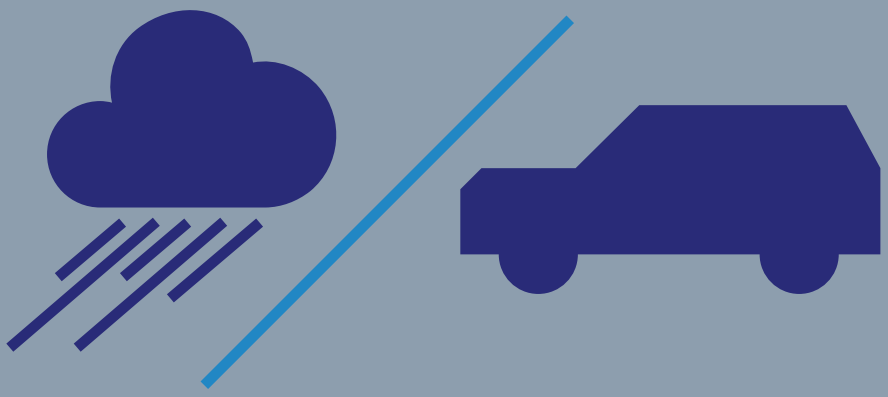

SEVERE WEATHER AND AUTOS

COMPARING THE COST OF CLIMATE CHANGE & DROUGHTS, STORMS, AND EXTREME TEMPERATURES WITH THE COST OF NEW CARBON EMISSIONS STANDARDS FOR POWER PLANTS

2015 Update

BUSINESSFORWARD FOUNDATION

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PREFACE

On June 2014, we issued our first report on the impact of climate change on American auto manufacturing. That report compared the costs associated with climate change to the potential costs of new Environmental Protection Agency (EPA) standards designed to reduce the amount of carbon American power plants emit. At the time, the EPA projected its draft standards could increase electricity rates by 6.2 percent in 2020. In August 2015, the EPA issued final standards, which are projected to increase rates by about half as much (3.2 percent). This update of our June 2014 report reflects these new, lower EPA cost estimates.

INTRODUCTION

On August 3, 2015, the Environmental Protection Agency (EPA) published final greenhouse gas standards for existing U.S. power plants. States may choose from a variety of options to meet the standards, including energy efficiency investments and relying more on natural gas or renewable energy.

The EPA estimates that utilities will increase their rates by 3.2 percent (in 2020)[i] to pay for the investments these new standards require. The standards' true impact on rates will vary from state to state. Moreover, rates will be determined by much larger forces, including the strength of our economy (which drives demand for energy).

Critics of the EPA standards argue that increasing manufacturers' electricity costs will encourage them to move automotive production overseas. The merits of this argument depend largely on two questions: (1) How much of an auto manufacturer's costs does electricity represent, and (2) How will a 3.2 percent increase affect the manufacturer's global competitiveness?

Proponents of the EPA standards argue that America must reduce its carbon emissions in order to reduce climate change. This argument raises a third question: How much does severe weather affect auto manufacturers' costs?

In answering these questions, we compare: (1) the cost of reforms intended to address severe weather with (2) the costs manufacturers face from severe weather itself.

EXECUTIVE SUMMARY

AUTO MANUFACTURERS AND SUPPLY CHAIN RISK

Automakers and auto parts suppliers are America's largest manufacturers (by revenue and by employment). Their supply chains are the largest, most complicated, and most important to our economy. For automakers and their suppliers, supply chain expenses are 75 percent of their total costs.[ii]

These supply chains operate on a just-in-time basis that requires factories to operate with as little as two to four hours of parts inventory on site. Just-in-time delivery saves manufacturers money on overhead, but it also makes supply chains more vulnerable to disruptions, like severe weather. Because supply chains are global, disruptions on the other side of the planet can slow down or shut down an American factory.

SEVERE WEATHER'S IMPACT ON AUTO MANUFACTURERS

Historically, U.S. factories have incurred four unexpected disruptions each year, causing 20 hours of factory downtime on average.[iii] Causes include mechanical failure, power outages, and supply disruptions. But large weather disasters are becoming more frequent.

Over the past four years, American factories have been disrupted by typhoons in Thailand, hurricanes in the Gulf of Mexico, droughts in Texas, tornadoes in Kentucky, erratic water levels across the Great Lakes, and flooding in the Northeast. The total impact per facility, per year, is far greater than the 20 hours of unexpected downtime a plant has historically experienced.

