

# Energy Implications of Autonomous Vehicles

Adam Jonas, CFA

[Adam.Jonas@morganstanley.com](mailto:Adam.Jonas@morganstanley.com)

+1 212 761-1726

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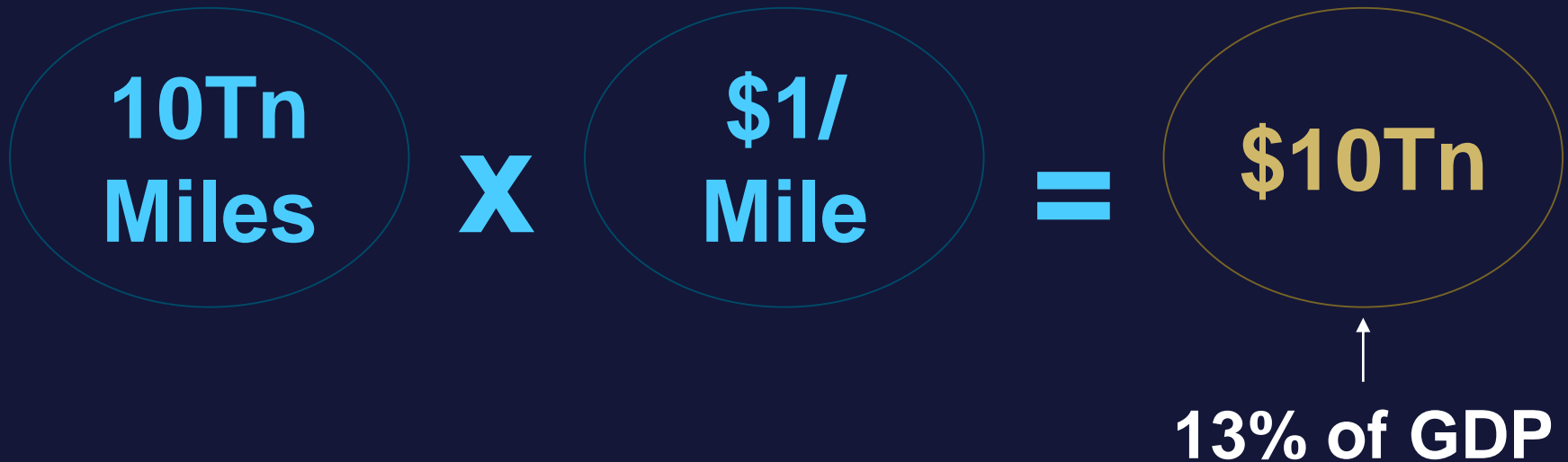
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## Addressable Market: Traditional

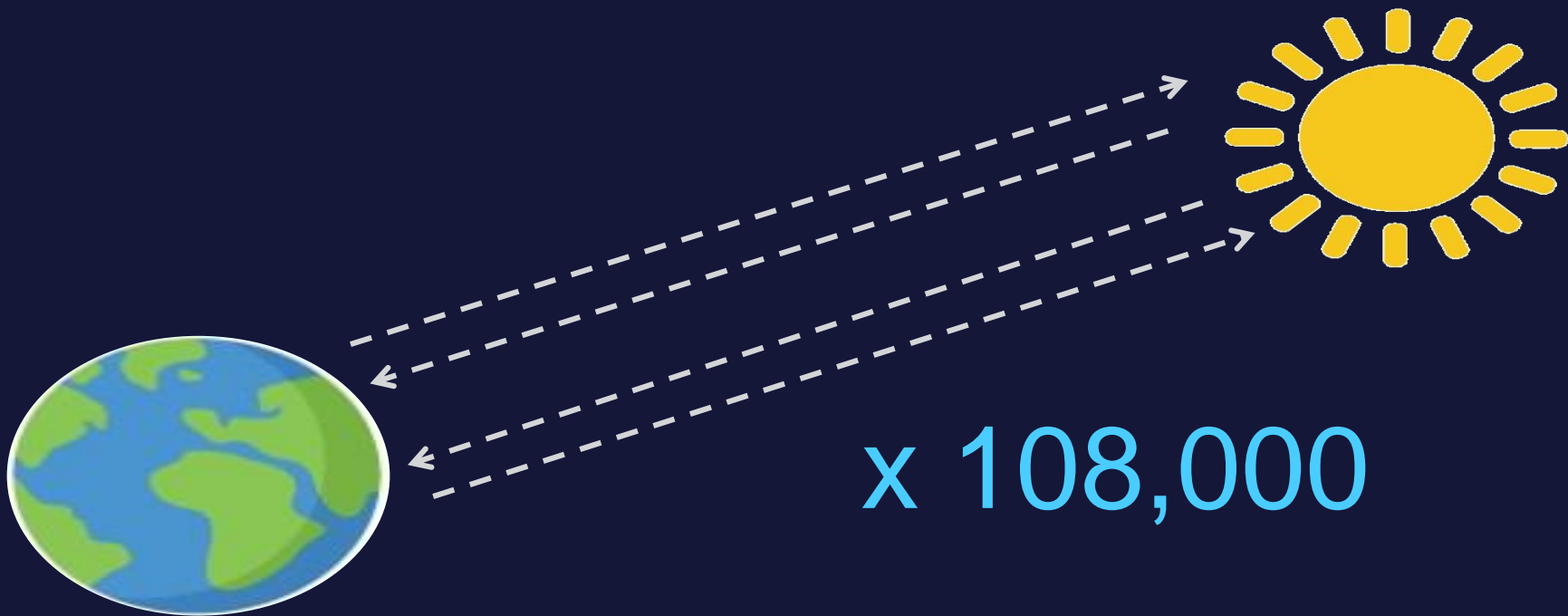


## Addressable Market: Silicon Valley



Source: US Federal Highway Administration, DFT National Road Traffic Survey, Statistics Canada, BITRE, Ministry of Land, Infrastructure and Transport (Korea), World Bank, Morgan Stanley Research

**10 trillion miles = 1.7 light years**



## The Next \$100bn Market?



**\$100bn**

# Global Mobility: 100 x \$100bn Markets

\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn
\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn	\$100bn

