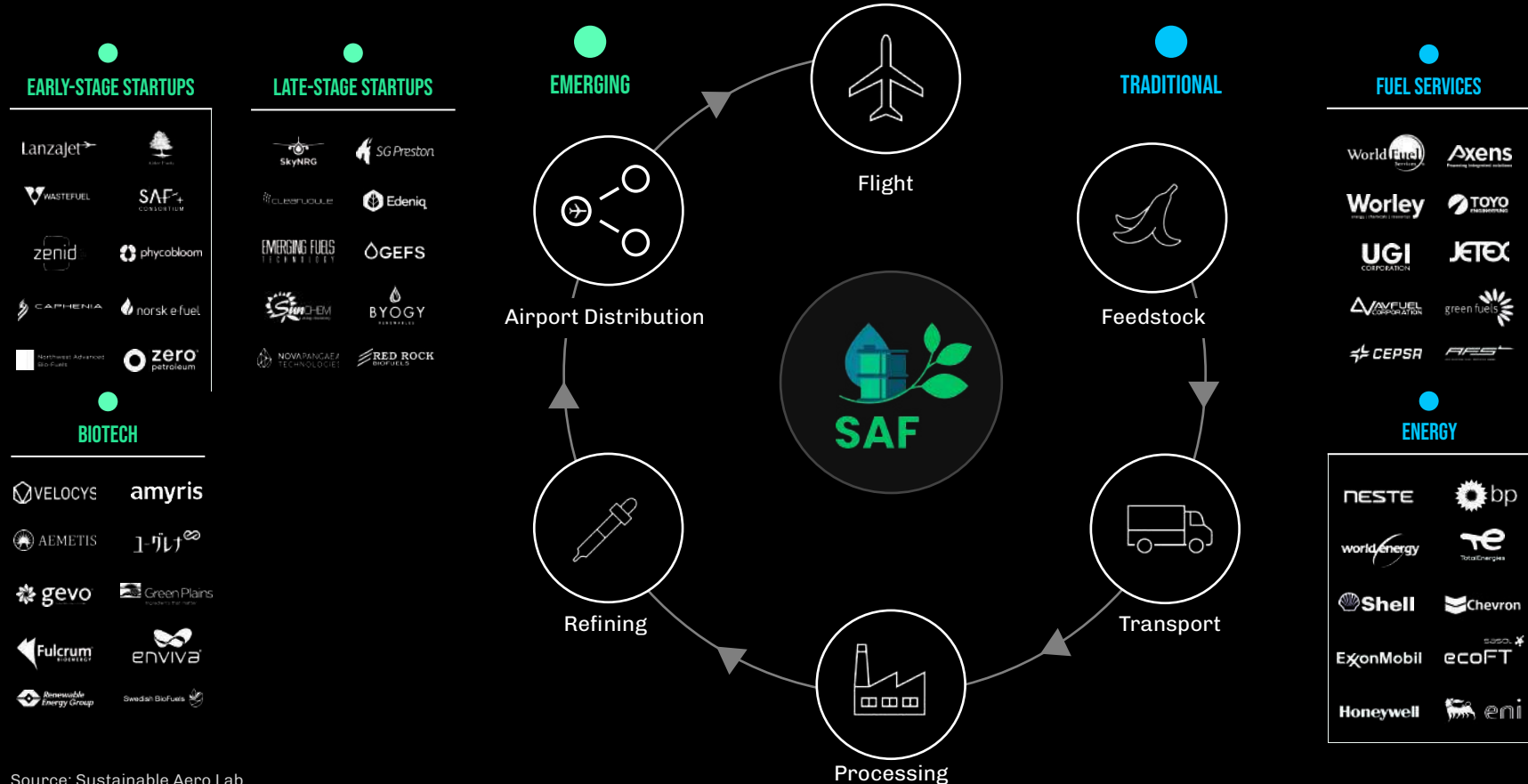
PtL fuel production cost (European-based PtL archetype¹)
\$ per tonne of jet fuel



Notes (McKinsey): Assuming offshore wind-based renewables and H2 produced in Europe for \$2.7/kg H2 in 2030, declining to \$1.8/kg H2 by 2050; additional \$0.2/kg H2 included for storage; carbon cost based on industrial point source at \$95/t CO2 capture with \$5/t CO2 intermediate storage; DAC cost assumed \$220/t CO2 in 2030, declining to \$135/t CO2 by 2050; reverse water gas shift + Fischer-Tropsch technology configuration

Sources: McKinsey / WEF Report (2022); Globalair.com

NEW SAF APPROACHES ARE DRIVEN FORWARD BY A GROWING ECOSYSTEM OF STAKEHOLDERS



WHILE CUSTOMERS MAKE SAF COMMITMENTS, IS IT GREEN WASHING OR TRULY SUSTAINABLE?



Coralie laurencin 🌱🍃🌿 @coralaurencin

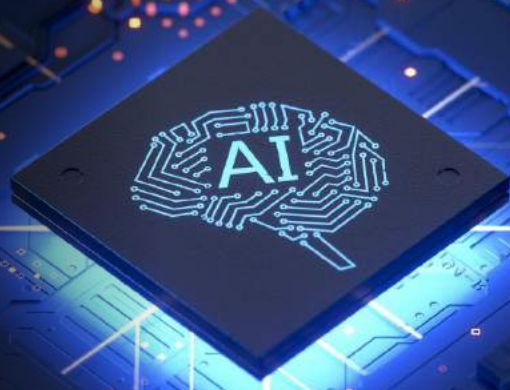
Ryanair has contracts to get 9.5% of its fuel from SAF by 2030 but its boss **isn't** sure where the supply will come from. Ryanair's Michael O'leary: **'There isn't enough cooking oil** in the world to power one day of green aviation | Ryanair | The Guardian






THE MOVING
WORLD REPORT 2024

AI IN MOBILITY



A large, stylized number '4' is positioned on the left side of the slide. It is composed of several overlapping, semi-transparent shapes in shades of teal and light blue, creating a layered, geometric effect.

“Artificial intelligence
is whatever hasn’t
been done yet.”

- Larry Tesler, American Computer Scientist

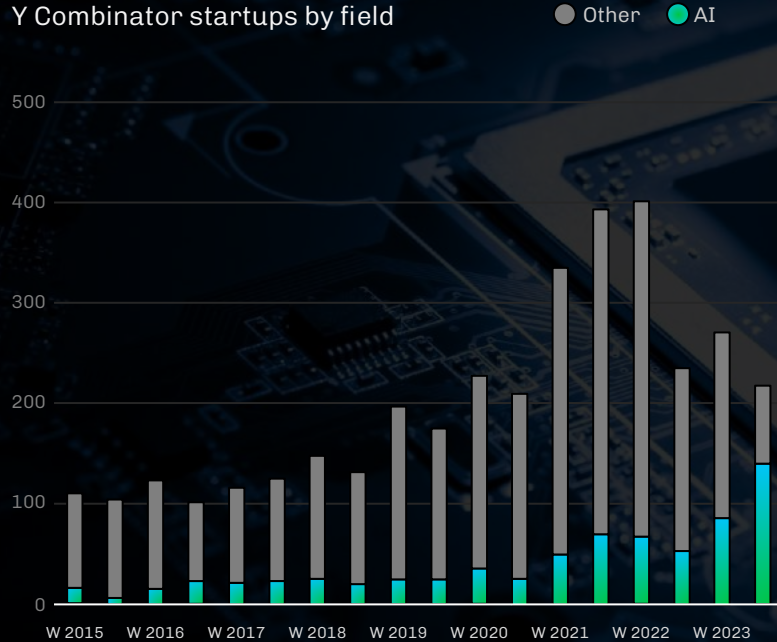
WHERE DOES AI SHOW UP IN MOBILITY?



THE AI STARTUP SURGE

If your startup isn't working on generative AI... what's wrong with you?

Y Combinator startups by field

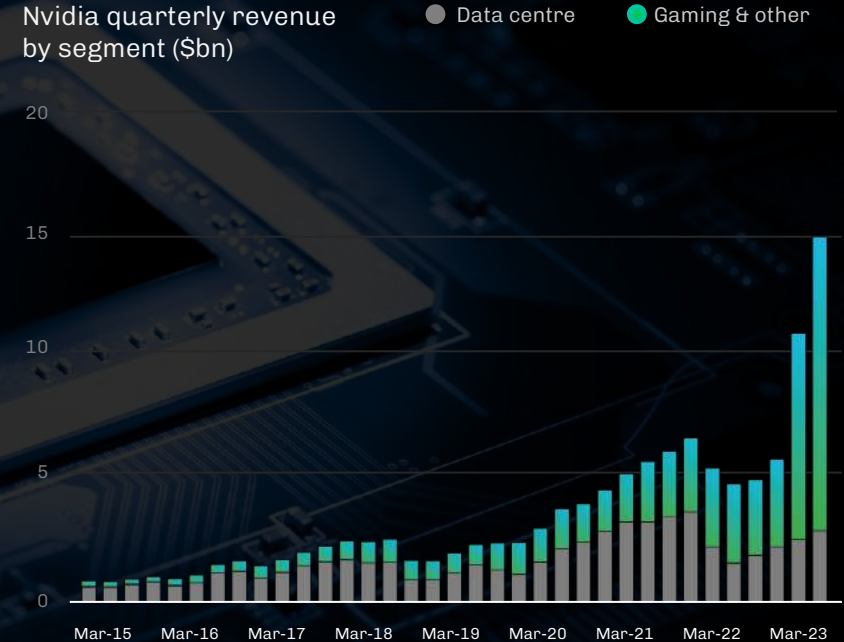


Source: Y Combinator

NVIDIA CAN'T KEEP UP

The rush to buy GPU compute capacity (at 40% operating profit)

Nvidia quarterly revenue by segment (\$bn)

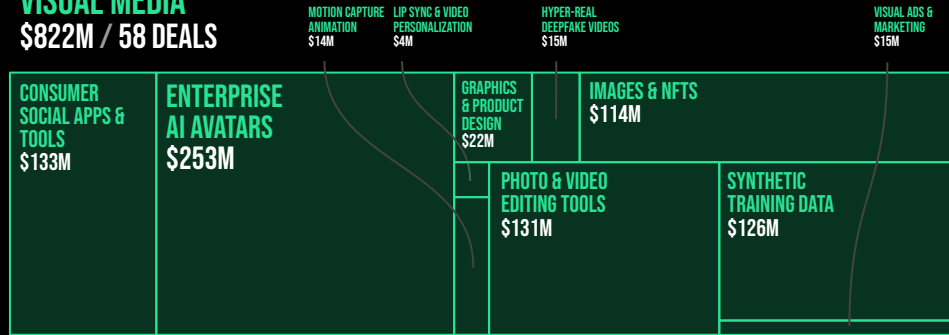


Source: Nvidia

WHERE IS ALL THE MONEY GOING IN GENERATIVE AI?

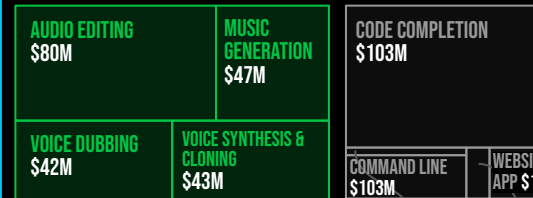
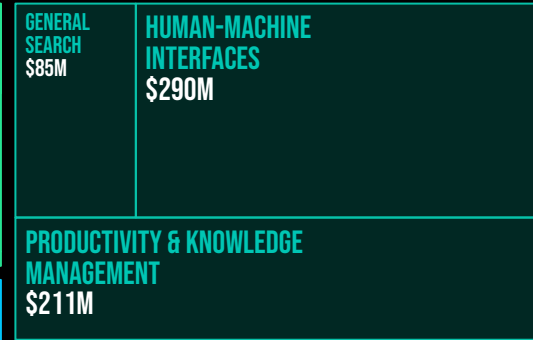
Distribution of generative AI funding, 2021-2022

VISUAL MEDIA \$822M / 58 DEALS

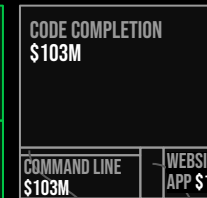


TEXT \$852M / 48 DEALS

GENERATIVE INTERFACES \$586M / 20 DEALS



SPEECH & AUDIO \$212M / 26 DEALS



CODE \$140M / 20 DEALS

MOBILITY

WHEN IS THIS COMING?



Source: CB Insights

Based on an analysis of 210+ generative AI companies building cross-industry enterprise solutions; excludes deals do industry-specific companies and model developers such as OpenAI.

NEURAL NETWORKS ARE BEING TRAINED TO BRING OUR MACHINES TO LIFE

FROM:

MAKING PRETTY AI
PICTURES IS COOL



TO:

NEURAL NETWORKS FOR TRAINING ROBOTS

Neural networks for training machines to include cars, planes, humanoids, etc. is coming

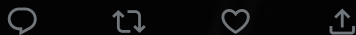
NEURAL NETWORKS ARE THE “FINAL PIECE OF THE PUZZLE” FOR TESLA FSD V12



TESLARATI @Teslarati - Jan 21



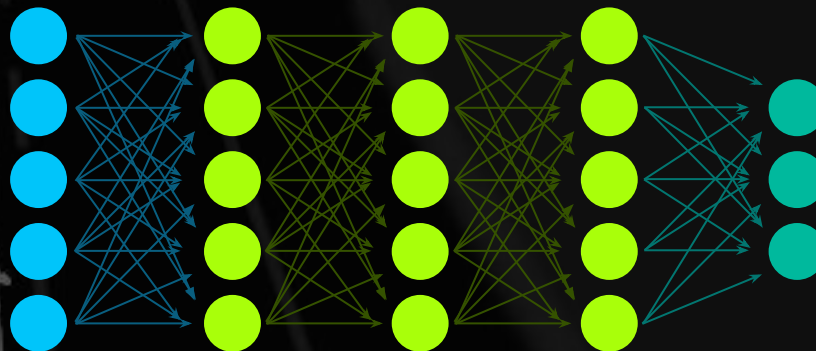
Buckle up cause Tesla FSD Beta v12.12 is hitting the streets. Testers report smoother rides with zero intervention or takeovers. #TeslaFSD #SelfDrivingCars



With Tesla FSD 12 the power of neural networks is unleashed, deleting 300,000 lines of C++ code in exchange for a model trained on millions of video clips.

Photons in

Controls out



IF WE CAN DO THIS IN CARS, WE ARE NOT FAR AWAY FROM BEING ABLE TO DO THIS WITH PLANES USING THE SAME FRAMEWORK

You just need the training data and the controls both in the plane and in the cockpit.

The controls in the plane are already built in: Autopilot
The controls in the cockpit are next: A humanoid robot?

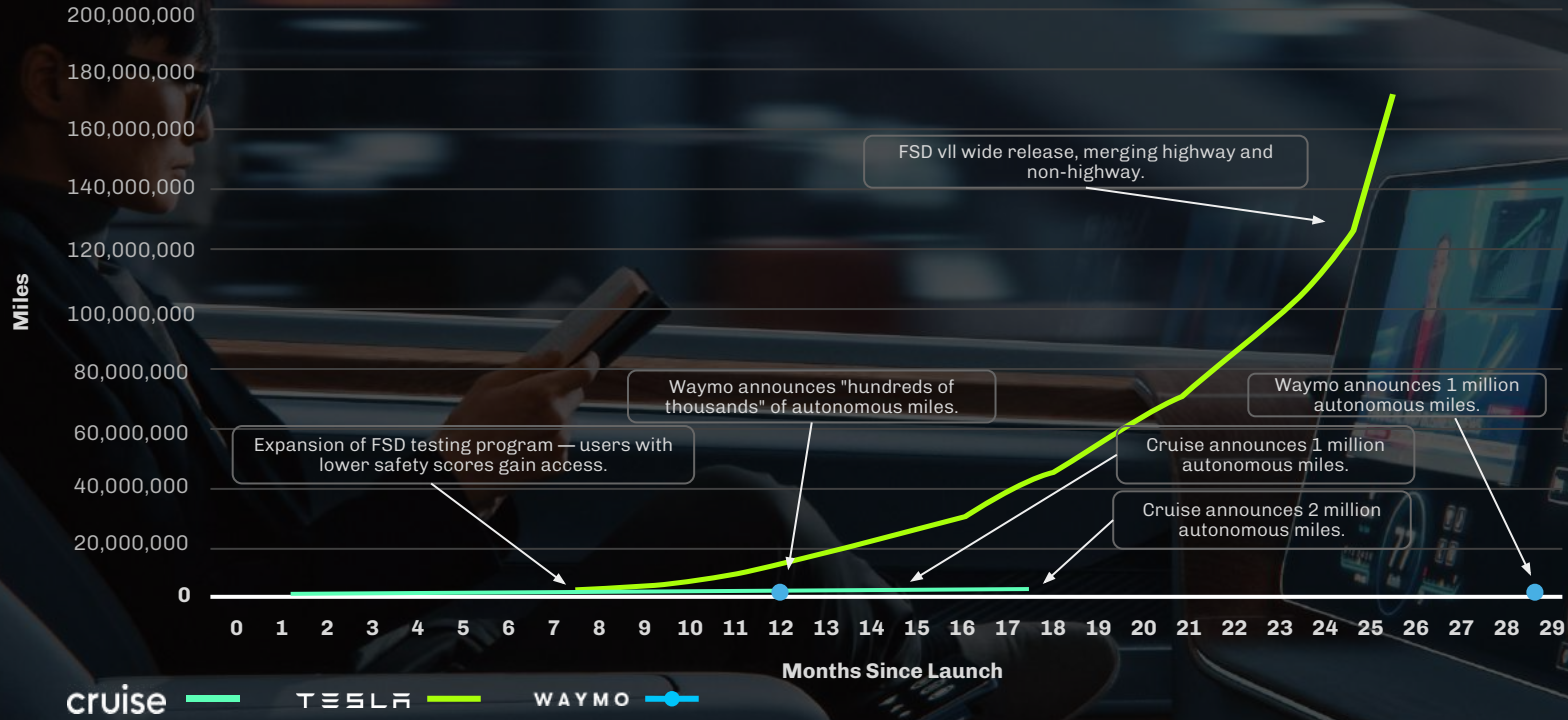
ARE WE IN FOR ROBOT
CO-PILOTS SOON?

