BLUEGREEN ALLIANCE

PREVIEW

SUPPLYING INGENUITY II:

U.S. Suppliers of Key Clean, Fuel-Efficient Vehicle Technologies

More than 1,200 U.S. factories in 48 states are building technology that improves fuel economy for today's innovative vehicles.

PREVIEW | SUPPLYING INGENUITY II

Over the past decade, the U.S. automotive industry has demonstrated that we can bring back American jobs and manufacturing and enhance industry competitiveness and profitability. The industry is building world leading, popular vehicles that save consumers billions at the pump, enhance energy security, and cut pollution.

Sound fuel economy and manufacturing policies have been critical to this success, and remain critical to continued automotive recovery, to strong innovation and job growth, and to continuing to strengthen the manufacturing sector as a whole.

This issue brief provides a preview of research from the upcoming report *Supplying Ingenuity II: U.S. Suppliers of Key Clean, Fuel-Efficient Vehicle Technologies* due out in 2017.

I. AUTOMOTIVE INNOVATION AND INVESTMENT IS ANCHORING THE U.S. MANUFACTURING RECOVERY

A successful domestic automotive industry is critical for preserving U.S. jobs and creating new ones. Since the 2008-2009 recession, the auto industry has recovered rapidly while seeing the rewards of domestic innovation and investment in advanced, fuel-efficient technology. Overall job growth in the industry has been strong, aiding a recovery of U.S. manufacturing. (see Table A).

Today, the automotive industry directly employs nearly 3 million Americans. Employment at auto dealerships has fully recovered from the recession and, at 2 million jobs, is at its highest level ever. Motor vehicle and motor vehicle components manufacturing currently support nearly 1 million direct manufacturing jobs nationwide, up nearly 50 percent since the recession. Since 2009, the industry has added over 300,000 direct manufacturing jobs. In fact, auto manufacturing job growth accounted for 40 percent of all net jobs added in U.S. manufacturing since the recession. In turn, these manufacturing jobs support millions of additional jobs indirectly, throughout the economy.[1]

TABLE A: Automotive sector manufacturing employment and job growth in key states

State	Auto & Parts Manufacturing Jobs Today (September 2016)	Change Since Recession (June 2009)
Michigan	164,700	+69,500
Indiana	114,100	+45,000
Ohio	94,900	+29,800
Kentucky	55,600	+20,600
Alabama	39,300	+17,500

Source: U.S. Bureau of Labor Statistics. Totals above include sum of Motor Vehicle Manufacturing and Motor Vehicle Parts Manufacturing employment for each state. Indiana also includes manufacturing of Motor Vehicle Bodies and Trailers.

To be clear, the auto industry hasn't yet brought back the several hundred thousand manufacturing jobs lost in the decade before the recession. But the past seven years have seen the first period of sustained growth in automotive manufacturing jobs—and in U.S. manufacturing jobs as a whole—since 1999.[2] Continuing to

grow will require constant innovation, actively moving new technology from research to manufacturing to deployment, and respecting the vital role a skilled workforce has in the economy.

Industry is Strongly Implementing Fuel Economy and Greenhouse Gas Standards

While the industry was bringing back jobs and seeing a dramatic return to profitability and record sales, they were also successfully implementing national fuel economy and greenhouse gas standards, and in so doing, transforming the vehicles Americans and the world drives.

Americans continue to want more from their vehicles, while spending less at the pump, and have consistently shown strong support for improving vehicle efficiency.[3] Under standards promulgated in 2010 (for 2012-2016) and in 2012 (for 2017-2025), automakers are on track to dramatically improve fuel economy from an average real world fuel economy of 22 miles-per-gallon (mpg) in 2011 to more than 36 mpg in 2025.[4] Under federal rules, which rely on treadmill tests and credit systems, these real-world ratings translate to 28 mpg and 51 mpg in regulatory language, respectively.