## Inefficiencies of Today's Model

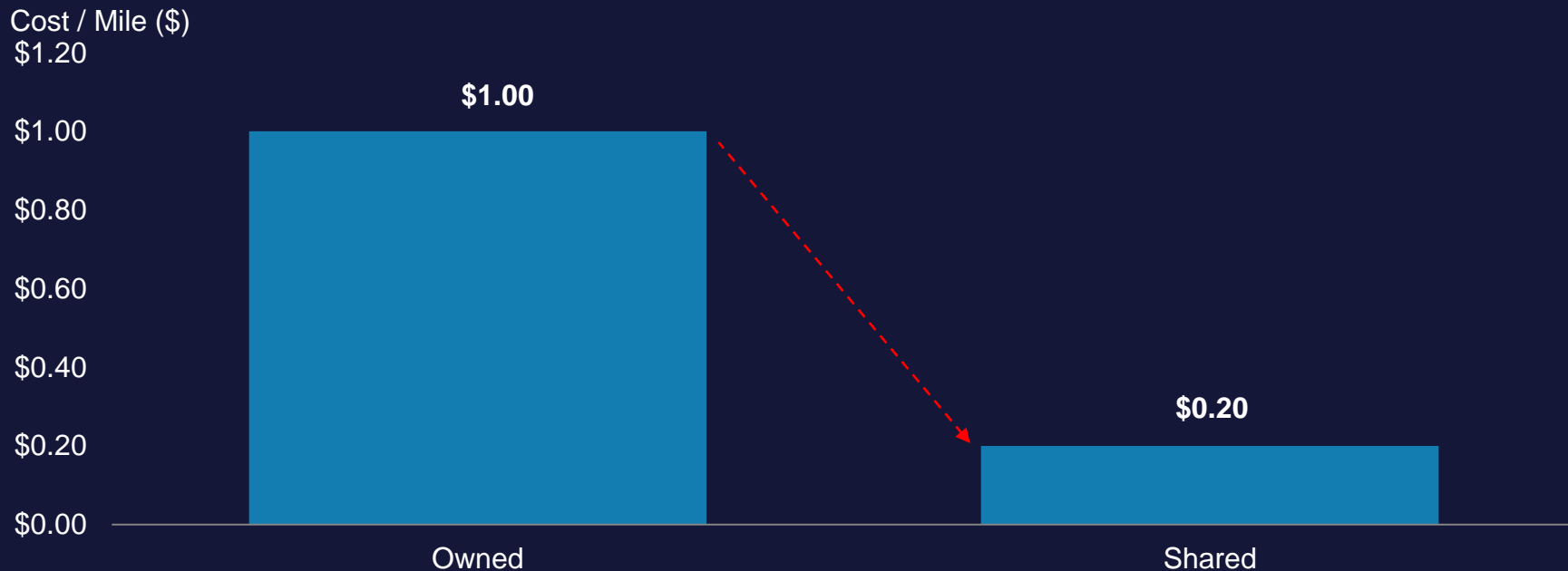




## Available Seat Mile Utilization $\approx 1\%$

$$\left( \frac{1 \text{ hr}}{24 \text{ hrs}} \right) \times \left( \frac{1.55 \text{ passengers}}{5 \text{ seats}} \right) = 1.3\%$$

# The Deflationary Mile



Source: Morgan Stanley Research

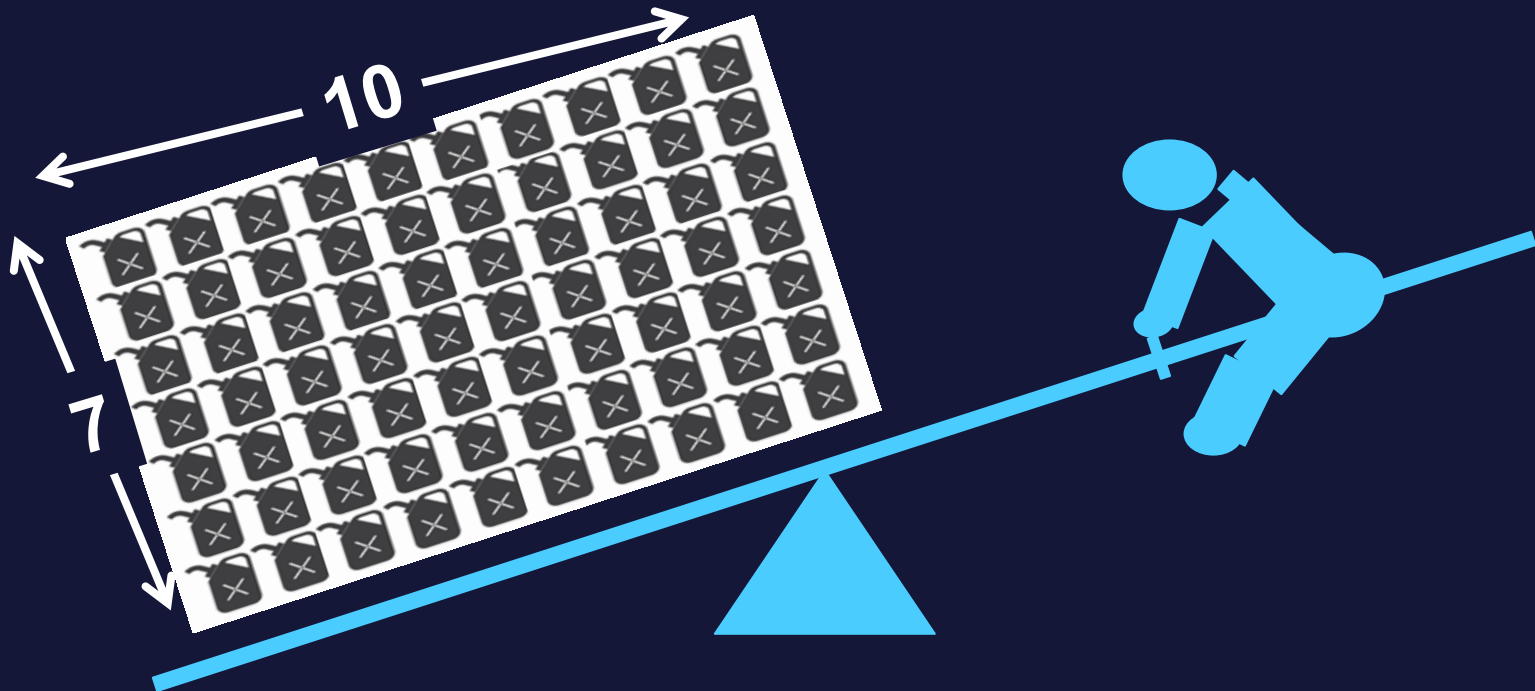
## Global Gasoline Consumption

$$\left( \frac{10 \text{ tn miles}}{20 \text{ mpg}} \right) = 500 \text{ bn gallons}^{(1)}$$

Source: Morgan Stanley Research

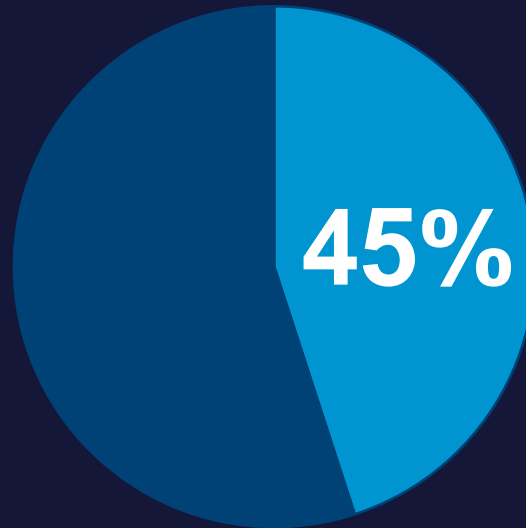
1. Includes diesel consumption.

# Total Gasoline Consumption



Source: Shutterstock, Morgan Stanley Research

## Global Oil Demand



**Passenger  
Vehicle  
Consumption**



Source: Shutterstock

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## Time Spent in Cars

$$\left( \frac{10 \text{ Tr Miles}}{25 \text{ Mph}} \right) = 400 \text{ Bn Vehicle Hours} \times 1.55 \text{ Occupancy Rate}$$