Yes

No



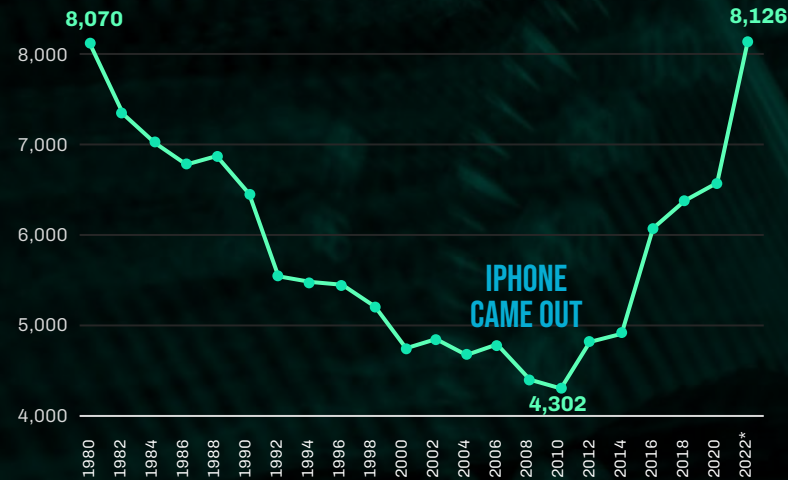
TESLA'S AI TRAINING ADVANTAGE



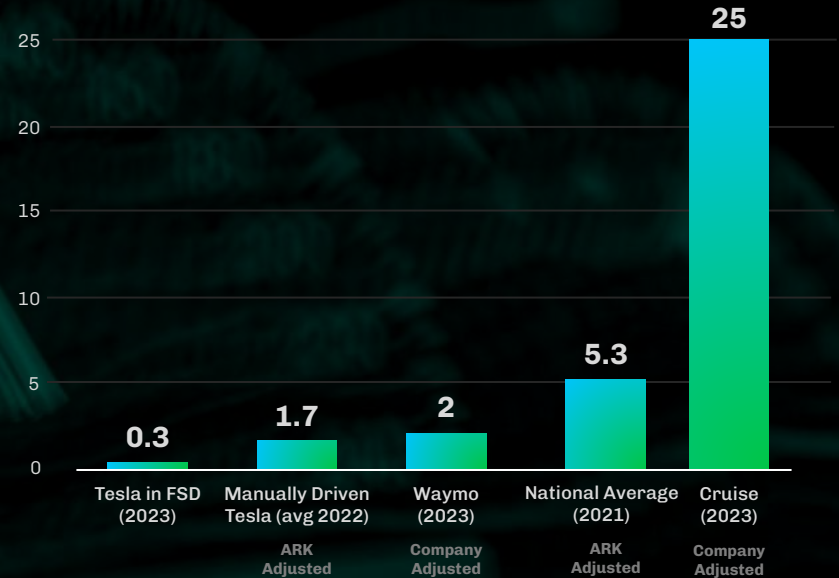
Note: We define the data points as follows: Cruise - "fully driverless miles" i.e. from when Cruise completed its first driverless ride in November 2021. Waymo - "public rider-only miles" i.e. from when Waymo's public service opened up in October 2020. Tesla FSD - when Tesla began disclosing FSD miles in February 2021.

Source: ARK Investment Management LLC Tesla, Cruise, Waymo.

NUMBER OF ANNUAL U.S. PEDESTRIAN FATALITIES, 1980-2022



ADJUSTED CRASHES PER MILLION MILES ON SURFACE STREETS ONLY



Notes: Cruise and Waymo figures are for the first million miles driven in each service. Both companies adjusted figures for a more apples to apples comparison of what would be reported in the national average statistics. The National Average and the Tesla statistics Sources: ARK Investment Management LLC, 2023.

<https://www.nhtsa.gov/press-releases/traffic-crash-death-estimates-2022#:~:text=The%20National%20Highway%20Traffic%20Safety,42%2C939%20fatalities%20reported%20for%202021,https://www.tesla.com/VehicleSafetyReport,https://waymo.com/blog/2023/02/first-million-rider-only-miles-how.html,https://getcrui.com/news/blog/2023/cruises-safety-record-over-one-million-driverless-miles/#:text=Throughout%20our%20first%20million%20driverless,in%20a%20comparable%20driving%20environment,https://tesla-cdn.thron.com/static/AA7YQM Investor Day 2023 Keynote W9DARX.pdf?xseo=&response-content-disposition=inline%3Bfilename%3D%22Investor-Day-2023-Keynote.pdf%22,https://www.tesla.com/VehicleSafetyReport,https://www.bts.gov/content/roadway-vehicle-miles-traveled-vmt-and-vmt-lane-mile-functional-class,https://www.bts.gov/content/us-vehicle-miles,https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813515,https://www.fhwa.dot.gov/policyinformation/travel-monitoring/21dectvt/21dectvt.pdf,https://cdan.nhtsa.gov/SASStoredProcess/guest>
 Forecasts are inherently limited and cannot be relied upon. For informational purposes only and should not be considered investment advice or a recommendation to buy, sell, or hold any particular security. Past performance is not indicative of future results.

*Projected

Source: ARK Invest, FARS, GHSA analysis of SHSO data and UP.Partners research

MEANWHILE, WAYMO IMPROVES ROAD SAFETY WITH ITS AUTONOMOUS VEHICLES AND EXPANDS ITS ROBO TAXI SERVICE THROUGHOUT SF AND LA



In 2023, Waymo has served over 700,000 ride-hailing trips with public riders and no human driver.



57%

reduction in police-reported crashes*

85%

reduction in injury-causing crashes*

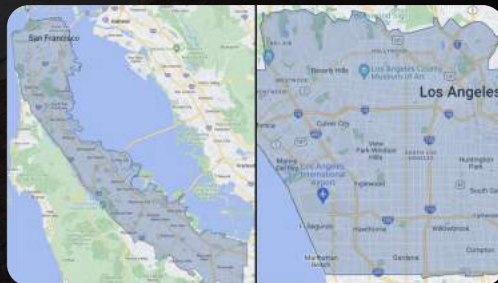
*Compared to a human driver

Source: The Verge, Waymo and UP.Partners research



James Hoffmann @JamesHoffmann3

@Waymo is scaling!! Here are maps from CPUC permit of proposed LA and SF service areas. WOW! @Christiano92 @microterf @Filtercopy1983 @AutonoD



Waymo @Waymo



Providing a safe, reliable and efficient service for our riders is key to our future success.

We'll soon begin testing of our rider-only operations without a human driver on freeways in Phoenix. See how we're safely approaching this next step: [https://waymo.com/blog/\(...\)](https://waymo.com/blog/(...))

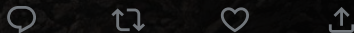
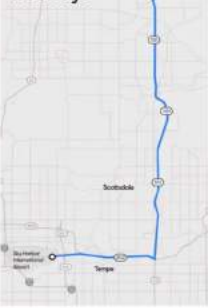
50 min
25.4 miles

Arizona route not utilizing freeways



25 min
23.8 miles

Arizona route utilizing freeways



USING AI TO MAKE BETTER BATTERIES



AIONICS



Satya Nadella   @satyanadella



With our new MatterGen model, we're applying the next generation of AI to one of the biggest challenges in materials science: increasing the rate at which we design materials with desired properties.



Unlocking a new era for scientific discovery with AI: How Microsoft's AI screened over 32 million candidates to find a better battery

Using AI to design next-generation batteries and materials

GENERATIVE DESIGN



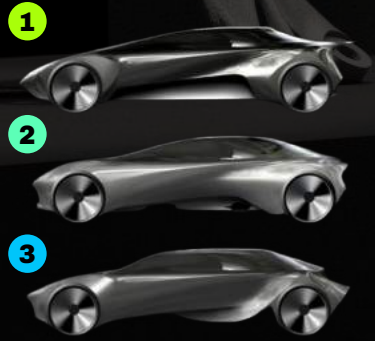
●●● Medium

DES-AI : DESIGNING CARS WITH ARTIFICIAL INTELLIGENCE & 3D PRINTING

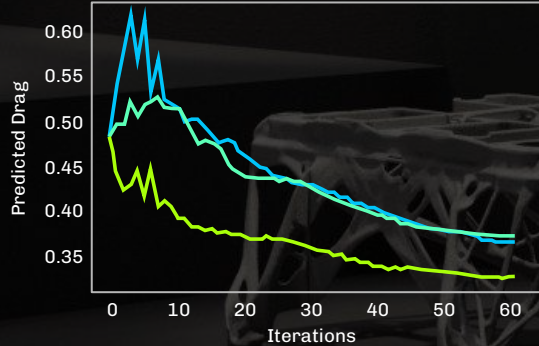


Automotive News

TOYOTA RESEARCHES GENERATIVE AI USE IN CAR DESIGN



Optimizing Aerodynamics



Donut


A.I. DESIGNED THIS



Source: UP.Partners research

HUMANOIDS



Christian Keil  @pronounced_kyle




The robot wars are here — and the score is 1-1.

- Making coffee (@Figure_robot)
- Folding a shirt (@Tesla_Optimus)

How long until one of these things can read IKEA instructions and assemble furniture?





“The total addressable market for a general purpose humanoid robot is all human labor. That’s a really big number.”

- Cyrus Sigari, Co-founder, UP.Partners

AI DRIVEN HUMANOIDS ARE **INEXTRICABLY** CONNECTED TO THE MOBILITY ECOSYSTEM



OPTIMUS will be integral into the **Tesla** manufacturing process




FIGURE
Commercial agreement with BMW Manufacturing



 **HYUNDAI**
Hyundai acquired **BOSTON DYNAMICS** in 2021



 **OpenAI**
OPEN AI led an investment in March 2023




APPTRONIK
Developed in partnership with NASA

PROGRESS IS ACCELERATING



TIME TO WALKING HUMANOID:

BostonDynamics  (1992)

21 YEARS (252 months)

 **HONDA**
ASIMO (1993)

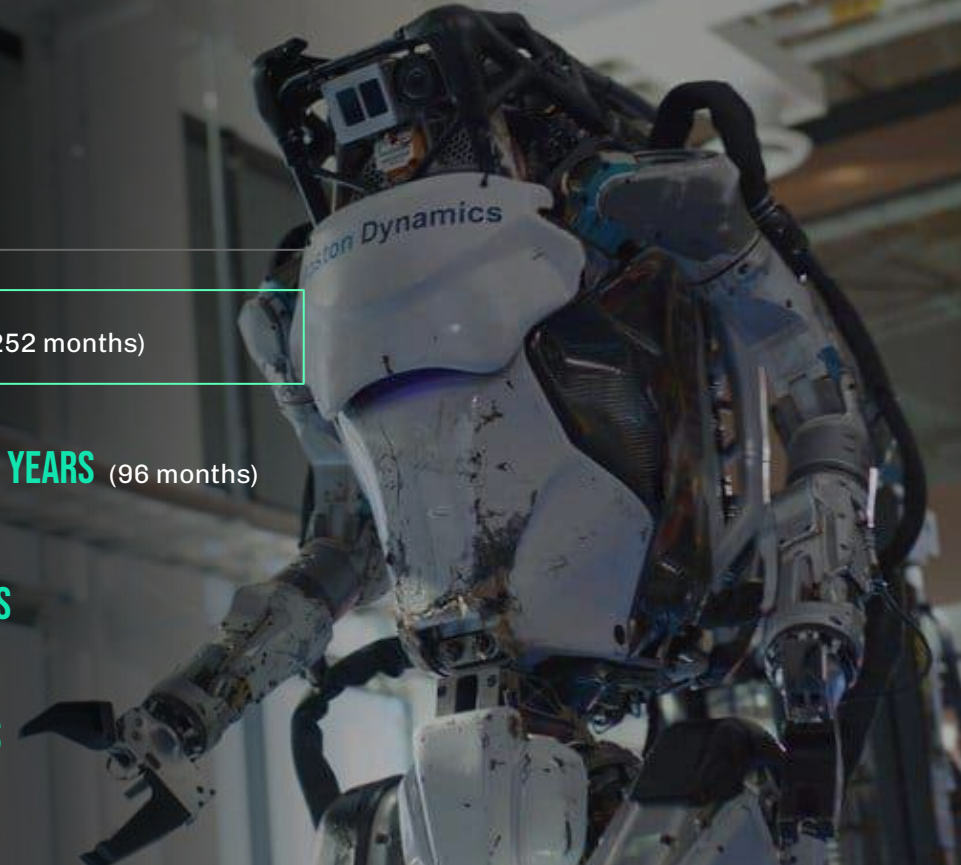
8 YEARS (96 months)

TESLA (2021)













15 MONTHS

 **FIGURE** (2023)

12 MONTHS

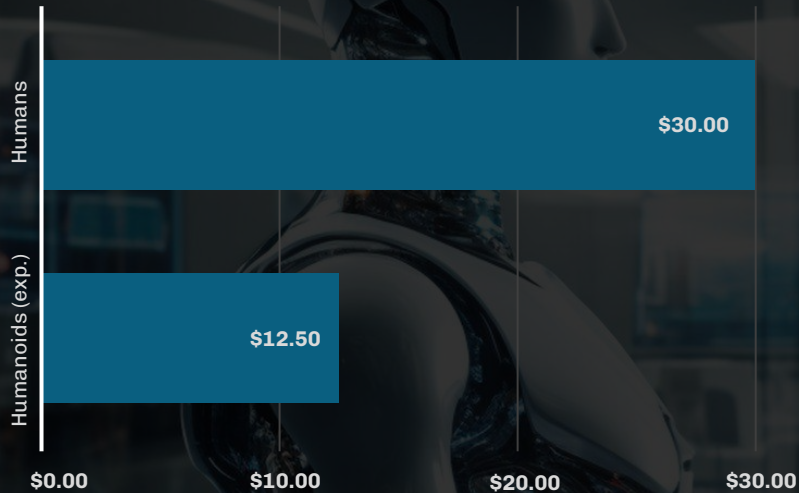


THE BEST COMPANIES IN NORTH AMERICA AND CHINA ARE QUICKLY FOLLOWING SUIT

	 SANCTUARY AI	 AGILITY ROBOTICS	Unitree	 agibot 敏捷医疗	 CLONE	 XPENG	Fourier Intelligence
Year Founded/ Humanoid Unveiled	Founded 2018	Unveiled 2019	Unveiled 2023	Founded 2023	Founded 2021	Unveiled 2023	Unveiled 2023
Robot Name	Phoenix	Digit	H1	RAISE-A1			GR-1
Partners/ Investors	Bell, Magna, Ansys	Amazon					
Noteworthy		Announced a factory to produce 10K/year in Sept 2023		Trained to walk in 6 months	“Biomimetic” using hydraulic valves as muscles	Xpeng is a leading EV OEM	
HQ							

HUMANOIDS WILL START IN WAREHOUSES WHERE COSTS HAVE ALREADY DROPPED BELOW PARITY AMIDST A TIGHTER LABOR MARKET

Avg. \$ Per Labor-hour



U.S. unemployment rate



But the inevitable TAM for a general purpose robot is “all human labor”

“Optimus ultimately will be worth more than the car business”

-Elon Musk



THE MOVING
WORLD REPORT 2024

AUTO



“Yes, my grandfather worked with Thomas Edison on the electric car, and he sold electric cars at the 1900 World's Fair in Paris.”

- Al Jardine

HERE'S TWO MAGAZINE **COVERS** BY THE ECONOMIST, 10 YEARS APART



2013

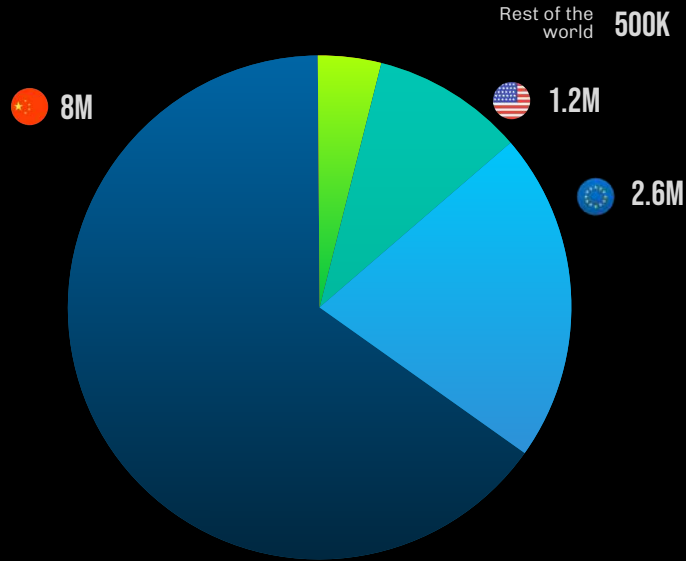


2023

CHINA IS BY FAR LARGEST EV PRODUCER BY 6X THE U.S., CRUISING BY JAPAN AS LARGEST EXPORTER OF CARS

CHINA UTTERLY DOMINATES GLOBAL EV PRODUCTION

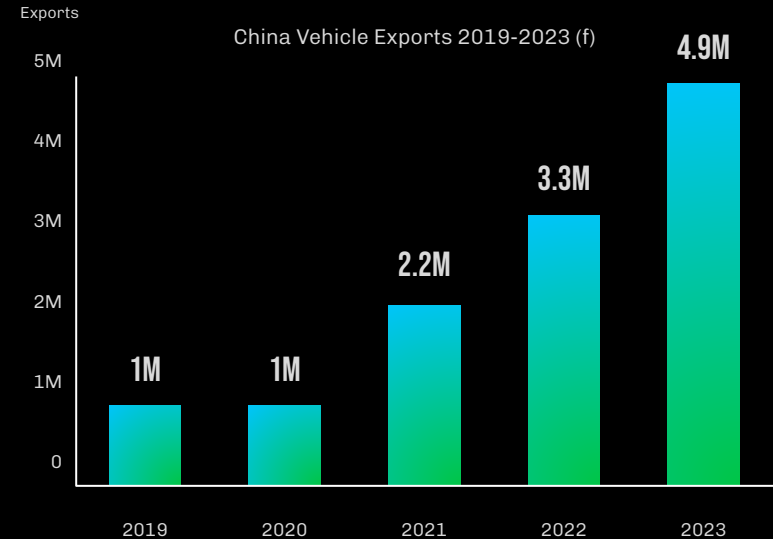
China also has world's two largest battery makers: CATL and BYD



Global EV Production 2023 (f)

EXPORT POWERHOUSE:

China has blown past Japan to become the world's No. 1 exporter

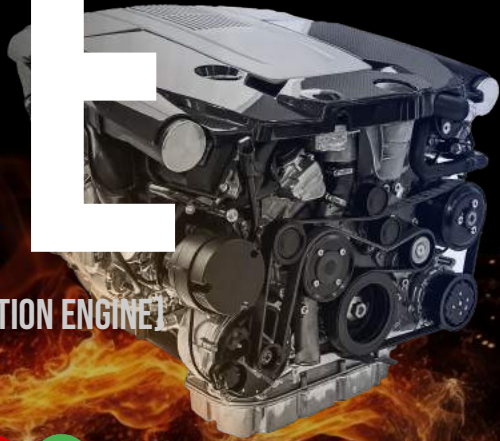


Shipping to more than **100 countries** in 2023.

CHINA'S STRATEGY IS TWOFOLD ON EXPORTING ICE AND EV (DEPENDING ON MARKET)

A GLOBAL TWO-TRACK EXPORT STRATEGY

ICE



(INTERNAL COMBUSTION ENGINE)



EV



(ELECTRIC VEHICLE)



China has capacity to build
40 million cars a year.
Domestic demand is **25 million**.

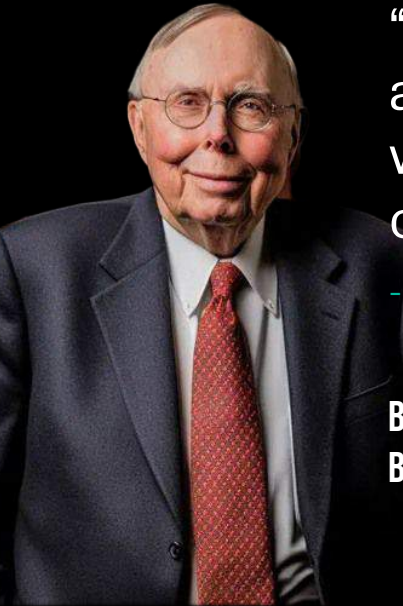
THE #1 EV CAR COMPANY IN THE WORLD IS CHINA'S BYD — DELIVERING 3M CARS IN 2023

BYD

“I have never helped do anything at Berkshire that was as good as BYD and I only did it once.”