Fuel economy standards adjust with the mix of cars and trucks, ensuring that no matter how the market shifts, each size of vehicle makes gradual but steady progress. Thus, even during times of low gas prices, automakers have been able to comply with the standards while also increasing sales of larger vehicles such as SUVs and pickups. Big fuel savings in popular vehicles have translated into record-high fuel economy in vehicles of all sizes, big pollution reductions, record sales, and strong profitability.[5]

Standards Have a Been a Critical Part of this Recovery

Standards have not only brought savings to drivers of all types of vehicles, but they have also played a key role in the industry recovery, rebuilding a robust automotive supply chain, and securing and growing jobs in the industry.

Sound long-term targets have provided the greater certainty needed to invest in developing far more efficient technology and to retool and rebuild the automotive sector to manufacture a new generation of vehicles. These efficient advanced vehicles now compete and lead in domestic and global markets. At the same time, sound manufacturing policies and decisions helped ensure that more of the investment to transform technology and manufacturing in this sector took place in America.

Our analysis looks at the role thousands of American factories—and hundreds of thousands of American workers—play in deploying new, cutting edge automotive technology.

II. SUPPLIER INNOVATION IS CRITICAL TO FUEL ECONOMY AND ECONOMIC GAINS

A single vehicle typically has thousands of components built by dozens to hundreds of companies across the United States and around the globe. These components determine a vehicle's performance, safety, connectivity, fuel savings, and many other features.

Since 2011, the auto industry has impressively met—and in many cases exceeded—fuel economy standards as familiar cars, SUVs and trucks have become significantly more efficient. Achieving these gains is a result of

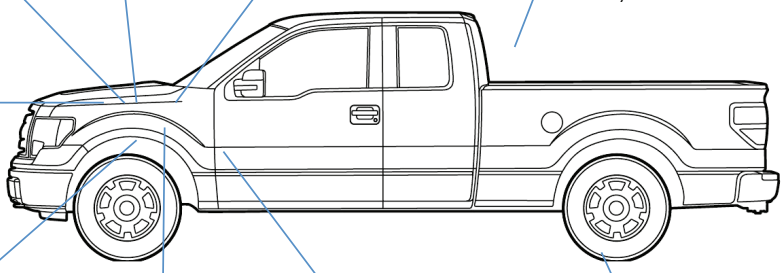
innovation and investment by major automakers, such as General Motors and Ford, and by thousands of auto suppliers that produce the components and materials that go into these vehicles.

To achieve fuel economy gains, the industry has adopted a variety of key technologies across the vehicle. These include advanced gasoline and diesel engines and transmissions, including components like turbochargers; increased us of hybrid and electric propulsion technology; lightweight body, frame and component materials and improved aerodynamics; more efficient ancillary systems such as electric power steering, and many more. These technologies are saving consumers billions at the pump, and they often provide ancillary benefits, such as improved power and performance and enhanced safety.

The 2011 Supplying Ingenuity report found that suppliers were already manufacturing a first round of new components and technology to meet the 2012 standards.[6] Today we see many of the same companies—and new ones—building the next generation of advanced technology.

The diagram below illustrates the technology change underway and examples of the U.S. suppliers of this added or enhanced technology.

FIGURE 1: Examples of U.S. Suppliers of Fuel Efficient Vehicle Components



Note: Many addition US manufacturers produce each of these technologies . Indicators of growth are drawn from agency , industry and press reports.

It's important to note that while numerous companies are already producing fully electric or plug-in hybrid electric vehicles, federal agencies estimate that only a very small percentage of electric or full hybrid vehicles are necessary to meet the standard. As a result, ongoing rapid innovation in advanced conventional powertrain, lightweight materials and integration of electric drive components into gasoline vehicles is expected to be the bulk of technology deployed between now and 2025. In fact, more rapid-than-expected deployment of EVs might make the standards easier for automakers to meet. At the same time, EV research, development and technology deployment complements efforts to meet standards, as technologies developed for EVs crossover into applications—such as start-stop and regenerative braking—that make conventional vehicles more efficient.

In a recent technical assessment report reviewing technology adoption under the first five years of the light-duty standards, the U.S. Environmental Protection Agency (EPA) and the Department of Transportation's

National Highway Traffic Safety Administration (NHTSA) found that advanced conventional technologies—both those identified in 2012 and others that had not been anticipated—were taken up more rapidly than anticipated at the time of the original rulemaking, and that the industry was on track to meet 2025 standards at reasonable cost.[7]

Our analysis shows these new technologies are being built today in factories all across America.