For each hour an assembly line is shut down due to severe weather, the plant loses $1,250,000.[iv]

TRENDS AGGRAVATING SUPPLY CHAIN RISK

First, as supply chains grow and become more global, they become less transparent. Second, small businesses, which dominate the lower levels of supply chains, are less likely to survive catastrophic events. Third, our infrastructure is aging, while congestion is growing. Fourth, disruptions cost more at plants operating at full capacity.

ELECTRICITY USAGE, POTENTIAL IMPACT OF EPA STANDARDS

Electricity represents 0.9 percent of an automaker's costs and 0.75 percent of a parts supplier's total costs, on average.[v] The total cost of electricity used from rolled steel through final assembly is about $105 per car or truck.[vi] A 3.2 percent increase on that cost would increase that automaker's assembly costs by less than $3.50 per car or truck (in 2020). The average car sells for about $30,000.

COMPARISON OF ELECTRICITY COST INCREASE TO A FINAL ASSEMBLY PLANT VS. COST OF ASSEMBLY LINE DISRUPTION

About $60 of the $105 parts suppliers and automakers spend on electricity (per car) is consumed at the final assembly plant. If 1) per car electricity costs for an assembly plant ($60) increase by $1.92 (3.2 percent); 2) a plant assembles 300,000 vehicles each year; and, 3) it has typical downtime costs ($1,250,000 per hour), the increase in the plant's electricity-related costs ($576,000) is less than the cost of losing 30 minutes of production time.

During the winter of 2014, several assembly plants lost days of production to severe weather.

SEVERE WEATHER COSTS AN AUTO ASSEMBLY PLANT MORE

IN 30 MINUTES

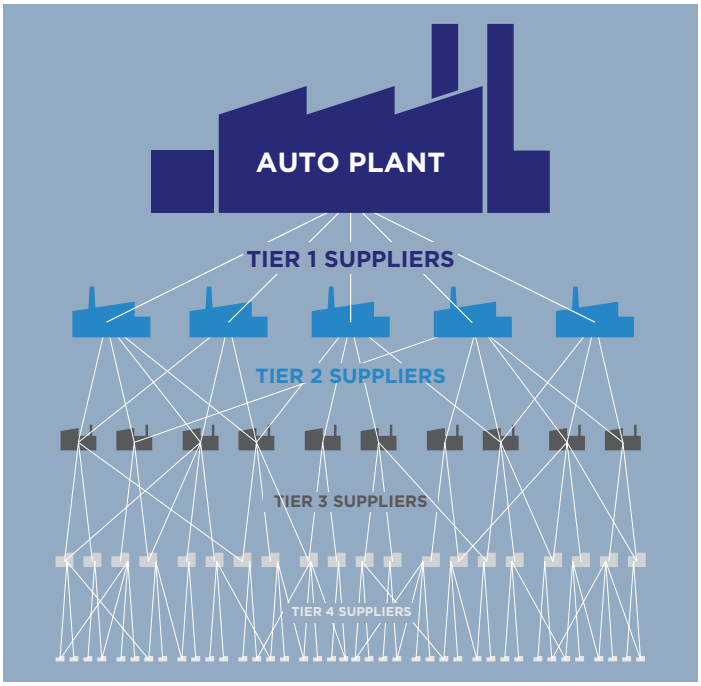
THAN EPA STANDARDS WILL COST IT OVER AN ENTIRE YEAR.

SCALE AND INTERDEPENDENCE OF 21ST CENTURY SUPPLY CHAINS

SCALE

Over the past 50 years, the auto industry has transformed from one in which the major automakers purchased raw materials and made all of their own parts to an industry that has outsourced nearly all production, except for the final stage of assembling a motor vehicle. As a result, the bulk of an assembly plant's expenses (75 percent) come from its supply chain.

Cars and trucks sold in the U.S. contain between 8,000 and 12,000 different components, made from as many as 15,000 different parts.[vii] A mid-size sedan contains 3,000 pounds of steel, aluminum, glass, rubber, copper wiring, and electronics. A typical assembly plant purchases $3 billion worth of parts each year. Parts typically arrive by truck, and those trucks arrive every three to five minutes, nearly 24 hours each day.



