

# Congressional Briefing Book



Securing America's  
Future Energy

# INTRODUCTION

---

The past decade has been one of historic change in the U.S. energy economy, yet one fact remains unaltered: American mobility continues to depend almost entirely on oil. While oil has facilitated the rise of the modern era, its price volatility—caused by a myriad of factors, most notably OPEC’s longstanding market collusion—creates tremendous energy security vulnerabilities for the United States. Such manipulation undermines the regular, transparent price discovery upon which markets depend to function properly. Moreover, these distortions constrain U.S. foreign policy options, affect the flexibility and activities of the military, and threaten economic growth and fiscal stability.

Fortunately, there is a range of solutions that could further strengthen U.S. energy security and reduce the threats posed by the anticompetitive cartel activity that supports oil’s monopoly over the transportation sector. SAFE advocates for a comprehensive policy approach that consists of both supply- and demand-side solutions. These include:

- » Maximizing domestic oil production;
- » Implementing robust U.S. fuel economy standards, accounting for the latest driver-assist and crash-avoidance technologies, and the ridesharing business models of companies like Uber or Lyft;
- » Promoting the widespread deployment of alternative fuel vehicles, which run on domestically-sourced fuels including electricity, natural gas and hydrogen that are both low and stable in price; and
- » Advocating for connected, shared and autonomous vehicles, which promise to significantly improve system-wide fuel efficiency and roadway safety.

SAFE’s 2019 Congressional Briefing Book offers concrete policy solutions that will help reduce problems posed by American oil dependence. Data and information included covers the following topics:

- » Fundamentals of the global oil market, including consumption, production, prices and reserves;
- » Alternative fuel vehicles, vehicle efficiency trends, and strategic minerals;
- » The role new and innovative technologies—such as shared, autonomous vehicles—may play in cutting oil consumption while delivering widespread social and economic benefits; and
- » Policy recommendations designed to ensure the long-term security and prosperity of the United States through reduced oil dependence.

# TABLE OF CONTENTS

---

Introduction.....	ii
Part I: Fundamentals of the Global Oil Market.....	1
Part II: Problems with Oil Dependence.....	15
Part III: Increasing Efficiency and Achieving Fuel Diversity.....	31
Part IV: AVs: Improving the Safety and Efficiency of American Transportation.....	49
Part V: Policy Measures for Improving U.S. Energy Security.....	63

Securing America's Future Energy (SAFE) is an action-oriented, nonpartisan organization formed in 2004 to reduce America's dependence on oil. Near-total reliance on petroleum in the transportation sector undermines the nation's economic and national security and constrains U.S. foreign policy.

To combat these threats, SAFE advocates for expanded domestic production of U.S. resources, improvements in vehicle fuel efficiency, the widespread use of alternative fuels including electricity, natural gas, and hydrogen, and the deployment of connected, shared, and autonomous vehicles.

Even though the United States has become a global leader in oil production, we continue to send nearly \$1 billion abroad each day to pay for oil, often to countries that share neither America's strategic interests nor its values. In addition, every U.S. recession in the past 40 years has been associated with an oil price spike, while more than \$3.4 trillion in U.S. wealth has been transferred abroad since 1970. Regardless of how much oil the United States produces, American businesses and consumers remain exposed to a volatile global oil market manipulated by OPEC and its petrostate allies like Russia.

In 2006, SAFE joined with General P.X. Kelley (Ret.), 28th Commandant of the U.S. Marine Corps, and Frederick W. Smith, Chairman and CEO of FedEx Corporation, to form the Energy Security Leadership Council (ESLC), a group of business and former military leaders committed to reducing U.S. oil dependence. SAFE and the ESLC published *Recommendations to the Nation on Reducing U.S. Oil Dependence and A National Strategy for Energy Security*, which helped the Council play a major role in the drafting and passage of the Energy Independence and Security Act of 2007, containing the first improved fuel economy standards in a generation. Frederick W. Smith continues today as co-chair, now with General James T. Conway (Ret), 34th Commandant of the U.S. Marine Corps.

Successfully addressing the enormous challenge that oil dependence poses to our nation requires a multi-faceted approach. SAFE's ambitious plan focuses on expanding responsible domestic production of oil and natural gas resources, modernizing U.S. fuel economy standards, and shifting toward new and innovative transportation technologies such as autonomous vehicles that will help end oil's monopoly over the transportation sector. Decoupling the U.S. economy from oil would represent a major strategic and economic victory for the nation, and we believe this goal is within reach. We urge policymakers to seize this opportunity.



---

## CO - CHAIRS

Frederick W. Smith  
*CHAIRMAN AND CEO, FEDÉX*

General James T. Conway (Ret.)  
*34<sup>TH</sup> COMMANDANT, U.S. MARINE CORPS*

## CHAIRMAN EMERITUS

General P.X. Kelley, U.S. Marine Corps (Ret.)  
*28<sup>TH</sup> COMMANDANT, U.S. MARINE CORPS*

## MEMBERS

Peter Ackerman  
*MANAGING DIRECTOR, ROCKPORT CAPITAL*

General Carlton D. Everhart II (Ret.)  
*FORMER COMMANDER, AIR MOBILITY COMMAND*

Admiral Dennis Blair, U.S. Navy (Ret.)  
*FORMER DIRECTOR OF NATIONAL INTELLIGENCE AND  
COMMANDER IN CHIEF, U.S. PACIFIC COMMAND*

James C. Fish, Jr.  
*PRESIDENT AND CEO, WASTE MANAGEMENT*

General Bryan "Doug" Brown, U.S. Army (Ret.)  
*FORMER COMMANDER, U.S. SPECIAL OPERATIONS COMMAND*

Sam Gilliland  
*FORMER CEO, SABRE HOLDINGS*

Admiral Vern Clark, U.S. Navy (Ret.)  
*FORMER CHIEF OF NAVAL OPERATIONS*

Adam Goldstein  
*COO, ROYAL CARIBBEAN CRUISES*

General Richard A. Cody, U.S. Army (Ret.)  
*FORMER VICE CHIEF OF STAFF, U.S. ARMY*

Maurice R. Greenberg  
*CHAIRMAN AND CEO, C.V. STARR AND CO.*

General Michael W. Hagee, U.S. Marine  
Corps (Ret.)  
*33<sup>RD</sup> COMMANDANT, U.S. MARINE CORPS*

Admiral Jonathan Greenert, U.S. Navy (Ret.)  
*30<sup>TH</sup> CHIEF OF NAVAL OPERATIONS*

General John W. Handy, U.S. Air Force (Ret.)  
*FORMER COMMANDER, U.S. TRANSPORTATION COMMAND*

General Michael T. Moseley, U.S. Air Force (Ret.)  
*FORMER CHIEF OF STAFF, U.S. AIR FORCE*

Admiral John C. Harvey, U.S. Navy (Ret.)  
*FORMER COMMANDER, U.S. FLEET FORCES COMMAND*

Nirmal Mulve  
*FOUNDER AND CHAIRMAN, NOSTRUM GROUP*

Admiral Michelle J. Howard, U.S. Navy (Ret.)  
*FORMER COMMANDER, U.S. NAVAL FORCES EUROPE AND U.S.  
NAVAL FORCES IN AFRICA*

General Michael E. Ryan, U.S. Air Force (Ret.)  
*16<sup>TH</sup> CHIEF OF STAFF, U.S. AIR FORCE*

Admiral Gregory G. Johnson, U.S. Navy  
(Ret.)  
*FORMER COMMANDER, U.S. NAVAL FORCES EUROPE*

Mark Joseph  
*GLOBAL CHIEF DEVELOPMENT OFFICER, TRANSDEV GROUP*

Admiral Timothy J. Keating, U.S. Navy (Ret.)  
*FORMER COMMANDER, U.S. PACIFIC COMMAND*

John F. Lehman  
*FORMER SECRETARY OF THE U.S. NAVY*

General David D. McKiernan, U.S. Army (Ret.)  
*FORMER COMMANDER, INTERNATIONAL SECURITY ASSISTANCE  
FORCE, AFGHANISTAN*

General Duncan J. McNabb, U.S. Air Force (Ret.)  
*FORMER COMMANDER, U.S. TRANSPORTATION COMMAND*

General Charles F. Wald, U.S. Air Force (Ret.)  
*FORMER DEPUTY COMMANDER, U.S. EUROPEAN COMMAND*

Josh S. Weston  
*HONORARY CHAIRMAN, AUTOMATIC DATA PROCESSING*

David Schwarz  
*FOUNDER, PRESIDENT AND CEO, DAVID M. SCHWARZ  
ARCHITECTS*

Eric S. Schwarz  
*FORMER CO-CEO, GOLDMAN SACHS ASSET MANAGEMENT*

Eric Silagy  
*PRESIDENT AND CEO, FLORIDA POWER AND LIGHT COMPANY*

Jeffrey C. Sprecher  
*CHAIRMAN AND CEO, INTERCONTINENTAL EXCHANGE AND  
CHAIRMAN, NEW YORK STOCK EXCHANGE*

Paul H. Stebbins  
*CHAIRMAN EMERITUS, WORLD FUEL SERVICES CORPORATION*

David P. Steiner  
*FORMER CEO, WASTE MANAGEMENT*

Michael T. Strianese  
*PRESIDENT, CEO AND DIRECTOR, L3 COMMUNICATIONS  
HOLDING*



PART I

# Fundamentals of the Global Oil Market



## Oil is Traded on an Unfree and Unfair Market

---

The global oil market is dominated by the Organization of the Petroleum Exporting Countries (OPEC), and by Saudi Arabia in particular. For decades, the cartel has intervened aggressively in the global oil market to influence prices by leveraging OPEC's significant advantages in reserves and production costs, and manipulating supply. The strategic outcomes OPEC seeks through its collusive behavior undermine U.S. energy security and broader national interests. Recently, OPEC has joined forces with petrostate allies like Russia to create a group known as OPEC+. Together, these states control 90 percent of the world's proven oil reserves.<sup>1</sup>

## The Oil Market is Prone to Geopolitical Instability

---

Oil prices are set on a global market, which means that changes in oil supply or demand anywhere affect prices everywhere. In some cases, events in countries that host important shipping channels or infrastructure can significantly impact oil prices. The impact on the United States is a function of the amount of oil consumed and is largely unrelated to the amount of oil imported.

Oil prices climbed in 2018 due to concerns that U.S. sanctions on Iranian oil would take the country's entire production off the market. Because of these concerns and the potential effect on gasoline prices, the United States was forced to temper its policy toward Iran, granting waivers of Iranian oil exports to key consumers. Additionally, in response to the global outcry following the murder of journalist Jamal Khashoggi, Saudi Arabia issued a statement through its press agency containing a veiled threat to weaponize the country's oil production once again—rhetoric unheard of since the 1973 Arab embargo that triggered the first oil crisis.<sup>2</sup>

---

<sup>1</sup> BP, p.l.c., *Statistical Review of World Energy*, 2018.

<sup>2</sup> Javier Blas, "Saudi Arabia Breaks 45-Year Taboo With Veiled Threat to Use Oil as a Weapon," Bloomberg, LP. October 15, 2018.

## The United States Will Continue to Remain Vulnerable

---

For decades, long-term energy security was defined as the attainment of self-sufficiency in energy supply. In the wake of the 1973 oil crisis, President Richard Nixon identified energy independence as a central policy concern, and every president since has advocated for policies to bolster U.S. national security by improving American energy independence.<sup>3</sup> Often equated with the ability to become “energy independent” from foreign oil suppliers, the energy security debate was often most intense during periods of high and volatile oil prices, particularly when such periods overlapped with high levels of U.S. imports. Recently, however, higher domestic oil production has sparked claims that this independence has been achieved.<sup>4</sup> This definition of self-sufficiency ignores America’s vulnerability as the world’s largest oil consumer.<sup>5</sup> True energy security is almost entirely a function of oil consumption in the domestic economy, regardless of the source of the oil.

---

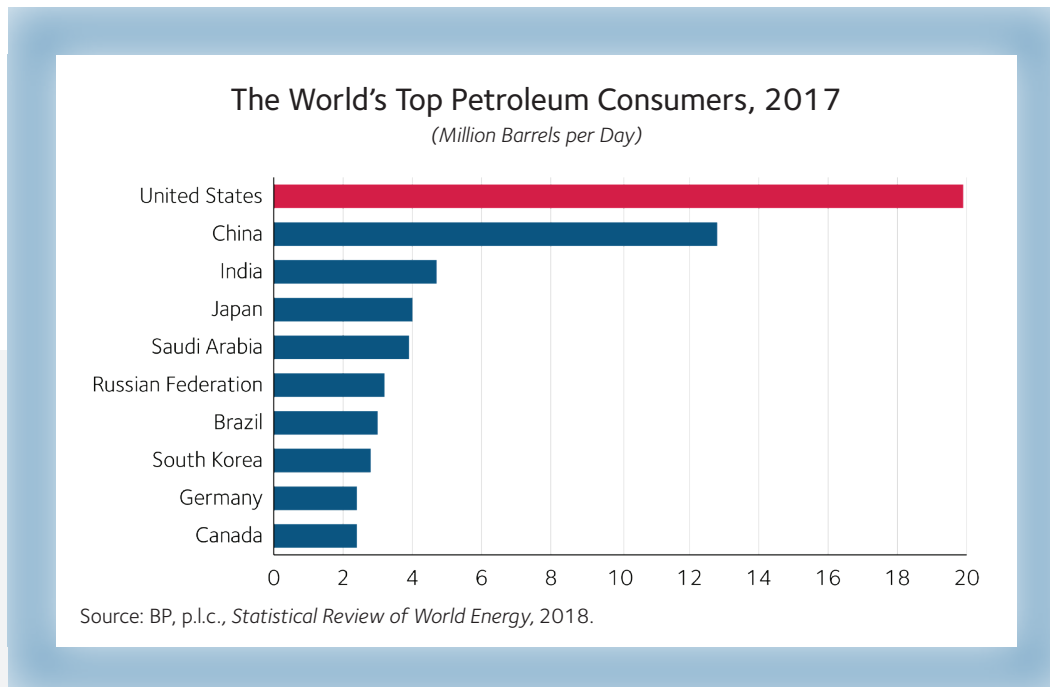
<sup>3</sup> University of California, Santa Barbara, “The American Presidency Project”

<sup>4</sup> Investor’s Business Daily, “Trump Just Achieved What Every President Since Nixon Had Promised: Energy Independence,” December 12, 2018.

<sup>5</sup> EIA, “What countries are the top producers and consumers of oil?,” December 3, 2018.

## Global Oil Consumption

While petroleum is a critical feedstock for many industries, it is most widely used in the production of transportation fuels. In the United States, oil is used to power 92 percent of the U.S. transportation system.<sup>6</sup> This dependence exposes the economy to oil market volatility and leaves the United States vulnerable to price shocks.



- » The United States is the world's largest consumer of petroleum. At 19.8 million barrels per day (Mbd), American oil consumption accounted for 20 percent of the global total in 2017.<sup>7</sup>
- » Oil demand in several countries and regions has risen sharply in recent years. China was the world's second largest consumer in 2017, using 13 percent of the global total.<sup>8</sup>
- » Oil demand in the economically-advanced Organisation for Economic Cooperation and Development (OECD) is flat to declining. Demand in emerging non-OECD countries, however, continues to rise, albeit at a slower pace than in the previous decade.

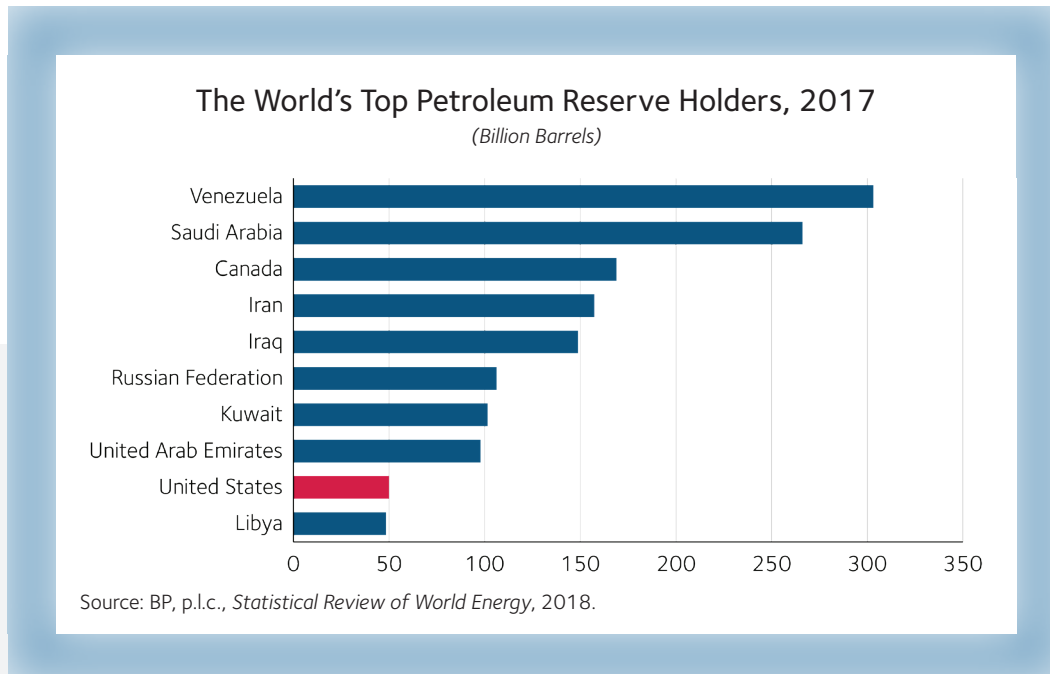
<sup>6</sup> EIA, "Energy Use for Transportation," May 23, 2018.

<sup>7</sup> SAFE analysis based on data from EIA's Short-Term Energy Outlook.

<sup>8</sup> BP, p.l.c., *Statistical Review of World Energy*, 2018.

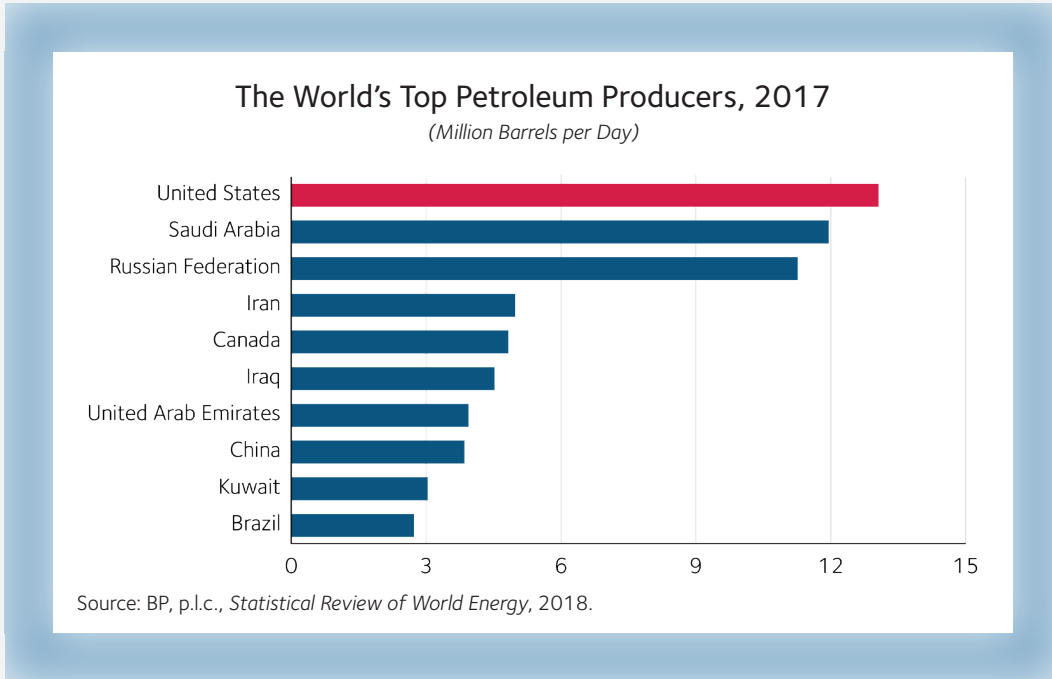
## Global Oil Reserves and Production

Global liquid fuels production topped 100.0 Mbd in 2018.<sup>9</sup> Despite a massive increase in U.S. reserves from shale, state-run enterprises in countries from Russia to the Middle East and North Africa still control 90 percent of global oil reserves. These governments, which make up the majority of OPEC+ nations and are often home to the world's least expensive oil supplies, make upstream investment decisions based on a complex and opaque mix of factors, including competing social and military spending needs. Despite having comparatively smaller reserves, private sector innovation has driven the United States to become the world's largest liquid fuels producer.