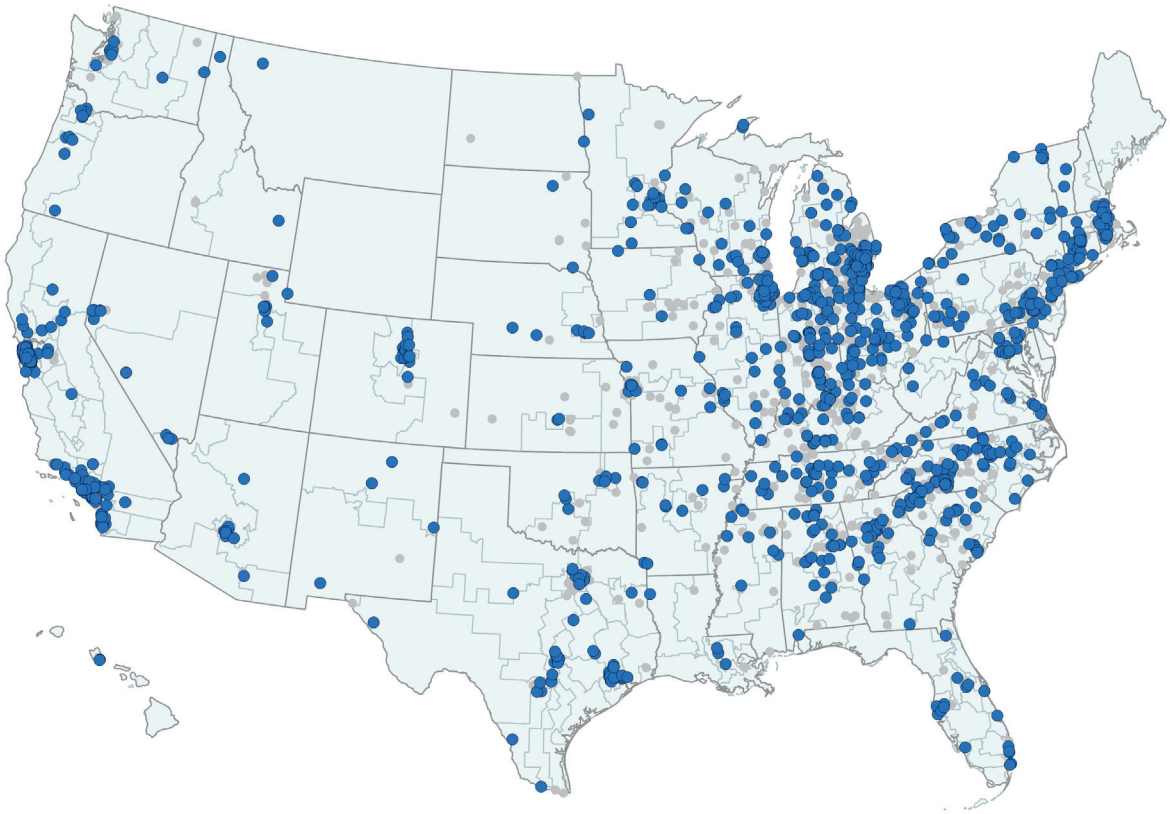
III. SUPPLYING INGENUITY: U.S. MANUFACTURING OF CRITICAL FUEL-EFFICIENT TECHNOLOGY

While innovation to build the next generation of vehicles reaches into virtually every part of the auto industry in some way, our analysis looks at just one industry sector, component manufacturers making the types of technologies specifically identified by EPA and NHTSA as contributing to meeting efficiency, GHG, and energy security goals.

Our analysis found more than 1,200 facilities in 48 states making the components and materials that go directly into improving fuel economy.