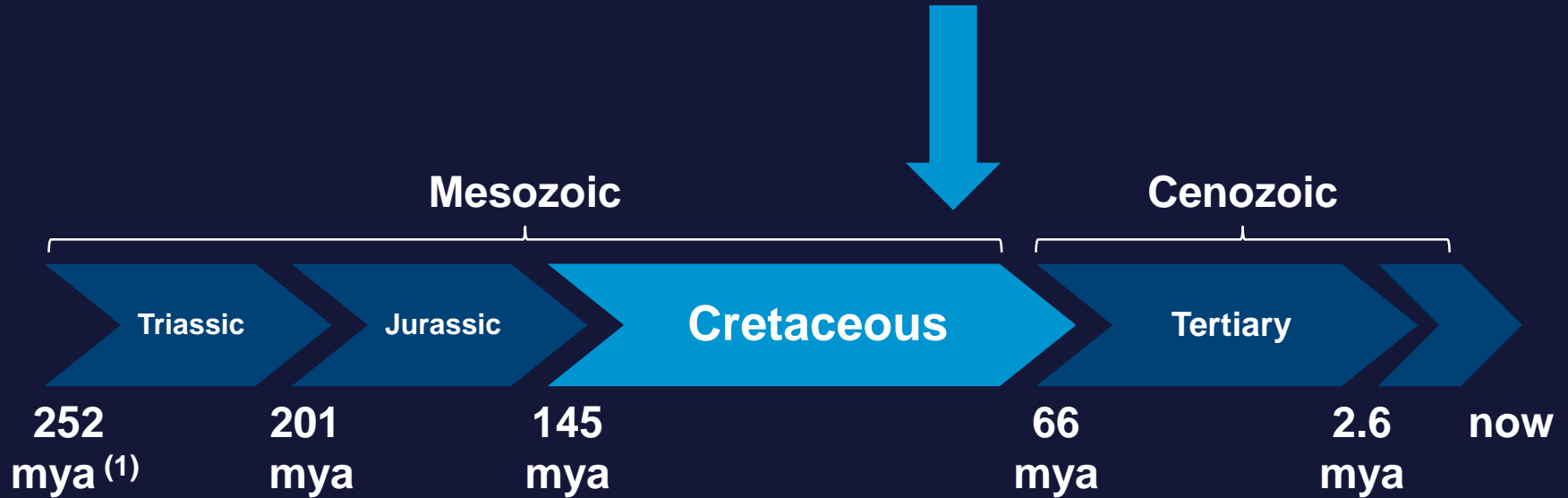
**> 600 bn**  
driver + passenger hours

## Time Spent in Cars (cont'd)

$$\left( \frac{600 \text{ Bn Hours}}{8,760 \text{ Hours/Yr}} \right) = 68\text{MM Years}$$



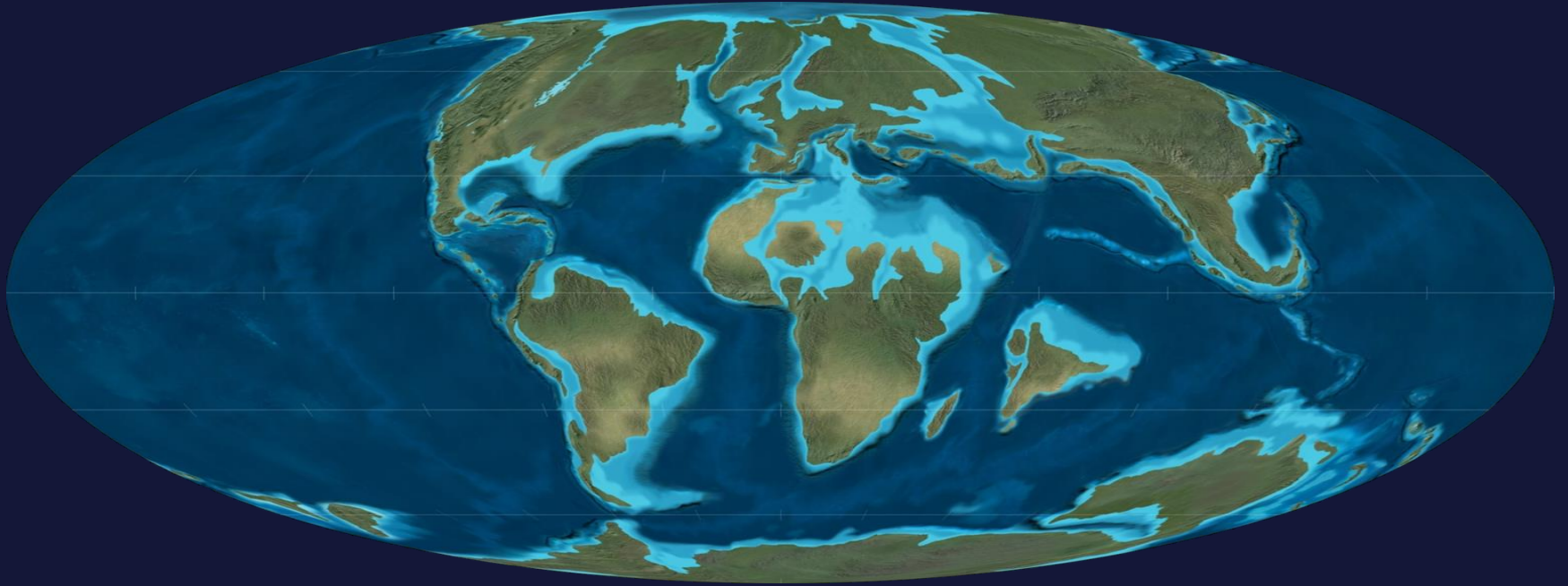
## Time Spent in Cars (cont'd)



Source: Wikipedia, Morgan Stanley Research

1. mya = million years ago







## The Value of Time

1 hour = \$?

## The Value of Time

$$\left( \frac{\text{GDP Per Capita} = \$10,500}{365 \times 16 \text{ hours}} \right) = \$1.80/\text{hour}$$

## The Value of Time



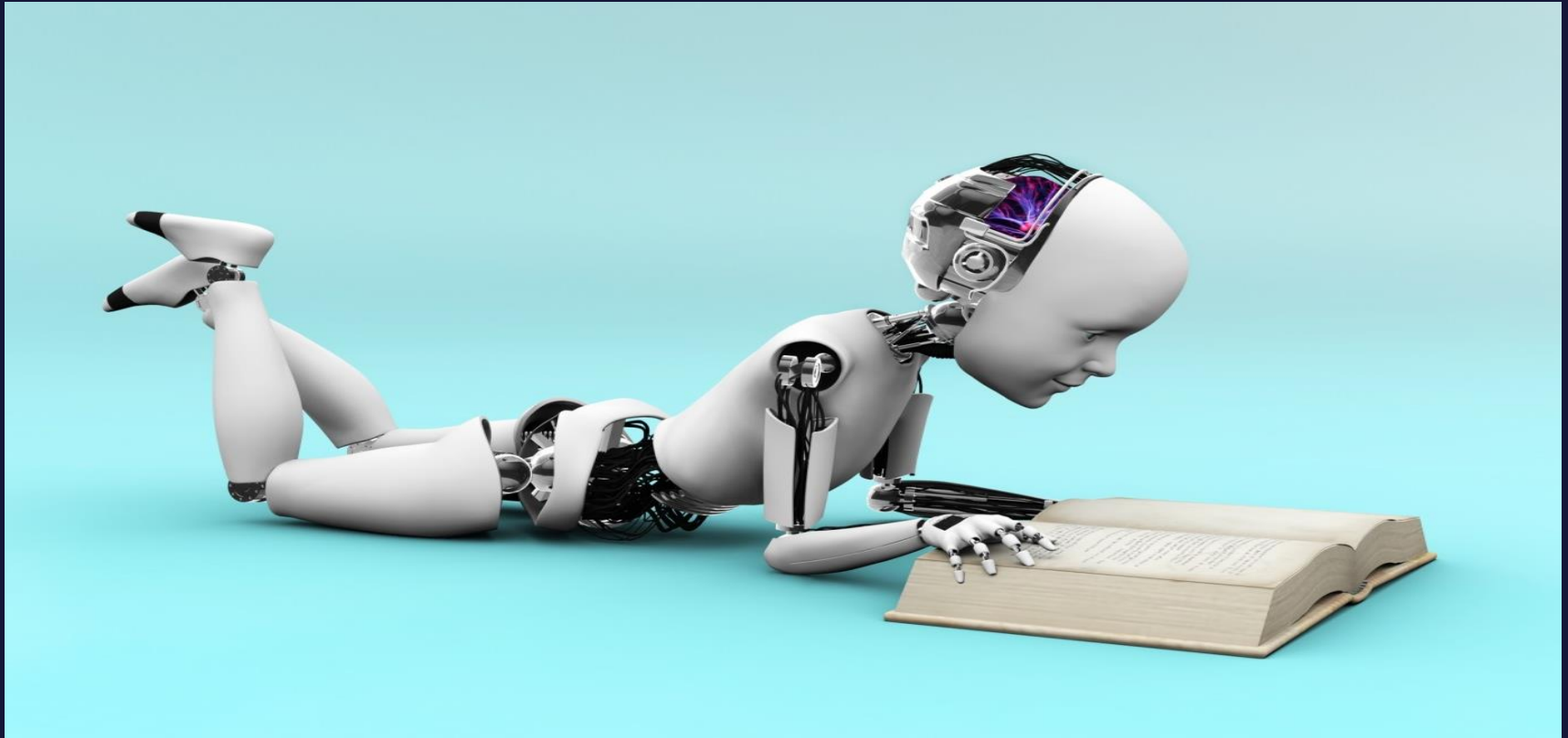
## Multi-Trillion TAM

600,000,000,000 hours

**ANYTHING**<sup>X</sup>

= a very large number





Source: Shutterstock



Source: Shutterstock

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## Global Traffic Fatalities