- Charlie Munger

BERKSHIRE HATHAWAY HAS OWNED UP TO 21% OF BYD, WITH THE FIRST INVESTMENT MADE IN 2008

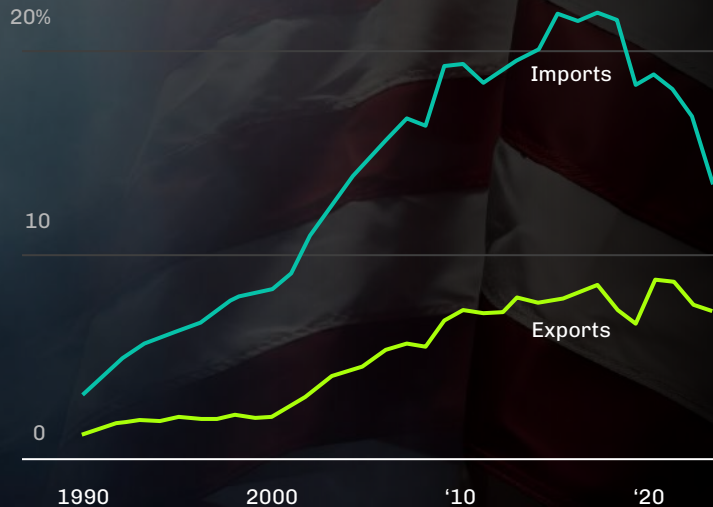


THE U.S. AND CHINA ARE **BREAKING UP**... AND MEXICO IS THE NEW BEAU

How U.S. and China Are Breaking Up, in Charts

Americans keep buying less from China, dropping its share of imports to a 20-year low

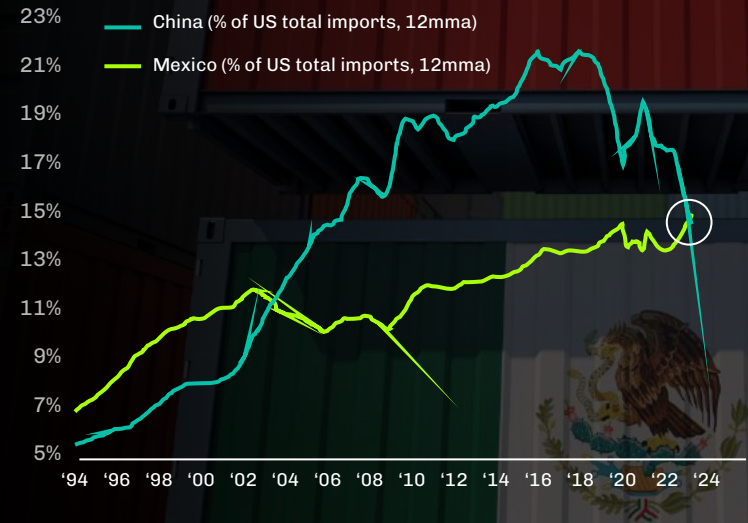
China's share of U.S. goods imports and exports



Source: The Kobeissi Letter

U.S. importing more from Mexico than China for first time since 2003

China and Mexico as % of U.S. imports (12-month moving average)



Source: BofA Global Investment Strategy, Bloomberg

BUT CHINESE EV GIANTS AND OTHER INDUSTRIALS ARE QUICKLY **RAMPING UP** FACTORIES IN MEXICO AND BRAZIL



BYD inks deal to take over former Ford factory in Bahia Brazil as a beachhead for Brazil



Stella Li, Executive Vice President of BYD and CEO of BYD Americas



In 2021, Chinese companies were responsible for 30 percent of foreign investment in Nuevo León, second only to the United States at 47 percent.

BYD IS BIG, BUT THE **DOMINANCE** OF TESLA IS UNMISTAKABLE

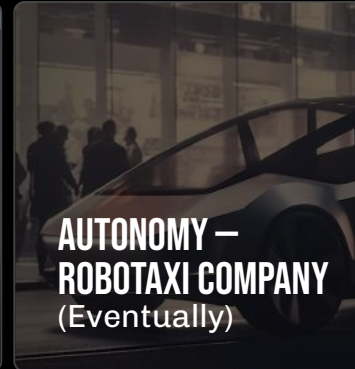
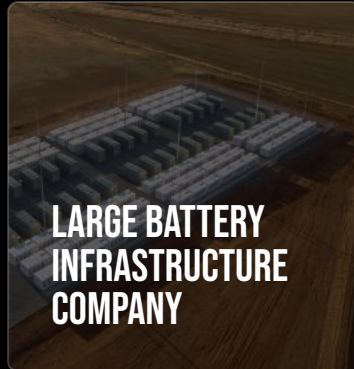
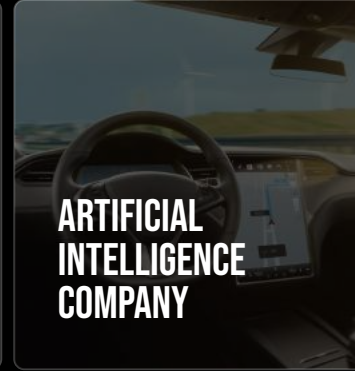
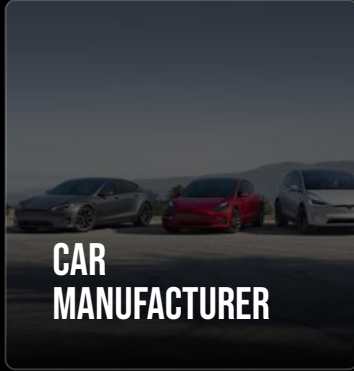
Berkshire cuts
BYD holding 11
times in 2023.

“We don’t want to
compete with Elon
in a lot of things.”

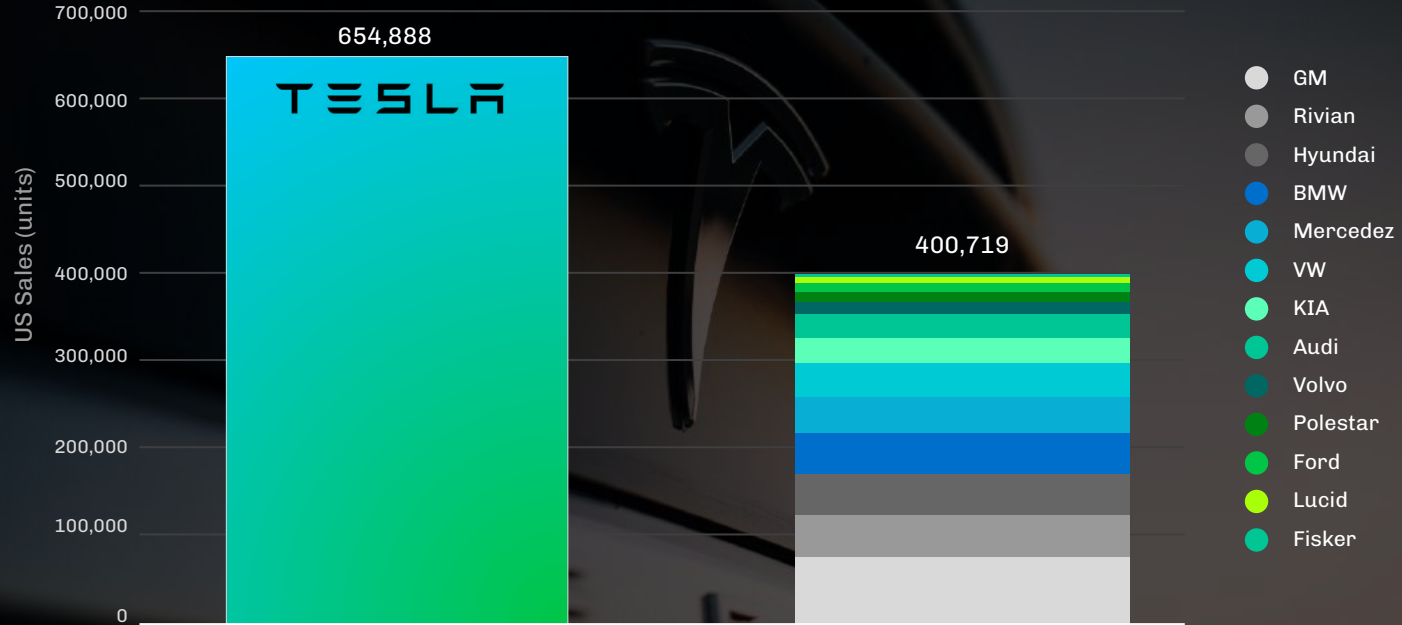
- Warren Buffett

TESLA IS NOT A CAR COMPANY. IT'S A MULTI-INDUSTRY TECHNOLOGY CONGLOMERATE

TESLA

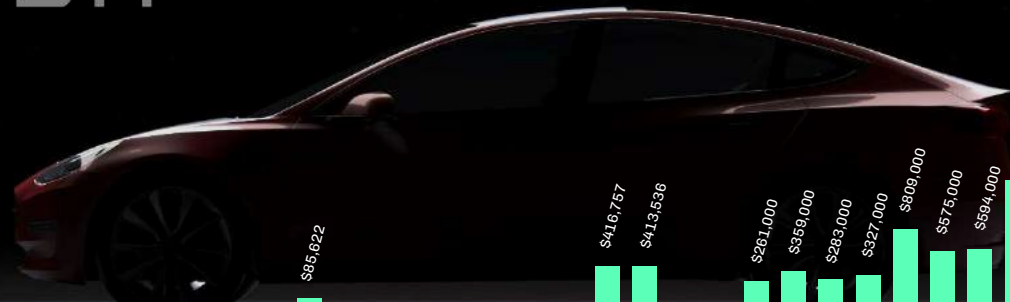


U.S. EV SALES COMPARISON: TESLA VS OTHER AUTOMAKERS (2023)



TESLA QUARTERLY EARNINGS

TESLA



Source: UP.Partners research and Tesla published financial statements

MEANWHILE, EV **RESET** ACROSS LEGACY AUTO OEMS MAKING HEADLINES

electrek

FORD WILL FOLLOW TOYOTA AS IT LEANS INTO HYBRIDS, SCALING BACK EV TARGETS

December 28, 2023

electrek

AUDI PUTS BIG EV PUSH ON THE BACK BURNER

December 19, 2023

Automotive News

FORD CUTTING 2024 F-150 LIGHTNING PRODUCTION PLANS BY HALF, SUPPLIERS TOLD
The news comes amid an industrywide pullback in EV investment due to slower-than-expected sales growth.

December 11, 2023

RDN REPAIRER DRIVEN NEWS

FORD, GM TEMPER EV EXPECTATIONS AS MERCEDES EXEC CALLS IT A 'BRUTAL SPACE'

December 19, 2023

REUTERS

TESLA JOINS GM, FORD IN SLOWING EV FACTORY RAMP AS DEMAND FEARS SPREAD

October 19, 2023

TESLARATI

PORSCHE WARNS SUPPLY CHAIN ISSUES ARE AFFECTING EV PRODUCTION

July 26, 2023

TheStreet

AUTO GIANT PAUSING PLANT PRODUCTION ON THIS NEW VEHICLE LINE

GM presses "pause" on its new EV truck at one key factory.

October 19, 2023

THE WALL STREET JOURNAL

TOYOTA CHAIRMAN SAYS "PEOPLE ARE FINALLY SEEING REALITY" OF EVS

October 25, 2023

CBS DETROIT

GM'S EV PARTNERSHIP WITH HONDA HITS THE BRAKES AMID UAW STRIKE, PRODUCTION DELAYS

October 25, 2023

electrek

VW DELAYS NEW PORSCHE MACAN EV PLATFORM, CUTS JOBS AS SOFTWARE STRUGGLES PERSIST

October 27, 2023

REALITY SETS IN FOR OTHERS





Sawyer Merritt  @SayerMerritt 

Rivian lost \$94,541 for every vehicle that they delivered in Q2 2023. This compares to \$383,000 per vehicle in Q2 2022.

Overall, the company lost \$13.1M per day in Q2 2023.



Farzad  @farzyness 

Lucid is **losing** ~\$596,616 per car.

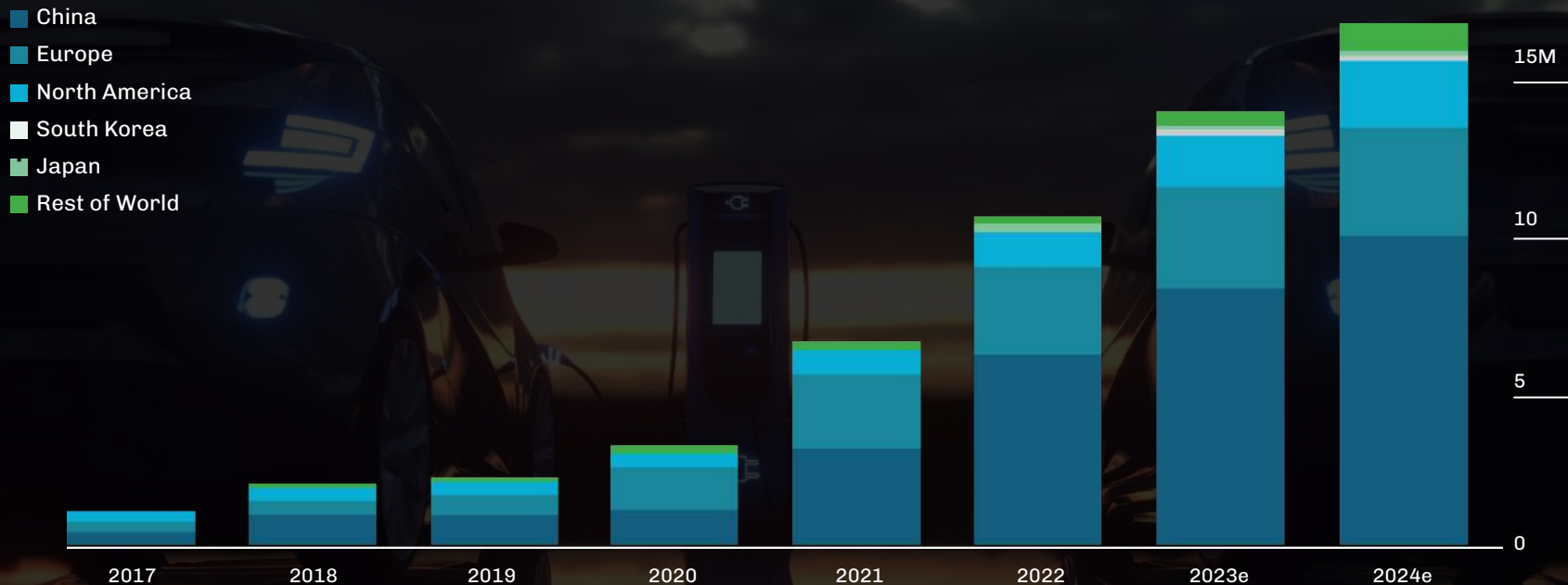
Lucid **delivered 1,404 vehicles in Q2 2023 and recorded -\$838M loss from operations**

[\\$LCID](#)



DESPITE ALL THIS, THE EV ADOPTION IS SLOW AND STEADY

Sales of passenger EVs



Note: Includes battery-electric and plug-in hybrid vehicles. Excludes commercial vehicles and two-and-three wheelers. December 2023 data estimated for some countries. 2024 is BNEF's forecast.

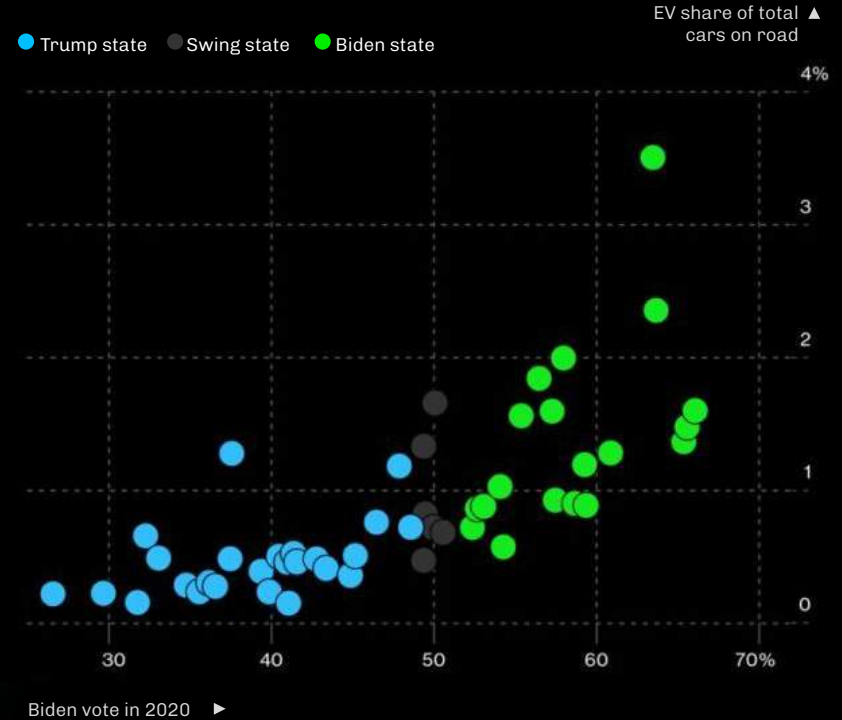
Source: BloombergNEF

BUT COULD CYBERTRUCK BE THE UNLOCK FOR TRUMP VOTERS?



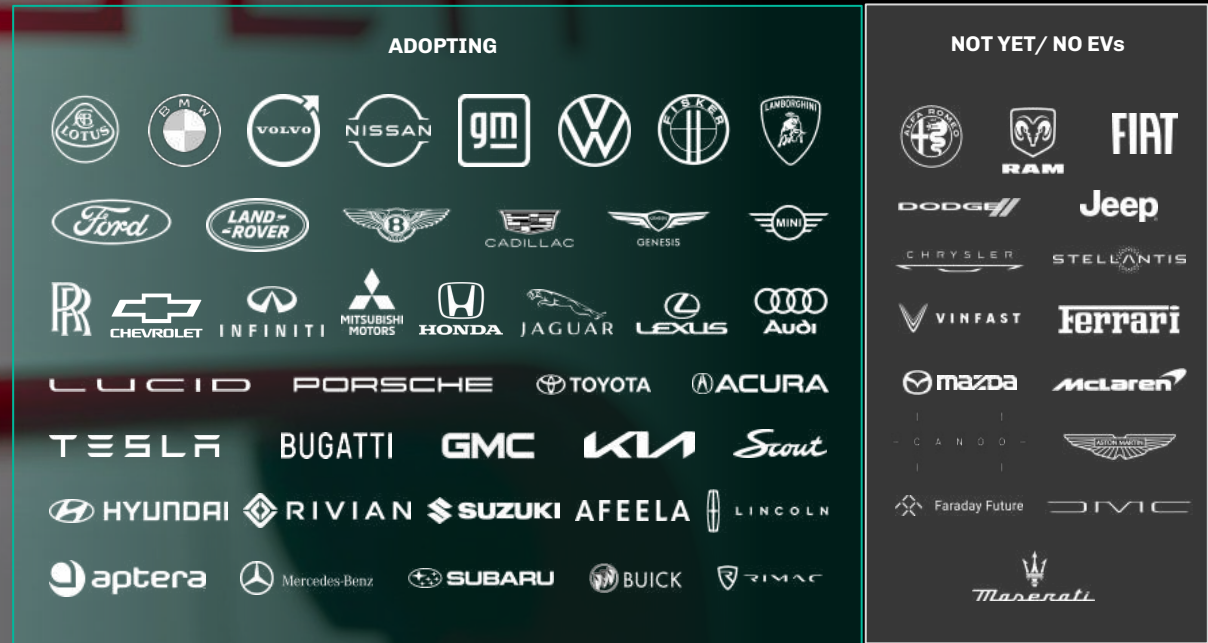
EV Ownership Is Split by Politics in U.S.