Suppliers of Fuel-Efficient Vehicle Technology – 1200+ Facilities

(Automotive Assemblers and Other Suppliers in Gray)

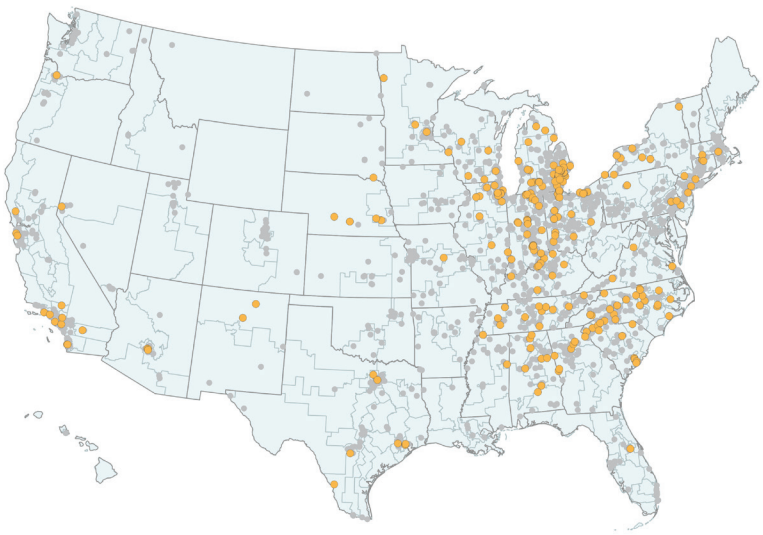


The companies analyzed in this report, shown in blue above, are part of an integrated automotive supply chain that includes hundreds additional facilities, shown in gray, building related technologies and assembling these technologies into cars, SUVs, and trucks in showrooms today.

FACILITIESTHAT PRODUCE FUEL-EFFICIENT COMPONENTS, MATERIALS AND TECHNOLOGY BY TYPE

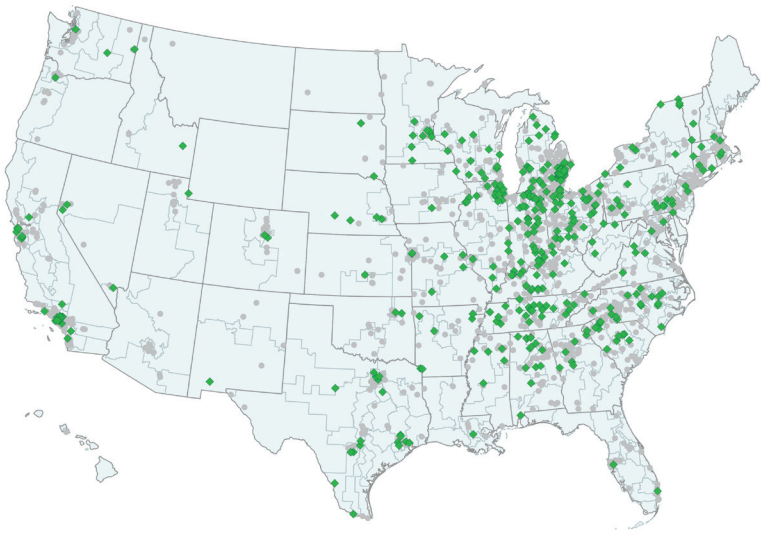
Advanced Gasoline or Diesel Powertrain Technology – 250+ Facilities in 30 States

(Automotive Assemblers and Other Suppliers in Gray)



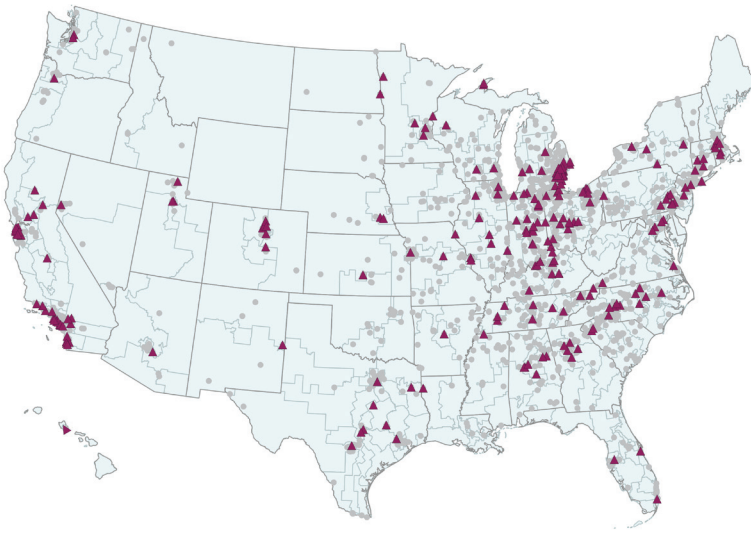
Advanced Materials and Common Components – 400+ Facilities in 42 States