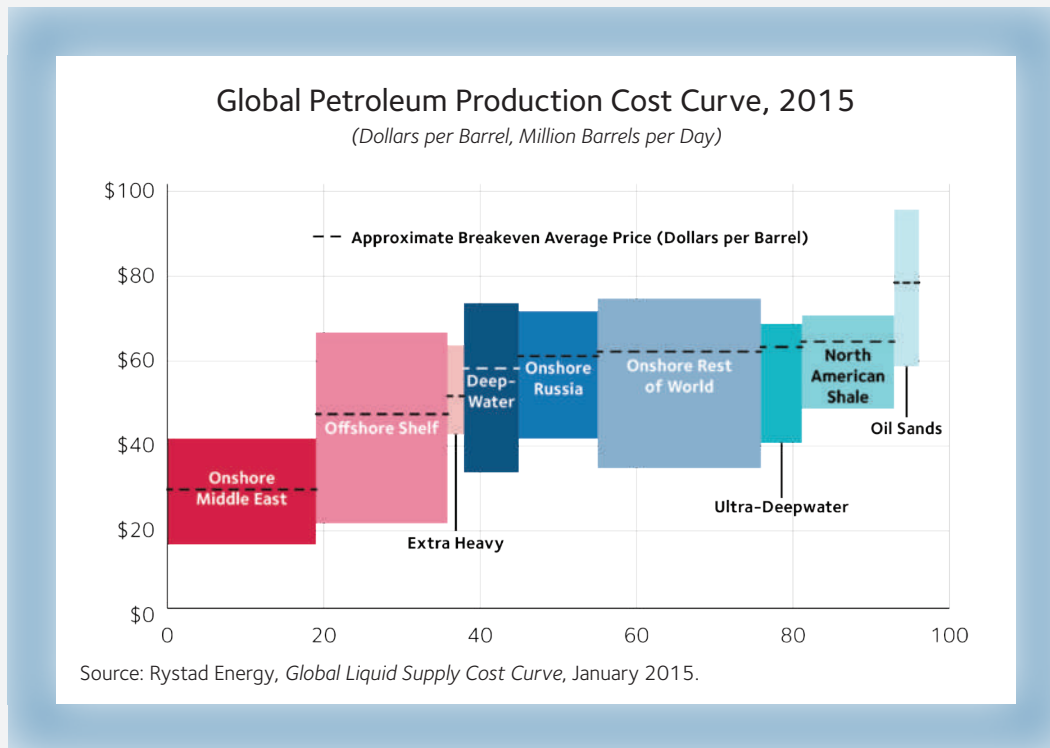
- » The top 10 holders of proven conventional oil reserves account for more than 85 percent of total global reserves.<sup>10</sup> Many of these top holders are politically or economically unstable OPEC member states subject to production quotas, emphasizing that the global oil market remains unfree.
- » The United States has the world's ninth-largest petroleum reserves.

<sup>9,10</sup> EIA, STEO, Global Liquid Fuels, February 12, 2019.



- » Saudi Arabia and Russia follow the United States as leaders in global liquid fuels production.<sup>11</sup>
- » The United States, Mexico, and Canada are the only three established liberal democracies of the world's top 10 oil producers. Three others—China, Iran, and Russia—are strategic adversaries, and three of the remaining four are undemocratic states located around the Persian Gulf.

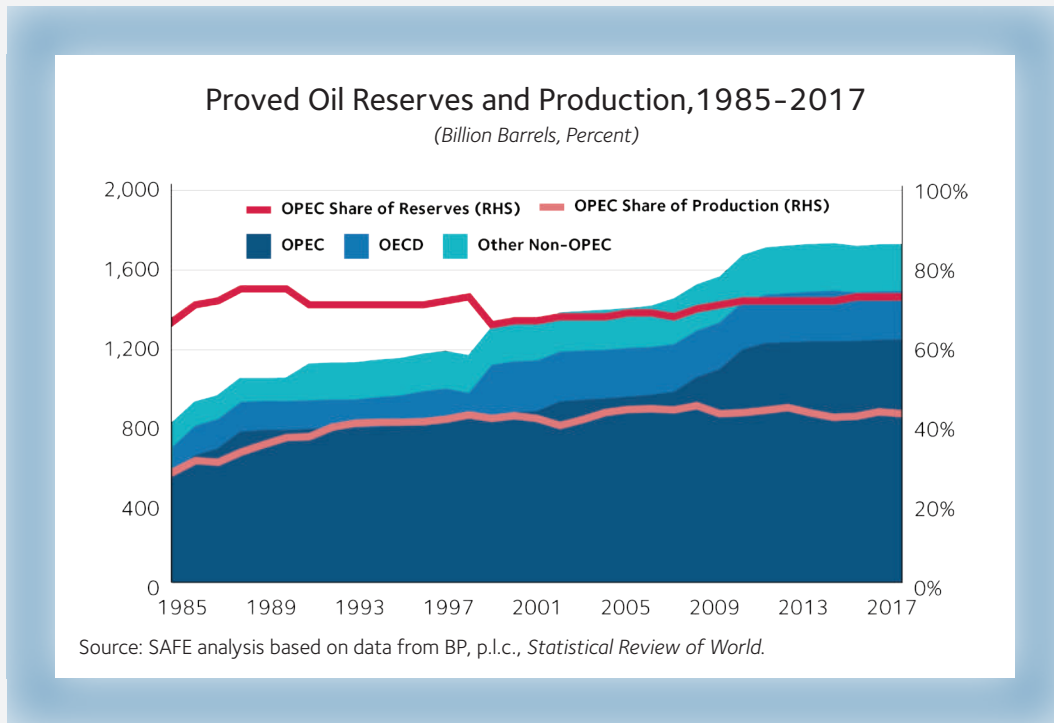
<sup>11</sup> BP, p.l.c., *Statistical Review of World Energy*, 2018.



- » U.S. shale oil has added a large source of supply in the middle of the cost curve, diminishing the need for investment in high-cost supplies.
- » At the bottom of the cost curve, core OPEC producers have the lowest production break-even costs in the world. They can generally continue pumping oil at a large profit even in a low oil price environment.
- » In 2017, the breakeven price for North American shale oil was above \$60 per barrel compared to the onshore Middle East, where breakeven prices averaged approximately \$29 per barrel.<sup>12</sup> Some observers have said U.S. shale oil is profitable at \$40 per barrel, but this estimate frequently omits the costs of land acquisition, financing, and abandonment liabilities.<sup>13</sup>

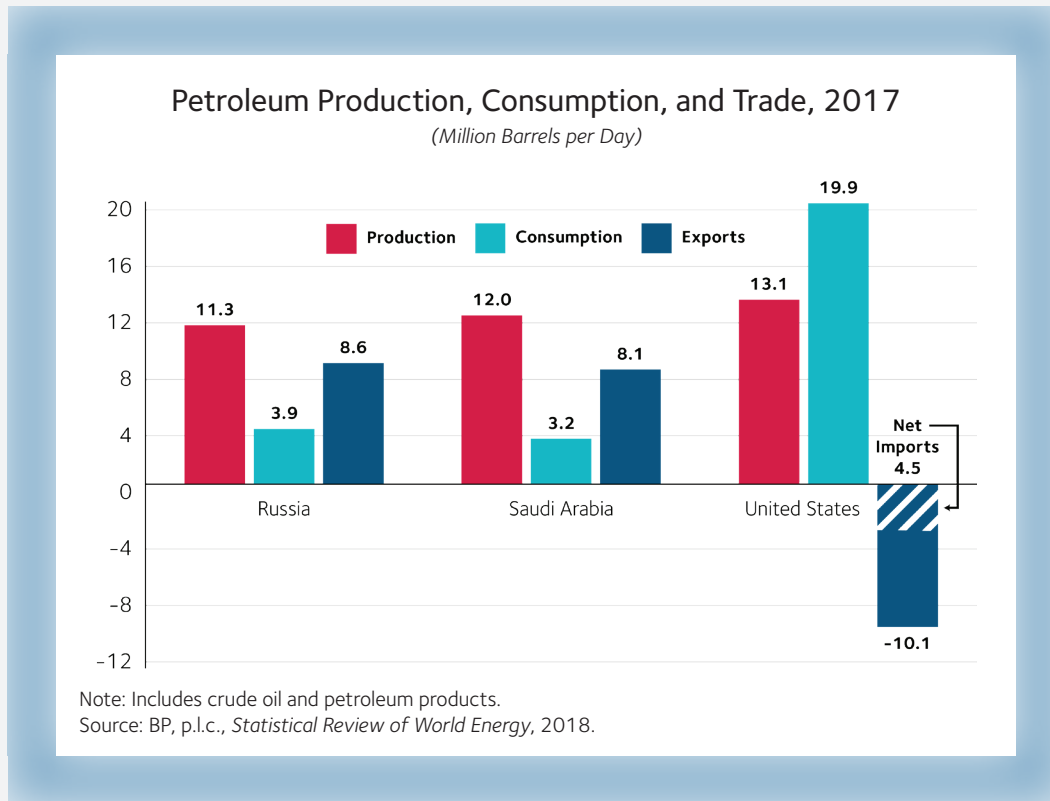
<sup>12</sup> Rystad Energy, *Global Liquid Supply Cost Curve*, January 2015.

<sup>13</sup> Bradley Olson and Rebecca Elliott, "Big Fracking Profits at \$50 a Barrel? Don't Bet on It." *Wall Street Journal*, December 4, 2018.



- » Despite their vast reserves and cheap production costs, OPEC's share of global output is disproportionately lower than would be expected under free market conditions.
- » OPEC member countries produce approximately 40 percent of the world's crude oil, and more importantly, OPEC's oil exports represent approximately 60 percent of the total petroleum traded internationally.<sup>14</sup>
- » Crude oil prices tend to increase when OPEC or Saudi Arabia reduce their production targets.

<sup>14</sup> BP, p.l.c., *Statistical Review of World Energy*, 2018.



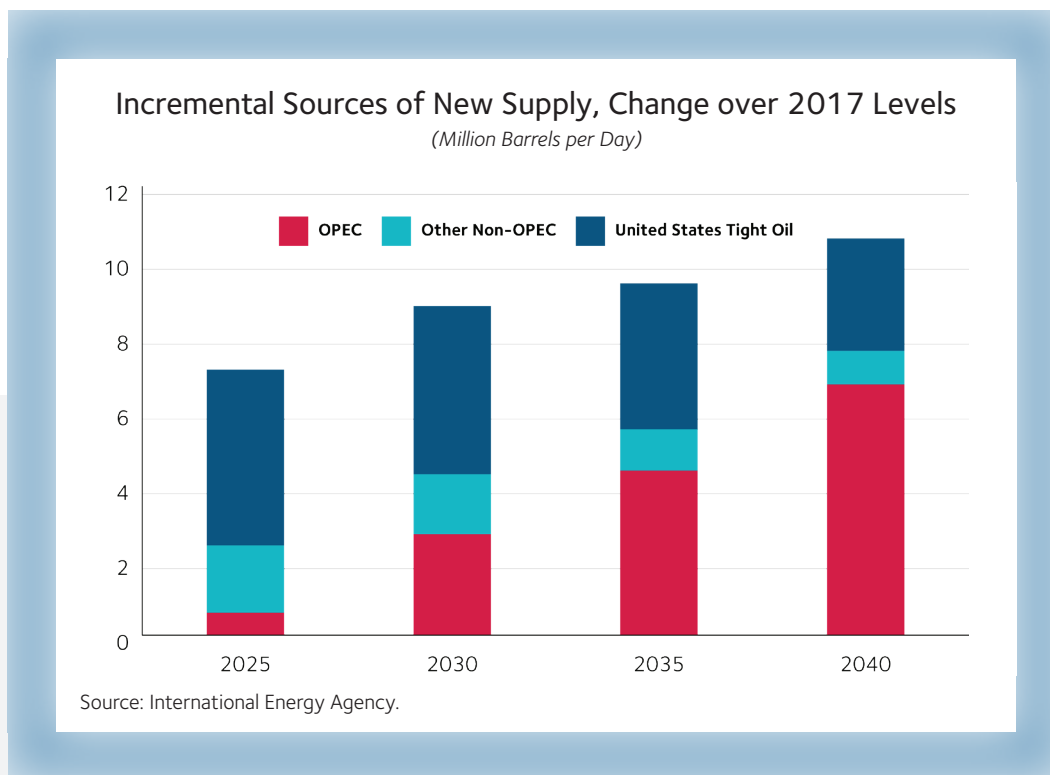
- » Although the United States is now the world's largest oil producer, Saudi Arabia and Russia supply much more oil than they consume, and benefit from lower production costs.<sup>15</sup>

<sup>15</sup> Ibid.



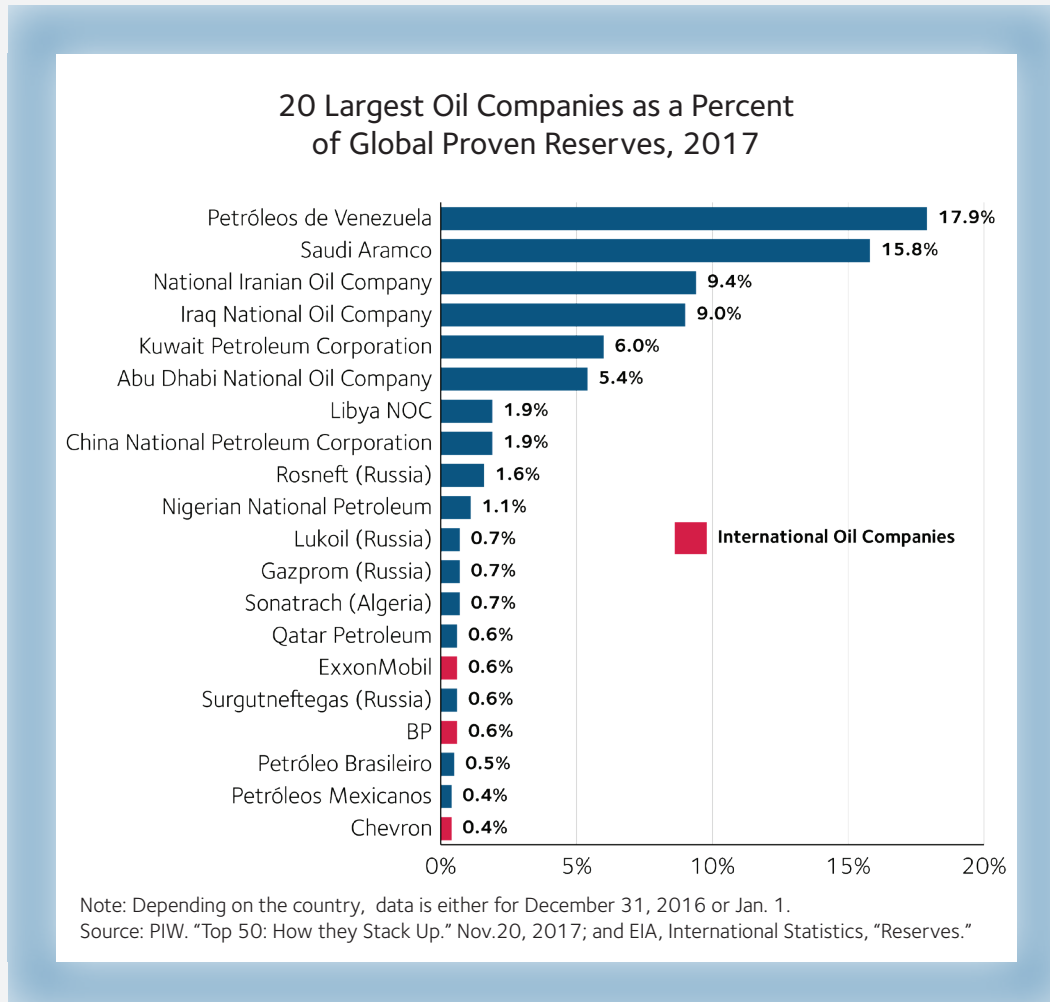
## Organization of the Petroleum Exporting Countries (OPEC)

OPEC was founded in 1960 to push oil prices higher and capture a larger share of the global revenue derived from oil production. OPEC exists to manage production, investment, and market perceptions as a cartel and drive prices higher than they would be if the global oil market operated under free-market conditions. OPEC, and its de facto leader Saudi Arabia, seek to actively manage oil production by setting production targets.



- » Projections from the U.S. Energy Information Administration (EIA) and International Energy Agency (IEA), among others, see OPEC market power increasing unless there are significant changes to current supply, demand, or policy trends.
- » The IEA has forecast that 63 percent of the 10.6 Mbd of petroleum production growth by 2040 will come from OPEC members. EIA says OPEC's contribution to new supply growth will be 87 percent, a substantially higher estimate than the IEA. The increase in the cartel's crude supply will far outpace growth in non-OPEC countries, including the United States and Canada.

- » IEA anticipates U.S. crude oil production to peak in 2027 at approximately 14.0 Mbd. OPEC production will grow to 46.3 Mbd in 2040.