COMPLEXITY

Automakers' 44 assembly plants rely on 61 engine, transmission, and stamping plants, as well as thousands of supplier manufacturing facilities nationwide. These supplier plants are concentrated in Alabama, Georgia, Illinois, Indiana, Kentucky, Michigan, Mississippi, Missouri, Ohio, Pennsylvania, South Carolina, Tennessee, and Texas. Together, those 44 assembly plants deliver more than 10.5 million vehicles to 17,000 dealerships across the U.S.

Auto supply chains are highly specialized and vertically integrated. More than 5,600 companies produce auto parts in the U.S. Tier 1 suppliers produce finished seats, wheels, tires, interior components, air bags, entertainment systems, brakes, exhaust systems, and other large components. To produce these parts, the Tier 1 suppliers rely on Tier 2 suppliers for stamped parts, rubber products, plastic components, and electronic components. Tier 2 suppliers rely, in turn, on Tier 3 suppliers, who manufacture basic items such as ball bearings, screws, lubricants, joining compounds, and various rubber and plastic parts. Beyond the Tier 3 suppliers are Tier 4 suppliers who produce rolled steel, plastic polymers, leather, fabrics, and other basic materials.

Because each supplier serves more than one other supplier or plant, and because components can move back and forth from factory to factory as they are produced, these four tiers of suppliers operate less as a chain and more as a network. For example, an automaker with plants in Michigan and Ontario, Canada, estimates that some of its parts will cross the U.S.-Canada border seven times before they are installed in a finished car or truck. The result? Every day, that automaker's U.S. plants rely on the timely arrival of 600 trucks crossing the Windsor-Detroit border.[viii]

GLOBAL

About half of the parts that go into making a car or truck sold in the U.S. are imported from other countries. Approximately 20 percent of those parts come from other continents, with the bulk of those coming from Asia.[ix]

Many of the auto industry's most important parts suppliers operate in regions or countries that are highly vulnerable to rising sea levels, severe storms, and extreme temperatures. In a May 2014 report, S&P ranked nations according to their vulnerability to climate change. The bulk of nations scoring worst were deemed vulnerable because their populations, cities, and factories are concentrated at low elevations, close to shore. Of 116 nations measured, several key auto parts supplying countries scored in the bottom quartile, including Thailand, Malaysia, Philippines, Vietnam, and Bangladesh. China, one of America's biggest parts suppliers, ranked 83rd out of 116 in terms of climate change resilience.[x]

SPEED

Today's supply chains also move at increasingly fast speeds due to the auto industry's increasing reliance on just in time inventory. In practice, just in time manufacturing means that a plant maintains only two to four hours worth of materials at the assembly plant at one time. In other words, an efficient plant should have only enough parts and materials on its shelves to operate for two to four hours before shutting down. The reason? Having one extra hour's worth of production parts onsite to prevent a shutdown costs as much as $950,000.[xi]

If all goes according to schedule, this practice is highly profitable, but if supplies are disrupted, that same plant shuts down. Each hour of down time costs the automaker $1,250,000 or more. To encourage suppliers to arrive on time, automakers penalize suppliers as much as $10,000 for every minute their shipments are late. Faced with these penalties, a supplier whose trucks are delayed will often hire a helicopter to deliver a substitute shipment.

TRADEOFF BETWEEN EFFICIENCY AND INTERDEPENDENCE

Specialization is meant to maximize each individual plant's efficiency. Sourcing globally is meant to reach low-cost providers. Just-in-time is meant to reduce overhead. But each of these characteristics also makes the auto supply chain vulnerable to disruption, including disruptions caused by droughts, storms, and extreme heat and cold. Because assembly plants are so large, so are these risks.

EACH HOUR OF DOWN TIME COSTS AN ASSEMBLY PLANT

$1.25 MILLION.

COSTS OF SEVERE WEATHER

HISTORIC DISRUPTION RATE

According to a survey of manufacturers across all industries, the average factory incurs four unexpected disruptions each year, causing 20 hours of assembly line downtime, on average.[xii] Causes include mechanical failure, power outages, and supply disruptions.