(Automotive Assemblers and Other Suppliers in Gray)



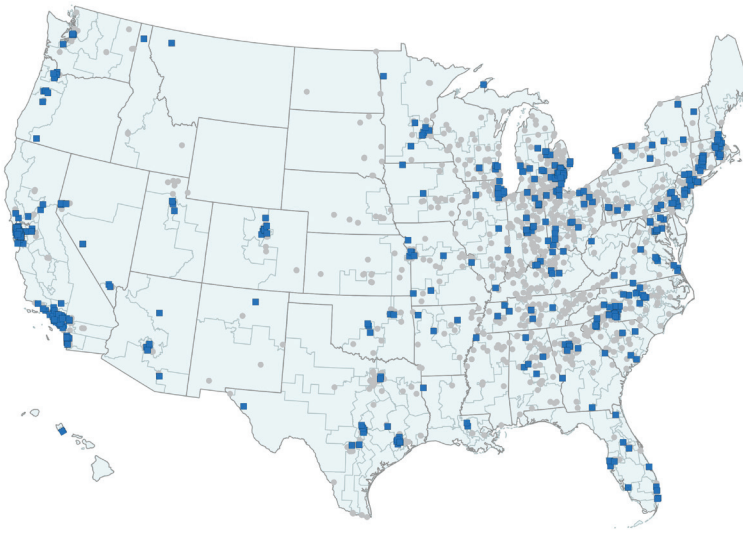
Hybrid, Alternative Fuel, Natural Gas Vehicle Technology – 250+ Facilities in 38 States

(Automotive Assemblers and Other Suppliers in Gray)



Electric Vehicle, Battery and Related Technology – 500+ Facilities in 43 States

(Automotive Assemblers and Other Suppliers in Gray)



The companies we assess develop and produce the full range of technologies that improve fuel economy and cut carbon emissions, from lightweight automotive steel and aluminum, and advanced engines and transmissions, to electric motors and batteries, and many more. They range from facilities owned by major automakers and suppliers employing thousands of people, to small, locally owned manufacturers with just a few employees.

These companies are clustered in the industrial Midwest, Southeast, California and Texas, but there is significant advanced component and technology manufacturing in almost every state east of the Mississippi, on both coasts, and in smaller clusters in the plains and southwest. What's more, innovation is taking place across all the major types of technology we reviewed in every region. For example, while Indiana has long been a leader in heavy truck manufacturing and is host to diesel engine and heavy-duty transmission innovators, it is also home to innovation in hybrid and electric drive technology. California is seeing growth in auto assembly; union steel mills in Ohio are bringing back jobs developing and producing cutting edge automotive materials; Texas is making the components that go into far more fuel-efficient SUVs; South Carolina is building advanced gasoline engine technology and electric buses.

TABLE B: Top 15 states by number of facilities engineering and manufacturing fuel efficient components (top 10 in bold).

State	Number of Facilities
Michigan	**200+**
California	**180+**
Ohio	**80+**
Indiana	**70+**
Texas	**50+**
North Carolina	**50+**
Illinois	**45+**
New York	**40+**
Tennessee	**35+**
South Carolina	**35+**
Kentucky	30+
Pennsylvania	30+
Massachusetts	25+
Alabama	25+
Georgia	25+

Note that states will rank differently if ranked by automotive employment.

While the upcoming *Supplying Ingenuity II* report identifies more than twice as many facilities as we did in our 2011 report,[8] our methodology does not allow us to compare the results of the two studies directly. Looking qualitatively at companies found in both studies, however, we see firms continuing to innovate and grow, reinforcing a larger industry trend in which innovation and recovery throughout the supply chain has been transformative.