1,300,000  
deaths / yr



> 3,500  
deaths / day

Source: World Health Organization, Morgan Stanley Research

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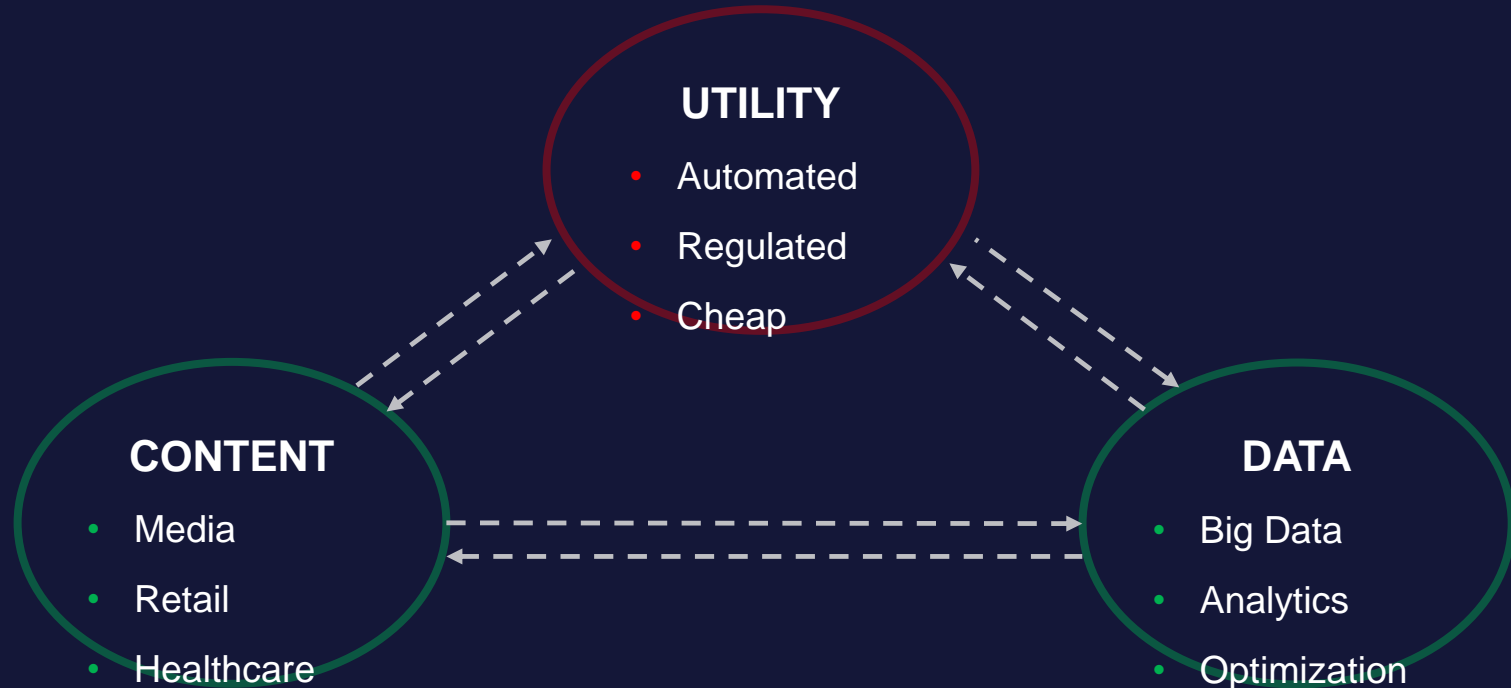