CURRENT DISRUPTION RATE, RECENT EVENTS

Temperatures from 2001 to 2014 were warmer than any previous decade in every region of the United States. For the contiguous 48 states, 13 of the 15 warmest years on record have occurred in the past 15 years. Large weather disasters, or weather events causing more than $1 billion in damages, are becoming more frequent. The country experienced 20 weather disasters in the 1980s, 47 in the 1990s, and 48 in the 2000s; but in just the past five years, 49 weather disasters have occurred, more than double the pace of the previous two decades.[xiii]

Because auto supply chains are global, American assembly plants are also affected by severe weather in other countries.

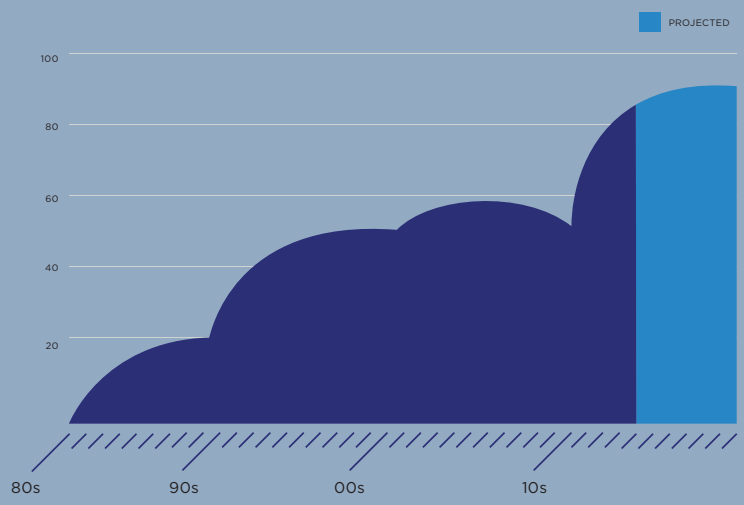
In 2010, when storms in Asia flooded more than 1,000 factories across Thailand, auto parts shipments from that country ceased. Nineteen days later, U.S. assembly plants across the U.S. began slowing down or shutting down. Some did not return to normal production for a full month.

IT TOOK ONLY

19 DAYS

FOR FLOODS IN THAILAND TO SHUT DOWN AUTO PLANTS IN THE MIDWEST.

DAMAGES FROM EXTREME WEATHER EVENTS COST THE U.S. MORE THAN $200 BILLION.



Projection based on 2010-2013 events.

EXAMPLES OF SUPPLIER DISRUPTION

SHIPPING

American auto plants rely on shipments of materials and parts shipped across the Great Lakes. Recent droughts have reduced Lake Michigan and Huron water levels to all-time lows, forcing shippers to leave cargo behind. This allows the ship to float higher in the water, reducing its draft. To gain a single inch of waterline, a large cargo ship must dump 270 tons of cargo. If that ship were carrying mid-size sedans, that inch would require the captain to leave about 90 cars on the dock.

In 2013, Lakes Huron and Michigan were 23 inches below their normal levels. Ships crossing those lakes carried 6,000 fewer tons per trip than they carried in 1997 (from 71,000 tons to 65,000 tons). That 8 percent drop in cargo meant lost revenue to the shippers and higher prices for the businesses that rely upon them.[xiv]

HIGHWAYS AND BRIDGES

The bulk of parts produced in the U.S. are shipped by truck for at least part of their journey. Imported parts arrive by ship and typically move by train but are shipped by truck from rail line to plant. The volume is enormous and so are the costs of severe weather disruptions. One automaker with plants in Michigan and Ontario reports that it ships approximately $4 billion worth of parts between the U.S. and Canada each year. More than 600 of its suppliers' trucks cross the Ambassador Bridge (which connects Detroit, Michigan, and Windsor, Ontario) every day. When a winter storm in 2010 closed Highway 402 near Port Huron, Michigan, officials diverted traffic south to the Ambassador Bridge, causing day-long delays for shippers. Plants in both Michigan and Ontario experienced parts shortages and shut down production lines.[xv]

Severe storms in 2014 slowed or stopped production at factories across the country. One plant in Indiana, which previously had experienced little snow-related downtime, lost five days of production to heavy snow during the winter of that year.

PORTS

Automakers rely heavily on parts shipped to ports in Norfolk, Virginia; Mobile, Alabama; and Los Angeles, California. Because of their location and elevation, the Mobile and Norfolk ports are considered to be two of the country's most vulnerable to hurricanes and other severe weather.