IV. MAINTAINING THE MOMENTUM: JOB GROWTH DEPENDS ON ONGOING AUTOMOTIVE INNOVATION, INVESTMENT AND MANUFACTURING IN AMERICA

The automotive recovery of the past decade depends significantly on the overall economic rebound, but the recovery of U.S. automotive jobs and manufacturing is enhanced by fuel efficiency standards and innovation, and by policies that encourage domestic reinvestment in manufacturing the next generation of technology. Ongoing fuel economy and manufacturing leadership will be critical for continuing to sustain and grow jobs in this sector. By contrast, stepping back from these policies would retard progress and put jobs at risk.

Since 2010, studies predicted that fuel economy standards would result in adding jobs above and beyond business as usual automotive investment.[9] They argued that this would happen indirectly as households and businesses spend less on gasoline, with net gas savings going into other spending categories, such as retail and food.[10] In addition, standards would drive direct job growth in manufacturing as a result of enhanced investment to develop, manufacture and incorporate additional automotive technology necessary to improve fuel efficiency. Studies also showed that the degree of job growth we see from automotive innovation is deeply dependent on what share of that new technology is not just invented—but built—in the U.S.[11]

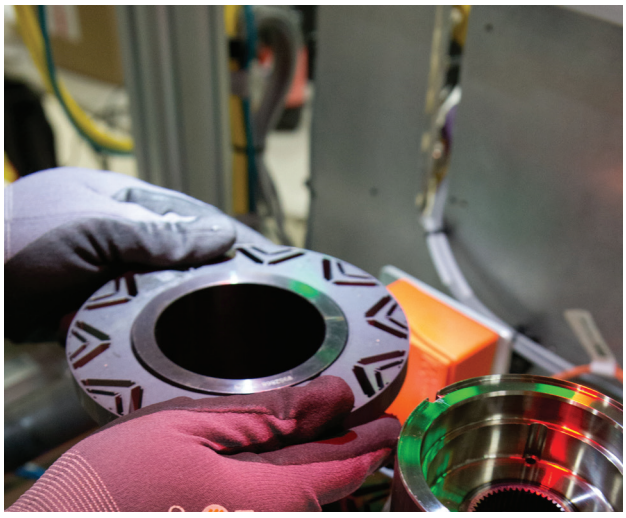
Today we're seeing these predictions of growth play out in practice in the companies we identify in this report. In addition:

- Companies are investing more. Over the past decade, automakers and suppliers have invested more than $100 billion in American factory expansion and retooling. Not only is this many times the amount they invested in Mexico over the same period, but it appears to greatly exceed investment in American auto factories before the recession, during a comparable period of high sales—but of industry stagnation.[12]
- The industry is increasingly resilient. Where the industry was once blindsided by volatile oil prices, in recent years the wider range of domestically manufactured fuel-efficient vehicles of all sizes has helped keep domestic sales strong as gas prices rise and fall. As fuel-efficiency improves, the American automotive sector is increasingly insulated against gas price volatility. A recent report by Ceres found that implementing strong standards through 2025 insulates automakers and suppliers against risks to market share and profits should gas prices rise.[13]
- The sector has led manufacturing job growth. Since the recession, job growth in the auto industry preceded and exceeded growth in other manufacturing sectors, and has been a bright spot for several industries otherwise negatively impacted by adverse global trade and market conditions.[14]

Across the automotive supply chain, American manufacturing is proving that it can compete and lead while keeping hundreds of thousands of Americans hard at work.

Sustain Sound, Bipartisan, Broadly Supported Action

Today's standards are rooted in a critical bipartisan agreement in the 2007 Energy Bill—the Energy Independence and Security Act (EISA)—that put fuel economy regulation on a new path. In conjunction with requiring agencies to set a new generation of much more stringent standards, Congress made several smart choices that remain part of standards today. It required a flexible, competitively neutral standard that adjusts along with the market and consumer preferences for smaller or larger vehicles. By encouraging fuel economy improvement across all sizes of vehicles, it also spurred broader innovation and consumer benefits. Congress also recognized that the new regulations would drive investment, but that for American communities and the economy to fully benefit, it was critical to manufacture that technology in America. It established programs at the Department of Energy, which continue to aid companies in building, expanding or retooling advanced auto or components factories in the US. In addition, when automakers faced bankruptcy in 2009, Congress approved the auto recovery loans, which were critical to retaining the automotive supply chain in the U.S. and were repaid by 2013 by a resurgent industry.