Source: Shutterstock

## First Autonomous Fleets

100 cars  
< 25 mph  
Autonomous  
Electric  
1 mi<sup>2</sup>

# Future Industry Model



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SECTION 2

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## Second Order Impacts

## Auto OEMs & Suppliers

### AUTO 1.0

- Human Driving
- Private Ownership
- Internal Combustion

### AUTO 2.0



**FOXCONN**<sup>®</sup>



**LG**

**SAMSUNG**

**amazon**



# Car Rental

## DAILY RENTAL



## AUTO 2.0



Utilization



Fleet Size



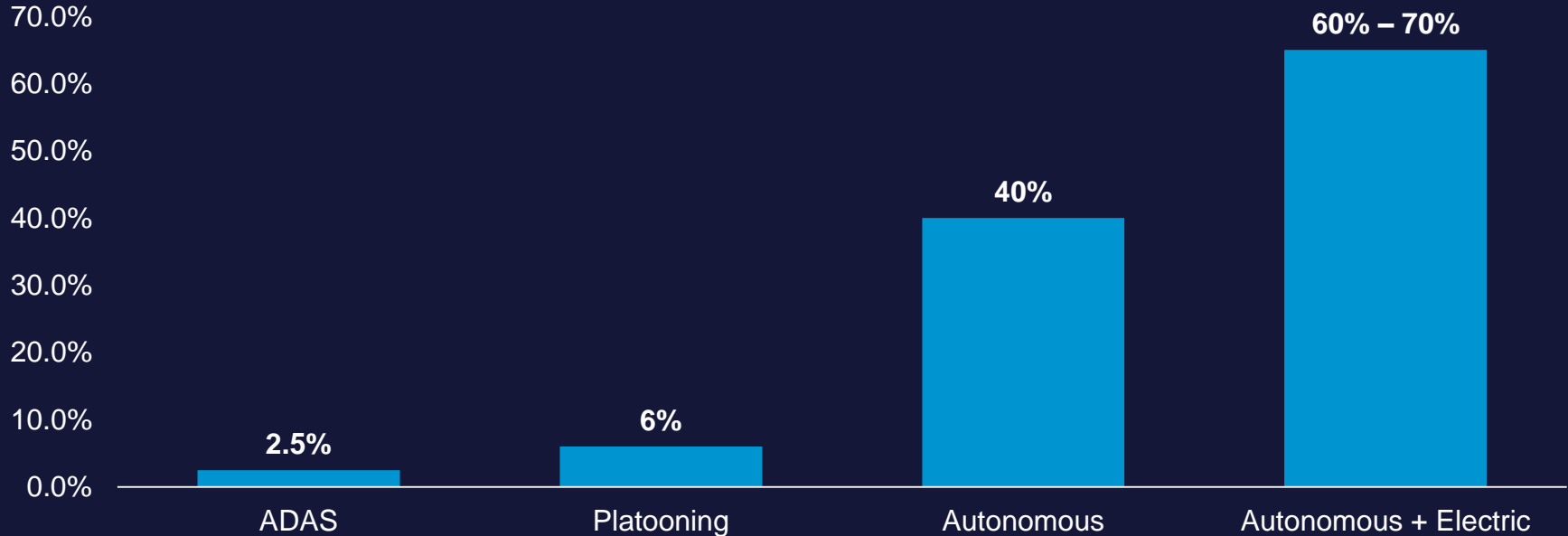
Real Time Data



Costs

# Freight Transportation

## % Reduction in Overall Truck Carrier Operating Cost



Note: Based on average TL carrier estimates  
Source: Morgan Stanley Research

# Insurance

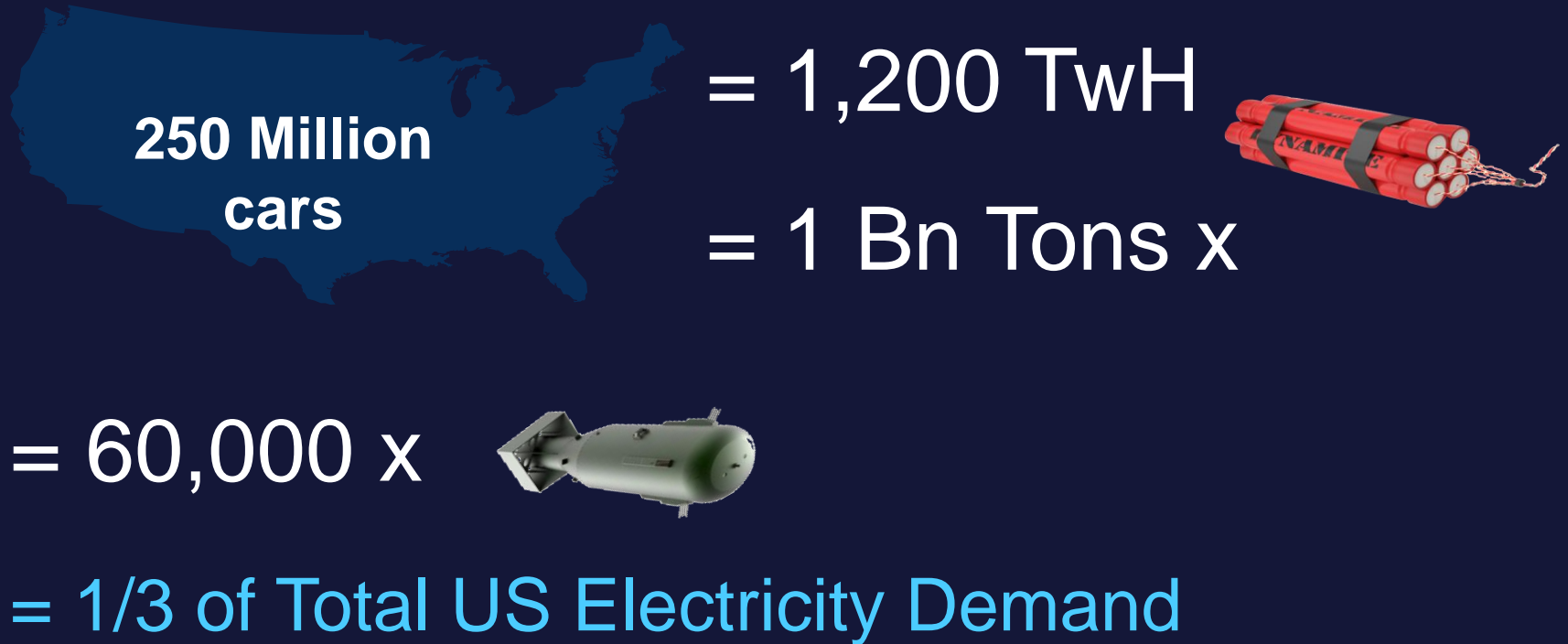
## Today

- B2C
- Actuarial advantage
- \$500Bn premium
- 70bps of GDP

## Future

- B2B
- Informational parity / disadvantage
- Diminished risk pool

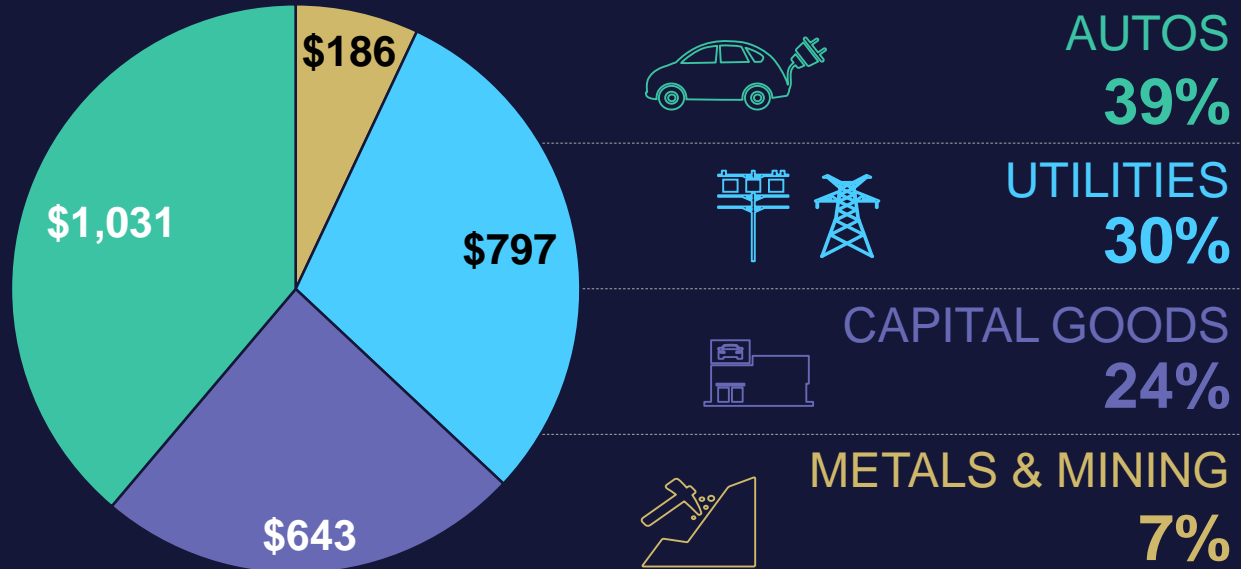
## Electric Utilities



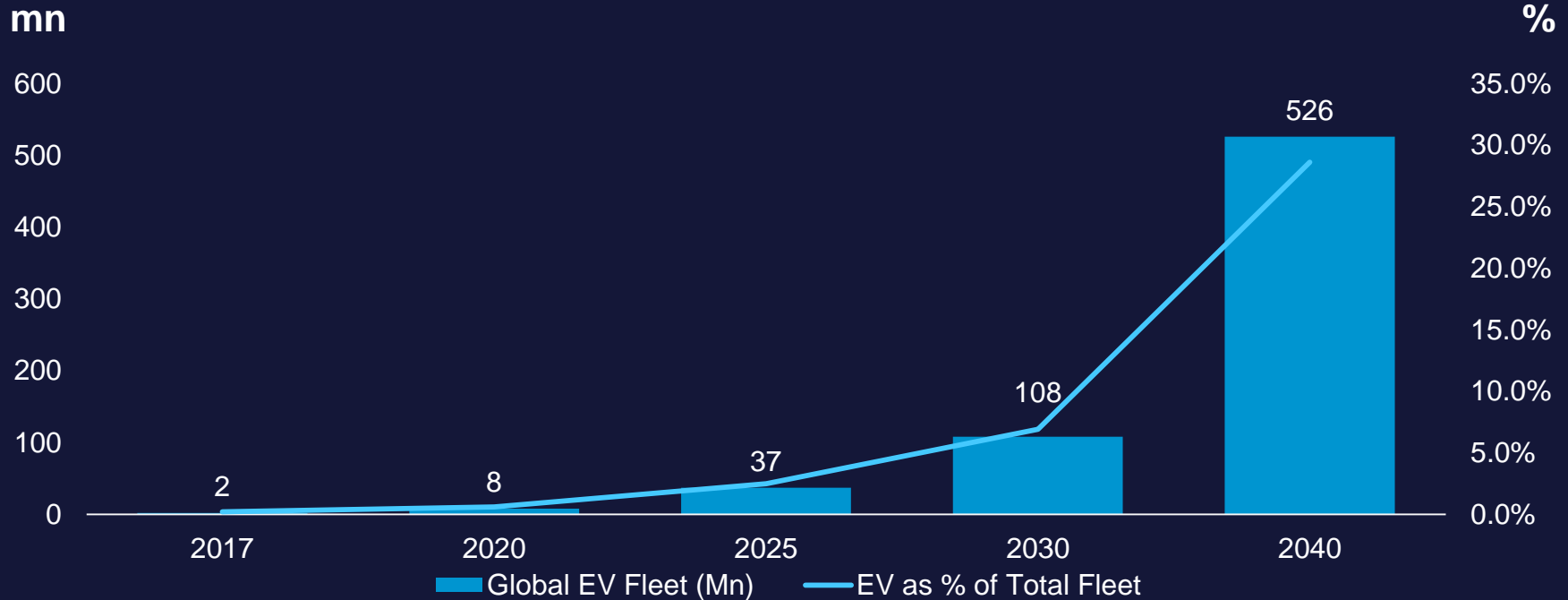
Source: Shutterstock, Morgan Stanley Research