RAIL

Severe heat and drought has compromised Union Pacific railroad lines across Texas, causing delivery delays for the state's two assembly plants and its more than 100 auto suppliers.

To gain one inch of draft, large cargo ships have to leave 270 tons of cargo on the dock. That's the equivalent of 90 mid-size sedans.

BUSINESS TRENDS INCREASING SEVERE WEATHER RISKS

Four industry trends threaten to increase supply chain risk substantially:

1. As supply chains grow and become global, they become less transparent. A plant or supplier may not know where all of its parts are sourced. For example, in a study of the industrial impact of the 2010 Thailand floods and 2011 Japan tsunami, nearly half of the production disruptions affecting automakers and electronics manufacturers were caused by lower tier suppliers that the manufacturers *did not know*.[xvi]

2. Small businesses, which dominate the lower levels of the auto supply chain, are less likely to survive catastrophic events. Tiers 2 and 3 of the supply chain are comprised largely of small businesses (typically fewer than 250 employees per location).[xvii] Disasters have a disproportionate impact on small and medium-sized enterprises. According to the U.S. Department of Homeland Security, one-quarter of small and medium-sized enterprises do not re-open after a catastrophic event. Because they have smaller cash reserves, tend to operate out of a single location, and are less likely to have backup systems, they have a harder time relocating.

3. America's infrastructure is aging, while congestion is growing. A study by the Texas Transportation Institute found that peak traffic periods (rush hours) have expanded to six hours per day, while off-peak hours have grown more congested. Across America's 498 urban areas, only one in nine trips were disrupted by traffic congestion in 1982. By 2011, one in four trips was disrupted. During this same period, the number of delays for commuters more than doubled.[xviii]

4. Disruptions cost more at plants operating near full capacity. Automotive manufacturing is a highly capital-intensive business, so automakers' profits depend largely on how well they manage the number of plants they build and use. Building a new plant costs more than $1 billion; having a plant that is underutilized or offline can cost hundreds of millions of dollars each year. For that reason, an automaker cannot compete unless its plants operate near full capacity. While a plant operating at 50 percent capacity can make up for a lost shift over time, a plant operating at full capacity loses that production entirely.