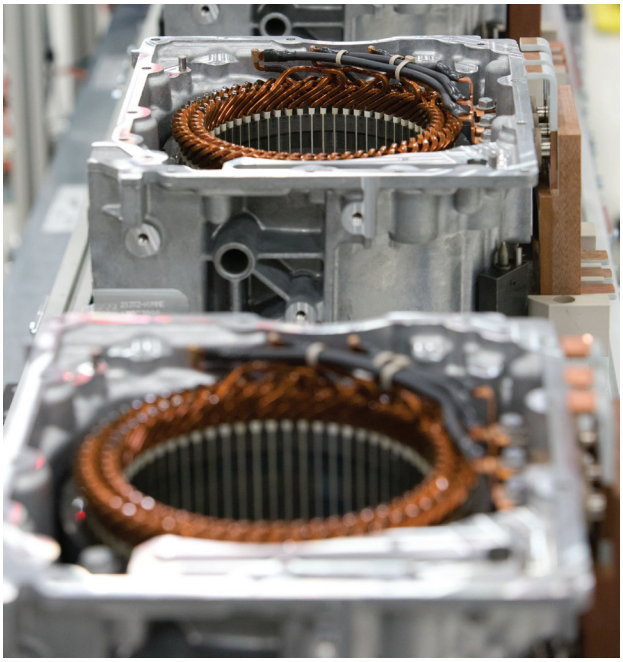
Since 2010, federal agencies and the State of California have developed and implemented tighter standards through a process that repeatedly engaged stakeholders and conducted deep technical analysis, resulting in rules that have been broadly supported by industry, labor, environmental and consumer groups.

Earlier this year, the three agencies (EPA, NHTSA, and the California Air Resources Board) conducted a thorough technical review of standards applying to model years 2022 to 2025. Based on the detailed analysis and feedback from stakeholders, the EPA has proposed that the standards remain as originally set.

V. POLICY RECOMMENDATIONS

Our analysis identified more than 1,200 facilities in 48 states building key technologies that go into meeting fuel economy standards. Over the past decade, America has done much to reverse a devastating decline in a core industry and returned it to competitiveness and growth. Continuing this trajectory depends on staying the course on the standards, policies and actions that made this transformation possible.

- Effective, long-term standards are critical to maintaining robust advanced technology investment, innovation, and job growth, as well as to continuing to position the domestic industry as a global leader.
- Policies that bolster fuel economy, domestic manufacturing, and family-supporting jobs must work together to ensure American workers and communities see real economic and environmental benefits from continued innovation in the automotive sector.



This photo and photo on previous page: U. S. electric motor manufacture for EVs. Both photos courtesy of General Motors.