Share of electric vehicles vs. 2020 presidential vote



2023 NORTH AMERICAN CHARGING STANDARD BECAME THE NORM — TESLA WON, AGAIN

North American Charging Standard (NACS) Adoption



Adopting

Not yet/no EV's

BY 2030, THE UNITED STATES WILL NEED ABOUT 28 MILLION PORTS TO MEET DEMAND FOR ZERO-EMISSION PASSENGER VEHICLES

U.S. charging demand for zero-emission passenger vehicles, millions of ports

Public Private

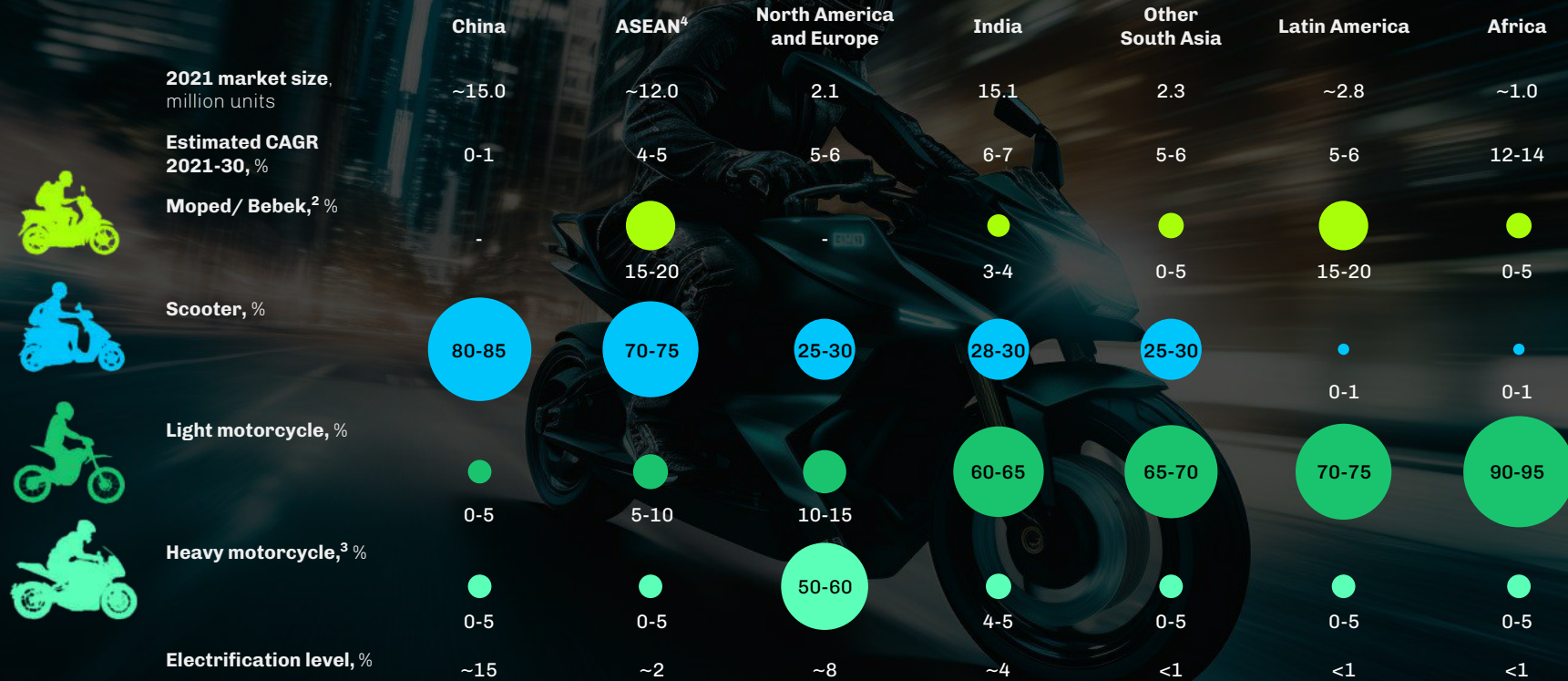


Note: Based on a scenario where passenger electric vehicles account for nearly half the vehicles sold in the United States in 2030, in line with a federal target.

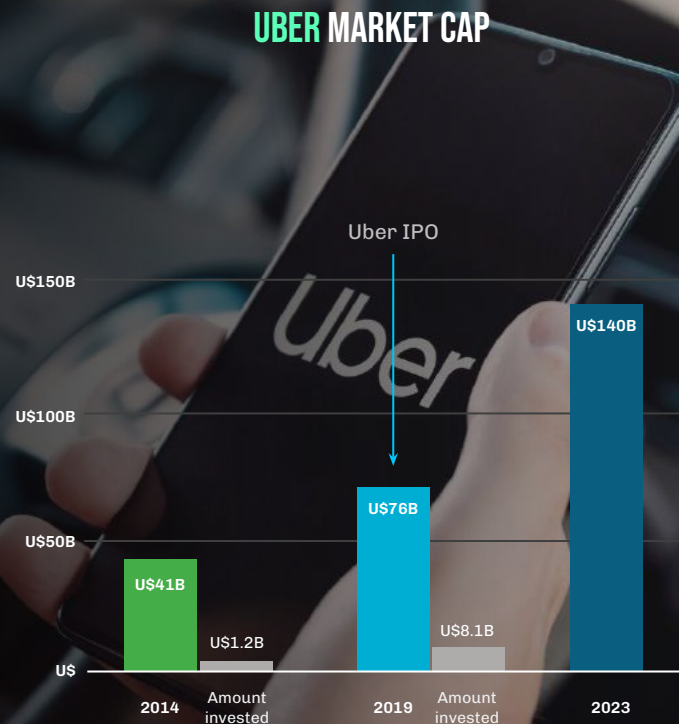
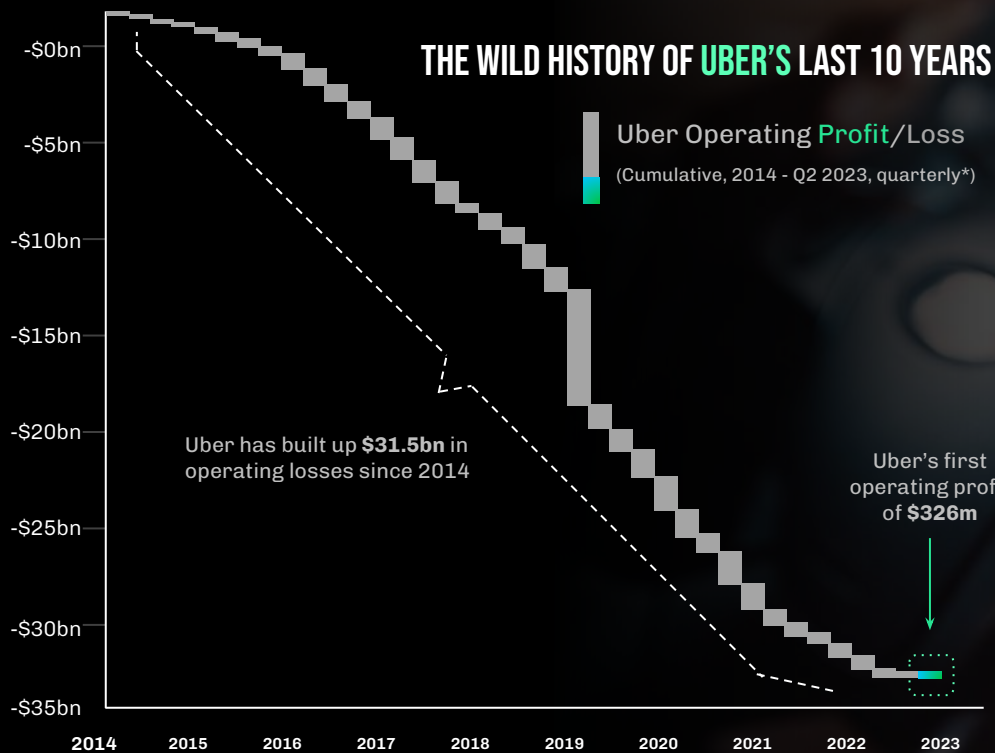
Source: McKinsey & Company

AFRICA AND INDIA TO EXPERIENCE FASTEST GROWTH RATES FOR E-MOTORCYCLES

Electric 2-wheeler facts and product mix, by geography¹



TRANSFORMING LEGACY BUILT WORLD INDUSTRIES TAKES DECADES AND BILLIONS





THE MOVING
WORLD REPORT 2024

GROUND AND SEA FREIGHT

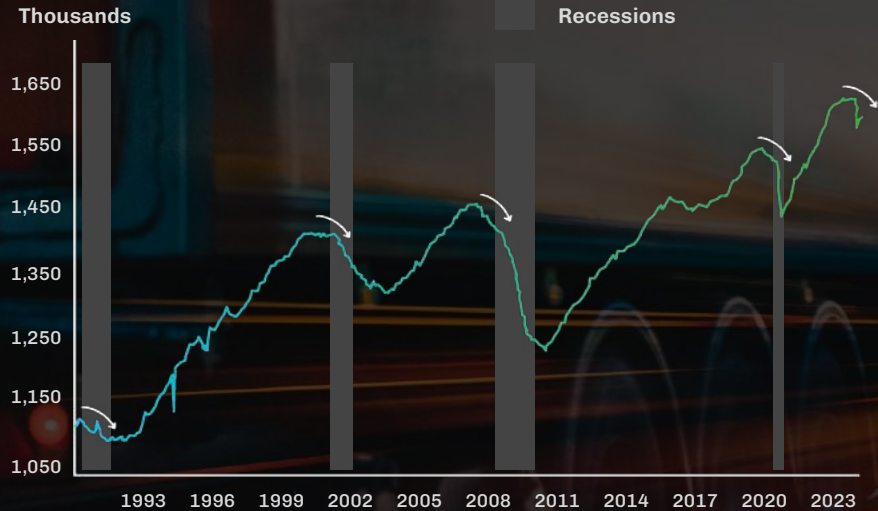
A large, stylized number '4' is positioned on the left side of the slide. It is composed of several overlapping, semi-transparent shapes in shades of teal and light blue, creating a layered, geometric effect.

“This freight recession is
unlike any other in history.”

- Craig Fuller, CEO Freightwaves

U.S. FREIGHT HAS GONE THROUGH A MAJOR RECESSION IN 2023

Trucking Sector Employees Laid Off
All employees, truck transportation



Trucking Employment Index for Each Cycle



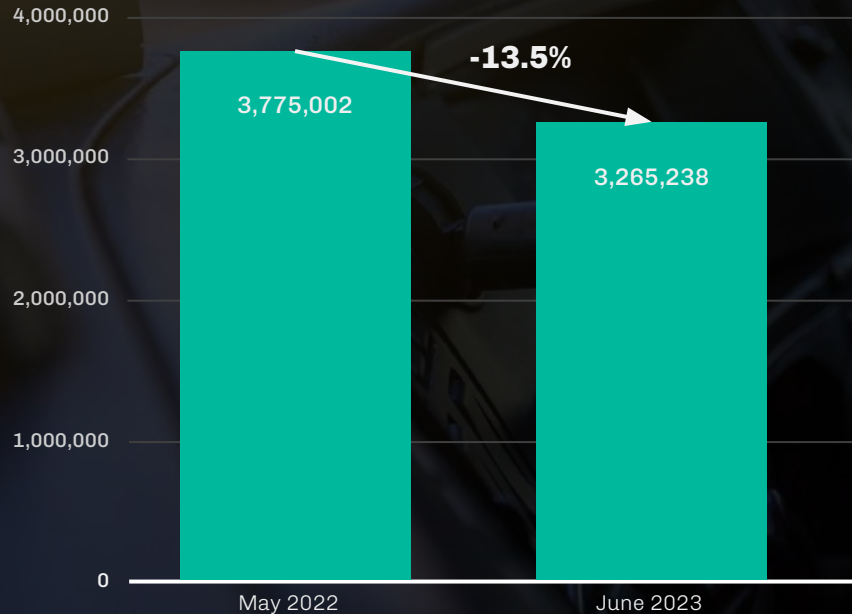
Dates: 1990 Through October 2023

Source: U.S. Bureau of Labor Statistics, Game of Trades and UP.Partners research.

50,000 TRUCKING COMPANIES HAVE CEASED OPERATIONS SINCE MAY 2022

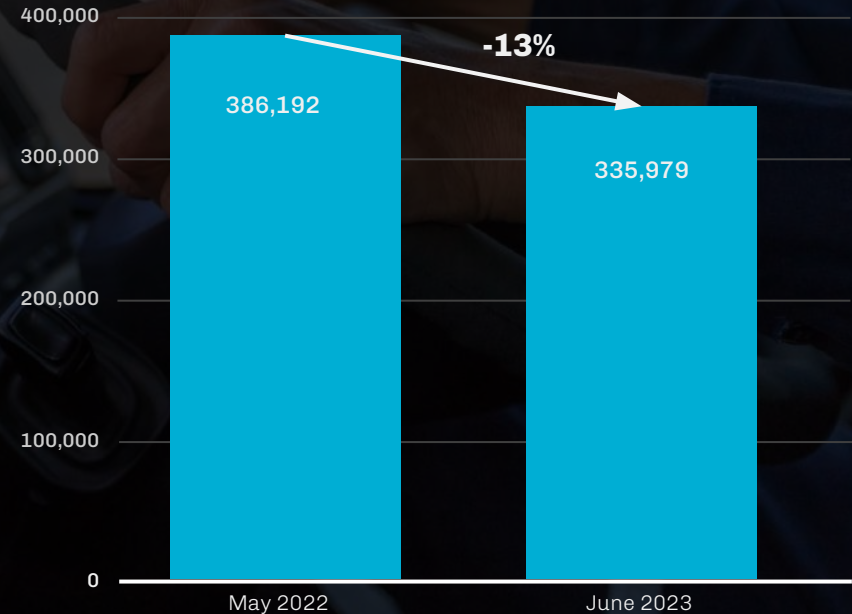
~510,000 Drivers Have Stopped Driving in 14 months

Drivers



Over 50,000 Fleets Have Ceased Operating

Fleets



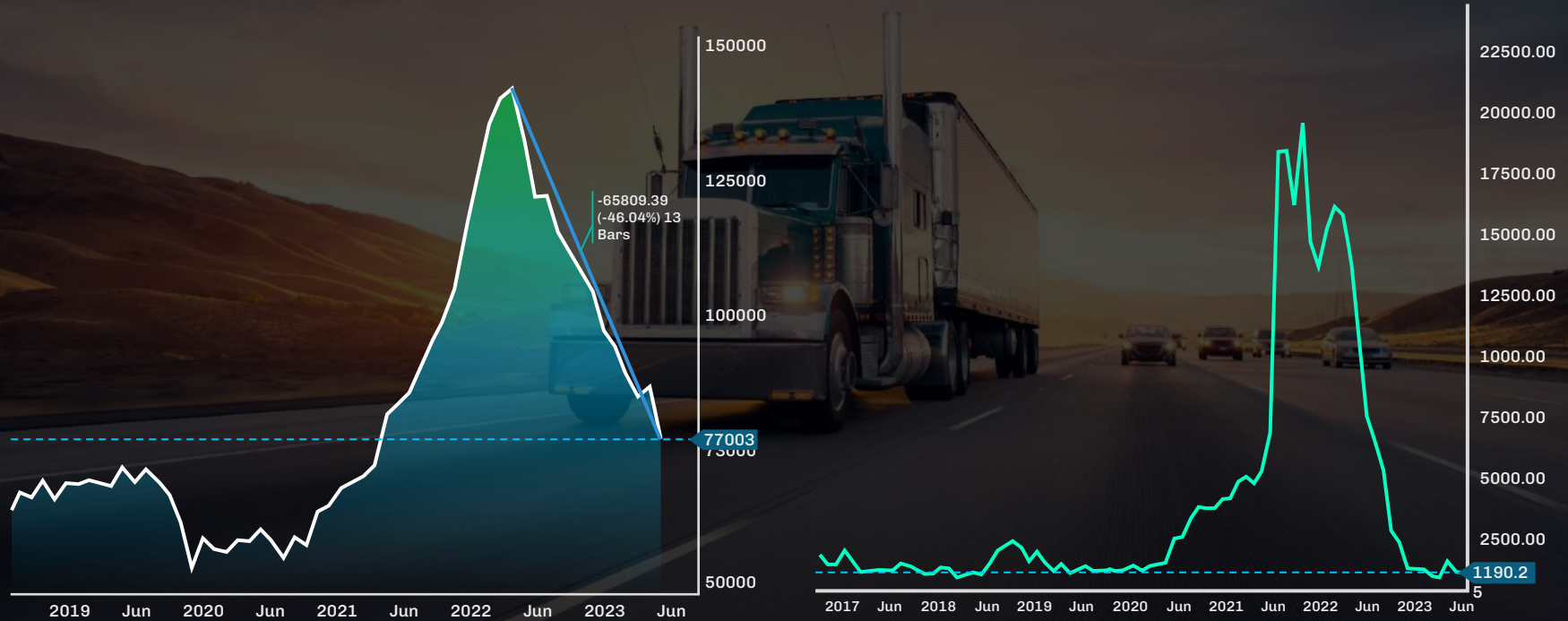
Notes: Active motor carriers excludes some categories, such as private not-for-hire fleets and vocational fleets. Active means insurance must be current. Motor carriers includes all truckload, final mile and LTL niches.

Source: FMCSA and QualifiedCarriers.com

USED TRUCK PRICES HAVE RETURNED TO EARTH, AS HAVE GROUND FREIGHT PRICES

ACT Research three-year-old used truck price index,
(United States of America)

Freightos Baltic Daily Index,
(China North America West)



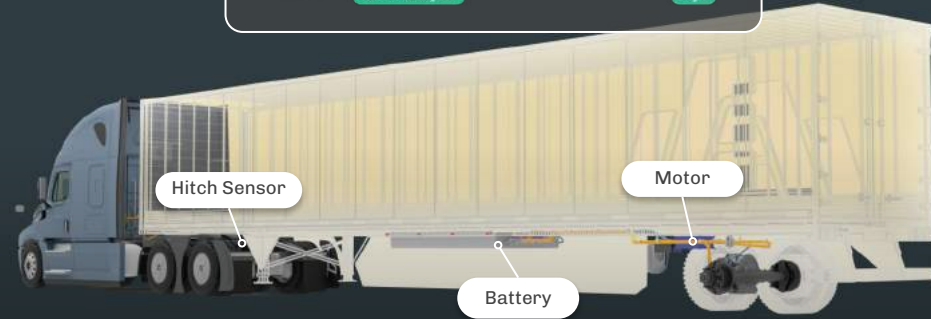
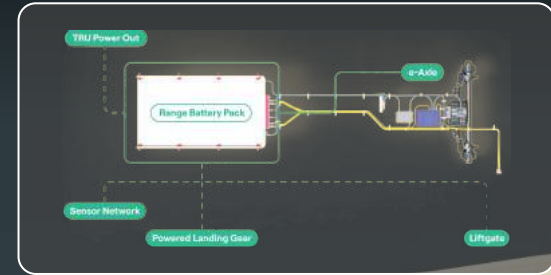
HARDWARE TO WATCH — GATIK AUTONOMOUS TRUCKS AND RANGE ENERGY TRAILER



Gatik

Gatik makes autonomous trucks exclusively for middle-mile logistics and has already delivered over 500K orders with no human driver in the cab.

Source: UP.Partners research and public company information



range

Range Energy offers a plug 'n' play electrified trailer solution that reduces fuel consumption in semi-trucks by nearly 40%.



**AROUND 80% OF
THE VOLUME OF
INTERNATIONAL
TRADE IN GOODS IS
CARRIED BY SEA**

SEA FREIGHT IS FARING NO BETTER AND HAS SOME OTHER ISSUES TO CONTEND WITH...