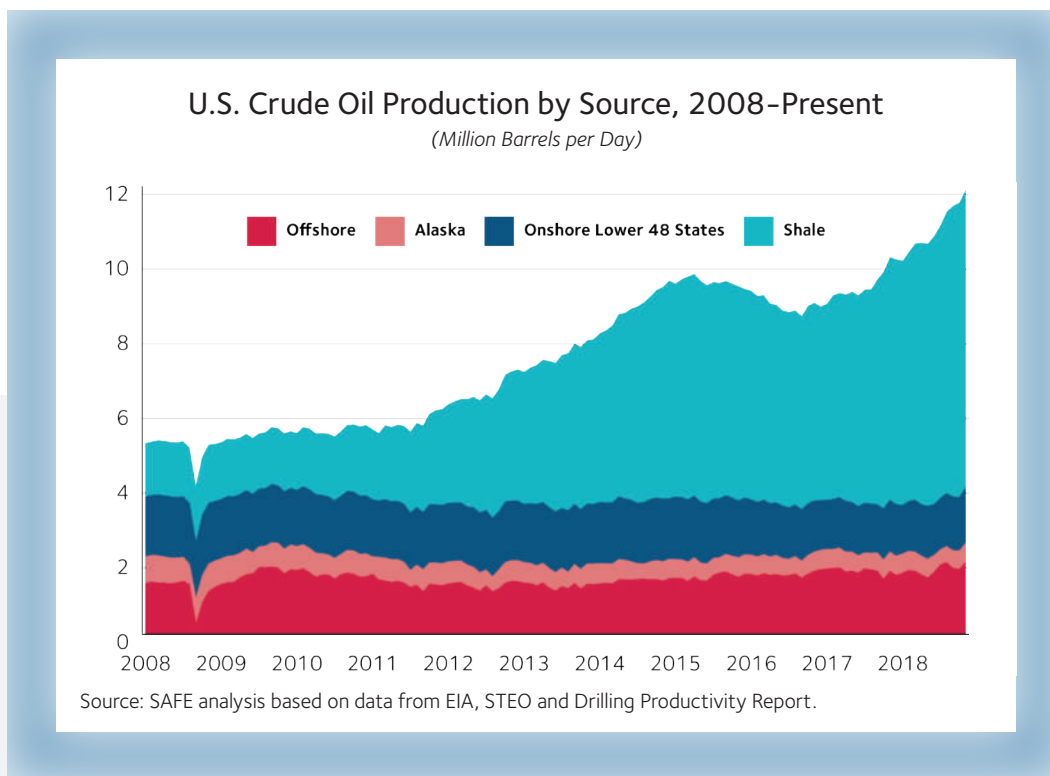
- » While private international oil companies continue to rank among the key producers of oil and gas today, their access to new reserves for future production is increasingly limited. State-controlled national oil companies (NOCs) dominate the list of the world's top reserve holders. OPEC's NOCs control most of the world's reserves.
- » NOCs possess more than 90 percent of the world's petroleum reserves and produce more than 75 percent of its oil.<sup>16</sup>
- » The top 14 holders of combined oil and gas reserves globally are NOCs. The highest ranked fully-private firm is ExxonMobil, at number 15 on the list.<sup>17</sup>

<sup>16</sup> PIW. "Top 50: How they Stack Up." Nov.20, 2017; and EIA, International Statistics, "Reserves."

<sup>17</sup> Ibid.

## Domestic Production

Following decades of near-constant decline, U.S. crude oil production entered a period of significant growth in 2008, with output increasing from 5.0 Mbd to an all-time high of 11.5 Mbd in 2018.<sup>18</sup> This was the most sustained period of U.S. production growth since the early 1980s and the most significant on a volumetric basis since the late 1960s. Much of the increase occurred in Texas' Permian shale formation, as well as North Dakota's Bakken shale formation. The surge in shale oil output—enabled by advances in horizontal drilling and well-fracturing technologies—also offset declines in more conventional sources of production.

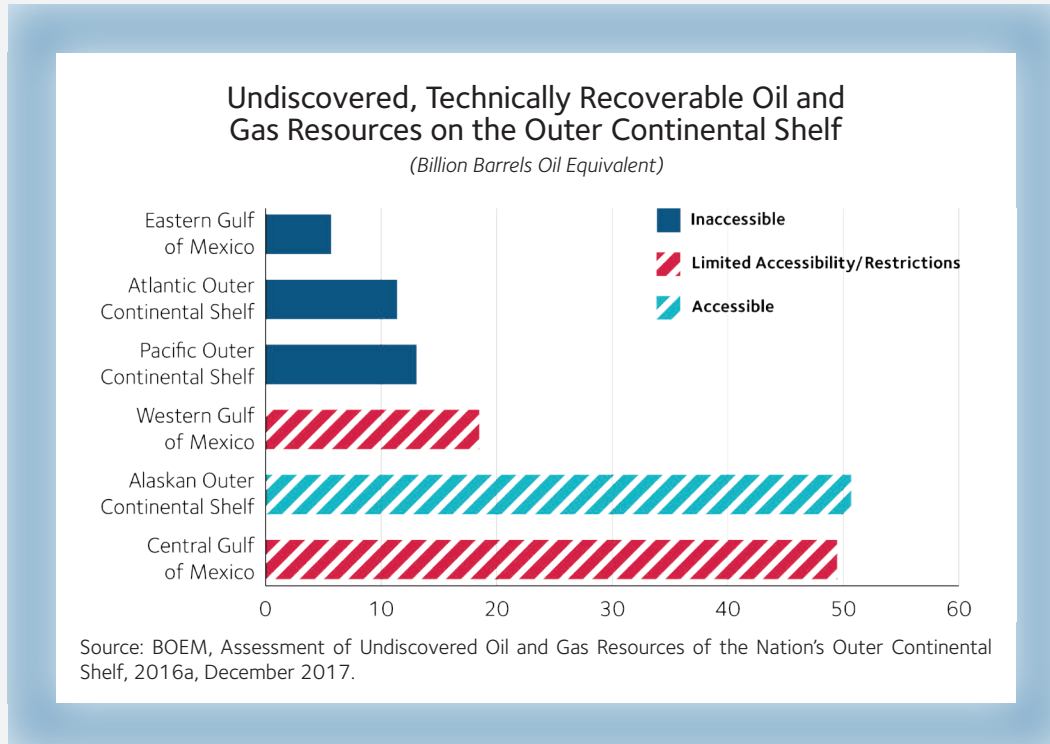


- » More than 55 percent of all U.S. oil is produced by the hydraulic fracturing of shale oil deposits.<sup>19</sup> By the early 2040s, EIA expects nearly 70 percent of U.S. production to come from hydraulically fractured wells.

<sup>18</sup> See, e.g., Stephanie Kelly, "U.S. October crude oil production sets record high: EIA," Reuters, December 31, 2018.

<sup>19</sup> SAFE analysis based on data from EIA, STEO and Drilling Productivity Report; and EIA, "Hydraulically fractured horizontal wells account for most new oil and natural gas wells", January 30, 2018.

- » While the increase in U.S. production since 2008 has reduced the amount of crude oil that needs to be imported, it has not eliminated substantial imports. Even if domestic production rises as expected from its current 11.0 Mbd to 14.0 Mbd in a few years, the United States will still need to import large volumes of crude oil because the U.S. refinery system is not optimized to process the increasing amounts of the new light crude oils produced from U.S. shale sources.<sup>20</sup>



- » The U.S. Outer Continental Shelf contains what is believed to be some of the country's most substantial undiscovered technically recoverable oil and natural gas resources. Only the Western and Central Gulf of Mexico are entirely accessible to industry.<sup>21</sup>

<sup>20</sup> SAFE analysis based on data from EIA, STEO and Drilling Productivity Report.

<sup>21</sup> BOEM, Assessment of Undiscovered Oil and Gas Resources of the Nation's Outer Continental Shelf, 2016a, December 2017.



PART II

# Problems with Oil Dependence

## Oil Overwhelmingly Powers American Mobility

---

The transportation sector accounts for more than 70 percent of the approximately 20 million barrels of oil the United States consumes per day, with 250 million registered light-duty vehicles accounting for more than 60 percent of that consumption. Medium- and heavy-duty trucks comprise 22 percent, and aviation constitutes almost 8 percent of consumption.<sup>22</sup> In 2018, the transportation sector relied on oil for 92 percent of its total energy consumption, a share essentially unchanged since the early 20th century.<sup>23</sup>

## Oil Prices are Volatile

---

Volatility is an ever-present condition of the global oil market that stresses both consumers and producers. Because the United States consumes a large quantity of petroleum, and because consumers have few substitutes for petroleum in the short term, even small fluctuations in supply or demand can cause relatively large movements in prices—both upwards and downwards—wreaking havoc on the U.S. economy. Price shocks also lead to geopolitical instability and reorder U.S. foreign policy priorities. These market gyrations have historically contributed to deep recessions and distorted investment decisions, causing severe supply and demand imbalances that damage the economic and national security of the United States.

---

<sup>22</sup> Stacy Davis, Susan Williams and Robert Boundy, "Transportation Energy Data Book," Oak Ridge National Laboratory, pp 1-21.

<sup>23</sup> Martin Melosi, "The Automobile and the Environment in American History," University of Michigan.

## Rising Domestic Production Does Not Mitigate the Economic Challenges of Oil Dependence

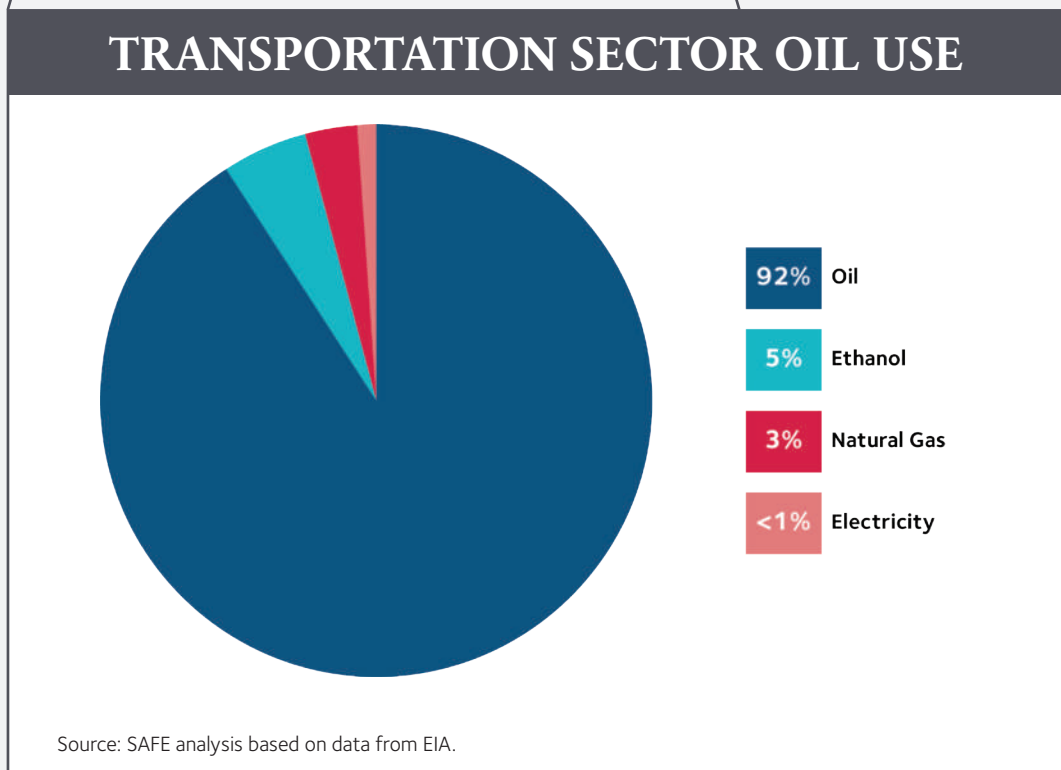
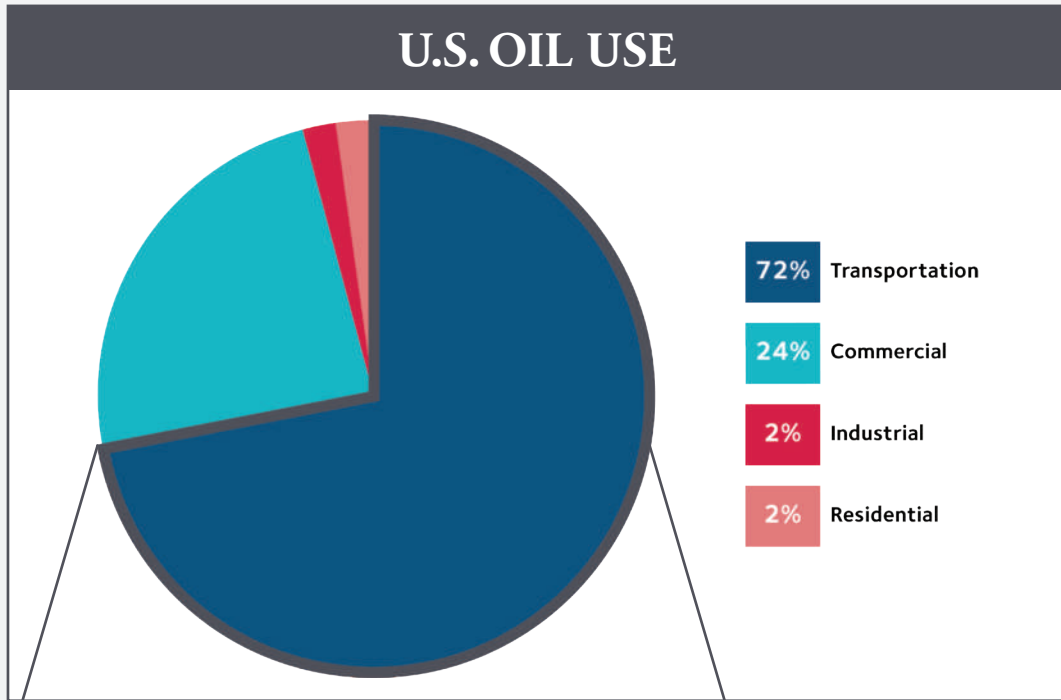
---

While there are significant economic benefits to increased domestic oil production, the dramatic shift in the U.S. energy export balance stems primarily from refined products, natural gas, and natural gas liquids. During the next 10-15 years, U.S. net imports of crude oil are unlikely to ever be reduced to zero, and gross imports will remain significant.<sup>24</sup> U.S. shale oil production alone will not ensure oil security for the country. Oil security can only be guaranteed by reducing consumption and achieving greater fuel diversity that does not track oil price volatility.

---

<sup>24</sup> See, e.g., EIA, Annual Energy Outlook 2019, Table: Total Energy Supply, Disposition, and Price Summary.



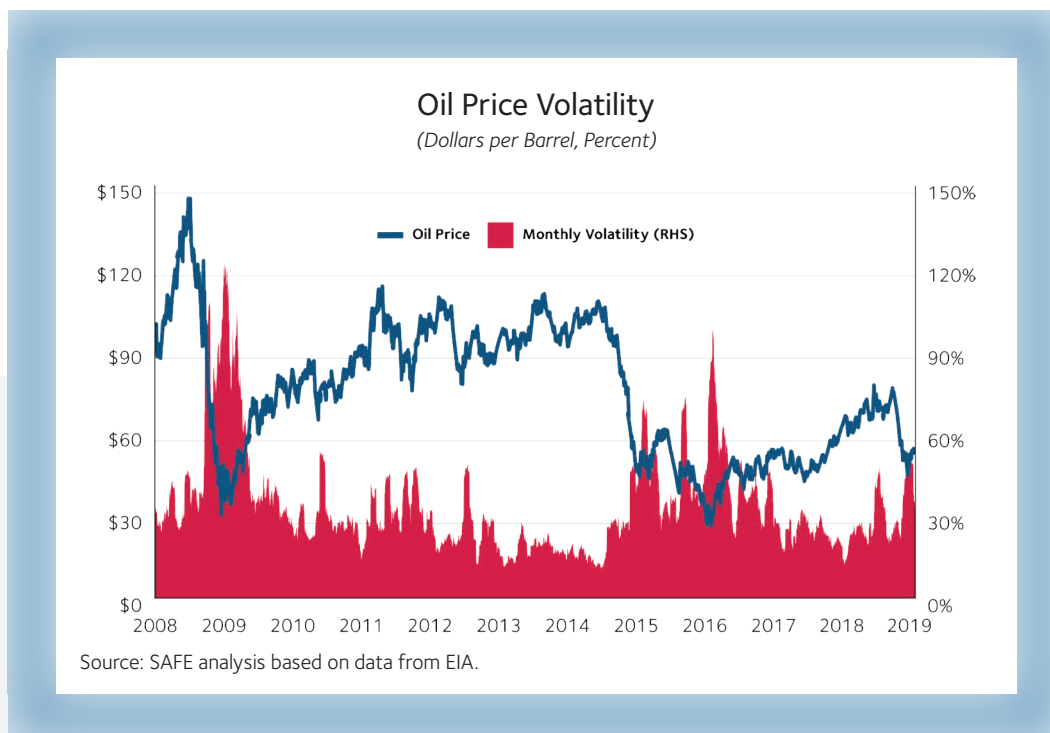


- » Oil accounts for 37 percent of U.S. primary energy use. More than 70 percent of this oil is consumed by the transportation sector.
- » Oil uses 92 percent of the U.S. transportation sector's total energy consumption (97 percent when including ethanol blending).

## PROBLEM

## Oil Volatility Can Induce Economic Shocks

Oil has been an economically and strategically important commodity for more than a century, but U.S. vulnerability to price shocks did not reach acute levels until 1973 when a group of oil-rich states deliberately cut production in what became known as the Arab Oil Embargo. The consequent quadrupling of prices profoundly shaped the economic and political landscape for the rest of the decade. U.S. real GDP contracted more than 3 percent between the first quarter of 1973 and the first quarter of 1975, and unemployment reached 9 percent.<sup>25</sup> The economic situation worsened in 1979 when the Iranian Revolution resulted in the peak loss of 5.6 Mbd of Iran's output, and other OPEC nations imposed a series of supply cuts.<sup>26</sup> Oil's ubiquity in our economy means that a price spike—such as those experienced in 1973 and 1979—can have far-reaching consequences. Not only do rising gasoline prices impact household budgets, but the cost of goods made with petroleum products also rise. A sharp rise in price, such as the 2007–2008 period, can push economies into recession.<sup>27</sup>

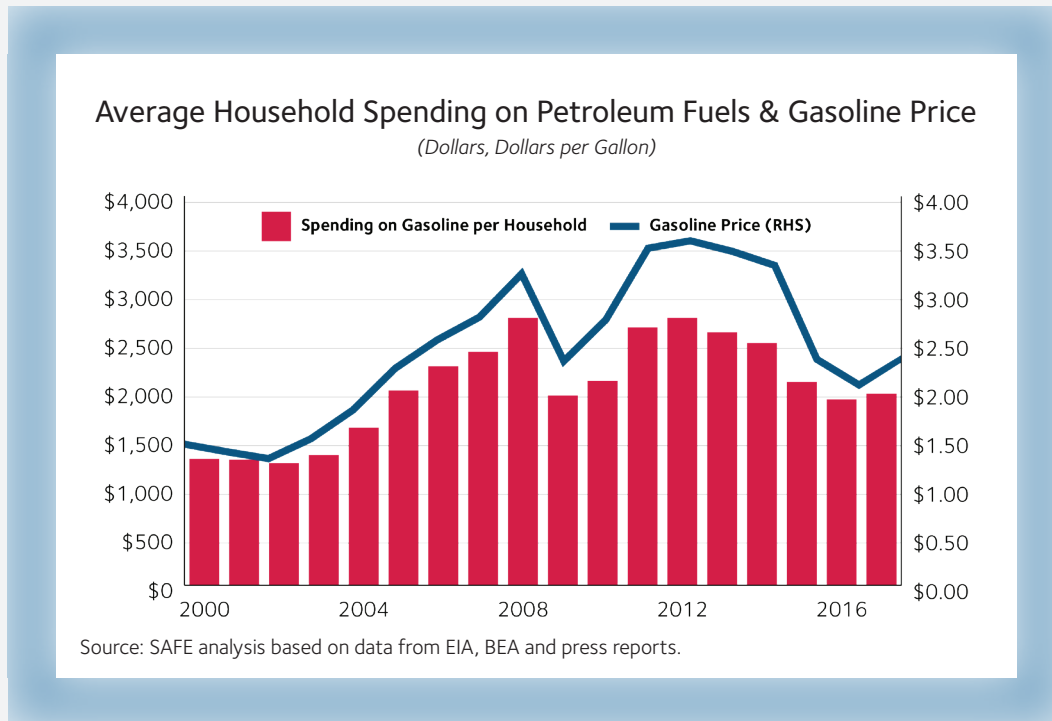


<sup>25</sup> National Bureau of Economic Research, "U.S. Business Cycle Expansions and Contractions"; and SAFE analysis based on data from BEA.