## 2040E Global Infrastructure Spending

\$2.7Tr

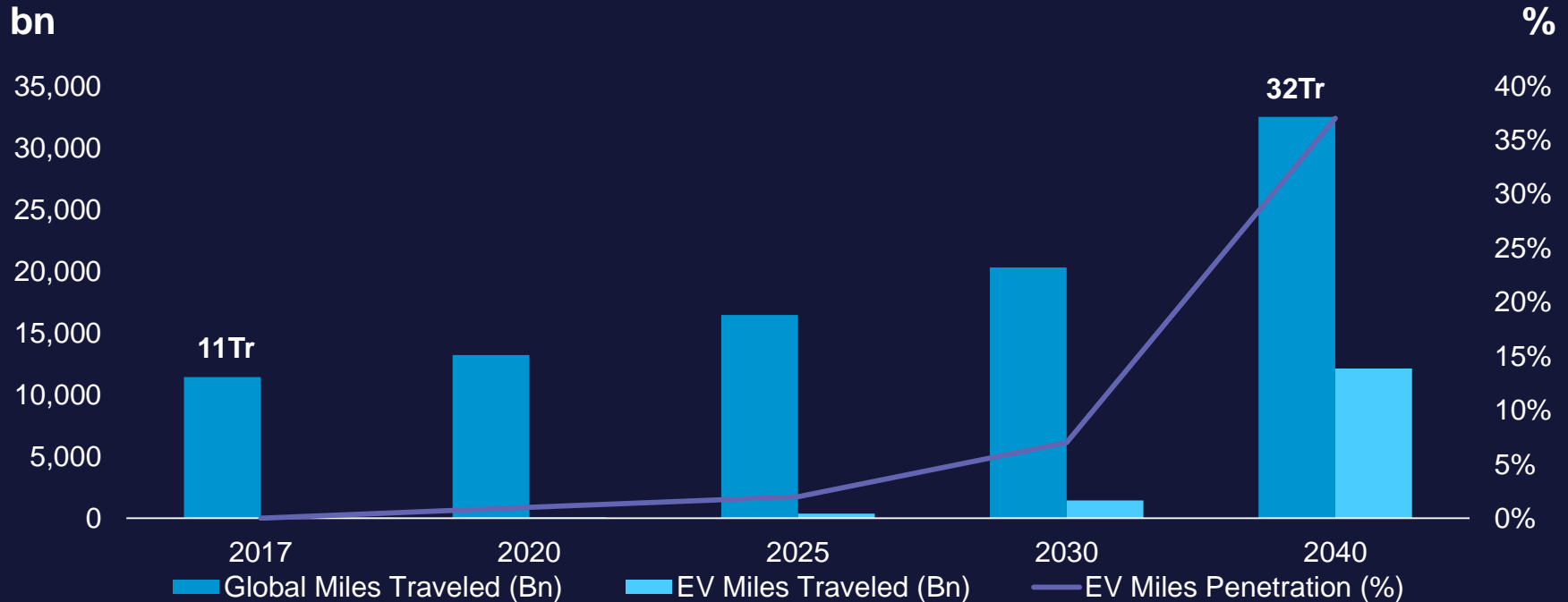


## EVs To See Exponential Growth ...



Source: Morgan Stanley Research

## ... But So Is Miles Traveled

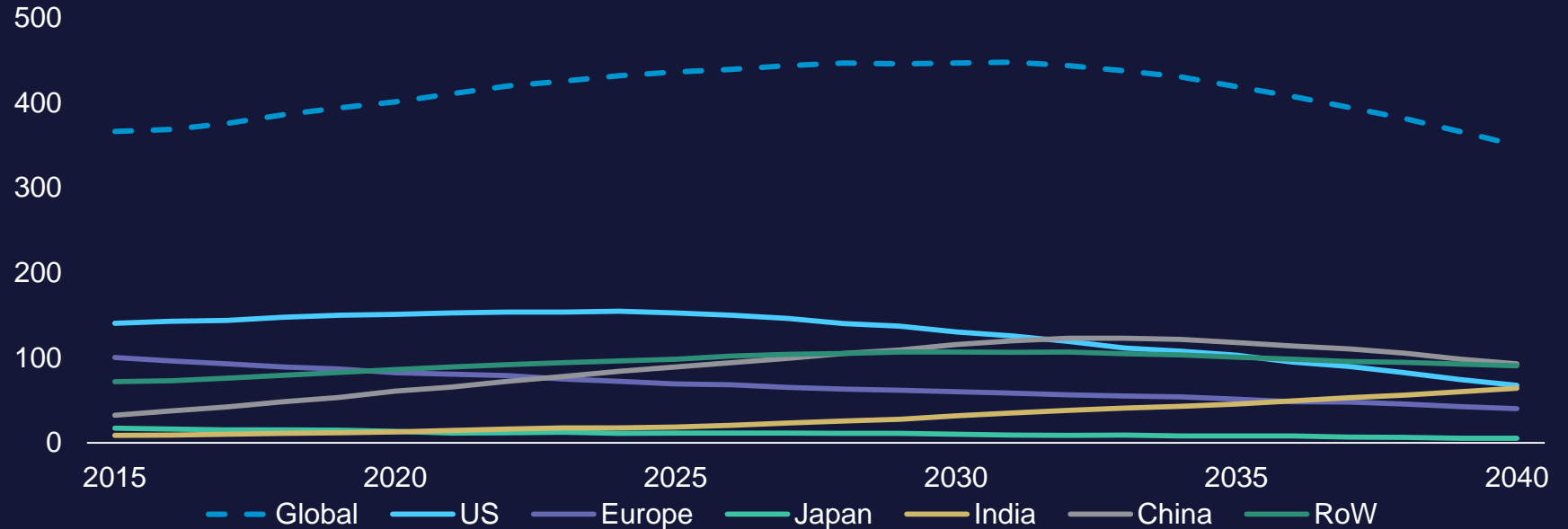


Source: Morgan Stanley Research

# Gasoline Demand Surprisingly High

## Gasoline Consumed

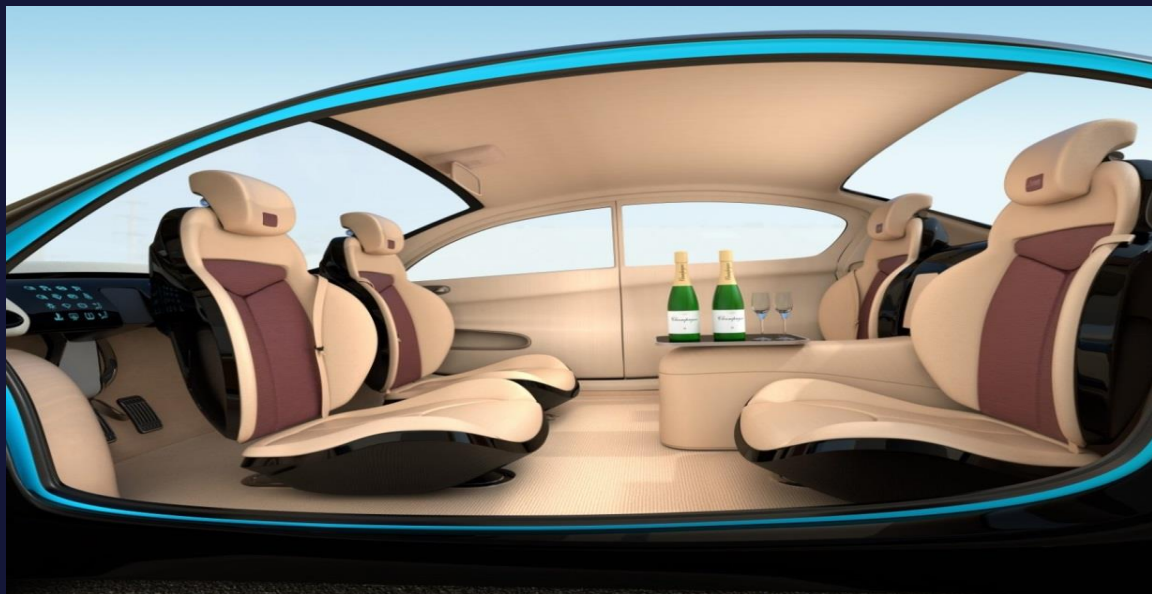
(Bn Gallons)