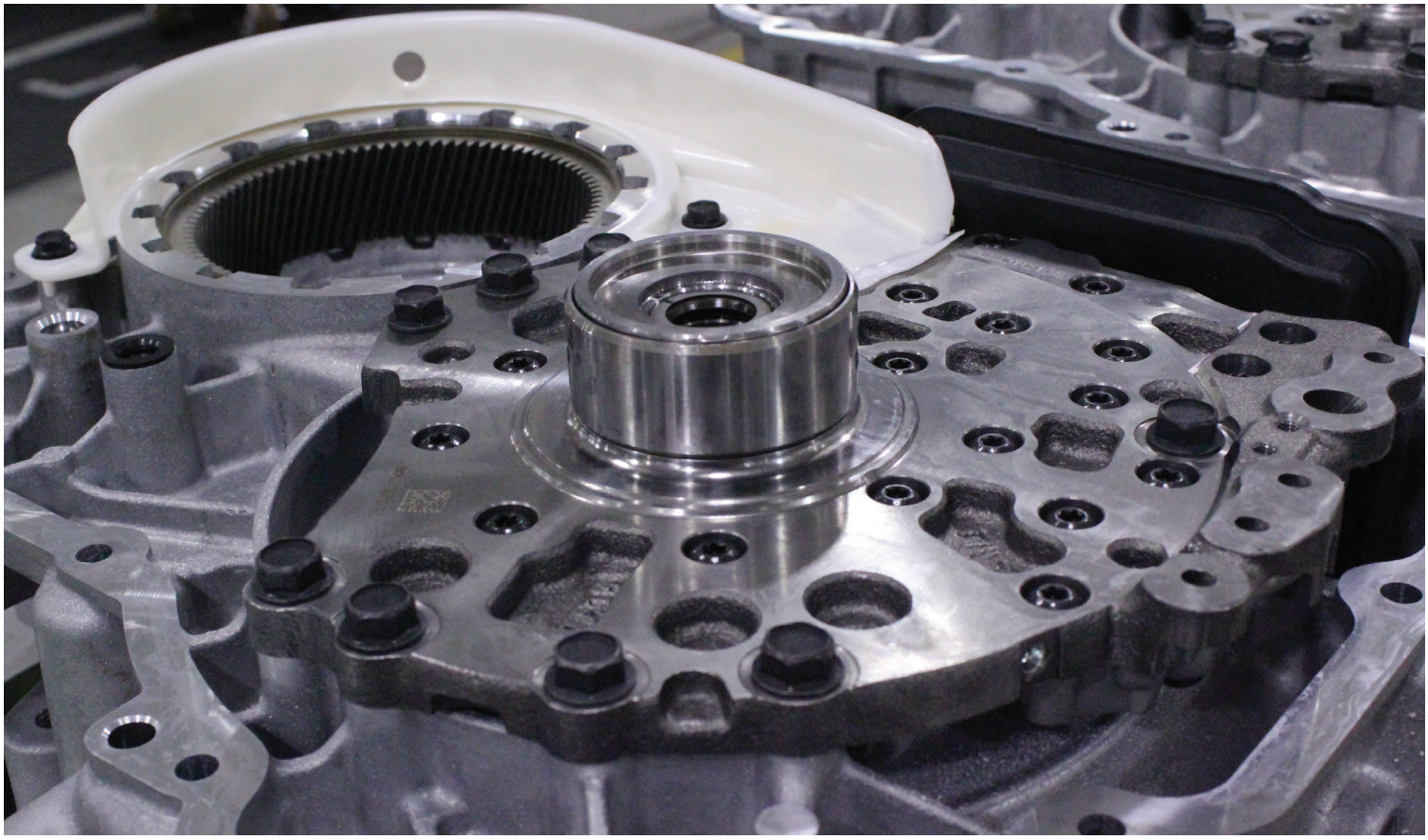
A strong economy depends on securing advanced manufacturing and jobs today while at the same time leading in capturing jobs in the emerging technologies of tomorrow.

This is a time to drive forward.

VI. ACKNOWLEDGEMENTS AND METHODOLOGY

This factsheet provides a preview of analysis carried out for *Supplying Ingenuity II*, a report to be released in early 2017. Research was carried out by Baum & Associates, the BlueGreen Alliance, and the Natural Resources Defense Council (NRDC). The report updates a 2011 report, *Supplying Ingenuity* released by NRDC, National Wildlife Federation, and the United Auto Workers, and based on research by many of the same individuals.

The companies identified in this factsheet come from proprietary databases developed by Baum & Associates, the BlueGreen Alliance, and the NRDC. Company level exploration of the data will be possible in conjunction with the release of the full report. Our research methodology builds a picture of the full clean vehicle value chain from company-level research. It includes companies/facilities wholly focused on fuel –efficient technologies, systems or components and those for whom these technologies are one part of a broader product line. As a result, it includes a broader range of technologies and companies than are included the BLS motor vehicles and parts definition, but it may also provide a less complete survey of any single technology or category. In other words, we are unlikely to capture every company in the auto sector, but we are more likely to capture manufacturing facilities technically outside the sector—such as a steel mill making dedicated lightweight automotive sheet—that are nonetheless important to understanding the scope of the industry and its impact on jobs and the American economy.



ENDNOTES

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