<sup>26</sup> IEA, Response System for Oil Supply Emergencies, 2012, at 11.

<sup>27</sup> Council on Foreign Relations, "Oil Price Volatility: Causes, Effects and Policy Implications." June 15, 2016.

- » Between 2007 and 2008, oil prices increased to \$147 per barrel, when volatility—a measure of how much prices have moved up and down—grew to an astonishing 120 percent.<sup>28</sup> The record high price contributed to the Great Recession.<sup>29</sup>

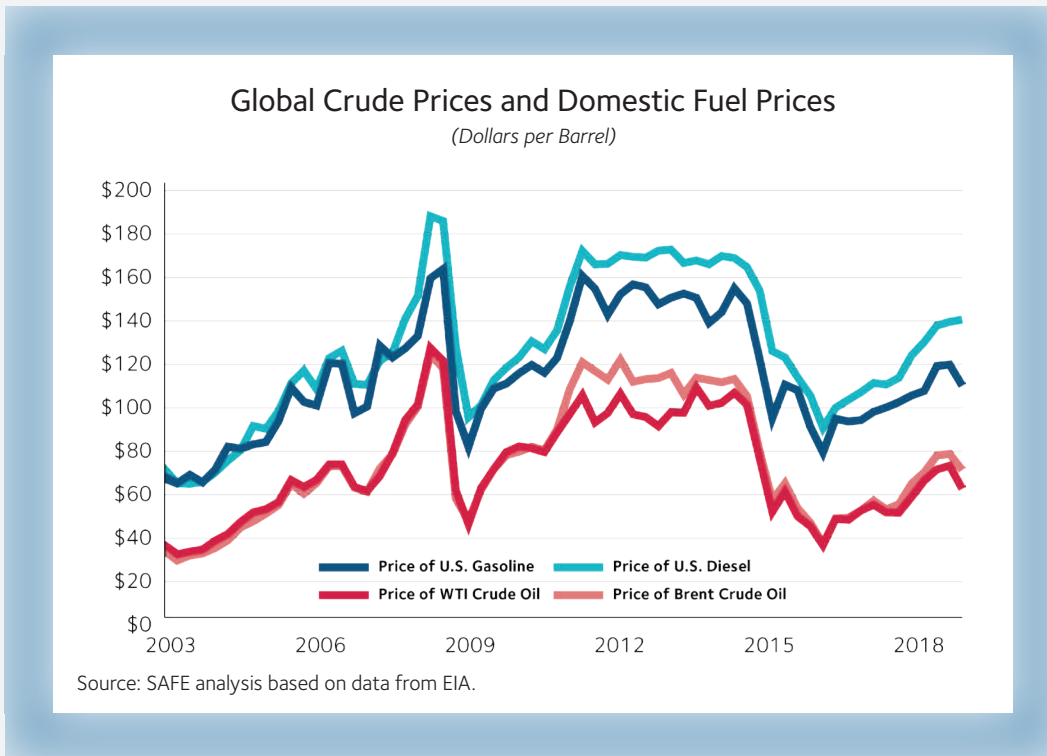


- » Domestic petroleum product prices like gasoline and diesel correlate closely with prevailing global crude oil benchmarks.
- » While average U.S. household spending on petroleum products fell by \$700 per household last year, motor fuels still represented a significant proportion of American household expenditures. Between 2002 and 2013, the average U.S. household saw spending on gasoline increase by \$1,400, even though demand fell.<sup>30</sup>

<sup>28</sup> SAFE analysis based on data from EIA, Brent Spot Prices.

<sup>29</sup> See, e.g., James D. Hamilton, "Oil prices and the economic recession of 2007-08," June 16, 2009.

<sup>30</sup> SAFE analysis based on data from Barclays Global Survey and press reports; See, e.g., Oil and Gas Journal, "Barclays: Revised North American upstream spending to increase 15% in 2018," August 31, 2018.

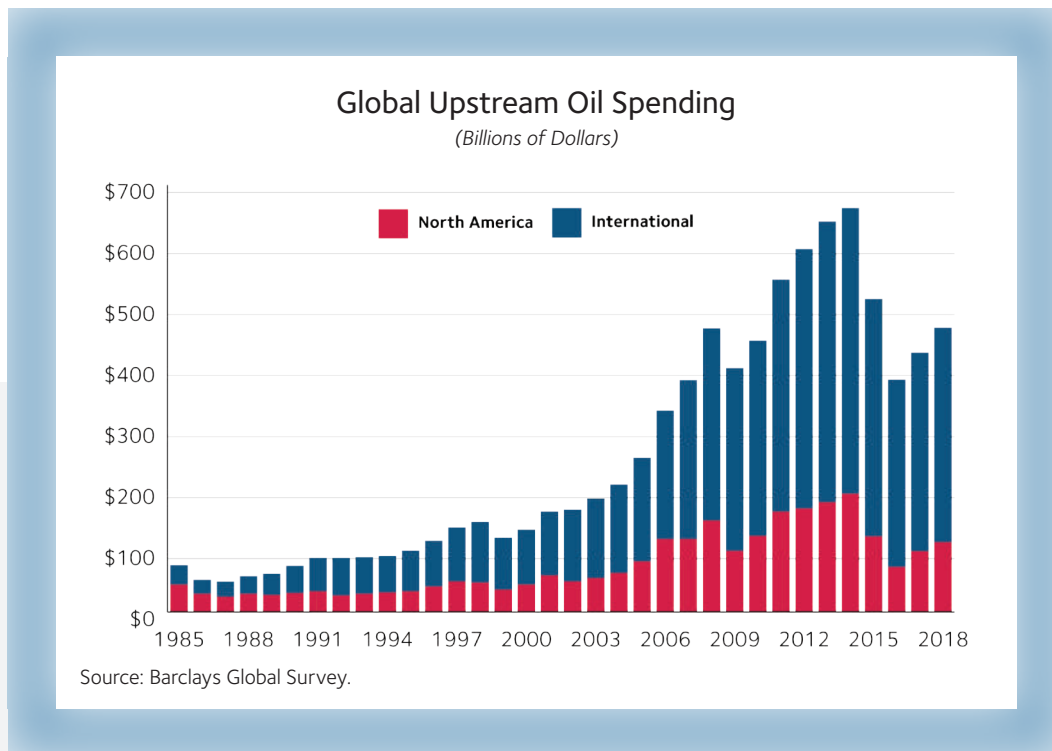


- » Although oil prices were comparatively low in 2018, the volatile nature of the oil market means high prices will almost certainly pressure American household budgets in the near-to medium-future.
- » Petroleum products accounted for less than 10 percent of the U.S. trade deficit in the first six months this year, down from almost 50 percent in 2008.

## PROBLEM

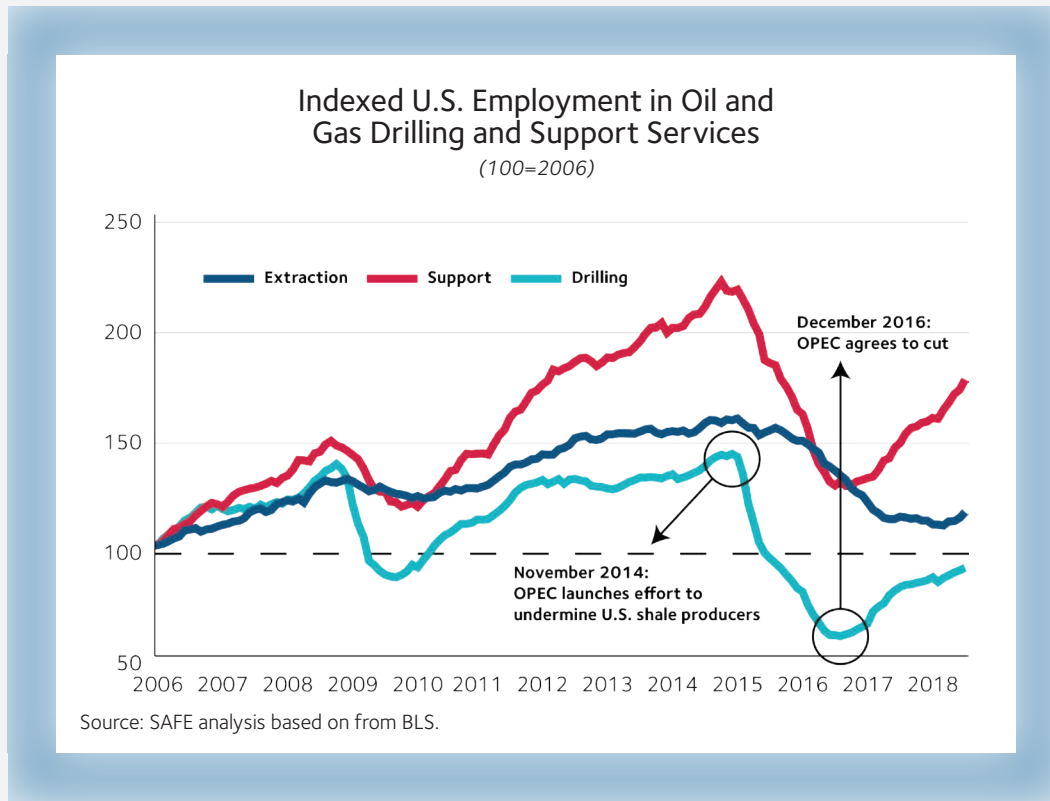
## Distorted Investment Leads to Future Problems

Price volatility creates a highly uncertain investment climate. When Saudi Arabia increased production in 1986, oil prices plummeted near \$10 per barrel, and global upstream oil spending declined approximately 30 percent between 1985 and 1986—and did not reach 1985 levels again until the early 1990s. Likewise, spending declined approximately 17 percent between 2014 and 2015, and fell further in 2016 as OPEC executed production cuts in 2015.<sup>31</sup> In the United States, where private sector innovation and price largely determine the level of investment, the effects of these global changes can be felt more severely than elsewhere.



- » Barclays Global Survey estimates that global upstream spending fell 23 percent in 2015 and 27 percent in 2016.<sup>32</sup>
- » The decline in upstream investment that followed the 2015–16 Shale Glut was only the fourth period of decline in the survey’s 30-year history, following the 1986–87 OPEC Oil Crash, 1999 Asian Crisis, and the 2009 Great Recession.<sup>33</sup>

<sup>31, 32, 33</sup> Ibid.



- » Between 2015 and 2017, there were more than 297 oil industry bankruptcies, including 160 oilfield service companies.<sup>34</sup>
- » The decline in upstream spending also led to some 238,000 workers losing their jobs.<sup>35</sup>

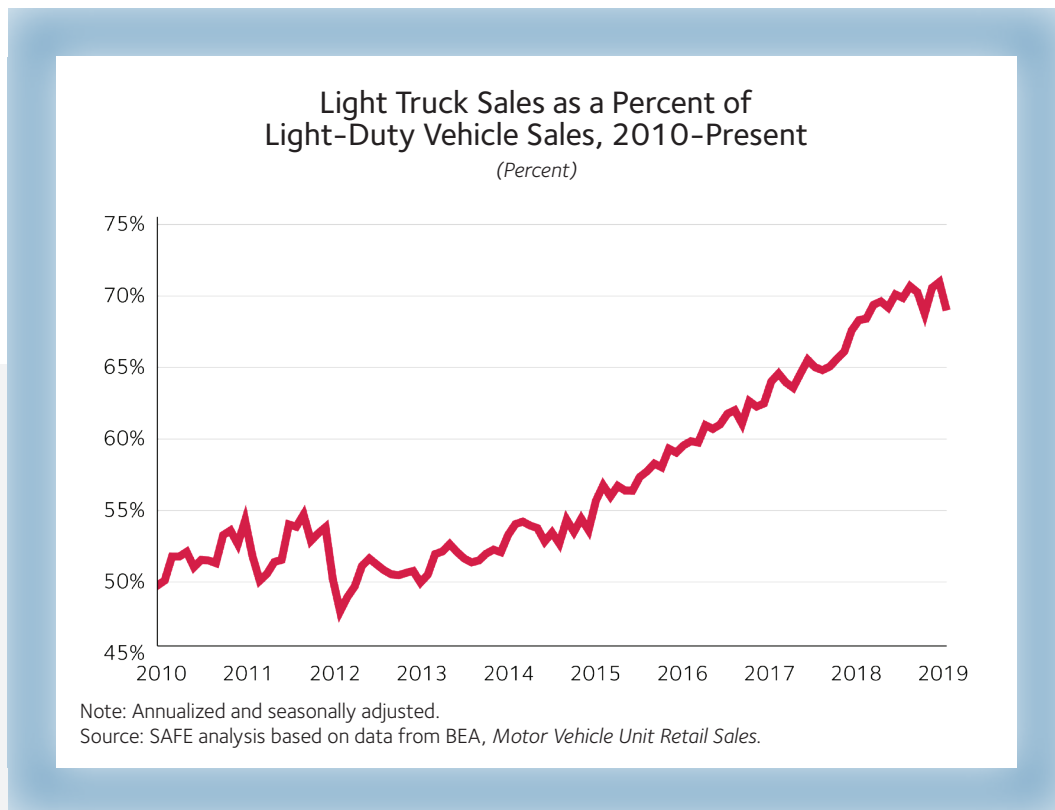
<sup>34</sup> Haynes and Boone, "Oil Patch Bankruptcy Monitor," January 7, 2019.

<sup>35</sup> Note: SAFE analysis based on data from BLS. Based on the difference of peak sector-wide employment in September 2014 versus the low set in December 2016.

## PROBLEM

## Stymied Innovation Influences Long-Term Prices and Consumer Behavior

Nearly every American president since Richard Nixon has pledged to pursue greater energy independence. These calls especially resonate with voters when gasoline prices overwhelm household budgets. However, memories are short and political pressure abates when oil prices recede. For example, fuel economy standards implemented in 1975 improved the average mileage of cars and light trucks by nearly 70 percent between 1975 and 1987.<sup>36</sup> However, no further improvement was made for more than two decades, as prices remained relatively low until the mid-2000s.<sup>37</sup>



- » Since preferences of American motorists frequently hinge on short-term gasoline prices, interventions—in some cases by foreign governments strongly incited to undermine competing fuel technologies—create price volatility that undermines private sector innovation and affects consumer behavior.

<sup>36</sup> EPA, "Light-Duty Automotive Technology and Fuel Economy Trends: 1975–2015," December 2017.

<sup>37</sup> *Ibid.*

- » As oil prices fell in 2015, sales of less fuel-efficient light trucks dramatically increased. By the end of 2018, light trucks represented nearly seven out of every 10 new vehicles sold in the United States on an annualized basis.<sup>38</sup> This trend was reflected in Ford's April 2018 announcement that it would largely exit the passenger car market.<sup>39</sup>
- » U.S. sales-weighted new vehicle fuel economy ratings also stagnated at 2014 levels, around 25.2 miles per gallon, following steady increases of roughly 1 mile per gallon per year between 2008 and 2014.<sup>40</sup>

---

<sup>38</sup> SAFE analysis based on data from BEA, *Motor Vehicle Unit Retail Sales*.

<sup>39</sup> Ford Motor Company, "Ford Delivers First Quarter \$1.7B Net Income, \$2.2B Adj. EBIT; Fitness Actions Improve 2020 Outlook," April 25, 2018.

<sup>40</sup> SAFE analysis based on data from Michael Sivak and Brandon Schoettle, University of Michigan, Transportation Research Institute.



## PROBLEM

# Compromised National Security

---

Oil's central role in the American economy creates national security challenges and undercuts the United States' ability to conduct effective foreign policy. More than 50 percent of daily oil supplies transit through seven major chokepoints in often unstable regions of the world, most notably in the Middle East.<sup>41</sup> The U.S. military shoulders the burden of protecting these maritime supply routes and vulnerable energy infrastructure across the globe. Moreover, the United States has participated in numerous conflicts in the Middle East, while also being confronted with terrorism—often funded by oil revenues.

- » The Strait of Hormuz, the Bab-el-Mandeb, and the Strait of Malacca are the world's most important strategic chokepoints by volume of oil transit.<sup>42</sup>
- » Flows through these regions often incur a geopolitical risk premium, which accounts for the increased uncertainty of wars, civil violence, and labor strife that can interrupt current and future supply.
- » According to SAFE calculations, the U.S. military spends at least \$81 billion per year protecting global oil supplies. This is approximately 16 percent of recent Department of Defense base budgets.<sup>43</sup>
- » Spread out over the 19.8 million barrels of oil consumed daily in the United States in 2017, the implicit subsidy paid by all petroleum consumers is approximately \$11.25 per barrel of crude oil, or \$0.28 per gallon consumed. A more comprehensive estimate from two highly-regarded economists suggests the costs could be greater than \$30 per barrel, or over \$0.70 per gallon.<sup>44</sup>

---

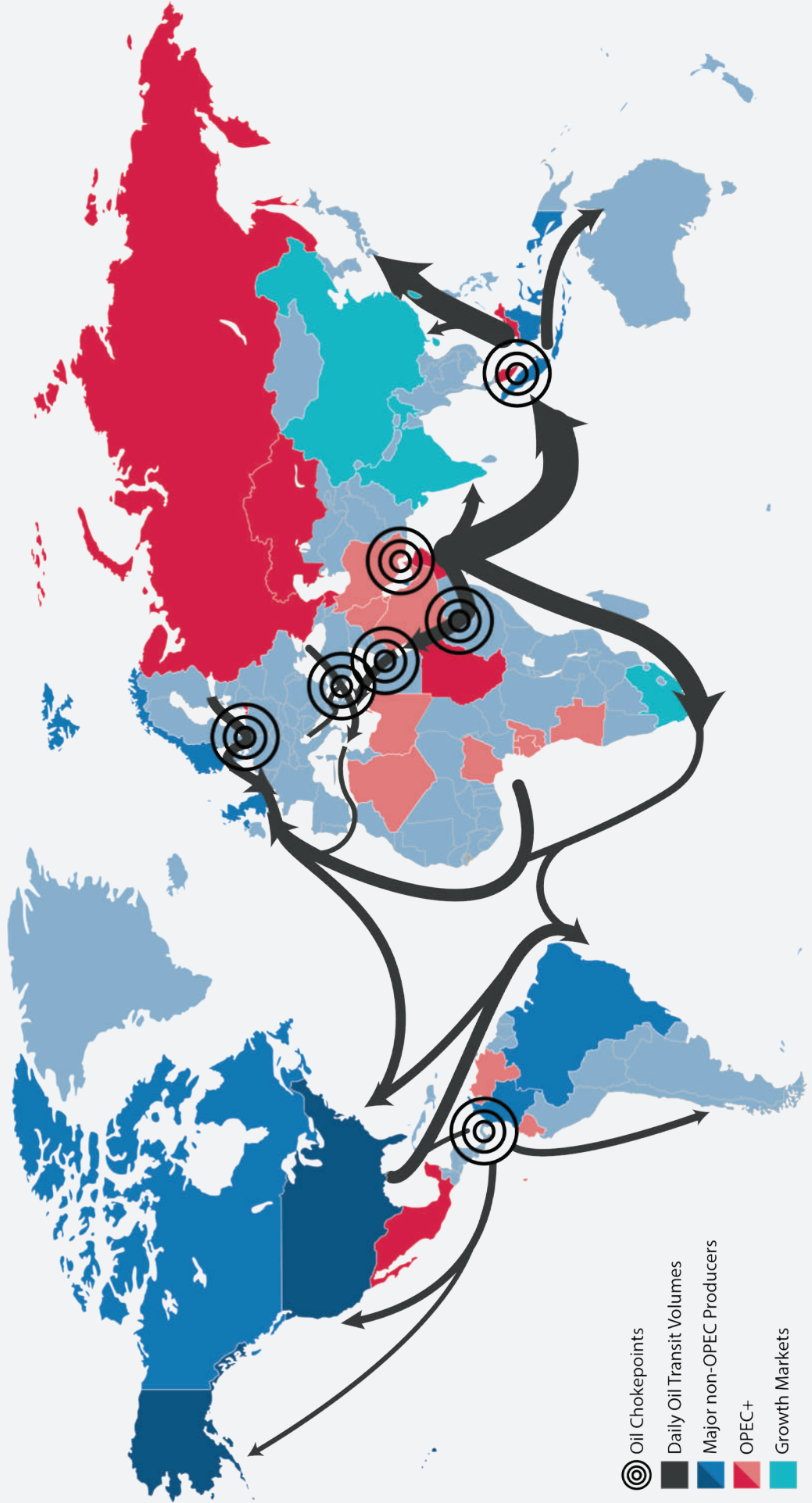
<sup>41</sup> EIA, "World Oil Transit Chokepoints," EIA.gov, July 25, 2017.