Source: Morgan Stanley Research



## Tech Hardware, Software & Internet



**facebook.**

 **Microsoft**

**Google**



UBER

**amazon**

**lyft**



**NETFLIX**

## Total US DUI Arrests (2005 – 2014)

### Total US DUI Arrests



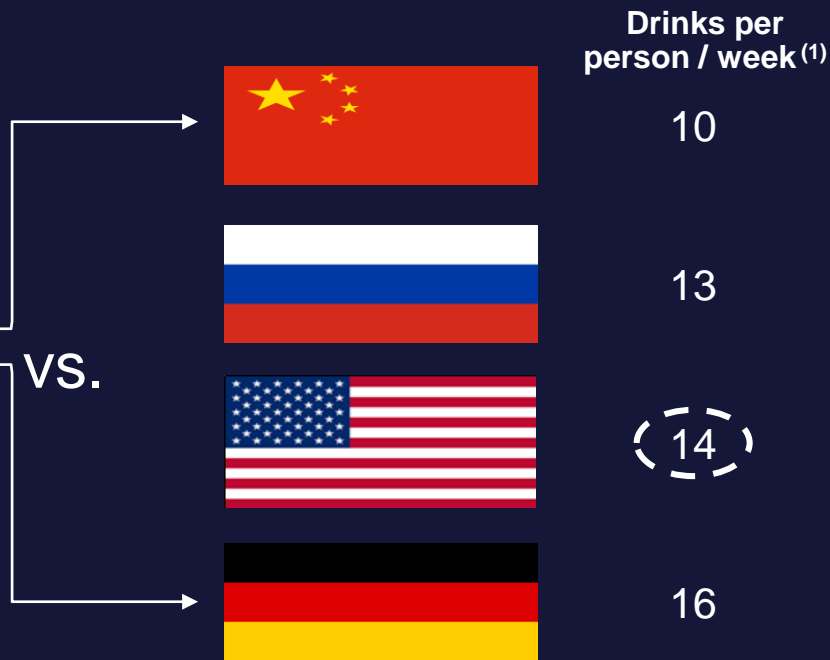
Source: MADD, U.S. Department of Justice, Federal Bureau of Investigation, Morgan Stanley Research

# Global Alcohol Consumption

## Sizing the Market & Incremental Opportunity

### GLOBAL ALCOHOL CONSUMPTION ECONOMICS

Global drinking population (Bn)	2.85
Total drinks consumed per year (Bn)	1,137
Value per drink	\$1.33
<b>Total value of drinks consumed (Bn)</b>	<b>\$1,509</b>
Drinks consumed per person per year	399
<b>Drinks consumed per person per week</b>	<b>8</b>
Drinks consumed per person per day	1
<b>IMPACT FROM SHARED AUTONOMY</b>	
Additional drinks consumed per person per week	1
Additional drinks consumed per person per year	52
Value per drink	\$1.33
<b>Incremental value created (Bn)</b>	<b>\$196</b>



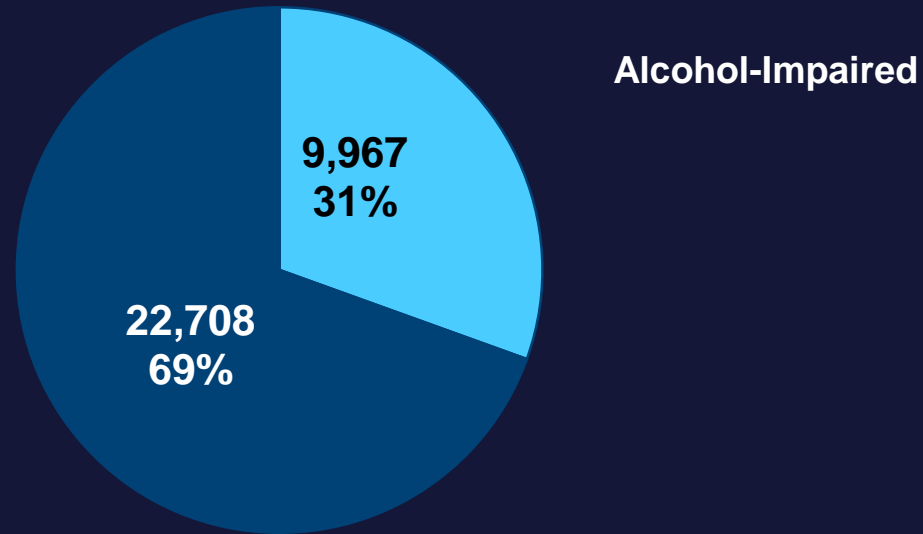
Source: Euromonitor Data, World Health Organization, Morgan Stanley Research

1. At this juncture, we make no assumption on shared/autonomous penetration. Implicit in our +1 drink/wk assumption is that a portion of the population continues to drive, for whom there is no incremental consumption.

How Much More Would You  
Drink if You Never Had To  
Drive?

# US Alcohol-Impaired Traffic Fatalities

## Total U.S. Traffic Fatalities in 2014 (FHA)





## Real Estate



x 1,886

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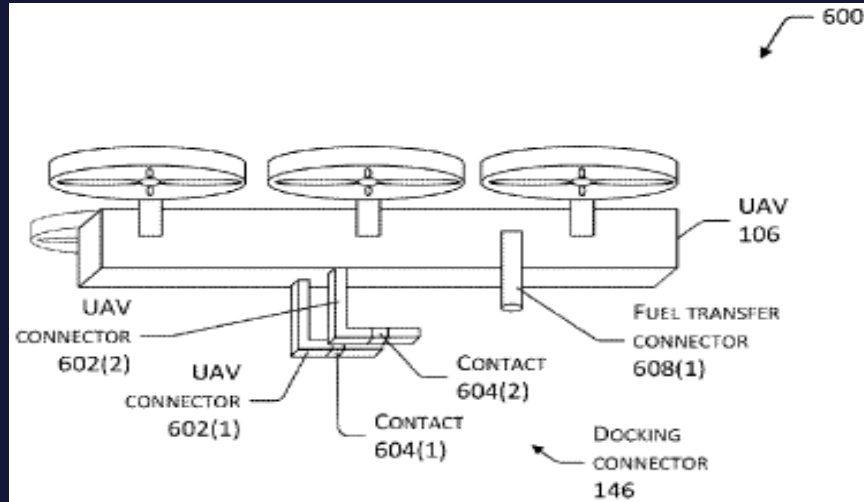
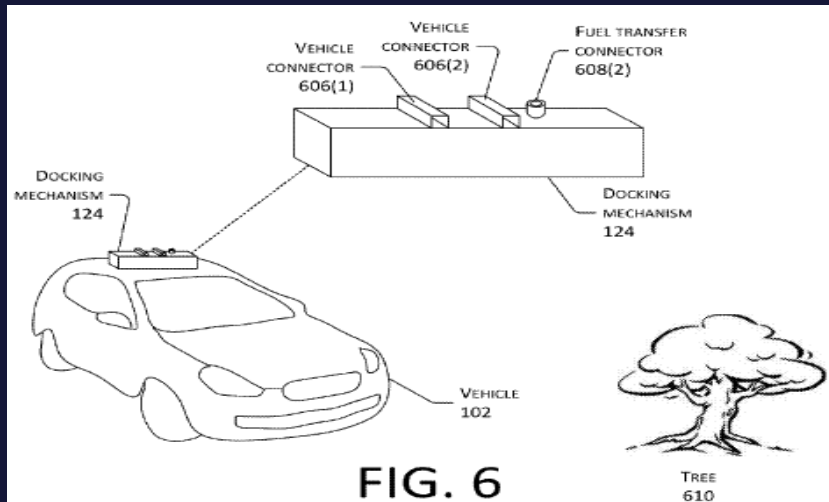
SECTION 3