Dooner  @TimothyDooner



"This is not a diet. This is a reset of the baseline." —Maersk CEO

Maersk cuts 10,000 jobs due to global trade downturn

They say the new normal is subdued macroeconomic outlook, soft volumes for coming years, inflation, global uncertainty



TWO OF THE MOST IMPORTANT MARINE CHOKE POINTS ARE **DISRUPTED**: PANAMA CANAL DUE TO DROUGHT AND SUEZ CANAL DUE TO THE HOUTHIS ATTACKS

MailOnline

Crucial waterway

Global trade faces even more turmoil as Panama Canal is forced to slash ship transits by more than a third due to drought

PANAMA CANAL

40%

of U.S. container traffic

Source: UP.Partners research



Houthi movement

Houthi attacks in the Red Sea

SUEZ CANAL

30%

of global container traffic

THIS MEANS HIGHER SHIPPING COSTS AND SLOWER DELIVERIES

“Several shipping giants have announced price hikes, signaling a potential 100% increase in Asia-Europe shipping costs.” NG-Terminal

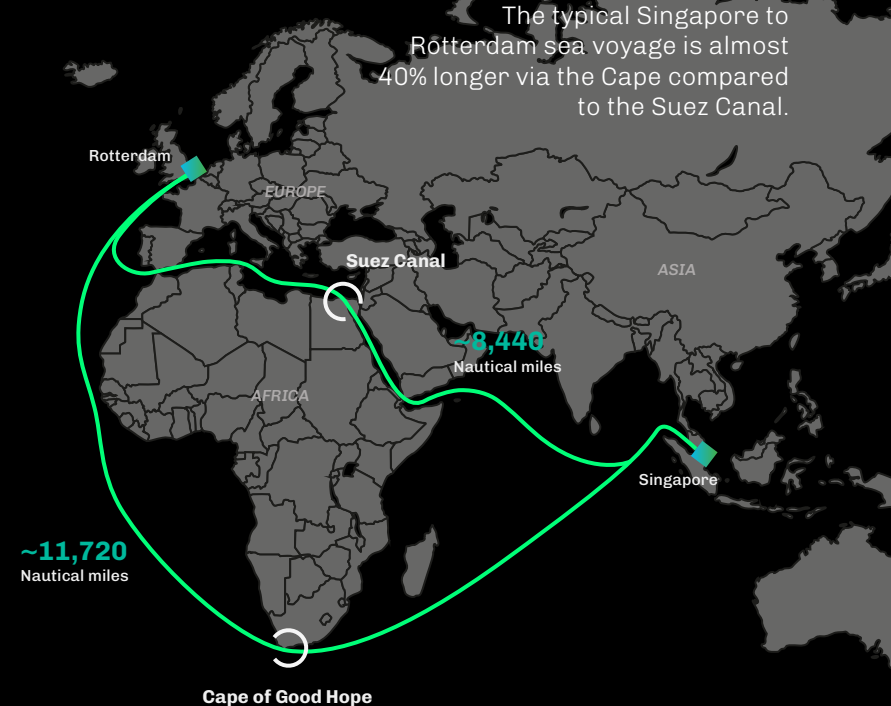
Panama Canal Jam Spurs Alternate Ship Routes

Shippers face higher costs with either increased voyages or surging canal fees



Note: Trip length assumes speed of 20 knots

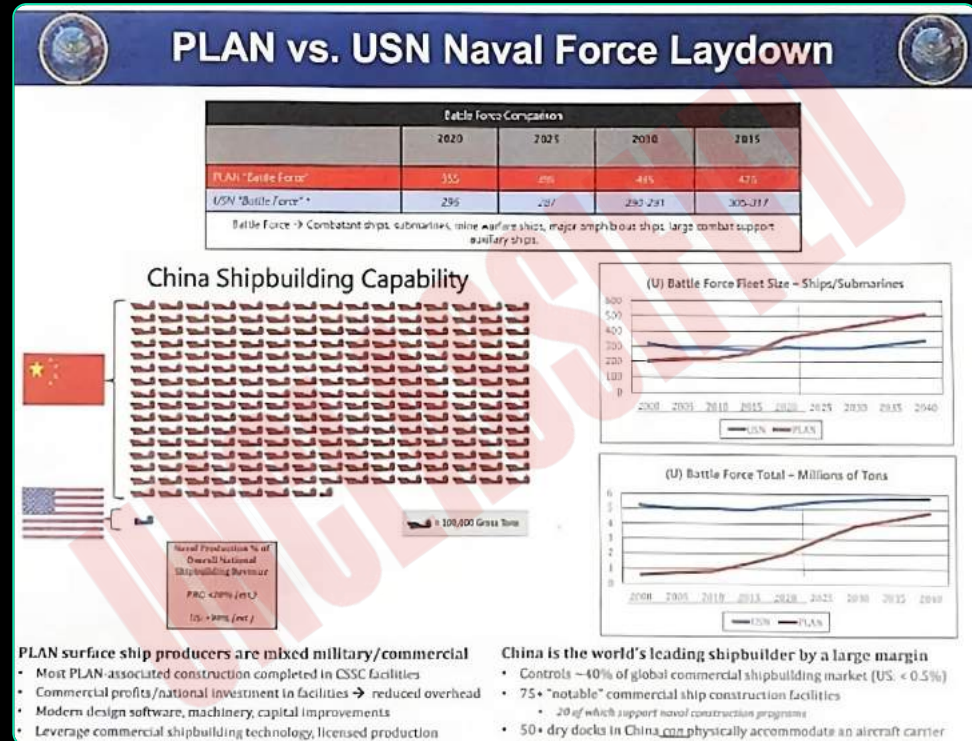
Source: Shiptracking data compiled by Bloomberg, Panama Canal Authority



CHINA HAS 232 TIMES THE SHIP BUILDING CAPACITY OF THE UNITED STATES THAT'S NOT A TYPO

“Indeed, the shipbuilding divide between China and the United States is vast. A recently declassified intelligence slide from the Office of Naval Intelligence estimates that China has 232 times the shipbuilding capability of the United States, owing to its much larger shipbuilding manufacturing industry.”

- AEI



HARDWARE TO WATCH

Airbus is renewing its sea fleet with low-emission ships featuring wind propulsion to reduce transatlantic carbon emissions by over half before 2030.



Source: Simple Flying



Regent — An electric flying boat, piloted by mariners. On par with price/seat as sea ferry but at airplane speeds.

HUMAN INTERVENTION IN COMPLEX SYSTEMS CAN HAVE UNINTENDED CONSEQUENCES: NO SULFUR, NO SEA CLOUDS

In 2020, sulfur was significantly removed from ship fuel for environmental reasons.

As a result, there has been a stark reduction in sea clouds, the clouds that form from sulfur-emitted exhaust from ships.

As a result, more sunlight is being absorbed in the atmosphere and increasing global temperatures, not reducing!

“It’s as if the world suddenly lost the cooling effect from a fairly large volcanic eruption each year.”


—Michael Diamond, atmospheric scientist, Florida State University.





THE MOVING
WORLD REPORT 2024

RENEWABLES, ENERGY, AND OIL

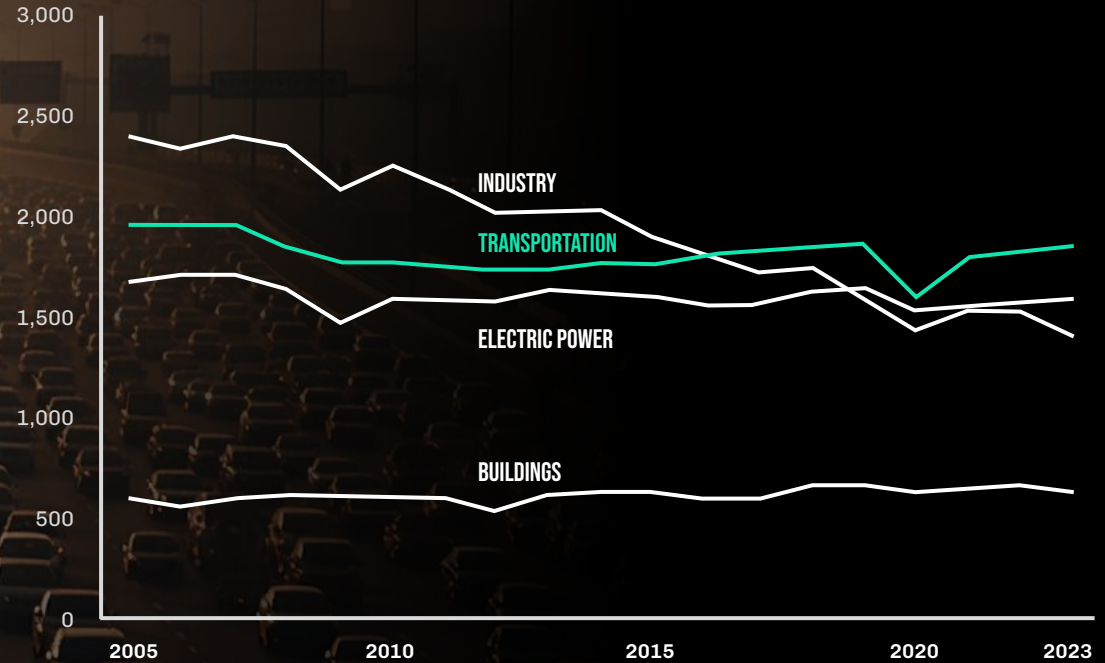


“Talking about mobility without talking energy is like talking about computers without talking about the internet.”

- Cyrus Sigari, Co-founder UP.Partners

MOBILITY IS THE LARGEST CO₂ CONTRIBUTOR IN THE UNITED STATES

U.s. ghg emissions by major emitting sector
Million metric tons CO₂ - equivalent



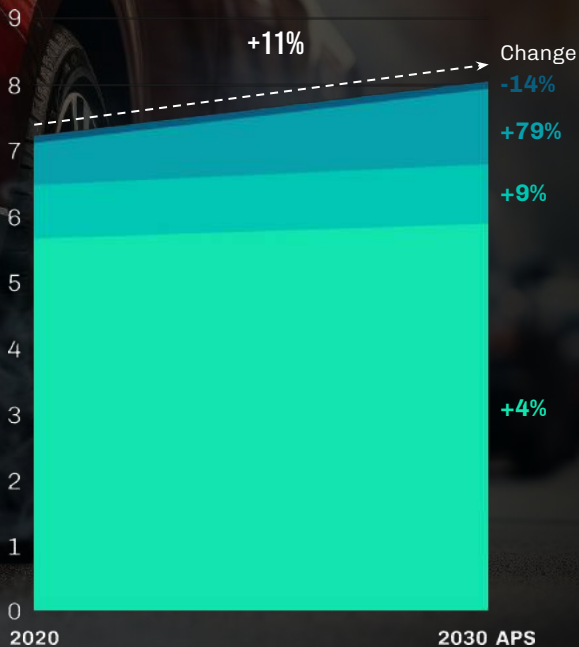
MOBILITY'S NET-ZERO FUTURE IS A FANTASY UNLESS RADICAL INNOVATION IS UNLOCKED

PROJECTED CO2 EMISSIONS GLOBALLY FROM TRANSPORT BY SUBSECTOR IN GT CO2

● Road ● Shipping ● Aviation ● Rail

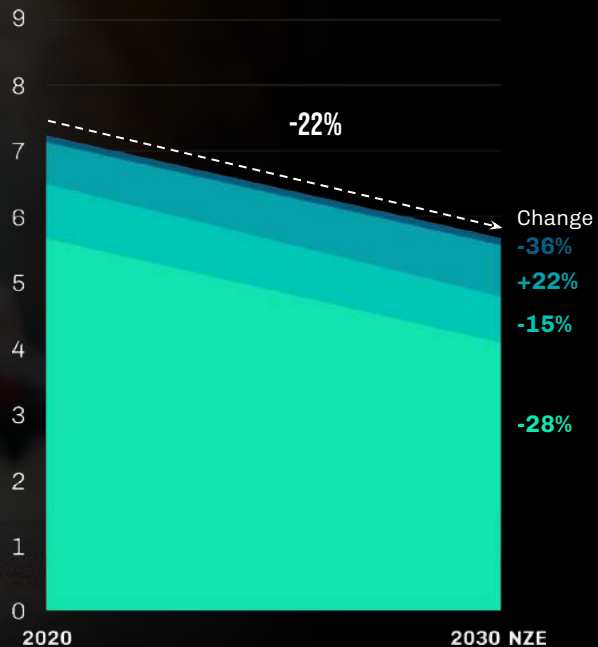
WHERE IT'S CURRENTLY HEADING

Announced Pledges Scenario (APS)



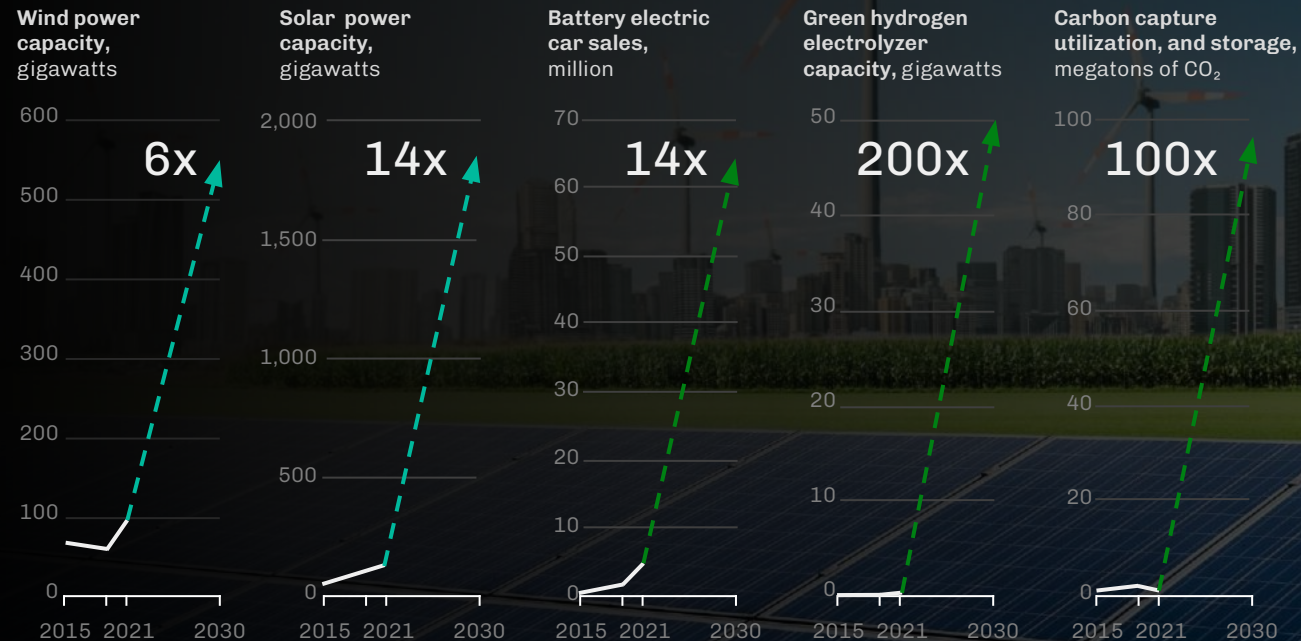
WHERE IT SHOULD BE HEADING

Net-Zero Emissions by 2050 Scenario (NZE)



TO REACH NET-ZERO TARGETS, A SET OF EXISTING CLIMATE TECHNOLOGIES WOULD NEED TO SCALE **EXPONENTIALLY** BY 2030

Annual deployment of climate technologies needed,¹
multiples of current supply

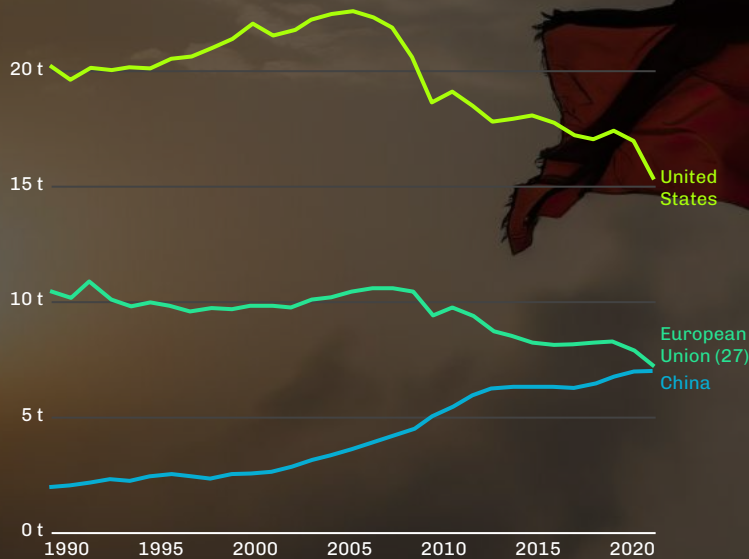


¹Based on the McKinsey 1.5°C achieved commitments scenario, which represents existing commitments from companies and policies from countries. To conduct this analysis, we estimated the current trajectory of supply of key climate technologies (based on historical and current activity), factored in current emissions-reductions commitments from countries and governments, and assessed the supply of these technologies that would be required by 2030 to stay on track for a 1.5° pathway. Source: EV-Volumes; IEA; International Renewable Energy Agency; McKinsey analysis

WEST IS CUTTING WHILE CHINA IS GROWING EMISSIONS

Per capita consumption-based CO² emissions

Consumption-based emissions¹ are national emissions that have been adjusted for trade. It's production-based emissions minus emissions embedded in exports, plus emissions embedded in imports.



1. Consumption-based emissions: Consumption-based emissions are national or regional emissions that have been adjusted for trade. They are calculated as domestic (or 'production-based' emissions) emissions minus the emissions generated in the production of goods and services that are exported to other countries, plus emissions from the production of goods and services that are imported.
Consumption-based emissions = Production-based – Exported + Imported emissions

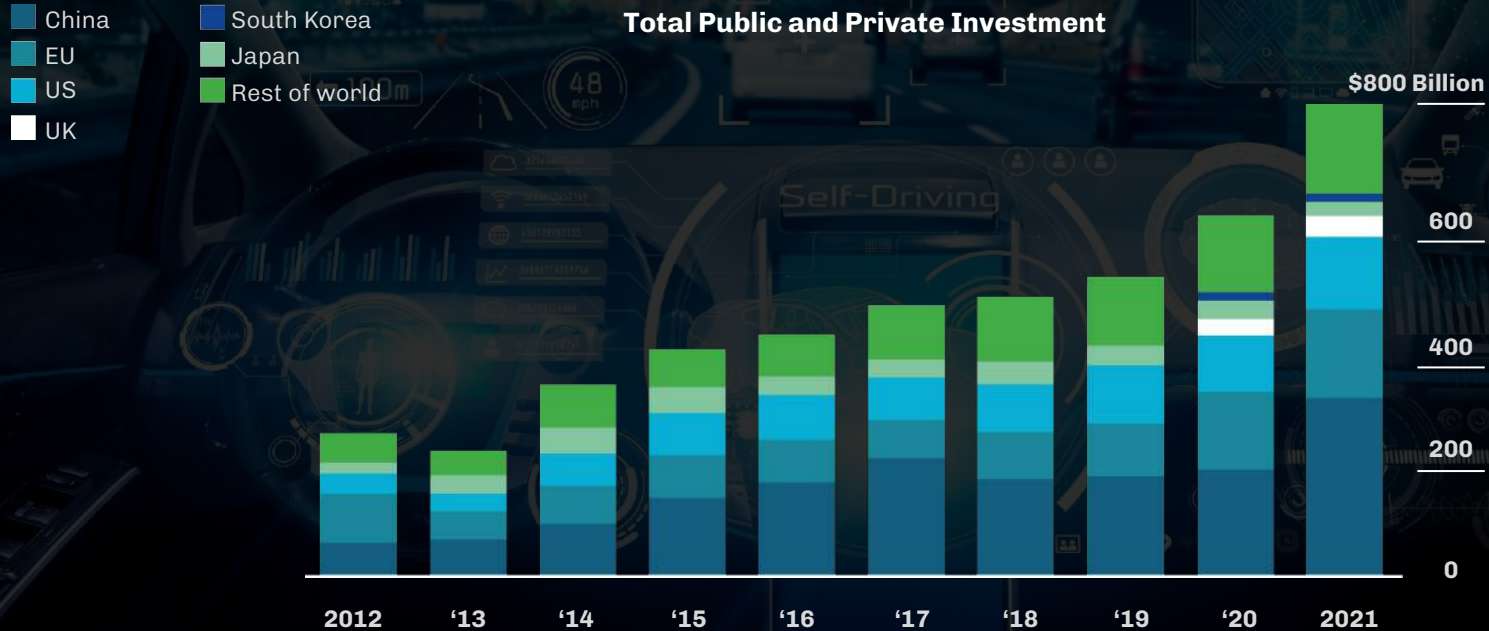
Annual CO² emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.