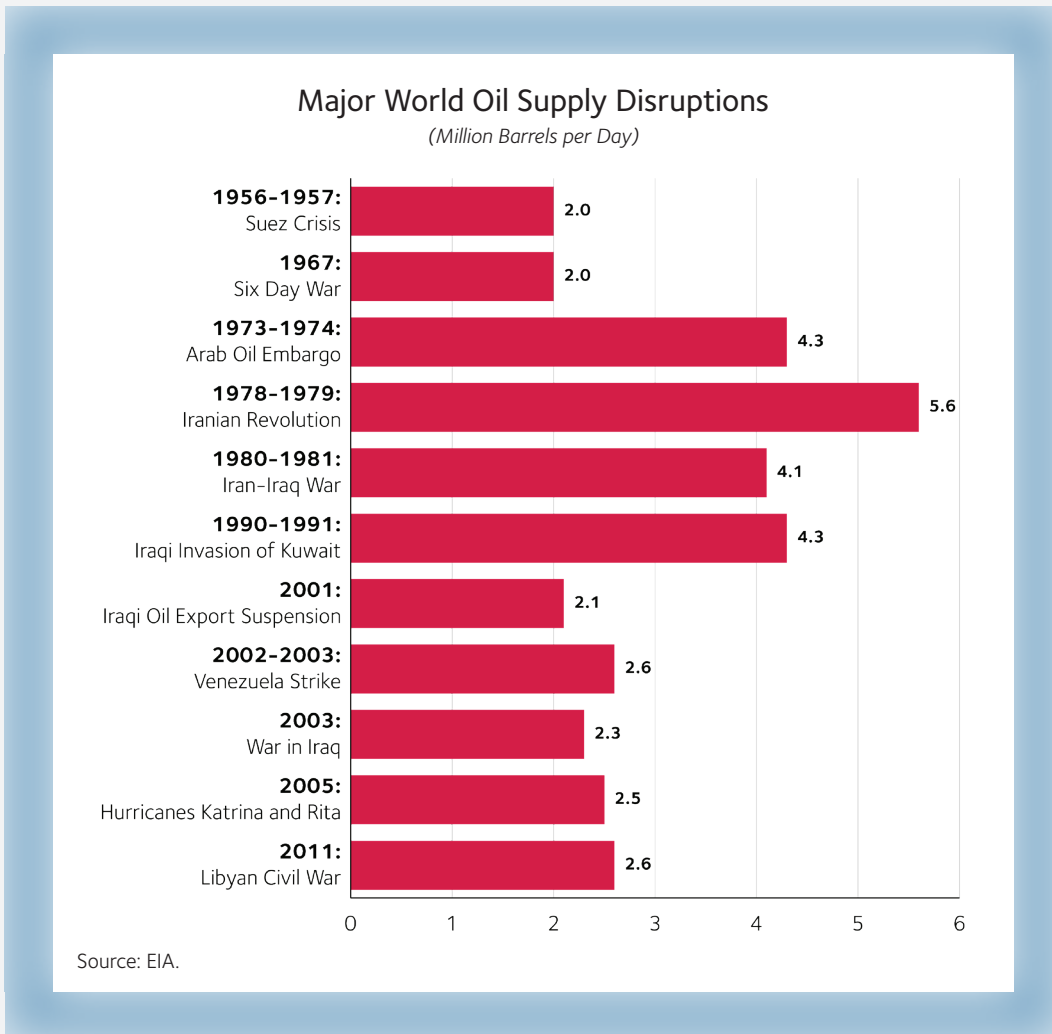
<sup>42</sup> Ibid.

<sup>43</sup> SAFE, "The Military Cost of Defending Global Oil Supplies," Securing America's Future Energy, September 20, 2018.

<sup>44</sup> Ibid.

### Daily Oil Transit Volumes and Oil Chokepoints





- » Unplanned oil supply shortages are a regular feature of the global oil market. In the most recent cases, when the lost production is less than 3.0 Mbd, other producers were partially able to make up for the lost volume, but when the outages are larger, prices rise sharply to ration supply.
- » Prices doubled in 1970, 1973, 2008, and from 2011 through 2014 due to geopolitical events and OPEC market interventions.

## WOULD OIL DEPENDENCE MATTER IF THE UNITED STATES WERE A NET OIL EXPORTER?

In the January 2019 Short Term Energy Outlook, the U.S. Energy Information Administration (EIA) projected that the United States would become a net exporter of petroleum and other liquids by the end of 2020. Here are some notes of caution regarding EIA's estimates:

- » Gross imports of crude oil are vital to the U.S. refinery system and will remain significant in size even if the United States becomes a net petroleum and other liquids exporter; and
- » Even if the United States became a significant net exporter of crude oil, it still would be tethered to the international pricing system for crude oil and transportation fuels.

### **1. Why does the United States need to import crude oil?**

The United States imports crude oil because it does not produce enough to meet domestic demand. Even if U.S. production rises from its current 11.5 Mbd to 13.0 in 2020, as projected by EIA, the United States will still need to import a substantial volume of crude oil. U.S. gross crude oil imports generally remained above 7.5 Mbd for most of 2018. This gross import dependence is unlikely to change significantly over the next decade, due to insufficient domestic production and the unique needs of the U.S. refining system, which requires crude grades that are not produced in the United States.

### **2. Why is so much crude oil production sub-optimal for U.S. refineries?**

The U.S. refinery sector is the most advanced and efficient in the world. However, it is not optimized to process the increasing amounts of new light crude oils produced from U.S. shale oil deposits. After domestic crude oil production began declining in 1970, refiners invested in equipment designed to process heavier grades of imported crude oils. While the turnaround in U.S. production since 2008 has displaced imported light crude oil from places like Nigeria or the North Sea, it has not eliminated the need for substantial amounts of heavier crude oil imports, including from countries like Venezuela and Saudi Arabia.

### **3. Can the U.S. drill its way to “energy independence”?**

No. The United States remains tethered to the global market so long as the transportation sector relies on oil. Through changes to production policy, OPEC and its allied producers manipulate the price of oil and force Americans to pay more for this vital commodity than they would if the market were free and fair. Additionally, the global oil market imposes a heavy burden on U.S. businesses and consumers due to oil's extreme price volatility. As a result, the U.S. economy allocates resources less efficiently, and it therefore fails to reach its full potential.



PART III

Increasing  
Efficiency and  
Achieving Fuel  
Diversity

## Efficiency Reduces Oil Dependence

---

The United States has made genuine progress toward advancing energy security since the country first became aware of the risks posed by oil dependence in the early 1970s. Observed vehicle fuel economy vastly improved with the introduction of increasingly stringent fuel efficiency standards for both passenger vehicles and heavy-duty trucks. Although oil dependence has caused serious challenges for the United States over the past several decades, these challenges would have been more severe without improvements to vehicle fuel efficiency.

Further strengthening the nation's energy security will require the United States to shift to a transportation system that is no longer predominantly beholden to the manipulated global oil market and its structural volatility. Alternative fuel vehicles (AFVs) powered by non-petroleum energy sources such as electricity, natural gas, and hydrogen are the only way to create commercially viable substitutes to oil, thereby ending the nation's singular dependence on oil.

## Alternative Fuel Vehicles are Powered by American Resources

---

To remain prosperous and secure, the United States must build more efficient cars, and enable greater fuel choice. Improved fuel diversity will help inoculate our consumers, cities, and businesses from the threat of oil price volatility. Electric vehicles (EVs) are the nearest-term option to meaningfully reduce oil demand, as they draw energy from the electrical grid's existing generation, transmission, and distribution infrastructure. This electricity is generated from a diverse set of domestic fuels including coal, natural gas, nuclear, and renewables. Other AFVs, such as hydrogen fuel cell vehicles (FCVs) and natural gas vehicles (NGVs), are also powered by abundant American resources. Additionally, while overseas events may cause oil prices to fluctuate, electricity is generated domestically with retail prices calculated over longer-term averages instead of on a real-time basis, resulting in fuel costs that are more stable for EVs than internal combustion engine (ICE) vehicles.

## AFVs Remain a New Technology

---

New innovations generally require many years to become widely adopted in the marketplace, and the automobile market is no different. Although EVs continue to make headlines, making a successful entrance into a century-old competitive automobile market is not an easy task. Tesla has attracted a tremendous amount of media attention recently, but in many ways its challenges are not unlike those of many new entrants in the vehicle technologies space.

Cumulative EV sales in the United States topped 1 million since their introduction nearly a decade ago. Yet, there are more than 250 million vehicles on U.S. roads and sales of AFVs hold only a small share of the market. Higher initial purchase prices, alongside concerns regarding range and convenient refueling infrastructure, continue to hinder consumer adoption of AFVs, but supportive policies can help AFVs to meaningfully reduce U.S. oil consumption.<sup>45</sup>

---

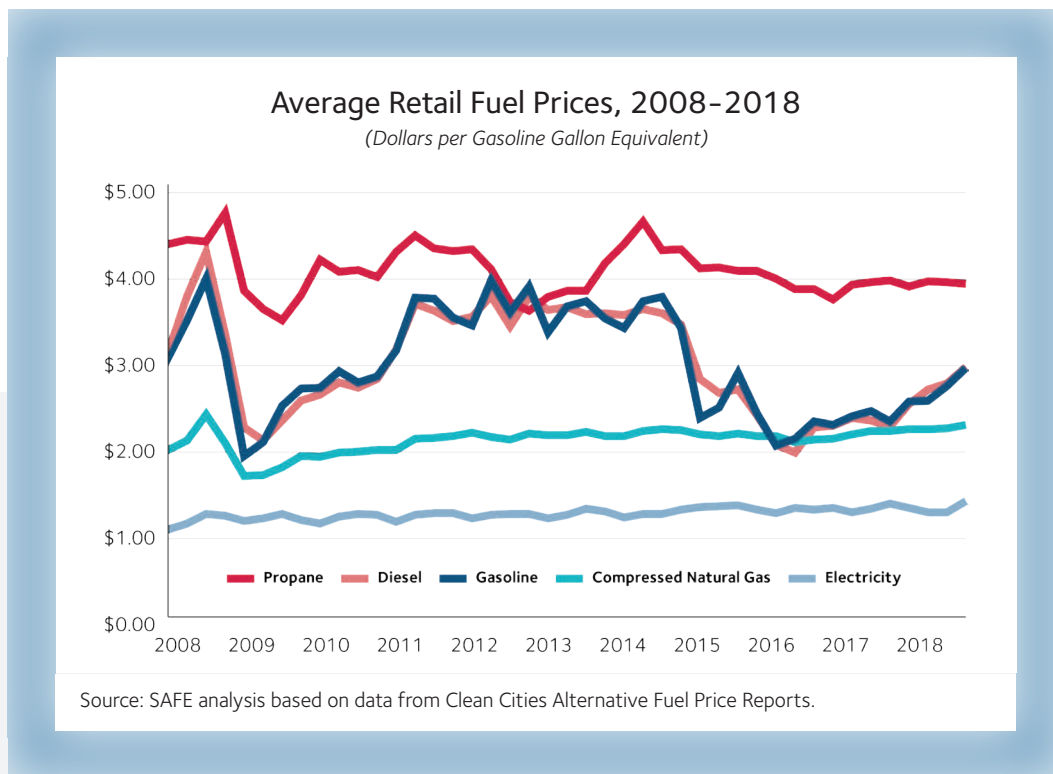
<sup>45</sup> Paul Ruiz, "EV Sales: Waiting For The Inflection," The Fuse, January 15, 2019



## SOLUTION

## Lower-Cost Mobility Powered by Domestic Resources

AFVs often have higher initial purchase prices than their ICE counterparts, but operating an AFV is considerably less expensive and energy intensive than a vehicle run on petroleum fuels.<sup>46</sup> EV prices are expected to decline over the next several years, making them even more cost competitive. In addition, AFVs are fueled by natural gas, hydrogen, or electricity, which is produced domestically by U.S. workers.



- » There are more than 8,600 power plants in the United States, and EVs are fueled by American-made electricity.<sup>47</sup>
- » Electricity prices are stable and low compared to petroleum-based fuels.

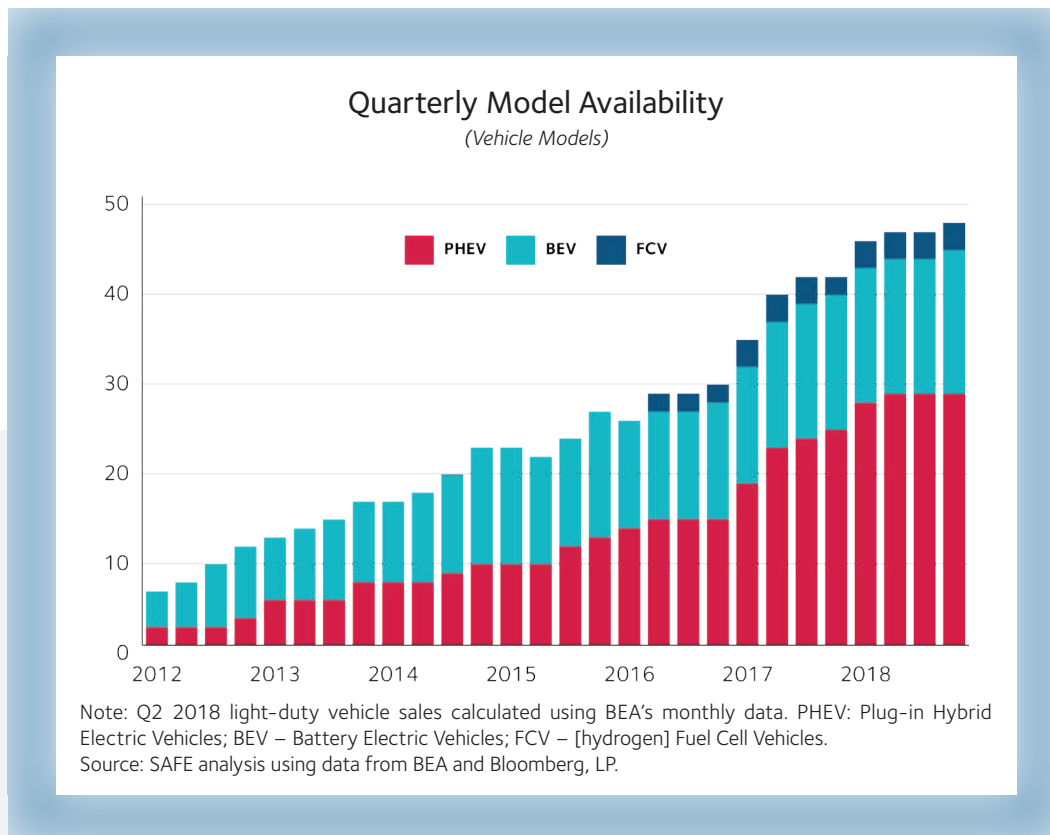
<sup>46</sup> Constance Douris, "The Bottom Line On Electric Cars: They're Cheaper To Own," Forbes, October 24, 2017.

<sup>47</sup> U.S. EIA.

## SOLUTION

## Support AFVs as an Early-Stage Technology

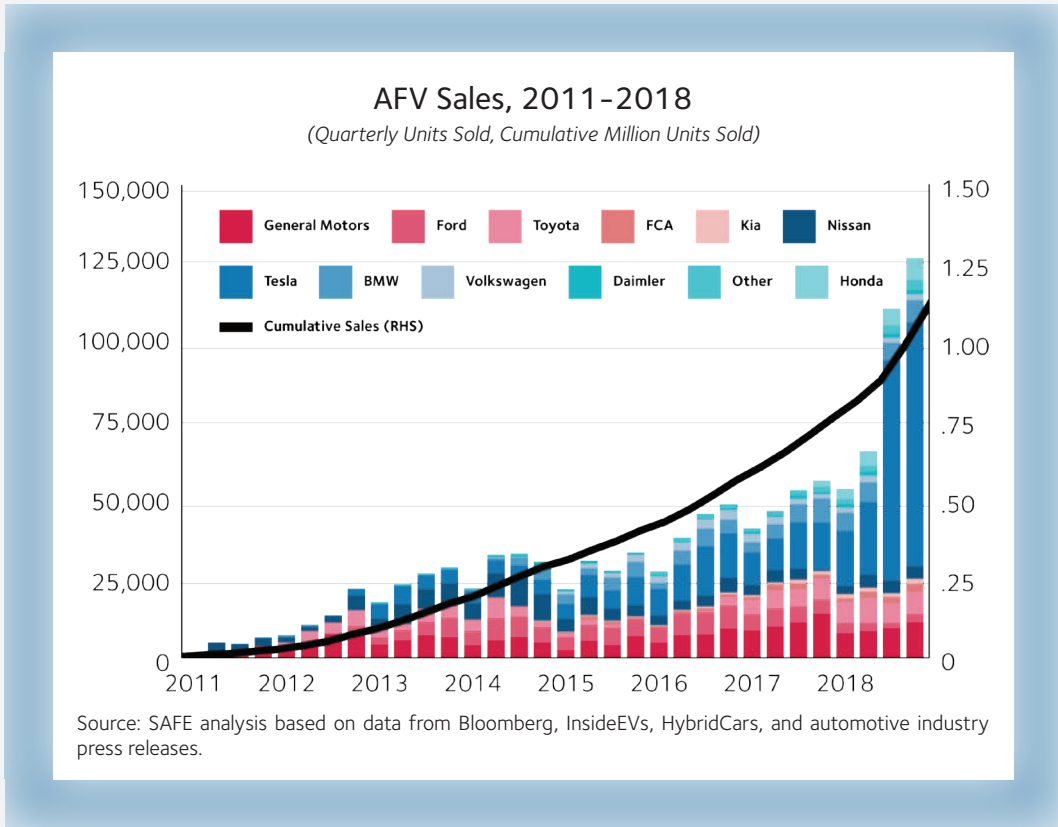
In 2011 there were only two electric vehicle options, but there are now more than 16 battery electric vehicle (BEV) models and 29 plug-in hybrid electric vehicles (PHEVs) available to consumers nationwide. However, AFVs represent just one out of every 50 new vehicles sold in the United States. This sales penetration ratio is undoubtedly better than the nascent market of only a few years ago, but still represent a niche within a car market that sold more than 17.4 million units last year.<sup>48</sup>



- » Greatly expanded model availability of EVs over the last several years has done much to attract new consumers. By the end of 2018, nearly 50 different AFV models were available in nearly every vehicle segment—compact cars, sedans, SUVs, and minivans.<sup>49</sup> Initial estimates predict another 70 models will be available for sale by 2022.