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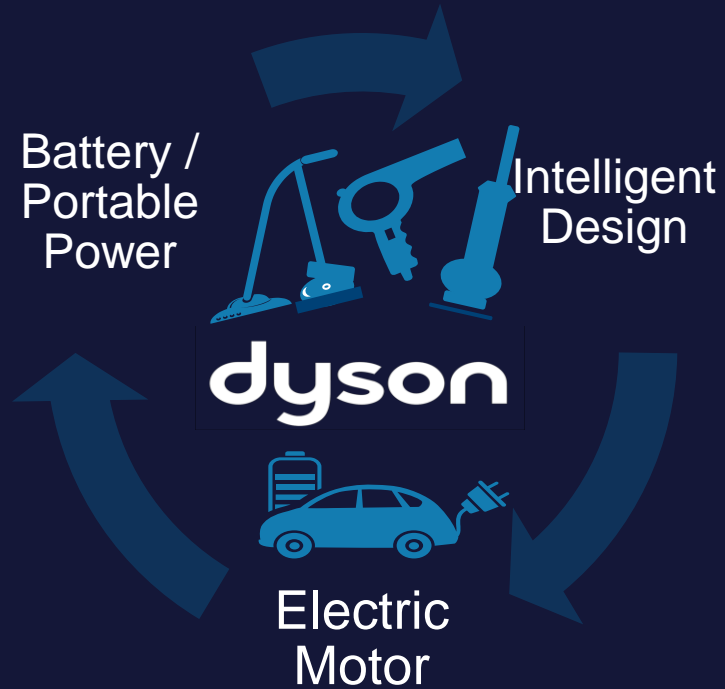
# Strange Things



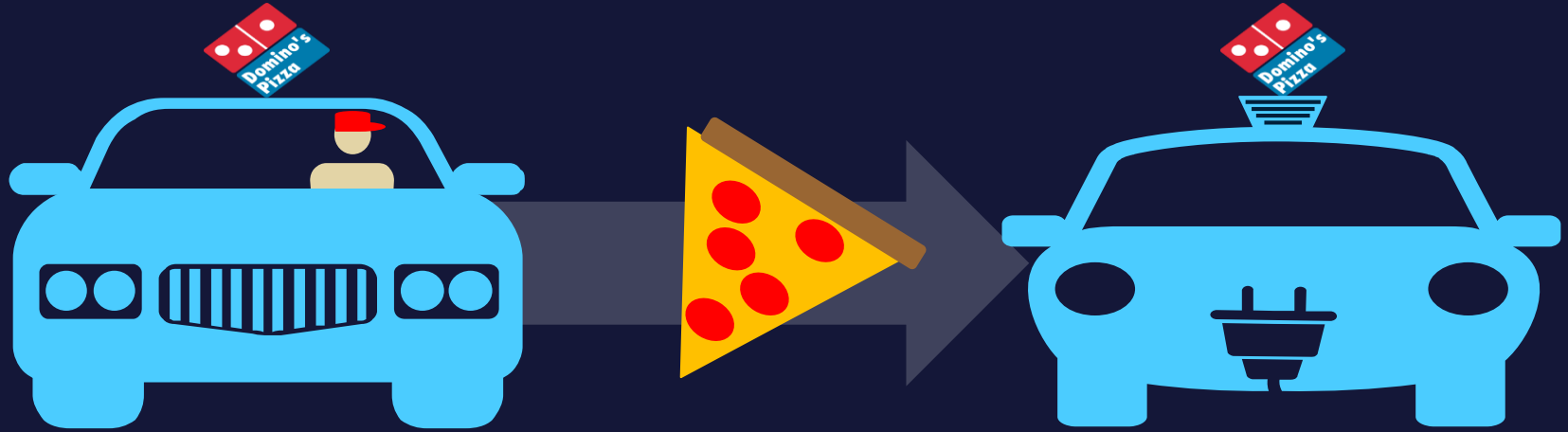
# Wait... What?



# I Drive a Dyson



# Autonomous Pizza



Source: Company Website, Shutterstock, Morgan Stanley Research

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# Welcome to Skynet...



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	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL OTHER MISC
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<b>Total</b>	<b>3,149</b>		<b>764</b>			<b>1,427</b>	

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COMPANY (TICKER)	RATING (AS OF)	PRICE <sup>(1)</sup> (03/21/2018)
<b>Adam Jonas, CFA</b>		
Adient PLC (ADNT.N)	O (02/21/2017)	\$60.05
American Axle & Manufacturing Holdings Inc (AXL.N)	U (09/08/2011)	\$15.05
Aptiv Plc (APT.V.N)	U (12/05/2017)	\$88.14
Asbury Automotive Group Inc (ABG.N)	U (09/12/2012)	\$65.40
AutoNation Inc. (AN.N)	O (07/13/2015)	\$48.06
Avis Budget Group Inc (CAR.O)	++	\$49.40
BorgWarner Inc. (BWA.N)	U (10/19/2015)	\$51.08
Carmax Inc (KMX.N)	U (02/01/2017)	\$61.51
Delphi Technologies PLC (DLP.H.N)	O (12/05/2017)	\$48.64
Ferrari NV (RACE.N)	U (09/07/2017)	\$123.53
Fiat Chrysler Automobiles NV (FCHA.MI)	O (02/24/2016)	€ 17.20
Fiat Chrysler Automobiles NV (FCAU.N)	O (02/24/2016)	\$21.53
Ford Motor Company (F.N)	O (03/14/2018)	\$11.10
General Motors Company (GM.N)	E (10/25/2017)	\$37.58
Goodyear Tire & Rubber Company (GT.O)	O (06/01/2017)	\$28.18
Group 1 Automotive, Inc (GPI.N)	U (10/08/2013)	\$64.10
Harley-Davidson Inc (HOG.N)	O (05/06/2013)	\$43.28
Hertz Global Holdings Inc (HTZ.N)	U (09/14/2017)	\$20.99
Lear Corporation (LEA.N)	U (06/08/2017)	\$192.60
Lithia Motors Inc. (LAD.N)	O (10/15/2014)	\$102.16
Magna International Inc. (MGA.N)	E (08/28/2017)	\$57.72
Mobileye NV (MBBYF.PK)	E (02/01/2017)	\$62.69
Penske Automotive Group, Inc (PAG.N)	O (09/06/2011)	\$44.61
Sonic Automotive Inc (SAH.N)	O (09/29/2014)	\$18.50
Tenneco Inc. (TEN.N)	U (09/23/2010)	\$55.41
Tesla Inc (TSLA.O)	E (05/15/2017)	\$316.53
Visteon Corporation (VC.O)	U (03/22/2018)	\$120.77

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1. Historical prices are not split adjusted.

## **The Americas**

1585 Broadway  
New York, NY 10036-8293  
United States  
+1 212 761 4000

## **Europe**

20 Bank Street, Canary Wharf  
London E14 4AD  
United Kingdom  
+44 (0)20 7425 8000

## **Japan**

4-20-3 Ebisu, Shibuya-ku  
Tokyo 150-6008  
Japan  
+81 (0) 3 5424 5000

## **Asia/Pacific**

1 Austin Road West  
Kowloon  
Hong Kong  
+852 2848 5200