1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

EVEN WHILE CHINA IS SPENDING MORE THAN THE WEST ON ITS ENERGY TRANSITION



EUROPE IS TURNING AGAINST CLIMATE CHANGE AGENDA



Peter St Onge, Ph.D. ✓
@profstonge



Sanity in Sweden as government abandons "renewables" for nuclear.

"The Swedish people wish to ground their economy in an energy source that is physically sound and secure, unlike renewables which are neither."



4:40 AM - Jun 26, 2023 - 2.8M Views



Net Zero Watch ✓
@NetZeroWatch



The anti-Net Zero rebellion is coming! Spain's main opposition party promises to tax renewables if it wins looming elections. Beware the [#CostofNetZero](#)



1:51 AM - Jul 8, 2023 - 1.3M Views

GERMANY IS THE CANARY IN THE LITERAL COAL MINE

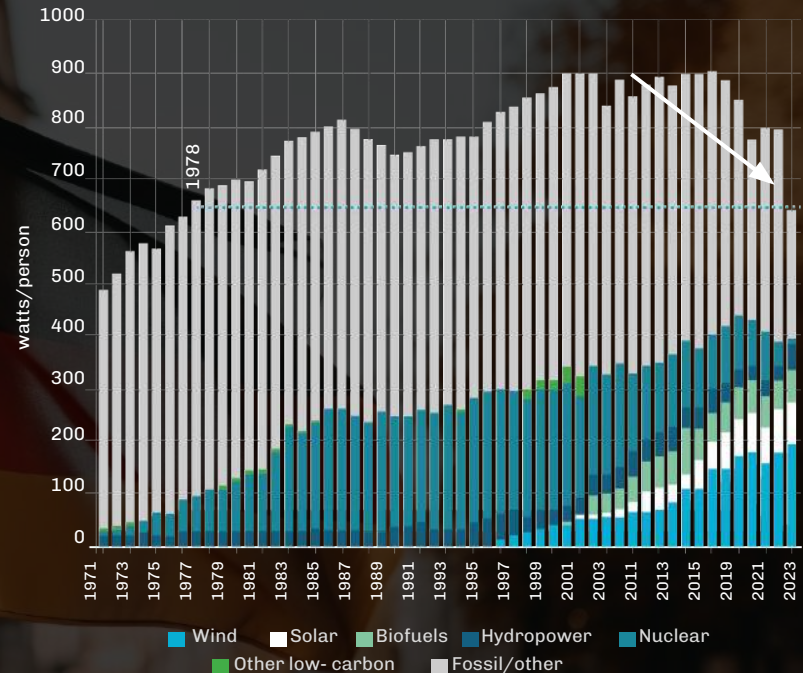
Average German now uses less electricity than in 1978

Greens praise lower emissions, but German de-industrialization is nothing to celebrate

German household electricity price, adjusted for inflation



Electricity consumption in Germany — watts/person

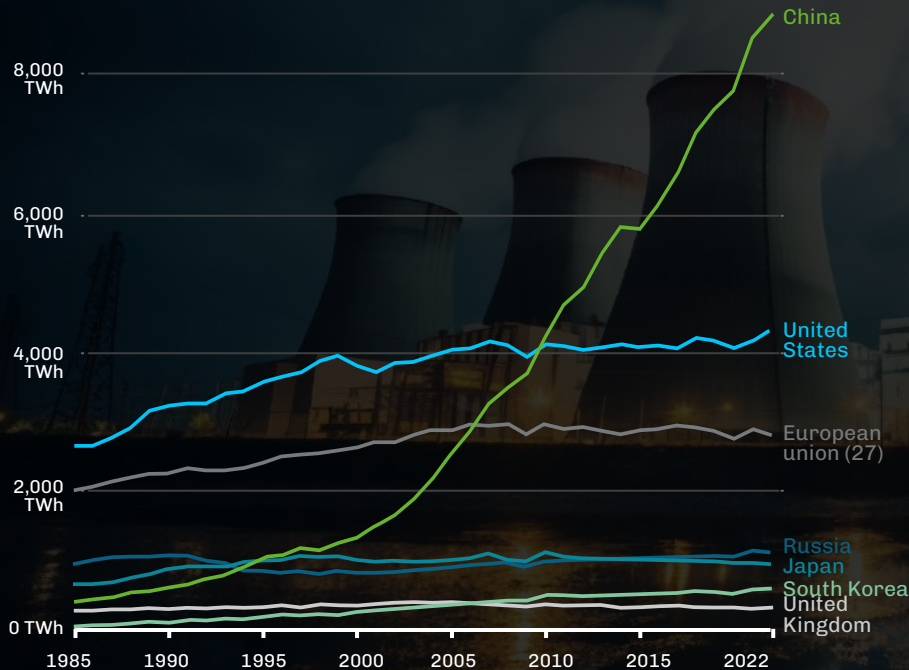


Source: Eurostat household electricity prices with taxes and consumer price index from details.de.twitter.com/bjornlomborg

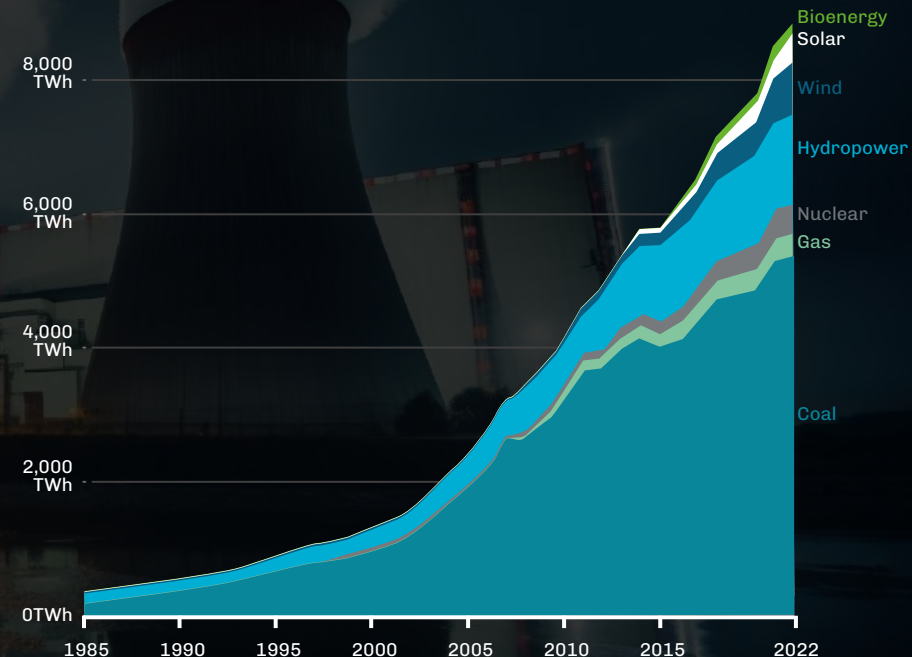
Source: LowCarbonPower. twitter.com/bjornlomborg

WHILE GERMANY GOES INTO THE DARK AGES, CHINA HAS A DIFFERENT PLAN

Electricity Generation



Electric Production by Source, China



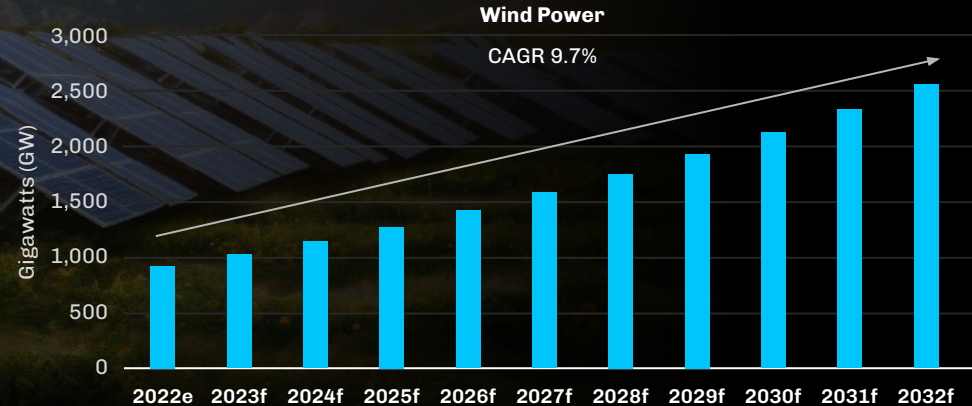
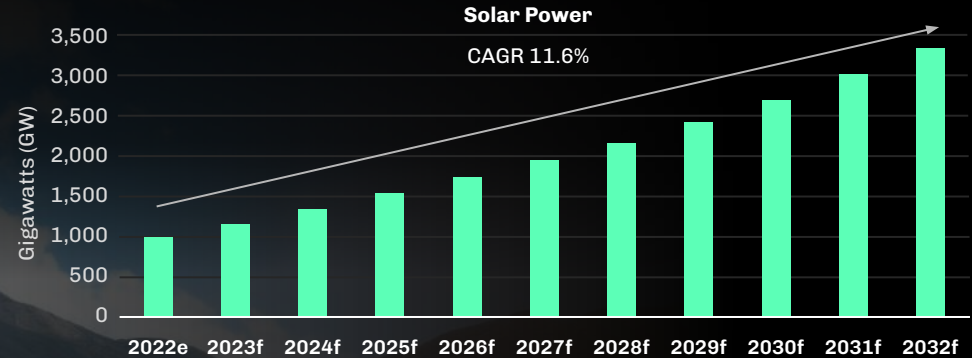
Data Source: Ember's Yearly Electricity Data; Ember's European Electricity Review; Energy Institute Statistical Review of World Energy
OurWorldinData.org/energy | CC BY

Source: Our World in Data based on BP statistical Review of World Energy (2022); Ember(2023)
Note: 'Other renewables' includes waste, geothermal, wave and tidal.

WE HAVE A FREE **NUCLEAR FUSION REACTOR**, THE SUN, WHICH WE JUST NEED TO ACCESS THROUGH SOLAR

While solar and wind cannot be the sole source of generation, planned capacity will grow rapidly

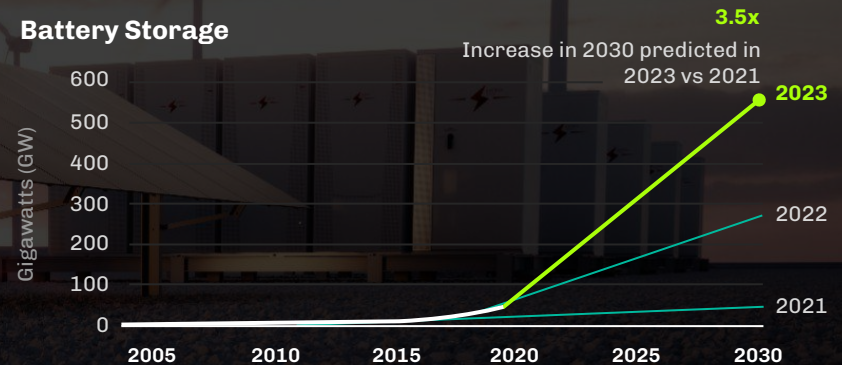
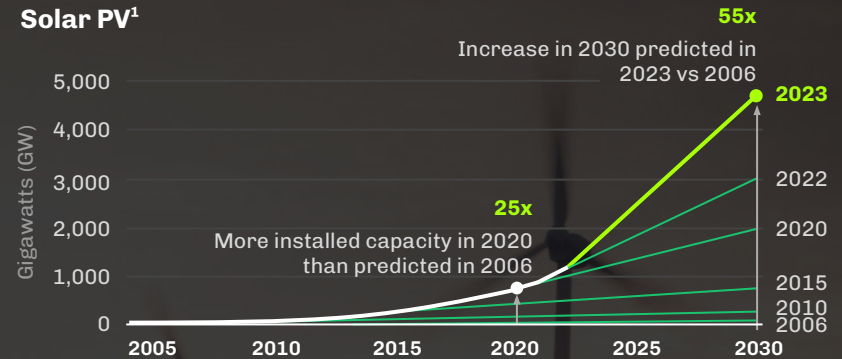
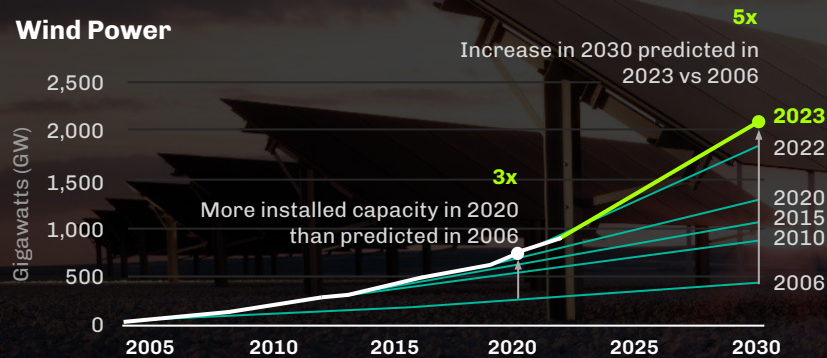
GLOBAL SOLAR AND WIND POWER CAPACITY (GW)



Note: CAGR is Compound Annual Growth rate, e= estimate, f=forecast.

MANY TRANSFORMATIONAL ENERGY TECHNOLOGIES HAVE OUTPACED FORECASTS OVER THE PAST DECADE

Annual global forecast of cumulative installed capacity, by IEA report year



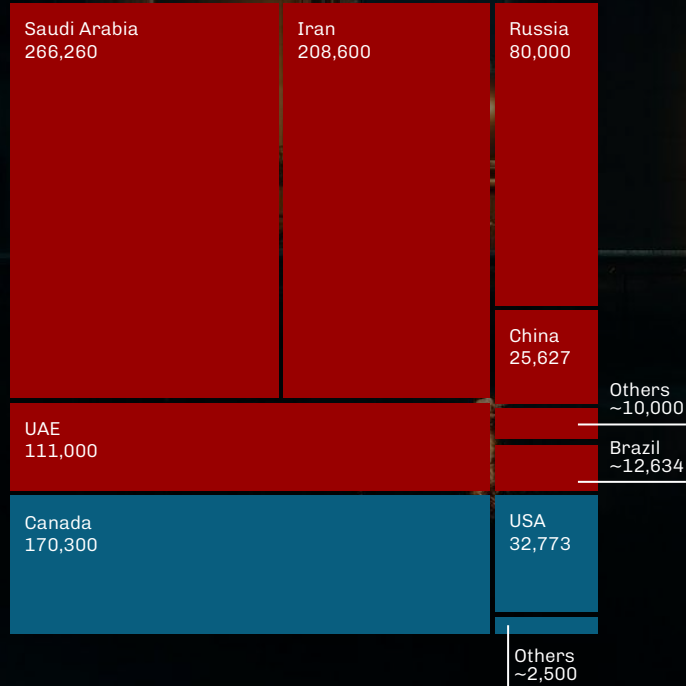
■ Historical ■ Forecasts

ELECTRIC IS INTERESTING, BUT WE STILL USE A LOT OF OIL: G7 V BRICS+

BRICS G7

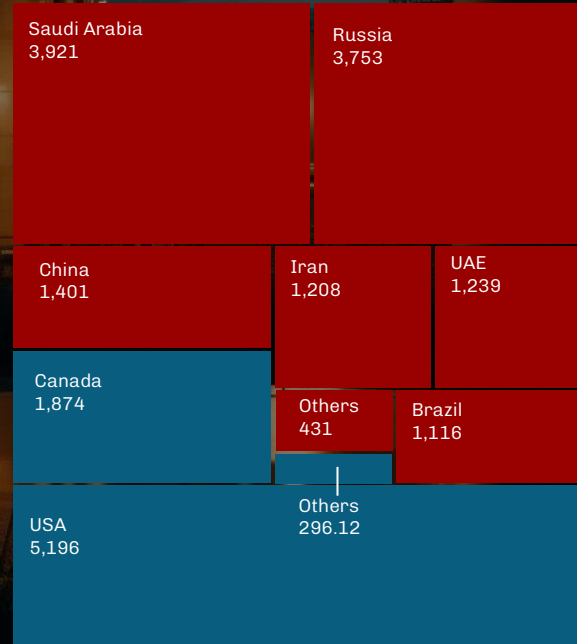
BRICS+ & G7 Proven Oil Reserves
(millions of barrels)

BRICS+: 78%
G7: 22%



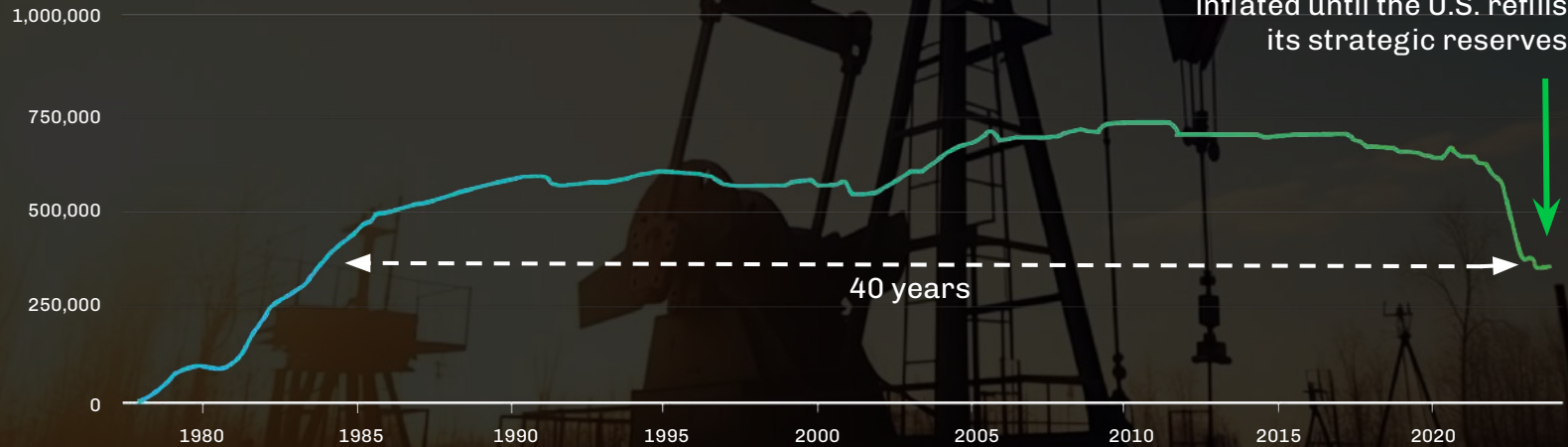
Oil Production, 2022
(millions of barrels)

BRICS+: 64%
G7: 36%



U.S. STRATEGIC PETROLEUM RESERVE AT A 40 YEAR LOW

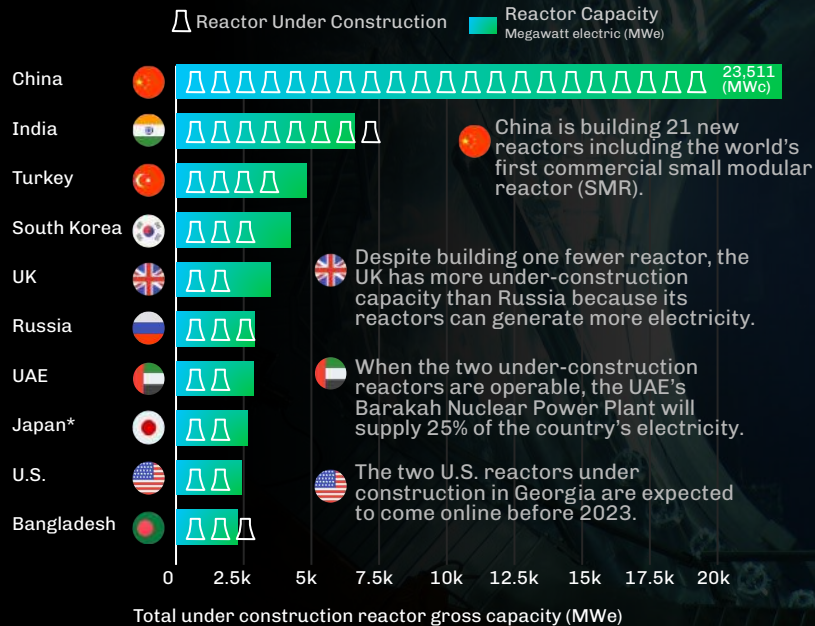
Thousand Barrels



ELEMENTAL ENERGY ANYONE? (AKA NUCLEAR POWER)

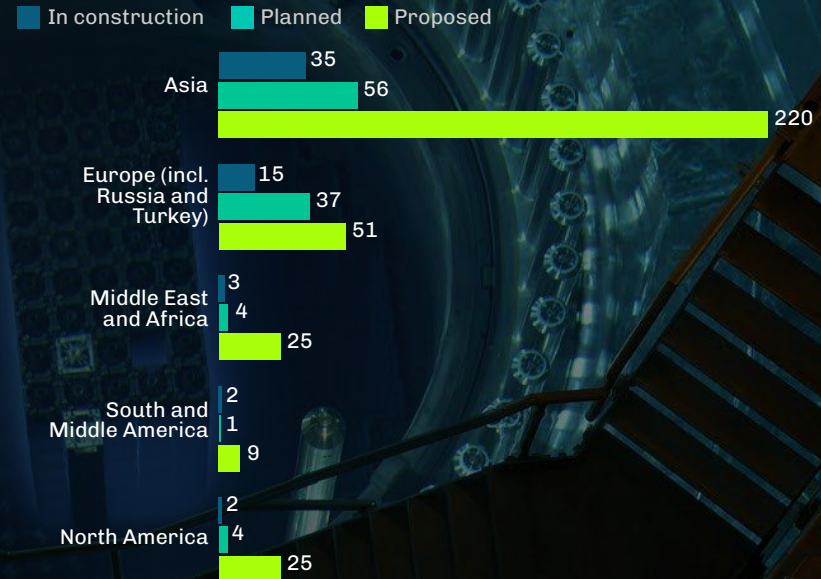
Who is Building Nuclear Reactors?