<sup>48</sup> Paul Ruiz, "EV Sales: Waiting For The Inflection," The Fuse, January 15, 2019.

<sup>49</sup> Ibid.



- » National sales remain heavily skewed. Approximately half of the nation's AFV sales have been concentrated in California, a state that in 2018 represented only 12 percent of the total new vehicle market. California's range of supportive public policies has boosted sales substantially.

## WHAT IS AN ALTERNATIVE FUEL VEHICLE?

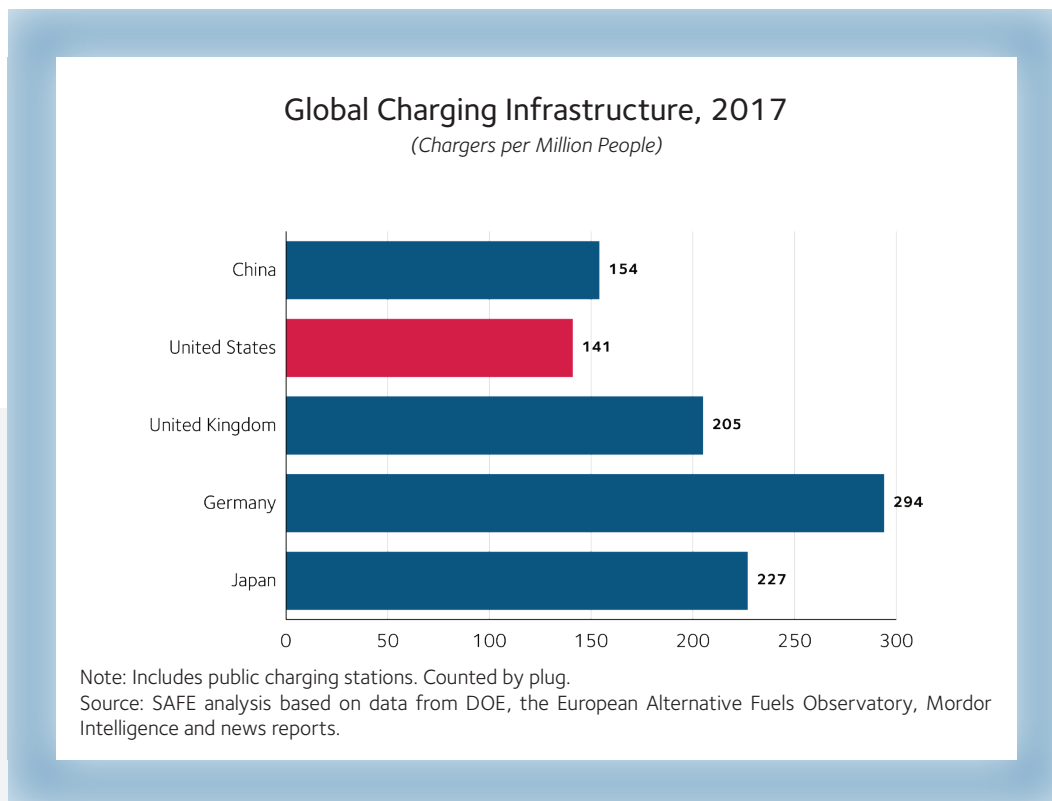
An alternative fuel vehicle (AFV) is one that is powered by fuels derived from something other than petroleum, such as electricity, natural gas, hydrogen, or biofuels.

- » The most common AFVs are electric vehicles (EVs), hydrogen fuel cell vehicles (FCVs), and natural gas vehicles (NGVs), and they are now available for almost all on-road vehicle classes.
- » EVs have thus far received the greatest consumer acceptance in the passenger vehicle segment and are rapidly expanding to the transit bus sector. Currently, 13 percent of all transit agencies have EV buses in service or on order.
- » Today, natural gas powers more than 160,000 vehicles on U.S. roads. There are also more than 17,000 natural gas refuse and recycling trucks operating across the United States.

## SOLUTION

## Build Out the Nation's Charging Infrastructure

The availability of charging and refueling infrastructure is critical to widespread AFV adoption. Potential AFV buyers often cite driving range and public charging station availability as their top concerns.<sup>50</sup> Consequently, easily-locatable charging stations are critical for market growth.



- » At the end of 2018, there were almost 70,000 U.S. AFV refueling or recharging stations available to the public.<sup>51</sup> The vast majority of stations are electric, as EVs have thus far achieved the greatest sales rate of all AFV types. Further study is needed to determine how many stations will be needed to meet long-term demand.

<sup>50</sup> Carolyn Fortuna, "Potential EV Owners Are Concerned About The 'Impact Of The Unknown On The Everyday,'" Clean Technica, June 11, 2018.

<sup>51</sup> Alternative Fuels Data Center, "Alternative Fueling Station Counts by State," Department of Energy, March 11, 2019. Note: Starting in 2011, electric charge equipment was counted by the plug rather than by the geographic location. This is different than other fuels, which only count the geographic location regardless of how many dispensers or nozzles are on site.

- » Additional AFV fueling corridors are required along high traffic routes, and future projects should emphasize wayfinding and signage.
- » The amount of time necessary to recharge an EV battery has also been a concern for consumers, but charging times are rapidly decreasing as higher-powered charging stations come online.
- » U.S. transportation electrification infrastructure is beginning to lag behind other OECD countries and China.<sup>52</sup> At its current rate of growth, China will soon have more charging stations per capita than the United States.

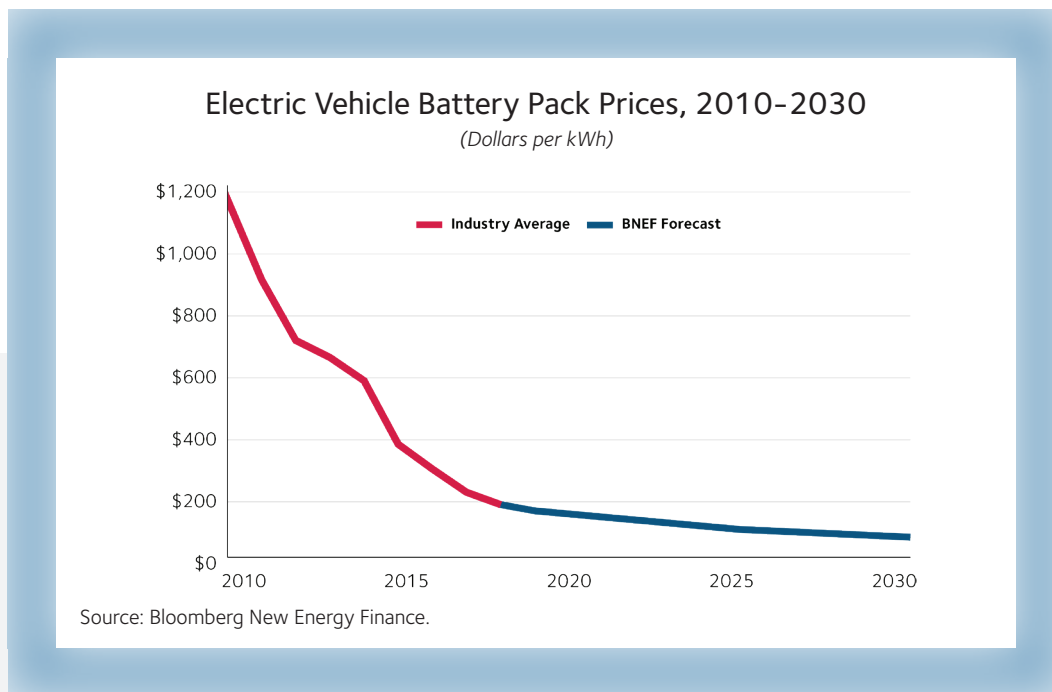
---

<sup>52</sup> Laurence Frost, "China, Europe drive shift to electric cars as U.S. lags," Reuters, January 15, 2017.

## SOLUTION

## Continue Reducing Battery Costs

In addition to longer refueling times at fewer stations, consumers often cite concerns regarding the limited range of EVs. Lithium-ion batteries represent a substantial portion of the initial cost of an EV. Consequently, current EV models do not offer larger batteries capable of traveling relatively long ranges. There are nevertheless more than eight EV models available in the United States with ranges exceeding 150 miles on a full charge.<sup>53</sup> If battery prices continue to decline, they will offer lower cost or greater range that meet consumer needs.



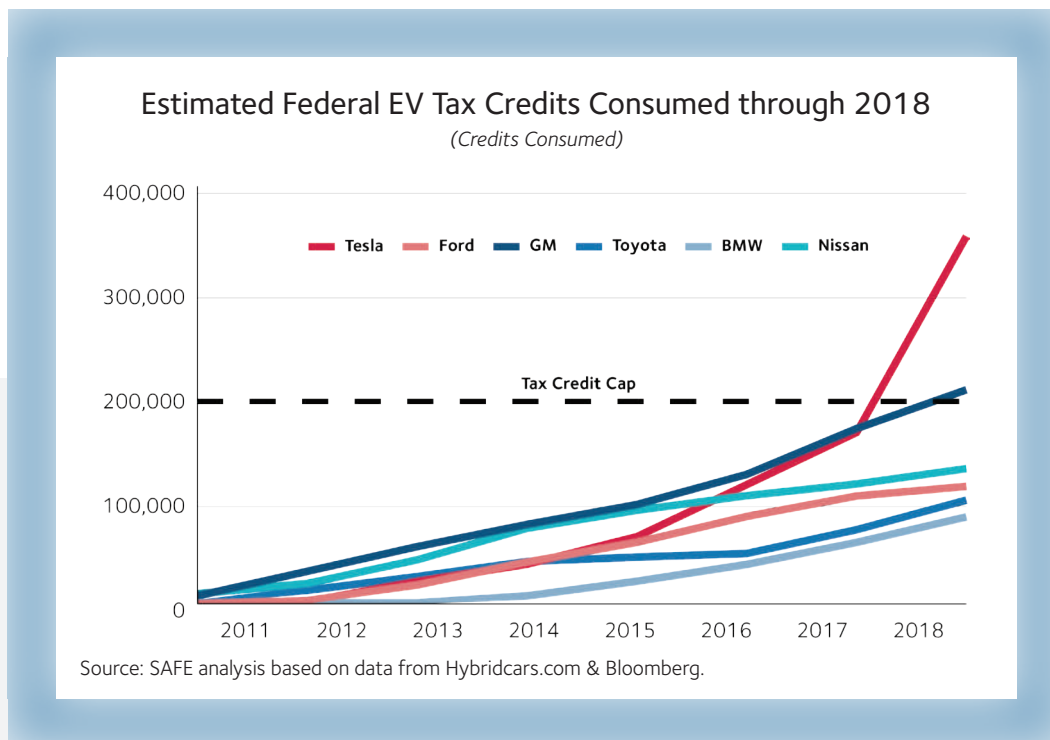
- » Due to the current cost of batteries, the initial purchase price for EVs is often higher than a similarly equipped ICE vehicle. Lithium-ion batteries currently contribute a substantial portion of the incremental costs of EVs. As battery prices drop, automakers will be able to lower the price of the vehicles and/or increase vehicle range.
- » In 2008, battery prices were as high as \$1,000/kWh and there were relatively large production inefficiencies due to lack of scale. Greater battery production is now underway and battery prices have dropped below \$200/kWh. Many experts believe that once battery prices reach \$100/kWh, EVs will become cost competitive with internal combustion engines.

<sup>53</sup> Note: Includes the Chevrolet Bolt and seven Tesla Models.

## SOLUTION

## Tax Credits and Other Incentives Will be Required Over the Next Few Years

The creation of federal tax credits of up to \$7,500 for the purchasing of new qualified EVs and up to \$30,000 for the installation of charging infrastructure (Internal Revenue Code Section 30D and 30C, respectively) played a crucial role in supporting early adoption of AFVs, by reducing the incremental costs and making the vehicles available to more consumers. Retention of this \$7,500 federal purchase incentive is vital to maintain momentum because some automakers have entered the tax credit's phase-out stage. SAFE supports lifting the cap on the total number of vehicles covered by the tax credit, and then sunsetting it at a time to be negotiated by stakeholders. Vehicle affordability should be the primary goal of these negotiations.



- » The existing tax credit is available to the first 200,000 vehicles sold by each manufacturer. This structure was intended to ensure the credit benefited each automaker, no matter when they began selling plug-in vehicles.



- » By the end of 2018, both GM and Tesla reached the 200,000-vehicle cap, and the credits for those manufacturers will be phased out over the next several quarters.<sup>54</sup>
- » Ensuring federal incentives remain appropriately aligned will be crucial to the AFV marketplace in the short to medium term.

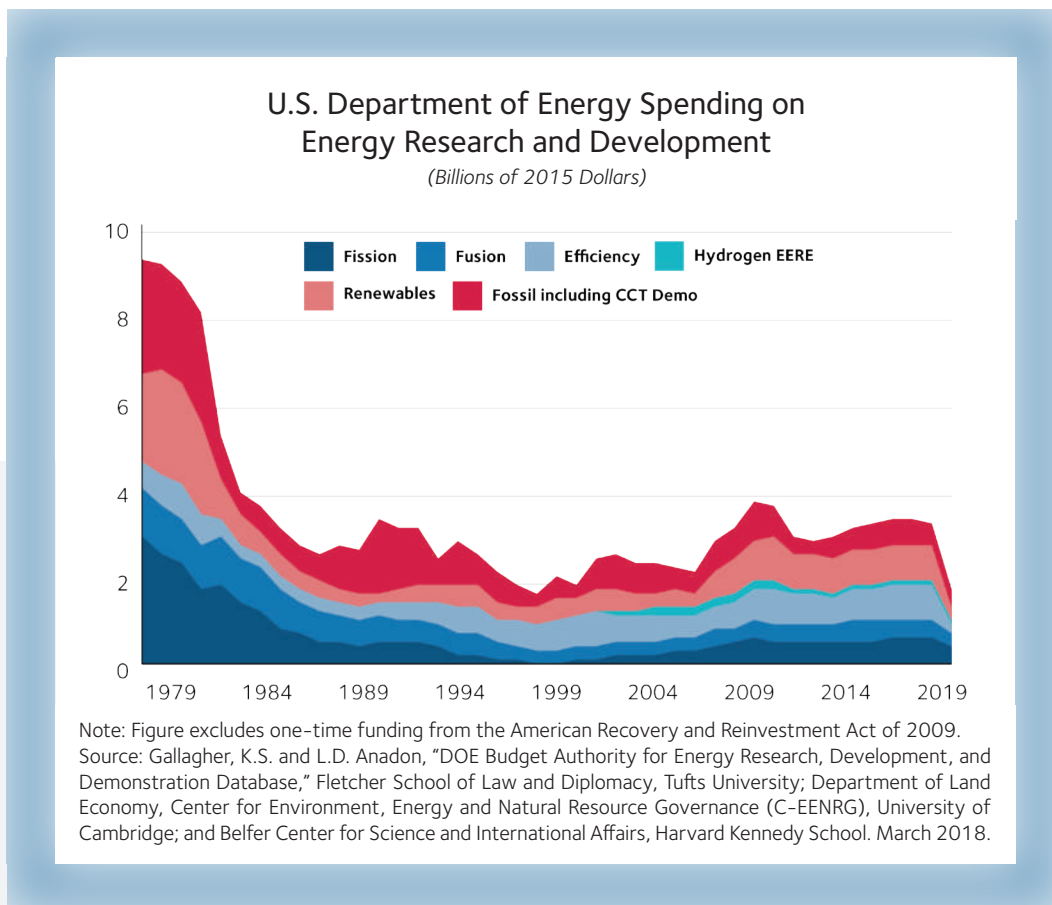
---

<sup>54</sup> Paul Ruiz, "EV Sales: Waiting For The Inflection," The Fuse, January 15, 2019.

## SOLUTION

## Research and Development Funding Supports AFV Innovation

Federally-funded research and development (R&D) helps ensure the United States remains globally competitive when it comes to the development of AFV technologies. The Advanced Research Projects Agency-Energy (ARPA-E), for example, has projects aimed at developing better batteries for EVs, supportive technologies for NGVs, and more advanced biofuels.



- » ARPA-E wants to improve existing battery technologies, as well as develop new battery chemistries. With NGVs, the agency has focused on reducing the cost of compressing natural gas for vehicles, as well as improving storage tanks.

- » Similarly, the wide range of energy storage research occurring in the Office of Science, the Office of Energy Efficiency and Renewable Energy, and throughout the nation's national laboratories have made valuable contributions that have supported U.S. innovation. Continued and adequate funding for R&D remains an important priority that will help advance AFV technologies.
- » The amount of federal funding for energy research and development has declined precipitously since the early 1980s.

## SOLUTION

# U.S. Must Counter China's Drive to Control Electric Vehicle Development

---

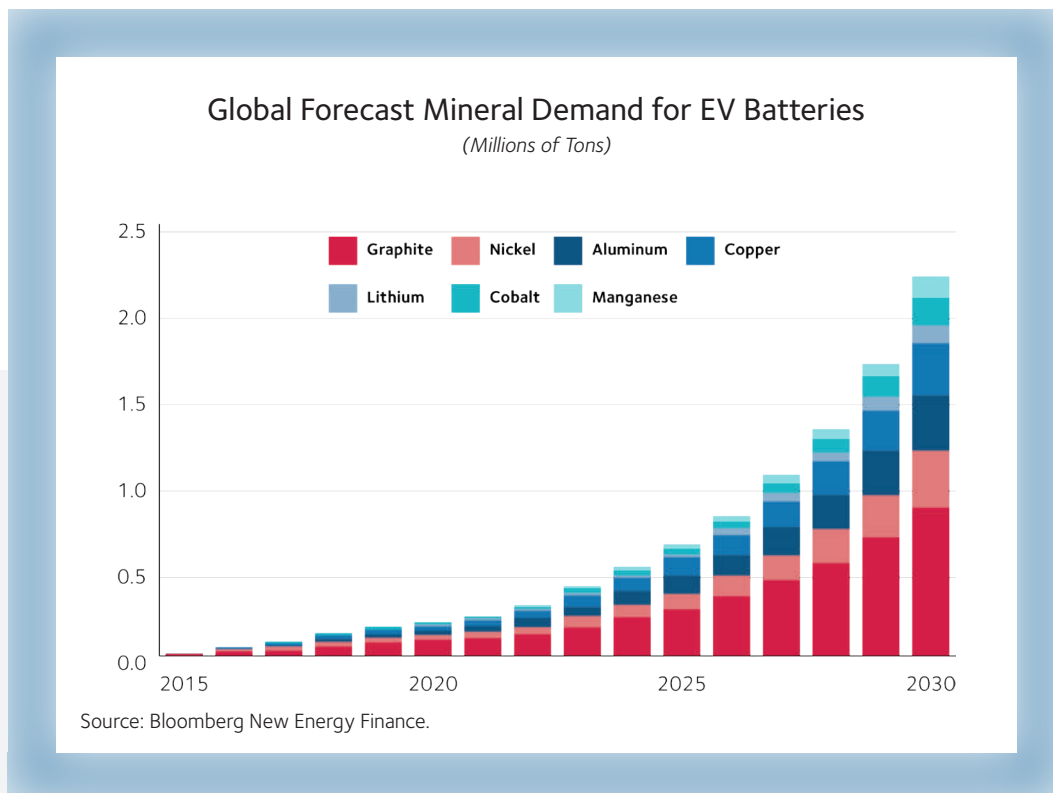
China's unprecedented investment in EVs represents a serious threat to the United States. Its sharp focus on EVs can undermine the United States' access to the global EV supply chain, global competitiveness for U.S. businesses, and American energy security. "Made in China 2025" reveals China's strident commitment to achieve economic dominance by developing and producing next-generation electric and autonomous vehicles. The following are among the many methods China is using to disadvantage and destroy U.S. AV and EV research and production:

- » Forced transfer/theft of U.S. technologies and intellectual property;
- » Economic espionage in the United States;
- » Securing and controlling core natural resources globally (i.e., vertical supply chain integration);
- » Directed and subsidized research and development;
- » Subsidized manufacturing;
- » Protecting the home market from imports and U.S. competition; and
- » Misuse of international credit facilities and sovereign wealth funds.