ELECTRICITY COSTS FOR MANUFACTURERS

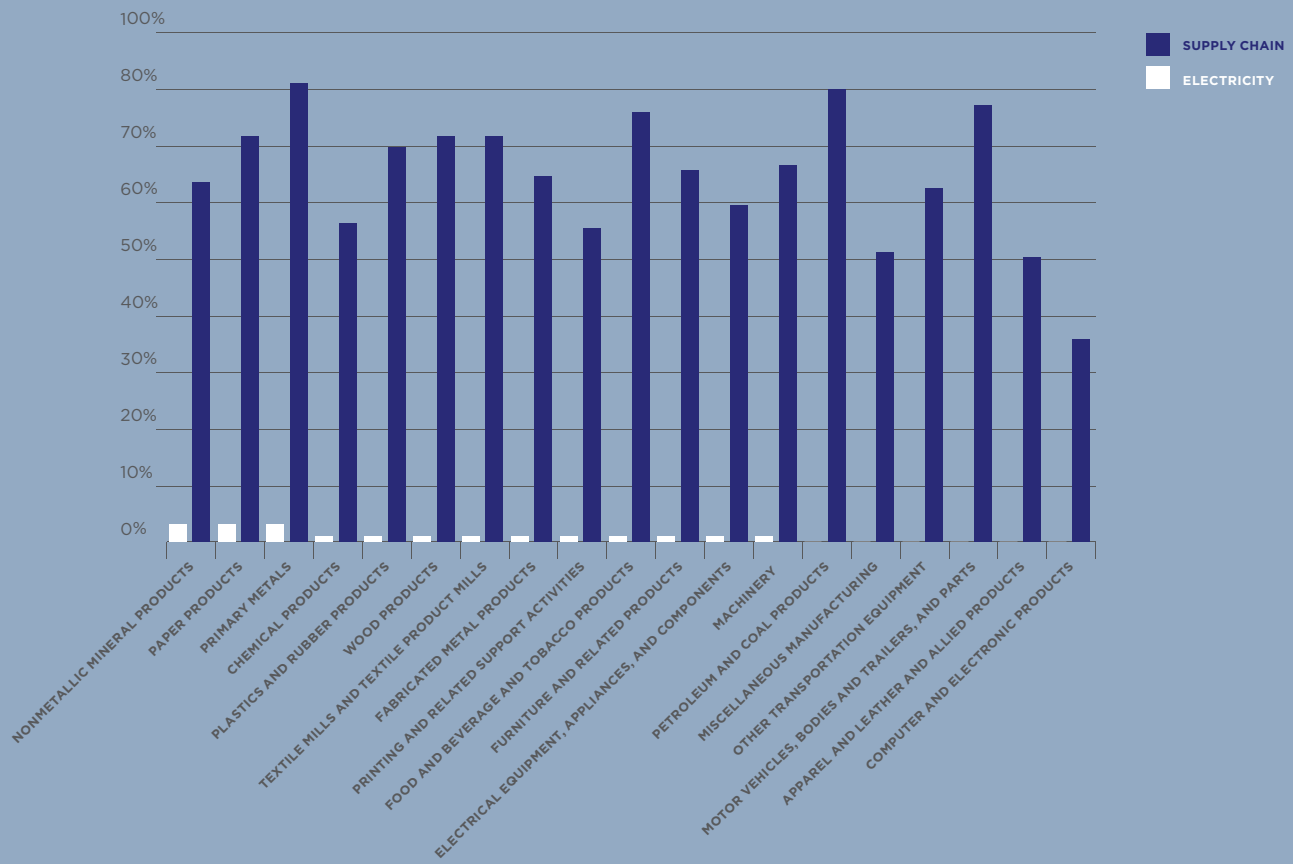
CURRENT ELECTRICITY USAGE

Assembly plants use a great deal of electricity, but it represents less than 0.9 percent of their total expenses. Labor costs, supply chain costs, and facilities (including taxes and land) represent 10, 75, and 14 percent, respectively. Because suppliers produce a wide range of parts and materials, their cost of electricity varies. On average, their electricity costs represent 0.75 percent of their total costs.

Automakers and suppliers are investing heavily in energy efficiency, which has caused their use of electricity to drop. A leading automaker announced in 2014 that it had reduced the energy use at its plants by 22 percent over the past eight years. It expects to reduce its usage by another 25 percent in the next three years. Other industries have taken similar steps. This is one reason why electricity usage by industry declined by 10 percent from 2000 to 2013. Industry's consumption of fossil fuels dropped by eight percent during that same period.

SUPPLY CHAIN AND ELECTRICITY COSTS BY INDUSTRY

(Percent of Total Costs)



IMPACT OF 3.2 PERCENT ELECTRICITY RATE INCREASE ON AUTOMAKERS AND PARTS SUPPLIERS

Because electricity represents such a small part of an assembly plant's total costs, an increase in that cost has a comparatively small impact.

Assembly Plant Economics. A final assembly plant consumes approximately $60 of electricity per car. If those costs rise 3.2 percent in 2020 as a result of the EPA's new standards, the assembly line's cost (per car) rises $1.92. If a plant assembles 300,000 vehicles each year, the increase in the plant's annual electricity-related costs ($576,000) is less than the cost of losing 30 minutes of production time ($1,250,000 per hour, multiplied by 0.5).

Under the EPA's rate projections, the cost of electricity for an entire shift (8 hours) could rise about $960. By comparison, if a plant has the typical downtime cost ($1,250,000 per hour), the cost of losing an entire shift is $10,000,000.

Complete Supply Chain Impact. From steel and glass through final assembly, the cost of electricity per car is about $105. If electricity rates were to rise 3.2 percent in 2020, it would increase a car's costs by .029 percent, or less than three basis points. In other words, a 3.2 percent increase on 0.9 percent of costs would increase that automaker's assembly costs by less than $3.50 per car. The average car or truck purchased in the U.S. sells for about $30,000.

CONTRIBUTORS

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With the help of more than 50 of the world's most respected companies, Business Forward is making it easier for tens of thousands of business leaders from across America to advise Washington on how to create jobs and accelerate our economic recovery. Business Forward, together with its partners and members, have organized hundreds of local briefings with more than 450 senior Administration officials, Members of Congress, mayors, and governors. The Business Forward Foundation is a new, independent research organization that takes a business-minded look at policy issues affecting America's economic competitiveness.

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