Top 10 Countries by Nuclear Capacity Under Construction



Asia is Going Nuclear

Number of nuclear reactors currently in construction or in preliminary construction stages per region



As of Dec 2021.

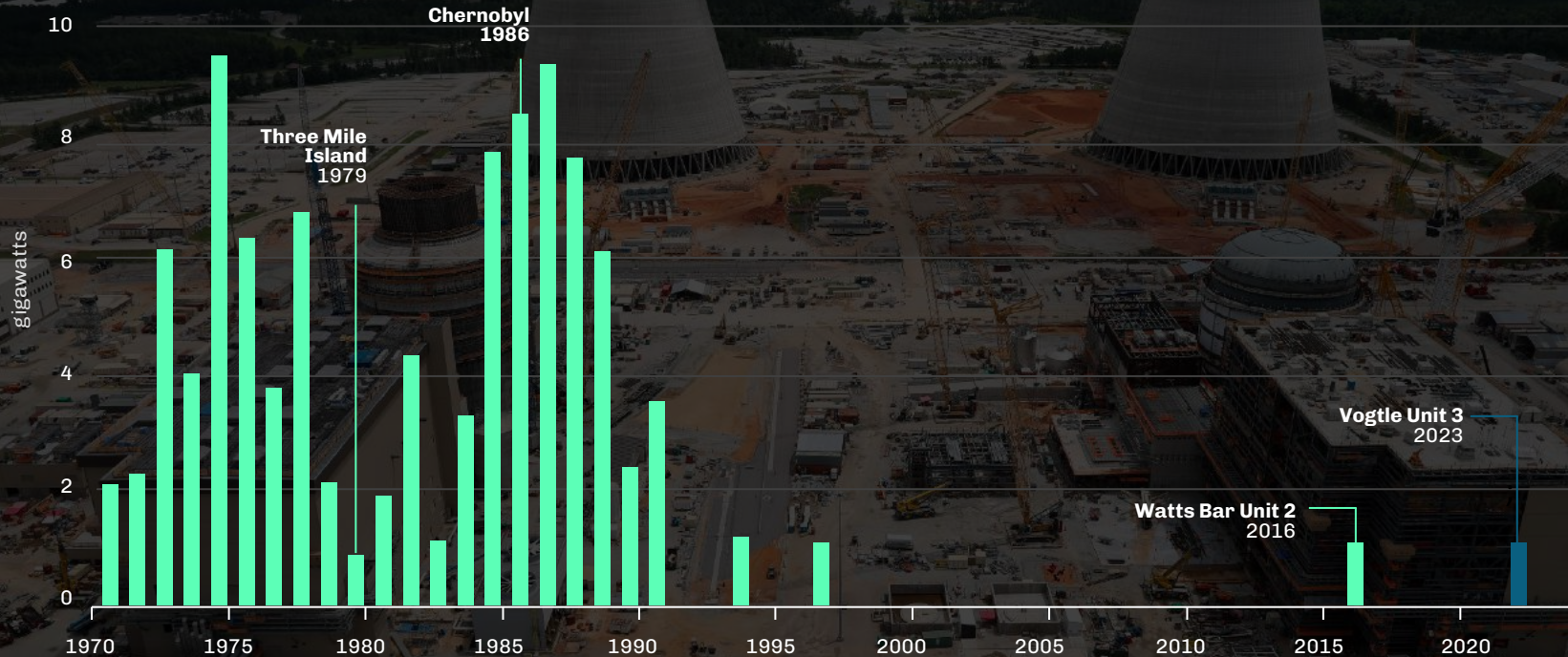
Source: World Nuclear Association

*Construction at Japan's reactors is currently suspended.

Source: World Nuclear Association

THE U.S. MISSED 30 YEARS OF BUILDING REACTORS — AND NOW WE'RE PAYING THE PRICE

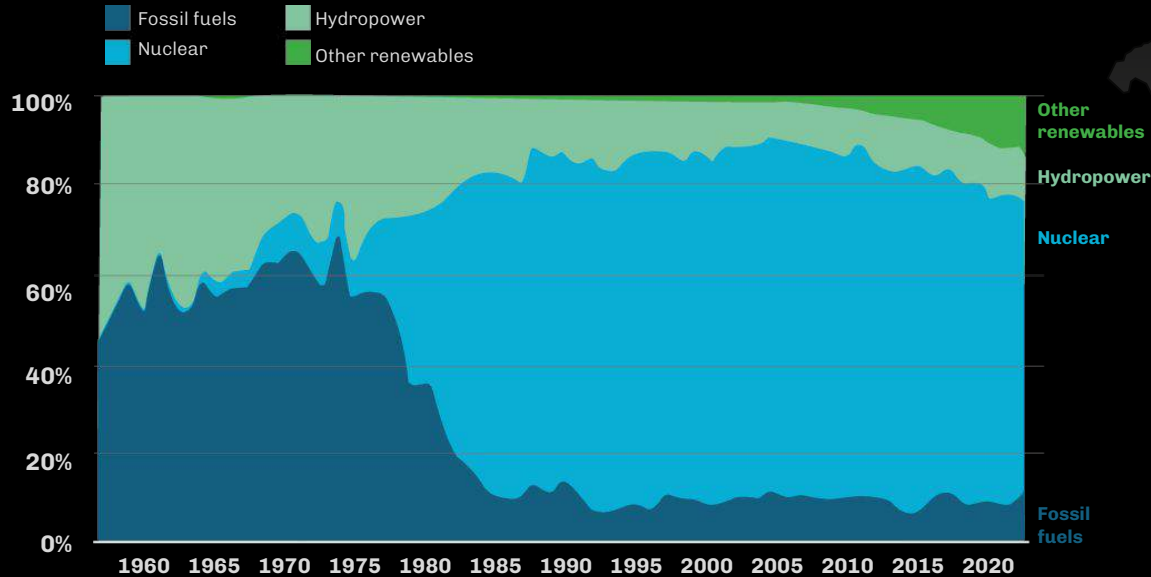
U.S. nuclear power capacity additions, by year of initial operation (1970-2023)



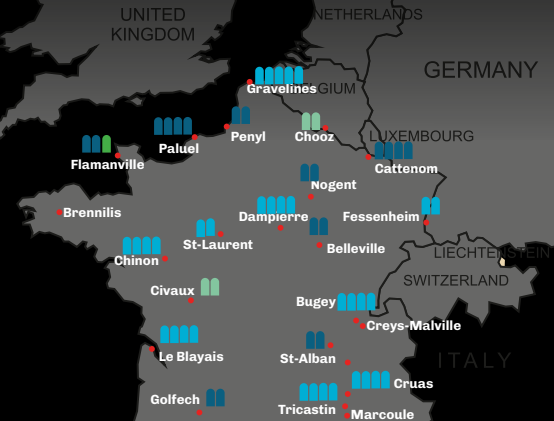
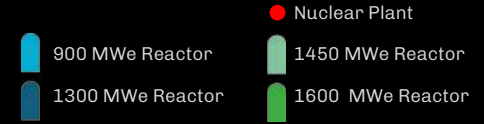
Note: Data excludes capacity built and retired before 2002.

Source: U.S. Energy Information Administration, Preliminary Monthly Electric Generator Inventory, and Georgia Power press release

FRANCE HAS BECOME ONE OF THE FEW EXAMPLES OF RATIONALITY IN THE WEST WITH NUCLEAR




"Other renewables" is all non-hydropower renewable sources.



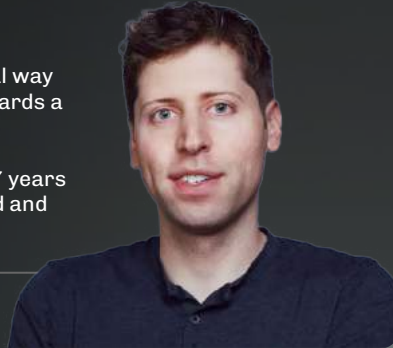
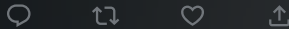
WILL SAM ALTMAN BACKED FUSION COMPANY, AND OTHERS, SAVE THE DAY?



Sam Altman 
@sama

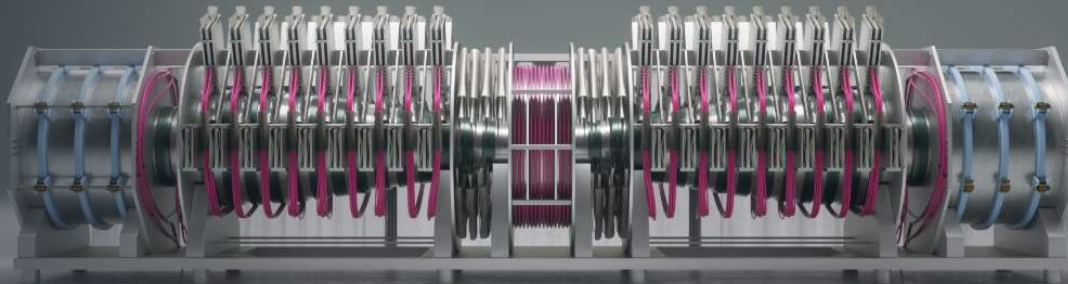
If Helion works, it not only is a potential way out of the climate crisis but a path towards a much higher quality of life.

Have loved being involved for the last 7 years and excited to be investing more. David and Chris are amazing.



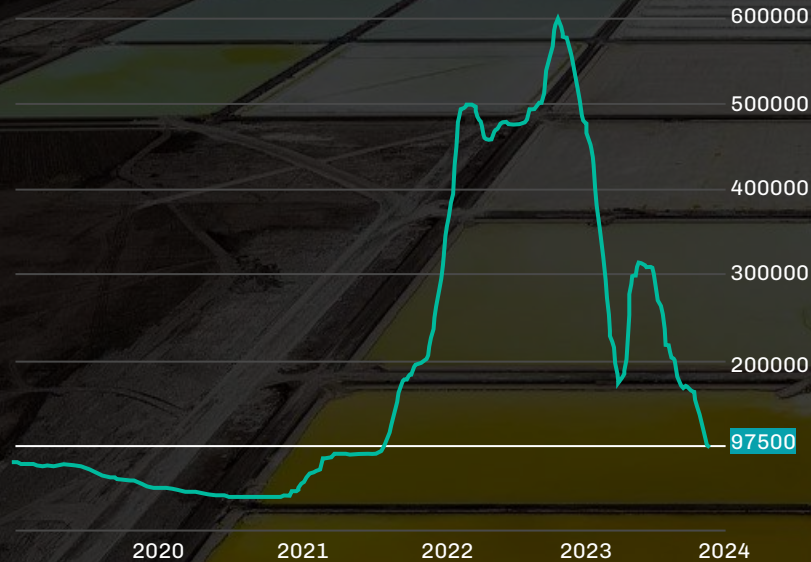
Helion announces world's first fusion energy purchase agreement with Microsoft

New facility aims to deliver at least 50 MW and begin producing electricity by 2028, dramatically shortening the projected timeline for commercially viable fusion energy



WITH THE COOLING EV MARKET, LITHIUM DEMAND HAS RATIONALIZED AND CELL PRICES CONTINUE TO DECLINE

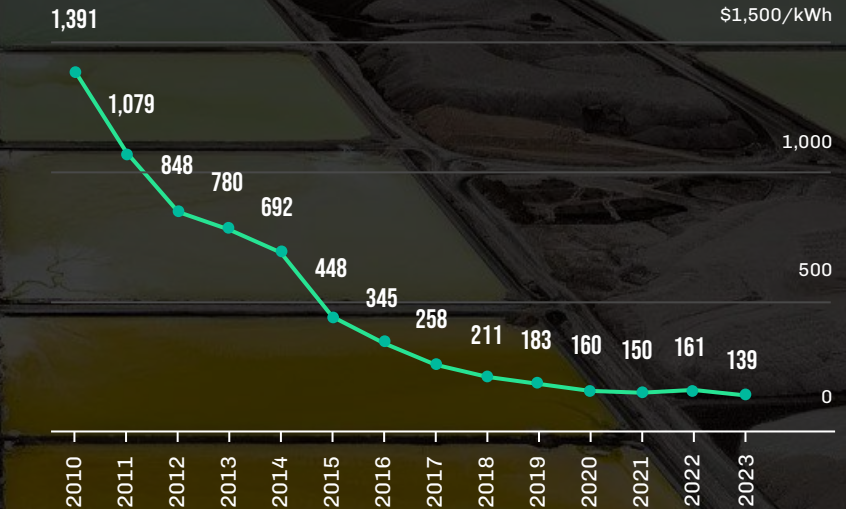
Lithium carbonate (CNY/T) 97500.00 -1000.000 (-1.01%)



Battery Prices Hit Record Low, Ending Brief Uptick

Lithium-ion battery price survey results:
volume-weighted average pack prices

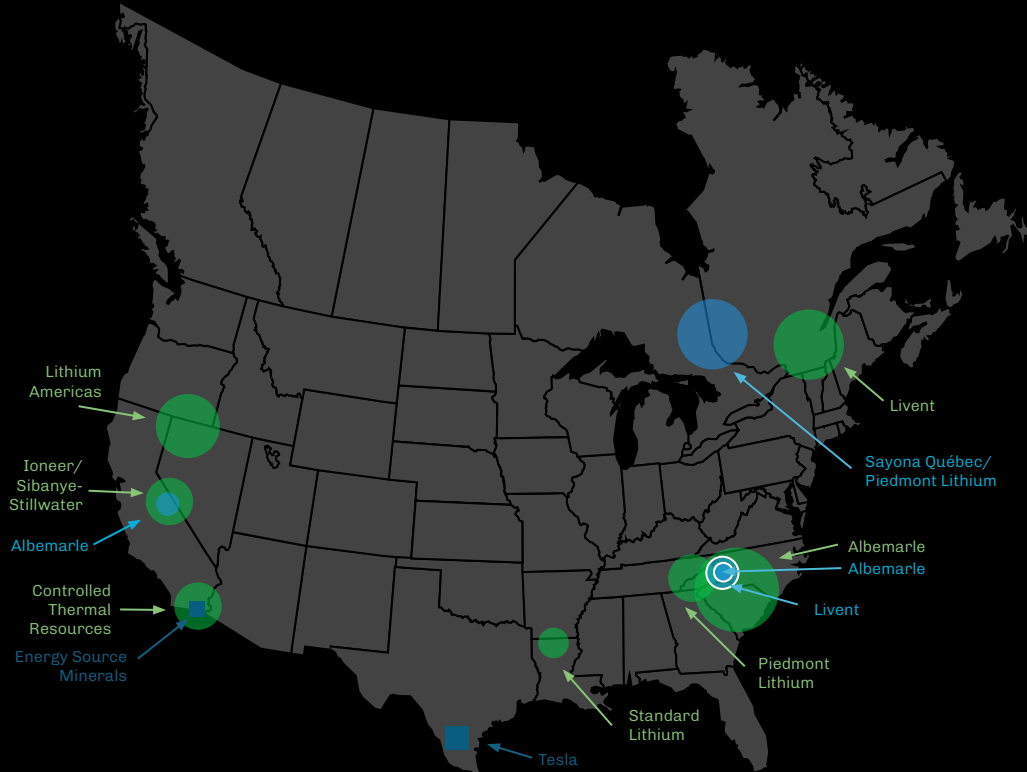
— Volume-weighted average in real 2023 dollars



Note: Historical figures have been adjusted to real 2023 dollars. Values are averages across passenger EVs, commercial vehicles, buses, two- and three-wheelers and stationary storage. Includes cell and pack.