## SOLUTION

## The United States Must Secure Supply of Strategic Minerals

EIA projects EV sales to reach 1.4 million per year by 2025 and 10 percent of total sales by 2040. The production of these vehicles' batteries will require many strategic minerals, including cobalt, graphite, lithium, manganese, dysprosium, and neodymium. The United States will have to compete for the global supply of these minerals amid increasing EV and consumer electronics sales.



- » Many of the most important strategic mineral resource reserves are located outside of U.S. control. For example, the United States holds only 38,000 tons of lithium reserves out of a global total of 14 million tons.<sup>55</sup> However, there are efforts underway to develop U.S. reserves, including a new lithium deposit in North Carolina.
- » A free, open, and fair market for critical minerals will remain important in the coming decades as battery demand grows.

<sup>55</sup> U.S. Geological Survey, "Mineral Commodity Summaries 2017," USGS.gov, January 2017.

## NATURAL GAS VEHICLES (NGVs)

Compressed natural gas (CNG) and liquefied natural gas (LNG) are two fueling options for natural gas vehicles (NGVs). On an equivalent basis, both are less expensive than petroleum fuel in the United States.

- » As of March 2019, there were more than 1,500 CNG stations and 121 LNG total stations in the United States, though many are not accessible to the public. Limited availability of natural gas refueling stations remains a significant barrier to adoption.
- » CNG vehicles are best suited for high-mileage medium- and heavy-duty truck fleets with predictable, regular routes and centralized refueling facilities. Fleet applications ideal for CNG include product delivery and refuse trucks.
- » LNG is well suited for applications—including those exceeding 80,000 pounds—requiring high-horsepower engines. Today, LNG vehicles are relatively rare on both U.S. roads and around the world. However, the higher energy density of LNG can make it a more attractive option than CNG for vehicles which require long ranges.

## HYDROGEN FUEL CELL VEHICLES (FCVs)

FCVs do not incorporate an internal combustion engine (ICE) or conventional fuel system. Instead, they rely on an electric motor for propulsion. The primary difference between FCVs and plug-in EVs is that the electric motor receives power from a hydrogen fuel cell rather than a battery. The hydrogen fuel cell converts hydrogen gas and oxygen from the air into electricity. The hydrogen gas is stored at high pressure in an onboard tank.

- » While hydrogen is incredibly abundant in nature, pure hydrogen suitable for use in FCVs must be produced from other compounds such as methane or water, and then compressed, before it can be used as a fuel. This process can be energy intensive. Several production options exist including electrolysis and steam reforming of natural gas.
- » For FCVs to achieve meaningful adoption rates in the passenger vehicle marketplace, they will require a network of public fueling stations. Currently, fueling stations for FCVs can only be found in California, where at the end of 2018 there were almost 40 stations. The cost of installing a hydrogen fueling station is currently estimated at around \$2 million.
- » Larger light-duty vehicle categories and fleet applications currently appear to be the most appropriate segments for FCVs given their on-board storage needs and the lack of refueling infrastructure.



PART IV

Autonomous Vehicles:  
Improving the Safety and  
Efficiency of American  
Transportation



## Autonomous Vehicles Can Lead to Significant Improvements in Safety and Efficiency

---

The automotive industry is standing on the cusp of a technological revolution, with autonomous vehicle technology advancing closer to commercial deployment. Unlike human drivers, autonomous vehicles (AVs) will be able to operate without distraction or impairment and have the potential to dramatically reduce the number of fatalities that occur on U.S. roadways every year.

AV technology can also better serve our economic and national security goals by accelerating adoption of EVs and by improving system-wide efficiency through ridesharing.

## Autonomous Vehicles Can Offer Access to Social and Economic Opportunities

---

There is intense public interest in AVs, in part because of their promise to enable new and lower cost mobility options for millions of Americans. AVs can dramatically improve the lives of communities underserved by our current transportation system, especially Americans with disabilities, seniors, and wounded veterans.

## Coordinated, Proactive Policies Will Facilitate A Smooth Transition to the Workforce of the Future

---

Although AVs are likely to bring meaningful social and economic benefits, concerns about job displacement should be taken seriously. However, supporting innovation while protecting American workers requires a realistic view of the timeline for deployment and a holistic assessment of impacts.

Research commissioned by SAFE shows that worker displacement from AVs will not be significant, will be temporary in nature, and can be proactively addressed by updating existing workforce provisions. While AVs are projected to bring \$800 billion in annual social and economic benefits by 2050, it is imperative that policymakers focus not just on enabling AV development and deployment, but also prepare to mitigate the potential negative impacts for workers.<sup>56</sup>

## Autonomous Vehicles Will Make Roads Safer

---

There are nearly 40,000 U.S. roadway fatalities every year.<sup>57</sup> In addition, there are 3.9 million non-fatal injuries annually from crashes.<sup>58</sup> Road traffic injuries are also the single largest cause of mortality and long-term disability among people aged 15 to 29.<sup>59</sup>

The National Highway Traffic Safety Administration (NHTSA) estimates that 94 percent of all traffic collisions are caused either wholly or in part by human error or choice (e.g., speeding, driving under the influence, distraction), underscoring the opportunity for AVs to meaningfully address this national crisis.

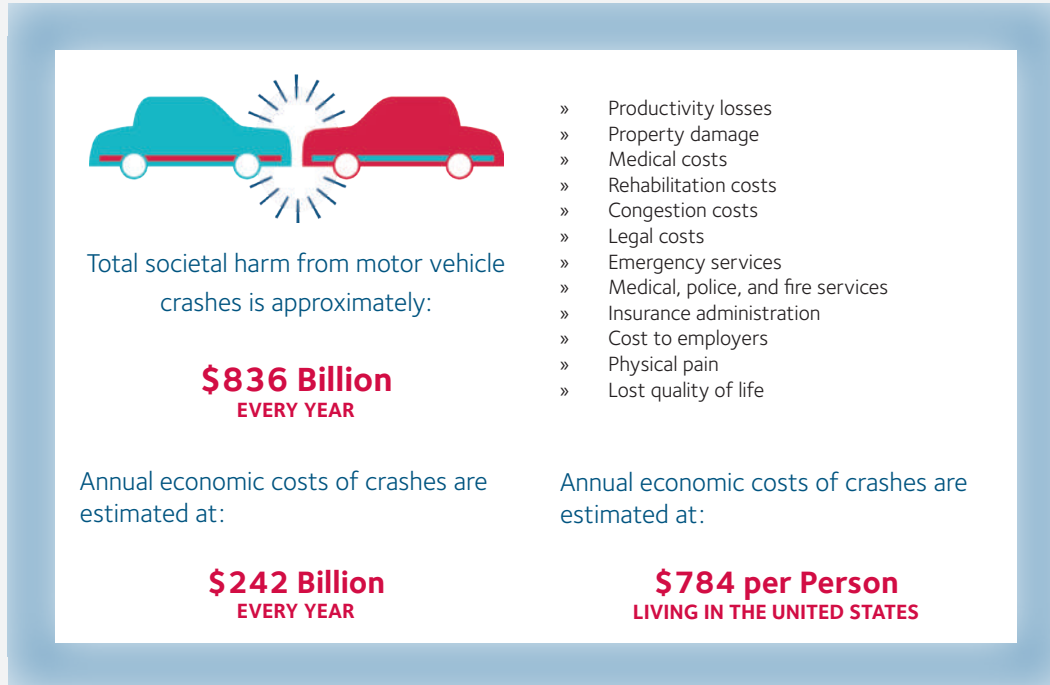
---

<sup>56</sup> Amitai Bin-Nun, Jeff Gerlach and Alex Adams, "America's Workforce and the Self-Driving Future," *Securing America's Future Energy*, June 2018, pg. 8.

<sup>57</sup> NHTSA, "2017 Fatal Motor Vehicle Crashes: Overview," October 2018.

<sup>58</sup> *Ibid.*

<sup>59</sup> The World Bank, "The High Toll of Traffic Injuries: Unacceptable and Preventable," January 2018.



- NHTSA estimates the annual economic cost of crashes in the United States to be \$242 billion, or approximately \$784 for every person living in the United States—amounting to 1.6 percent of U.S. GDP.<sup>60</sup> When fully accounting for some of the non-economic costs of crashes, this figure was over \$800 billion.<sup>61</sup> Extrapolating these values on more recent crash and driving data puts the annual societal cost of crashes well over \$1 trillion per year.<sup>62</sup>
- Collision avoidance technologies (known as Advanced Driver Assistance Systems, or ADAS) are already saving lives on the road. Pilot studies and research from the Insurance Institute for Highway Safety have documented significant reductions in collisions for vehicles with these technologies installed. The Boston Consulting Group estimates that if existing collision avoidance technologies were installed in all cars, about 10,000 lives would be saved each year.<sup>63</sup>
- AVs can further improve traffic safety. The RAND Corporation has stated that deploying AVs that are even just slightly safer than human drivers would eventually save more than one million lives in the United States by 2070.<sup>64</sup> The National Safety Council has identified AVs as a core component of its Road to Zero strategy of eventually ending road fatalities.

<sup>60</sup> NHTSA, "The Economic and Societal Impact Of Motor Vehicle Crashes, 2010," May 2015.

<sup>61</sup> Ibid.

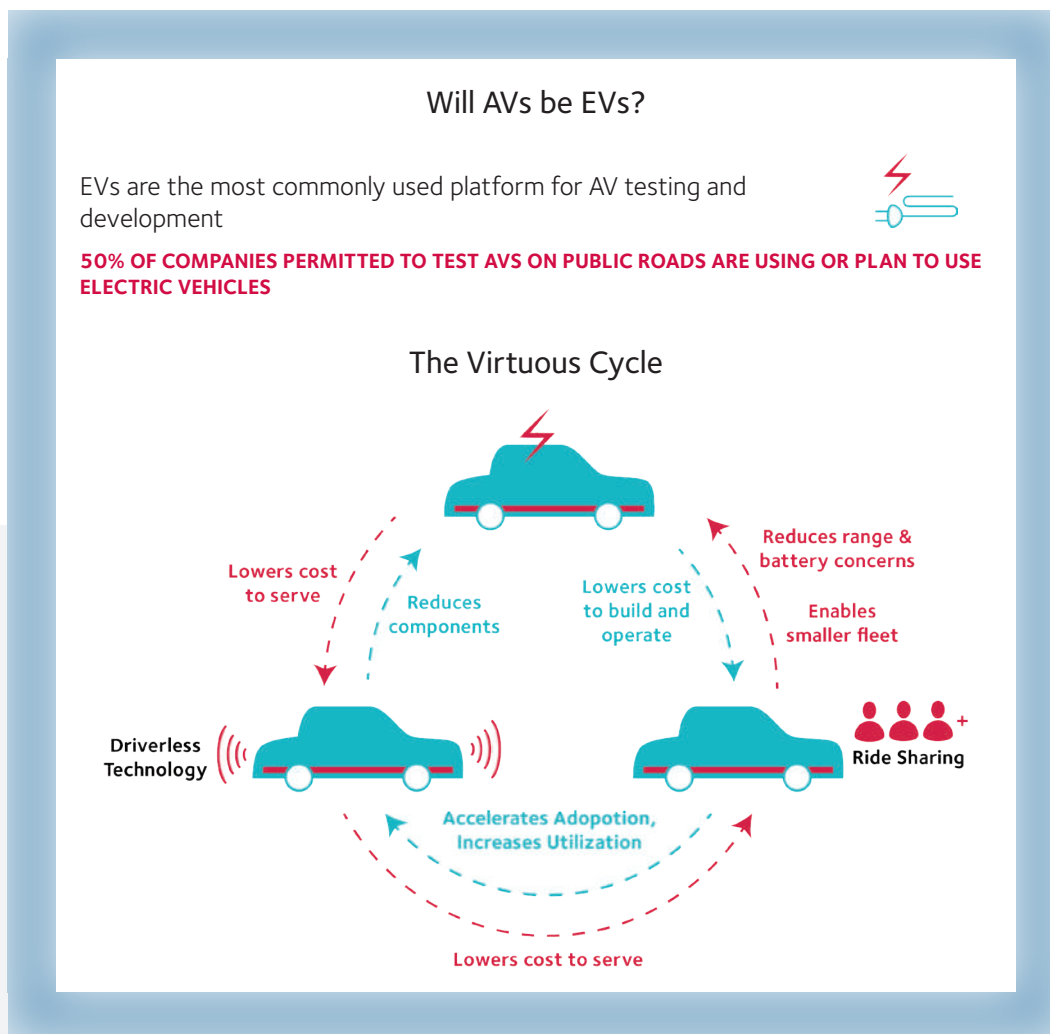
<sup>62</sup> Amitai Bin-Nun, Jeff Gerlach and Alex Adams, "America's Workforce and the Self-Driving Future," Securing America's Future Energy, June 2018.

<sup>63</sup> BCG & MEMA, "A Roadmap To Safer Driving Through Advanced Driver Assistance Systems," 2015.

<sup>64</sup> Melissa Bauman, "Why Waiting for Perfect Autonomous Vehicles May Cost Lives," RAND, November 2017.

# Autonomous Vehicles Will Strengthen U.S. Energy Security and Transportation Efficiency

In 2017, the United States consumed more than 9 million barrels of motor gasoline per day.<sup>65</sup> The combustion of fuels by vehicles in American communities has been linked to disease and premature deaths. While AFVs such as EVs continue to make progress, they still represent less than 1 percent of vehicles on the road today.



<sup>65</sup> EIA, Annual Energy Outlook, 2018.

- » AVs represent an opportunity to accelerate a transition to advanced fuels and reduce our oil dependence. Already, 80 percent of AVs being designed are electric or hybrid vehicles.<sup>66</sup> There are many contributing factors that explain why technology developers have overwhelmingly chosen electric platforms.<sup>67</sup> However, the principal reason is that cars used in ridesharing applications (as AVs are likely to be) will have high utilization rates. This favors the economics of electric and other AFVs, which are cheaper to operate on a per-mile basis. A rapid scaling of AVs could lead to significant transportation sector electrification.
- » AVs can reduce crashes and improve traffic flow. Every year, nearly 7 billion hours are lost in traffic and over 3 billion gallons of fuel are wasted due to crash-related congestion.<sup>68</sup> The improved safety of AVs and the resulting increases in throughput could save up to \$71 billion per year by 2050 through congestion mitigation alone.<sup>69</sup>

---

<sup>66</sup> SAFE analysis based on data from the California Department of Motor Vehicles.

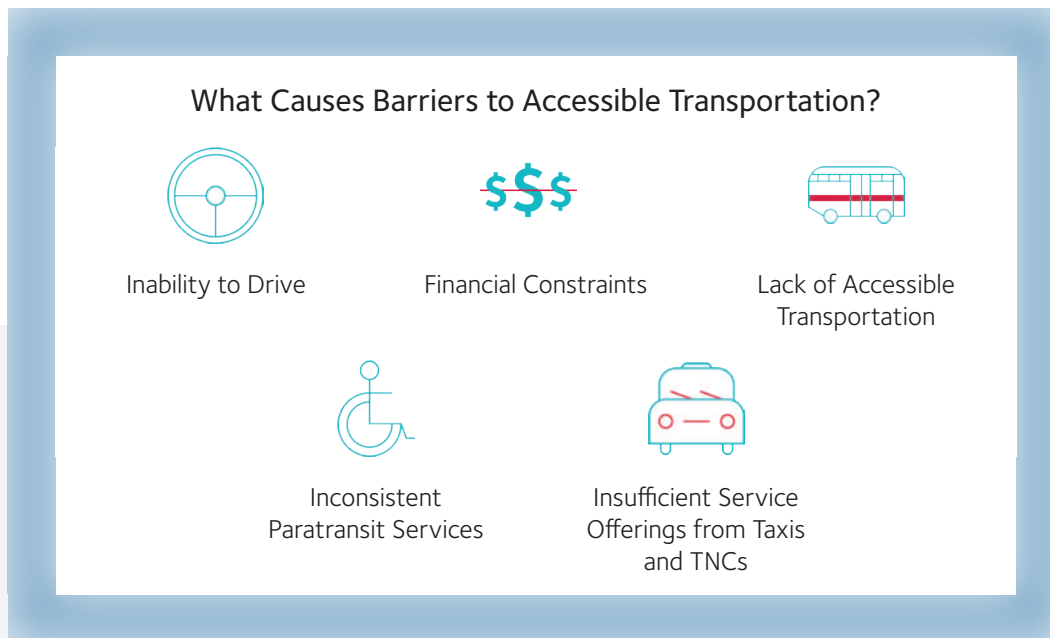
<sup>67</sup> Greg Gardner, "Why most self-driving cars will be electric," USA Today, September 19, 2016

<sup>68</sup> David Schrank, Bill Eisele, Tim Lomax and Jim Bak, "Urban Mobility Scorecard 2015," Texas A&M University, August 2015

<sup>69</sup> Amitai Bin-Nun, Jeff Gerlach and Alex Adams, "America's Workforce and the Self-Driving Future," Securing America's Future Energy, June 2018.

## The Promise of Greater Accessibility

In the United States, most recent government transport survey indicated that 6 million individuals with a disability have difficulty getting the transportation they need.<sup>70</sup> As autonomous vehicles enter the mainstream they offer significant potential for reducing transportation obstacles for Americans with disabilities.



- » For individuals with disabilities, limited transportation access significantly impacts other areas of life. Research has linked social isolation to increased problems with mental health and even early death. Individuals with disabilities are far less likely to be employed and far more likely to miss medical appointments because they are unable to find reliable transportation.<sup>71</sup>
- » SAFE analysis found that AVs and other transportation innovations could significantly enhance mobility options for the disability community. AVs will make it possible for millions more Americans to have better access to healthcare, live more independently, and achieve greater economic self-sufficiency.

<sup>70</sup> Henry Claypool, Amitai Bin-Nun and Jeff Gerlach, "Self-Driving Cars: The Impact on People With Disabilities," Securing America's Future Energy and the Ruderman Family Foundation, January 2017.

<sup>71</sup> Ibid.

### Autonomous Vehicles Offer Access, Jobs, and Healthcare Savings



#### ACCESS

**2 Million**

job opportunities would become accessible to individuals with disabilities.



#### JOBS

**4.3 Million**

working-age individuals with a disability (ages 18-64) face significant transportation barriers when attempting to travel to their medical appointments.