Source: BloombergNEF and UP.Partners research

LITHIUM MINING IN NORTH AMERICA



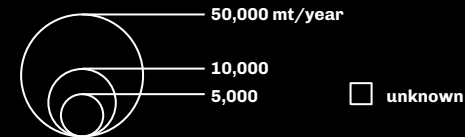
● Selection of lithium chemical production facilities under construction or with potential 2024 construction start dates ¹

Company	Project or locality	Project type	Project start date
Albemarle	Chester County (SC)	Processing facility	TBA
Livent	Nemaska Bécancour (QB)	Processing facility	2026
Tesla	Robstown (TX)	Processing facility	2024
Piedmont Lithium	MCMinn County (TN)	Processing facility	2026
Lithium Americas	Thacker Pass (NV)	Clay	2026
Standard Lithium	Phase 1A (AR)	Brine	2026
Ioneer/Sibanye-Stillwater	Rhyolite Ridge (NV)	Clay	2026
EnergySource Minerals	Imperial County (CA)	Geothermal brine	TBA
Controlled Thermal Resources	Imperial County (CA)	Geothermal brine	2025

● Current lithium and spodumene ² capacity

Company	Project or locality	Asset type
Albemarle	Kings Mountain (NC)	Processing facility
Albemarle	Silver Peak (NV)	Brine
Livent	Bessemer City (NC)	Processing facility
Sayona Québec/Piedmont	N. Am. Lithium (QB)	Spodumene mine

Sized by lithium production capacity



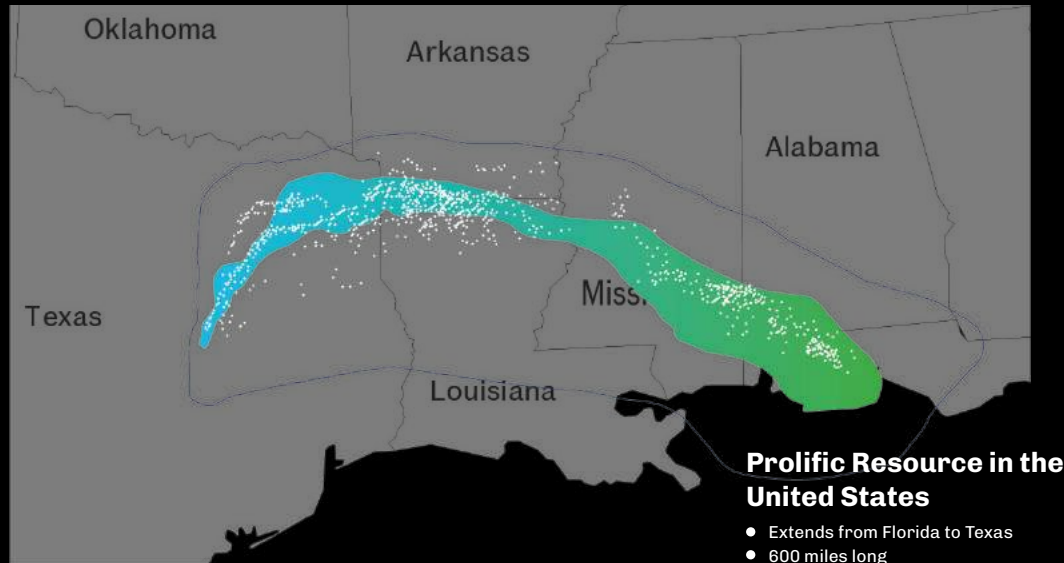
¹ Current as of December 2023. Includes facilities with at least 5,000 mt/year of lithium chemical production capacity. Information based on public company disclosures. Does not include recycling-only operations. Does not include spodumene projects with no integrated lithium conversion facility. ² Spodumene is a mined ore raw material that can be processed to produce lithium chemicals

Source: S&P Global Commodity Insights, company releases, company websites, executive comments; CI Information Design

THE GREAT **ARKANSAS LITHIUM** RUSH HAS IGNITED A NEW OPPORTUNITY FOR THE HEARTLAND

Smackover Formation | One of the World's Largest Brine Aquifers

Productive bromine operations and elevates lithium concentrations make the Smackover a promising lithium production powerhouse with room to scale



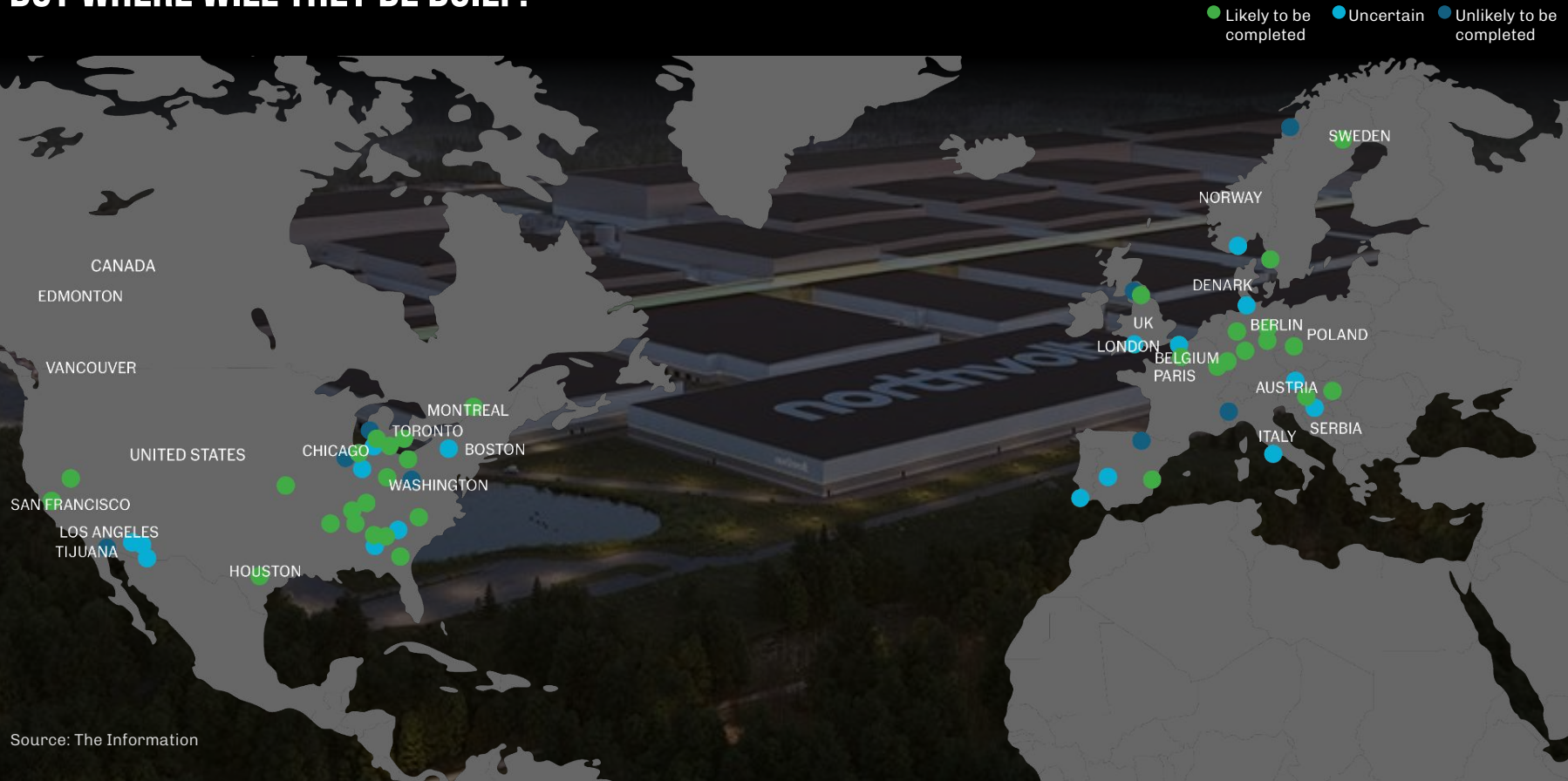
- Smackover Formation
- Represent wells drilled in the Smackover Formation

Sources: Standard Lithium, Arkansas Oil & Gas Commission data. USGS,2006.

Smackover Advantage:

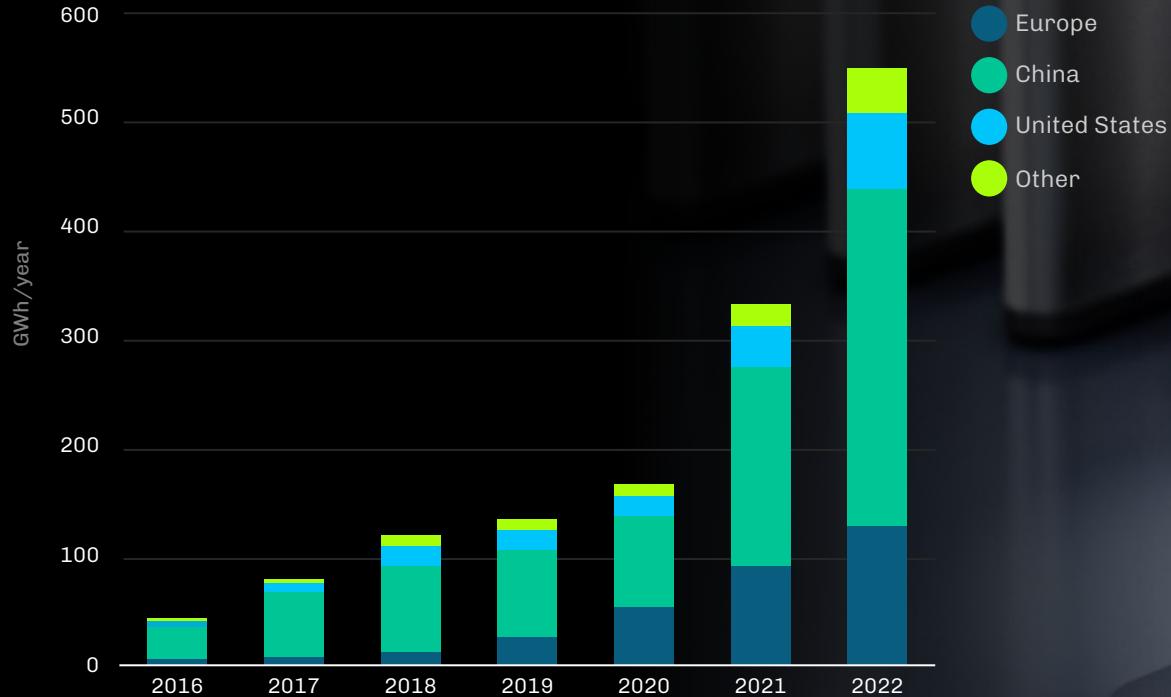
- Extensive, porous, and permeable limestone aquifer hosts huge volumes of mineral rich brine and can take large reinjection volumes.
- Geological data from thousands of wells demonstrates formation homogeneity in thickness, continuity and lithium chemistry.
- One of the world's largest sources of bromine, a mature regulatory framework with 60 years of commercial brine operations, and 8+ billion gallons of brine pumped, processed and reinjected annually.
- Brine has elevated lithium concentrations, typically ranging from 150-500mg/L.

GIGAFACTORIES ARE EXPLODING IN SUPPORT OF THE EV TRANSITION, BUT WHERE WILL THEY BE BUILT?

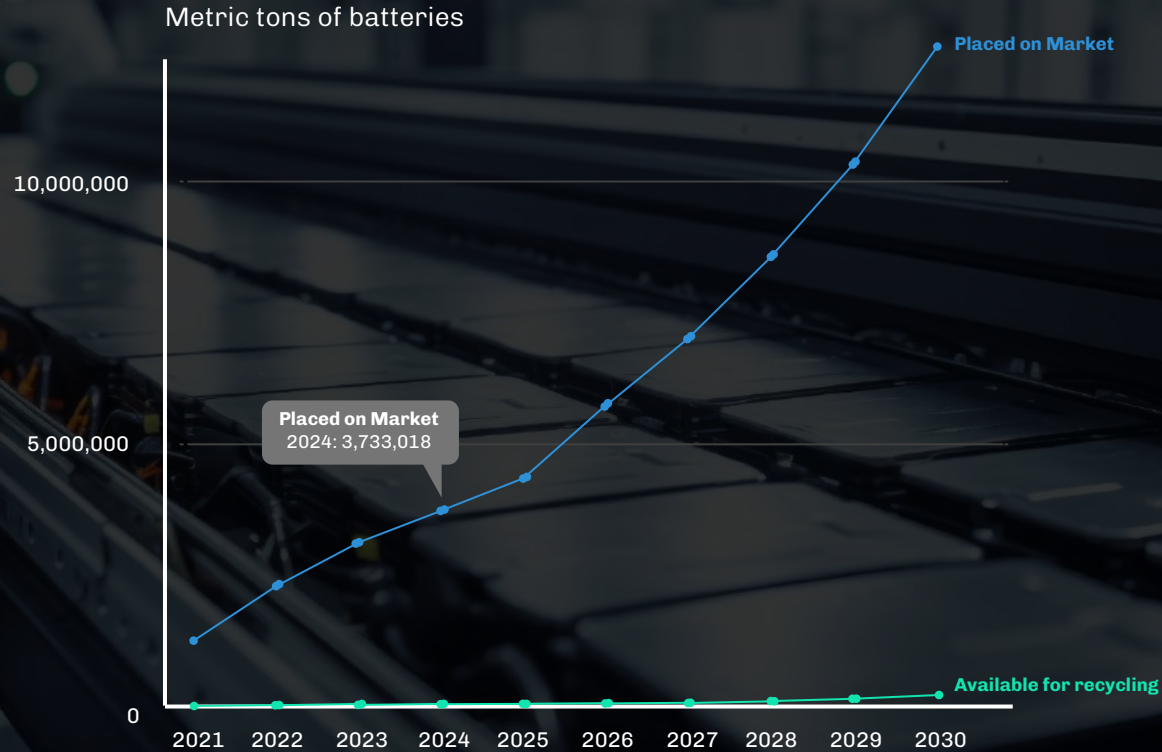


THE FUTURE OF BATTERIES

Lithium-ion Battery Demand by Region



NEW EV BATTERIES FAR OUTSTRIP AVAILABILITY OF RECYCLED MATERIAL



BATTERY TECHNOLOGIES TO WATCH



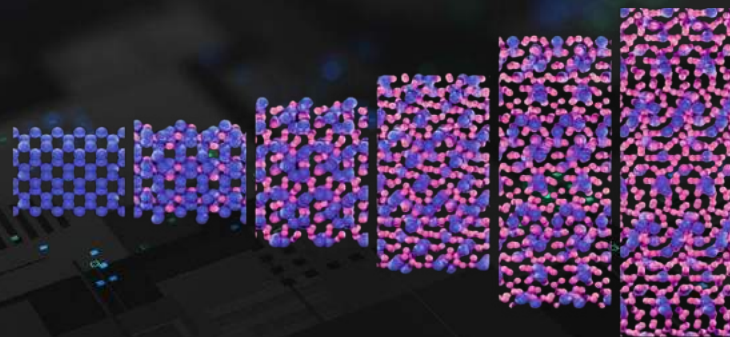
SOLID-STATE BATTERIES (SSBS)

have been an area of focus recently due to their unparalleled safety and high energy density. They could be safer with less chance of catching fire in a crash, too.

Companies to watch:



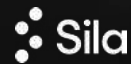
CATL



SILICON ANODES

Graphite anodes for lithium-ion batteries reached their energy limit years ago. Silicon promises longer-range, faster-charging and more-affordable EVs than those whose batteries feature today's graphite anodes.

Company to watch:





THE MOVING
WORLD REPORT 2024

KEY POINTS: TL;DR



DEFENSE AND CHINA

- The largest customer of mobility related technologies is the U.S. DoD.
- DoD catalyzed the iPhone, hydraulic brakes, internet, GPS, among others.
- The second-largest customer is the Chinese People's Liberation Army.
- U.S. military spending nears \$1 trillion.
- China's military is reaching near parity, with approximately 25% the annual spend.
- China's Military Civil Fusion strategy has propelled China to lead in 37 of 44 critical technologies, with the U.S. only leading 7 out of 44.
- China has the largest number of STEM graduates worldwide, 3X USA.
- China has 232 times the shipbuilding capacity.
- Defense focused VC is increasing at a rate of 30%/yr in response to global conflicts.
- 34% of U.S. tech employees are likely to apply their skills to military related technologies.
- Small Business Innovation Research Program grew 400% in 7 years.

SPACE

- Satellite constellations up 1000% in 4 years, led by Starlink.
- SpaceX dwarfs all launch providers, ~ 400% the payload of ALL other launch providers combined.
- China is quickly accelerating its space program and already landing reusable rockets.
- NASA Artemis Mission is complex and at risk.
- If it works, Starship will deliver a ton of payload to the moon for \$70M/ton vs. Apollo at \$36B/ton.
- VC investment in space startups up nearly 3500% in the last decade.
- With few exceptions, Space SPACS have fared poorly.

DRONES

- Outside war in Ukraine, Walmart is the largest driver of drone development in the world.
- 1.8M U.S. households in Dallas-Fort Worth Area eligible for drone delivery through Walmart and its partners.
- While Walmart has led the way, Amazon has faltered and has strategic disadvantages as compared to Walmart's store footprint and partnership strategy.
- Cost of drone delivery is reaching nearly a third of auto delivery at ~\$4/delivery.
- Drone delivery flights have increased 135%/yr since 2018, surpassing 1 million deliveries in 2023.

AVIATION

- Pilot shortage is getting worse, further putting pressure on a fragile airline system.
- Expected to be 65,000 pilots short by 2030.
- China introduced the world's first commercial electric air taxi flight in 2023.
- EVTOLs have reached an 18,000 units backlog, valued at \$111 billion.
- The commencement of the design of Boeing 737 is closer to the Wright Flyer than present day.
- Blended Wing Body commercial airframe design could cut fuel burn by 50%.
- Electrifying all flights under two hours could reduce aviation CO2 emissions by 28%.
- Sustainable Alternative Jet Fuel is 43% more costly than conventional fuel.
- Flying cars have arrived, with entry into service of products such as Pivotal's Helix and the Jetson One.

ARTIFICIAL INTELLIGENCE IN MOBILITY

- Tesla leads in Full Self-Driving data, with over 170 million miles accumulated.
- Two thirds of startups in 2023 Y-combinator winter class focused on the field of AI.
- Microsoft and others are using AI for battery innovation.
- Humanoids are now nearly 60% cheaper than warehouse hourly labor.
- Waymo autonomous driving delivery 6X safer than human drivers in reducing injury-causing crashes.
- Neural networks are being trained to bring our machines to life - Tesla's FSD v12.12 is a testament. Co-Pilots for aviation may not be far away.

AUTO

- China is the largest electric vehicle producer, 6X USA.
- EV sales hit a record 15 million in 2023.
- Largest EV producer in the world is Chinese based Berkshire backed, BYD.
- Yes, Berkshire cut BYD position 11 times in 2023 in fear of competing with Tesla.
- Tesla leads the U.S. EV market, 655K sales in 2023 - more than all other non-chinese OEMs combined.
- The U.S. needs 28 million EV charging ports by 2023, meaning a 34% per annum growth rate from the 2022 installed base.
- Tesla sets North American charging standard

GROUND AND SEA FREIGHT

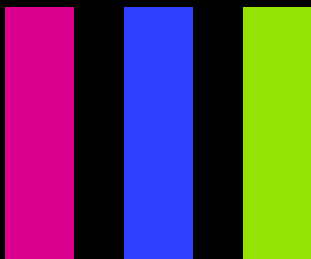
- Major trucking recession in 2023, 50,000 companies cease operations
- Used truck prices return back to earth
- Panama canal is at risk due to drought in Panama, potentially impacting 40% of US bound freight
- Concurrently, Suez canal is major risk of disrupting 30% of global container traffic due to Houthi attacks
- Cutting sulfur from marine fuel may have unintended consequences of heating the Atlantic due to the loss of sea clouds

RENEWABLES, ENERGY AND OIL

- Mobility CO2 emissions to grow 11% by 2030.
- Climate technology needs exponential growth by 2030 in order to reach net-zero targets.
- Largest energy transition investor is China, at nearly \$400 billion.
- China has the world's largest nuclear reactor capacity.
- BRICS+ leads in oil reserves and production.
- Shift away from fossil fuels in Germany, resulting in high electricity prices, usage back to 1978 levels and a de-industrialization of the country.
- U.S. strategic petroleum reserves at 40-year low.
- Sam Altman-backed Helion's fusion energy deal with Microsoft aims for production in 2028.
- Cooling EV market lowers lithium demand and prices, reaching 13 year low.
- Arkansas benefits from lithium rush due to the Smackover brine reserve.
- China dominates 50% of global lithium battery demand.
- Urgent need for battery recycling development, led by Redwood Materials.

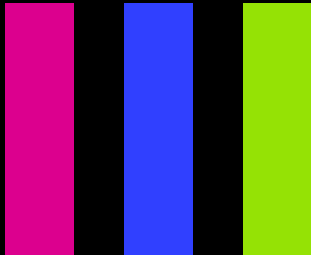
THE END

For questions or media inquiries, please
reach out to press@up.partners



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