#### HEALTHCARE

**11 Million**

medical appointments are missed annually by working-age individuals with disabilities due to inadequate transportation

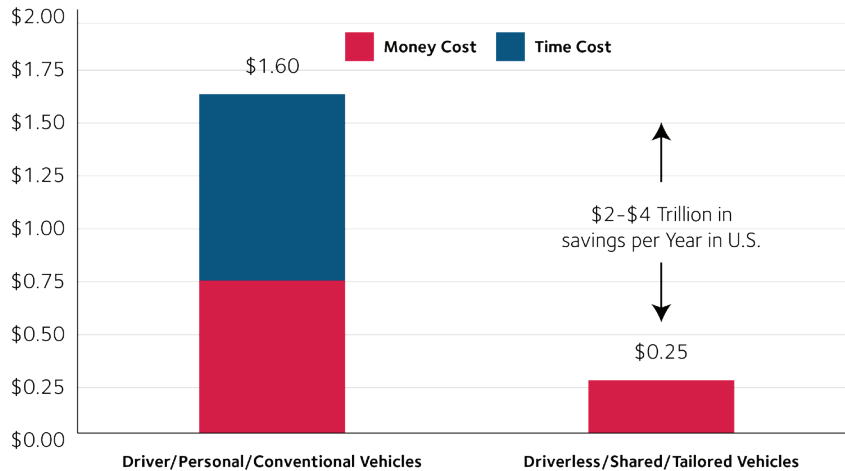


#### HEALTHCARE

**\$19 Billion**

in health care expenditures, mostly from public entitlement programs, could be saved annually through improved access to medical care for working-age individuals with disabilities

### Cost Savings with Driverless Vehicles



### Access to New Work Opportunities





## AVs Will Catalyze Economic Growth

AVs offer the promise of both stronger economic growth and higher quality of life through cheaper, safer, and more efficient transportation. Lower freight and personal travel costs could unlock additional economic opportunities for Americans living in rural and exurban areas. SAFE's analysis of current traffic patterns and job locations found that some economically-depressed regions could see improved access to large job markets for their residents through the deployment of AVs.<sup>72</sup>

Quantified Benefits of Autonomous Vehicles	
<b>Public Benefits by 2050 (annual)</b>	<b>\$633 Billion</b>
Congestion Mitigation	\$71 Billion
Accident Reduction - Economic Impact	\$118 Billion
Accident Reduction - Quality of Life Improvements	\$385 Billion
Reduced Oil Consumption	\$58 Billion
<b>Consumer Benefits by 2050 (annual)</b>	<b>\$163 Billion</b>
Value of Time	\$153 Billion
Reduction in Cost of Current Taxi Service	\$10 Billion
<b>Total Annual Benefits (by 2050)</b>	<b>\$796 Billion</b>

Source: David Montgomery, Public and Private Benefits of Autonomous Vehicles, June 2018.

- » Researchers have estimated that AVs could bring down the economic cost of driving from more than \$1.50 per mile to around just 25 cents per mile.<sup>73</sup>
- » Independent experts have estimated that the broad penetration of AVs would lead to approximately \$800 billion in annual economic benefits by 2050.<sup>74</sup>

<sup>72</sup> Amitai Bin-Nun, Jeff Gerlach and Alex Adams, "America's Workforce and the Self-Driving Future," Securing America's Future Energy, June 2018, pg. 25.

<sup>73</sup> See, e.g., Caitlin Huston, "Driverless cars could cost 35 cents per mile for the Uber consumer," September 2016.

<sup>74</sup> See, e.g., SAFE, "America's Workforce and the Self-Driving Future Realizing Productivity Gains and Spurring Economic Growth," June 2018.

## CURRENT STATUS OF AV TECHNOLOGY

Autonomous vehicle technology is advancing rapidly as technology giants, established automakers, and a myriad of startups work to develop and perfect the technology. Progress is expected to accelerate over the next several years, as all are intent on capturing a share of the colossal global transportation market, which encompasses nearly \$5 trillion of annual economic activity.

- » A recent report found that more than half of large cities are preparing for AVs by launching pilots or updating regulations. Google spin-off Waymo, and GM subsidiary Cruise, have rolled out or are currently planning self-driving commercial services. As the technology matures, large-scale commercial deployment is expected over the next few years.
- » U.S. leadership is not guaranteed. Foreign investment in AVs and regulatory development is accelerating. In particular, China has begun to issue permits for on-road testing of AVs, and dozens of companies have received permits in less than a year.

## AVs Impact on the Workforce

The development and near-term deployment of both light- and heavy-duty AVs has understandably raised concerns about its impact on American workers. In 2016, there were about 3.3 million driving jobs (out of 160 million total).<sup>75</sup> The largest categories were for long-distance tractor-trailer and delivery drivers, but there were significant numbers of taxi service drivers as well.

Event	Timing of Peak Impact	Marginal Increase in Unemployment at Peak
Autonomous Vehicle Deployment	Between 2045 and 2050	<b>0.06% - 0.13%</b>
Great Recession	2010	<b>4.9%</b>
Early 2000s Recession	2003	<b>1.3%</b>

Note: Marginal Increase in Unemployment at Peak assumes a baseline of 4.7 percent unemployment before event impact.  
Source: Data on AV deployment impacts from Groshen employment report; Data on historical annual unemployment rates from FRED.

- » According to independent research commissioned by SAFE, it will take a significant period of time before the impacts of AVs on employment are fully realized. Simulations of AVs market penetration project that employment impacts are unlikely to be observed before the 2030s.
- » At peak, AVs might increase the national unemployment rate by 0.13 percentage points before a return to full employment—which is an order of magnitude lower than the labor market impacts of even a mild recession.<sup>76</sup> This suggests that the economic growth from AVs, as well as proactive policymaking, can be leveraged to mitigate the potential negative impacts of worker displacement.

<sup>75</sup> See, e.g., Paul Eisenstein, "Millions of Professional Drivers Will Be Replaced by Self-Driving Vehicles," NBC News, November 5, 2017.

<sup>76</sup> Amitai Bin-Nun, Jeff Gerlach and Alex Adams, "America's Workforce and the Self-Driving Future," Securing America's Future Energy, June 2018, pg. 11.

- » Policymakers face the challenge of balancing the positive impacts of AVs—including significant economic growth, health, and national security impacts—with the need to guide workers through a transition to the jobs of the future. Expert projections show that there is time to implement a conscious and deliberate policy framework that is focused on workforce development. Ultimately, attempting to delay or prevent AV technology from reaching the market would be economically counterproductive and would forestall the realization of the significant social benefits of AVs.



PART V

Policy Measures  
for Improving  
Energy Security

## Measures for Improving U.S. Energy Security

---

Although robust domestic petroleum production has the potential to reduce some of the most negative consequences of oil dependence, energy security is primarily a function of consumption, not production. Therefore, the transition to AVs powered by alternative fuels is the key to reducing America's oil dependence. Below is a list of concrete policy solutions that will help the United States achieve its energy security goals.

## Combating Oil Market Manipulation

---

OPEC nations and other countries with national oil companies (NOCs) impede the free and efficient functioning of the global oil market. Foreign governments with vast oil reserves use production volumes, spare production capacity, lower production costs, and longer-term investment plans to manipulate oil prices and hurt U.S. consumers. SAFE recommends:

- » Congress pass the No Oil Producing and Exporting Cartels Act (NOPEC). This legislation amends the Sherman Act to prevent OPEC from hiding behind sovereign immunity and the Act of State doctrine to evade U.S. antitrust law. NOPEC gives the U.S. Attorney General the ability to bring lawsuits in the United States against OPEC or any of its member countries for anti-competitive conduct.
- » NOPEC would provide the U.S. government with significantly greater leverage over the cartel and/or specific members, reducing the likelihood and severity of future oil price manipulation.

## Bolstering American Oil Production

---

While U.S. production of oil and natural gas has achieved remarkable growth over the last several years, the United States should do more to maximize domestic production while strengthening and ensuring high environmental standards. There should be no tolerance for cutting corners and unsafe practices. Currently, vast tracts of federal lands and waters remain unavailable for exploration and development. SAFE recommends:

- » Congress and regulators maintain all existing offshore safety and environmental standards. Operational and technological improvements have lowered the risk of incidents and strengthened industry's capability to respond. DOI should ensure an appropriate set of safety performance metrics exist that cover a range of indicators, including spills, discharges of chemicals and other materials, and inspection violations. Individual companies that fall below a specified minimum performance rating should be ineligible to bid on new leases until they regain compliance.
- » Congress should continue to support the development of the Arctic National Wildlife Refuge (ANWR). Until recently, moratoria have limited commercial access to ANWR's vast reserves. For this reason, ANWR's remote location and lack of infrastructure mean production is still a decade away. Congress should continue to evaluate progress of Area 1002 development and ensure the reserve is meeting adequate high-standard benchmarks to expeditiously and safely develop the region's resource base. Before the moratoria was lifted, SAFE supported directional drilling into ANWR which could still be a pathway to compromise.
- » Congress open areas of the Atlantic Outer Continental Shelf (OCS) for responsible seismic testing with coastal state legislature input. Industry knowledge of the Atlantic region is limited by the lack of modern data. To understand the size of U.S. offshore reserves, Congress should allow in-depth seismic testing to pinpoint the most resource-rich areas.
- » Congress support energy production in the Arctic. For decades, commercial access to the Arctic expanse has been limited by the complexity of operating safely in a remote and challenging region. Federal policy can support responsible development in two ways. First, regulators should evaluate equipment and ice management techniques every two years to determine if the drilling season can be extended. Second, Arctic lease terms should be extended beyond ten years to accommodate for environment-based project complexity and the relatively short drilling season.
- » Congress, or DOI through its regulatory rulemaking authority, should establish an Energy Security Trust Fund (ESTF) with new OCS royalties to invest in technologies whose long-term success would strengthen energy security by lessening oil dependence. An ESTF would fund investment in cutting-edge R&D that advances AFV, AV, and fuel efficiency technologies. Fifty percent of the otherwise unallocated federal share of new oil royalty revenue from energy development in OCS regions should be placed into the ESTF.



## Alternative Fuel Vehicles

---

Currently, the market share of AFVs in the light-duty vehicle segment accounts for little more than 1 percent of U.S. sales. Much higher adoption rates are needed to meaningfully enhance American energy security so that the U.S. economy is not always held hostage to one fuel. SAFE recommends:

- » Congress lift all volume limitations on the current federal EV tax credit (30D). The credits should instead be phased out at a date to be determined through negotiations between Congress, industry, and relevant stakeholders. Affordability of EVs should be the paramount concern in determining the phase-out date. Stakeholders should seriously consider establishing a manufacturer's suggested retail price (MSRP) threshold for the credit.
- » Establish federal tax credits for class 3 – 6 vehicles to encourage first-mover action and accelerate electrification in those fleet segments.
- » Congress increase funding for federal research and development in automotive-grade batteries.
- » Congress maintain Department of Defense flexibility in purchasing alternative fuel vehicles, including the ability to participate in public-private purchasing consortia.
- » Congress establish a grant system for CNG, LNG, and EV fast charging station installations along high-priority corridors. Infrastructure should be prioritized along corridors that are responsible for a large proportion of long-haul trucking, and located no more than 200 miles apart along the National Highway Freight Network.
- » Congress pass legislation to allow trucks to pull 33-foot twin trailers on federal highways. Currently, twin trailers are restricted in length to 28 feet due to federal policy implemented in 1982. This change will enable freight carriers to better navigate shifting consumer demand due to the continued growth of e-commerce. The use of twin 33s would increase trailer volumes and reduce the number of trucks needed to move freight, saving fuel in the process.

## Fuel Economy

---

Improved vehicle fuel efficiency has been critically important to lowering the oil intensity of the economy. In order to continue reducing oil consumption, SAFE recommends:

- » NHTSA set a target of at least 2 percent for annual increases in fuel efficiency of all passenger vehicles. Such efficiency improvements would save approximately 1 Mbd of petroleum by 2050.<sup>77</sup> The simplest way to achieve these reductions would be for NHTSA to maintain existing model year 2021–2026 standards.
- » The Environmental Protection Agency (EPA) and NHTSA should begin planning for vehicle efficiency standards post-2025. Future efficiency standards should examine the transportation system holistically, accounting for new technologies and business models such as ridesharing. Corporate Average Fuel Economy calculations should account for fuel saved through congestion mitigation and safety technologies.
- » Federal policy should establish a fuel-neutral credit multiplier or Advanced Drivetrain Multiplier to be incorporated into the fuel economy standards. These credit multipliers should be reformed to incorporate natural gas and other non-liquid fuels.

## Autonomous Vehicles

---

Autonomous and connected vehicles have emerged as technologies that could strengthen U.S. energy security. Congress should ensure that government not stymie the development and deployment of this nascent technology. SAFE recommends:

- » Congress enact a comprehensive federal regulatory framework to expedite the safe development, testing, and deployment of AVs. This framework must preempt the current patchwork of state regulations, which could infringe upon NHTSA's authority to regulate motor vehicle design, construction, and performance.
  - » The framework should include medium- and heavy-duty vehicles, with appropriate participation by the Federal Carrier Motor Safety Administration (FMCSA) to update its regulations.

---

<sup>77</sup> EPA. "Proposed Determination on Appropriateness of the MY 2022–2025 LDV GHG Emissions Standards Under the Midterm Evaluation: Technical Support Document." Nov. 2016. P. 3–24, Table 3.10 and NPRM 42995.

- » The federal government facilitate AV deployment communities and pilot programs for passenger vehicles, shuttles, and automated trucks. Such programs would allow for the collection of real-world data to inform recommendations that will guide the responsible development of AVs.
- » EPA and NHTSA modernize fuel economy standards to include the impacts of new technology such as partially- and fully-autonomous vehicles, connected vehicles, and ridesharing services.
- » The federal government enhance its exemptions program to provide a pathway for developing and deploying AVs with novel design configurations. In addition, the cars enabled by this exemptions program would accelerate the construction of more accessible vehicles.
- » The federal government clarify its position that AVs not require a licensed driver and act to prevent states from imposing such requirements.
- » The federal government convene industry and disabilities advocates to better prioritize policies, R&D, and technology development to improve accessibility. Federal AV pilots should include an accessibility component.
- » Congress and the federal government enact forward-thinking workforce policies to prepare for any labor market displacement AVs may cause. Key policies should include better data tracking on the impacts of automation to inform policy and broad enhancements to workforce education, safety nets, and economic development policies. Society does not have to choose between the compelling benefits of AVs and the stable evolution of the workforce.
- » The federal government preserve the 5.9 GHz spectrum for connected vehicle applications that will contribute to significant increases in roadway safety and efficiency. The 5.9 GHz spectrum should be opened to other uses only if the federal government has demonstrably found that the spectrum can be shared without endangering roadway safety.

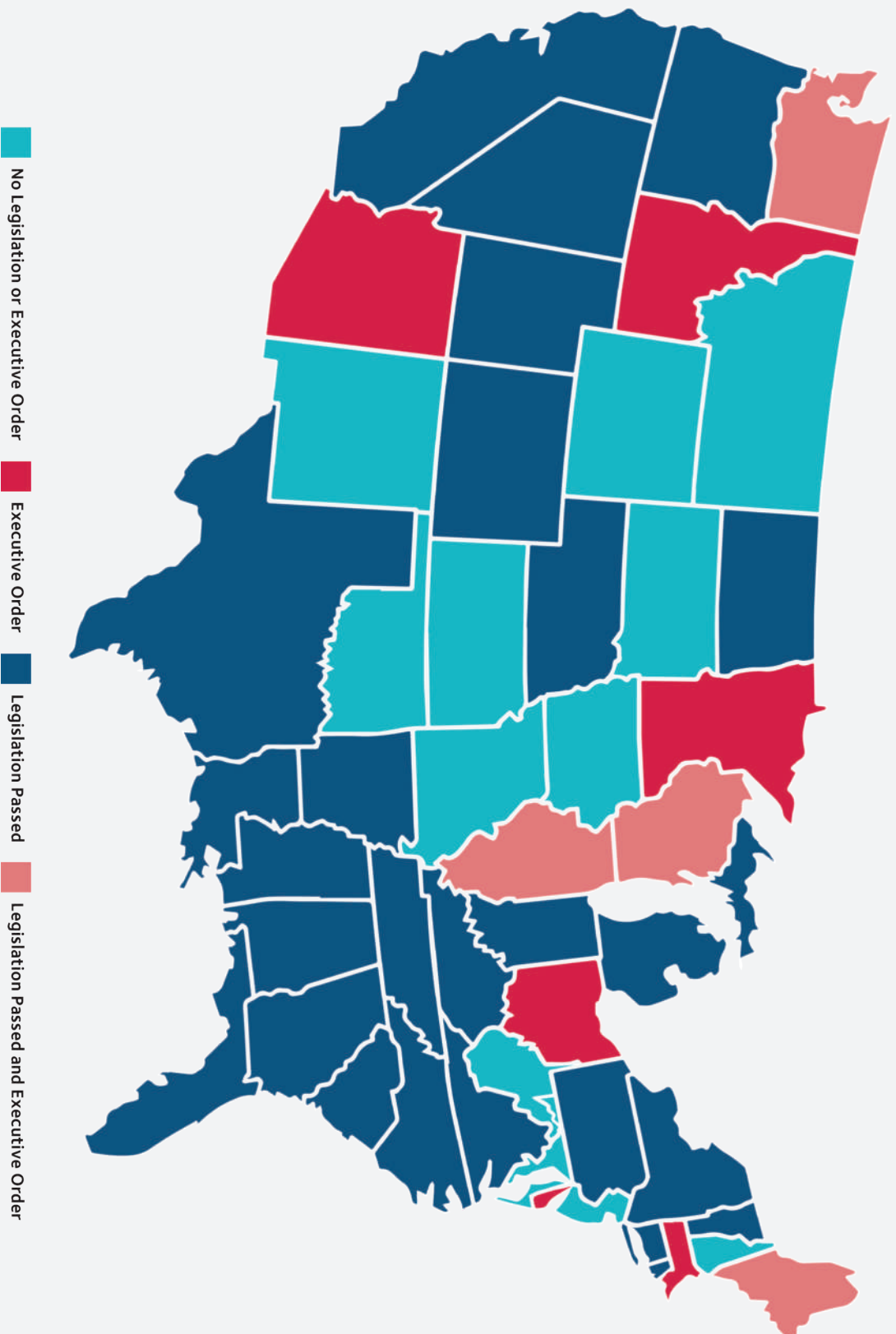
## Strategic Minerals and Supply Chain

---

Many strategic minerals are critical to the products we use in our everyday lives. The materials used to build smartphones and computers and are also crucial for the production of EV batteries and motor magnets. Shortages of these minerals would create strategic vulnerabilities for the United States. The challenges associated with interrupted access, however, do not remotely approach those created by the U.S. petroleum dependence. Congress should support the Department of the Interior's actions to fulfill the President's 2017 Executive Order on critical minerals. SAFE recommends:

- » Congress identify minerals critical to U.S. economic and national security and advance the United States' ability to explore, mine, recycle and reprocess critical minerals. Congress should also support private industry efforts to produce higher-quality topographic, geologic, and geophysical mapping data and make these materials more widely available to industry participants. Greater private sector involvement in domestic minerals production should be encouraged by streamlining leasing and permitting procedures. The United States should take diplomatic steps to ensure access to these minerals and other supply chains.

### U.S. Legislative Adoption of Autonomous Vehicles



Source: National Council of State Legislatures.



## Securing America's Future Energy

1111 19th Street, NW, Suite 406 Washington, DC  
20036 · Tel 202.461.2360 · [SecureEnergy.org](http://SecureEnergy.org)

---

© Copyright Securing America's Future Energy (SAFE). The statements and data expressed in this report reflect the views of SAFE. Although the authors and endorsers of this report have used their best efforts in its preparation, they assume no responsibility for any errors or omissions, nor any liability for damages resulting from the use of or reliance on information contained herein. The authors have sought to obtain permission from all image, data, and chart owners and apologize to any who could not be properly traced for permission and acknowledgment.