



Compete.

Council on
Competitiveness

U.S. Energy & Manufacturing Competitiveness Partnership

Updated August 2015



Meeting the grand challenges—
and even grander opportunities—
of the 21st century demands
an innovation-driven economy
powered by a secure, sustainable,
affordable energy portfolio
and a robust, agile, advanced
manufacturing sector.

**America's ability to compete
in and lead the global
economy through this era
of transformation hinges on
bold, collaborative policy
solutions leveraging America's
total innovation ecosystem—
industry, academia, labor and
the national laboratories—
at the heart of the nation's
productivity and prosperity.**

Welcome

Today, America finds itself at the edge of a new frontier, shaped by the convergence of a distinctly modern breed of energy abundance with America's re-emergent manufacturing sector. Throughout history, these two forces have been essential building blocks of the world's great societies. But today's great challenges—from globalization to climate change to meeting the basic needs of the world's growing population—are forcing us to understand the nexus of energy and manufacturing as a whole more powerful than the sum of its parts.

We are pleased to present the U.S. Energy and Manufacturing Competitiveness Partnership (EMCP)—a collaboration among national leaders from all sectors of the economy committed to deepening our understanding of the complexities of the energy and manufacturing nexus, and building a roadmap to


ensure that America captures the competitiveness opportunity of this new frontier. The EMCP is the vanguard of the movement to dream, discover and deliver the economy of tomorrow—built upon the virtuous cycle of energy for manufacturing, and manufacturing for energy.

Led by the Council on Competitiveness and a coalition of private sector CEOs, university presidents, labor leaders and national laboratory directors, the EMCP will—over the course of this 3-year partnership—build public and private sector strategies to seize this once-in-a-generation opportunity to create unparalleled competitive advantage—the catalyst for a new wave of productivity and prosperity.

We hope you will join us on this journey into America's great new frontier.



Samuel R. Allen
Chairman and CEO
Deere & Company; and
Chairman, Council on
Competitiveness



Jeff M. Fetting
President and CEO
Whirlpool Corporation;
Industry Co-Chair, EMCP



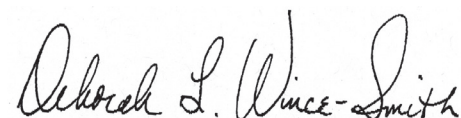
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Vision

For more than two centuries, American industry harnessed the nation's abundance of natural resources, energy, talent and ingenuity to power and unleash the most productive economy in the world.

For the last several decades, however, globalization, recession, regulatory and tax trends, ascendant and increasingly advanced industrial activity around the world, and accelerating changes in consumer demand have buffeted America's industrial and manufacturing enterprises. Since its peak in the late 1970s, American manufacturing employment has fallen from nearly 20 million jobs to just over 12 million¹. America's global leadership in manufacturing output is narrower than ever before—dropping from 30 percent of global output in 2002 to less than 18 percent in 2012.²

This is not to suggest that all is lost. America's manufacturing sector remains the nation's primary driver of research and development, the largest employer of science and engineering graduates in the country and a central catalyst for technology innovation throughout the economy. And, America's energy innovation ecosystem is unparalleled around the world. In one top ten clean energy company ranking, nine of ten were American firms.³ Additionally, America's research universities remain the envy of the world, and with America's entrepreneurial community, leverage the nation's best-in-class intellectual property protections and venture capital assets.

What's clear is that American industry faces an inflection point. Newfound abundance of non-conventional fossil fuel—primarily the proliferation of low-carbon natural gas—heralds lower energy costs, a new generation of energy innovation, and an energy-productivity driven renaissance in manufacturing; and, promises to begin to reverse trends in climate change-inducing greenhouse gas emissions. Concurrently, sky-rocketing global energy demand and prices are creating new markets for energy-generating and energy-saving technologies, products, processes and services—from renewables to energy-efficient appliances and buildings, to energy-conserving manufacturing processes.

In *Make: An American Manufacturing Movement*, the Council declares “the image of manufacturing as dumb, dirty, dangerous and disappearing is inaccurate.” Far from it—today's manufacturing, underpinned by today's energy portfolio, is increasingly “smart, safe, sustainable and surging.”

But to transform this outlook into a clear competitive advantage for industry and workers, business practices, government policies, and strategic investments must reflect the opportunities and needs of the private sector. Capitalizing on the opportunities of America's energy-manufacturing nexus requires overcoming barriers in talent, technology, investment, and infrastructure.

1 Bureau of Labor Statistics, Current Employee Statistics Survey, 1939-2014.

2 Congressional Research Service, “U.S. Manufacturing in International Perspective,” March 2015.

3 Fast Company. “The World's Top 10 Most Innovative Companies in Energy.” February 10, 2014.

We must foster a business environment that cultivates innovation and talent, supports risk-taking and new investment and achieves rapid commercialization and manufacturing at scale. Leveraging the opportunities and meeting the needs of our energy and manufacturing future will be central to U.S. competitiveness.

The Council is prepared to ignite the dialogue and action necessary to achieve these goals. Building upon more than a decade of work on energy and manufacturing policy, the Council launched the **U.S. Energy and Manufacturing Competitiveness Partnership (EMCP)**. This C-suite group of leaders from the private sector, academia, labor and the national laboratories is assessing the challenges faced by America's energy and manufacturing sectors, and will present to national policymakers and private sector leadership a roadmap for concrete actions all stakeholders in our economy must take to leverage the seminal opportunity presented by today's energy and manufacturing landscape.

Critically, this initiative approaches America's diverse industrial landscape not as a monolith, but as a network of distinct but interdependent productive sectors, each with its own challenges and opportunities. The EMCP will explore how cross-cutting factors play out within each sector, identify the discrete factors shaping different sectors and assess common challenges and opportunity threads across all sectors.

EMCP Leadership



Industry Co-Chair

Mr. Jeff M. Fettig
Chairman and CEO
Whirlpool Corporation



Industry Co-Chair

Mr. Mayo A. Shattuck, III
Executive Chairman
Exelon Corporation



University Co-Chair

The Honorable Subra Suresh
President
Carnegie Mellon University



National Laboratory Co-Chair

Dr. William Goldstein
Director
Lawrence Livermore National
Laboratory

A Decade of Leadership in Energy and Manufacturing

The EMCP builds upon and merges more than a decade of leadership in the Council's energy and manufacturing work streams, including most recently the Energy, Security, Innovation and Sustainability Initiative (ESIS, 2008-10) and the U.S. Manufacturing Competitiveness Initiative (USMCI, 2010-13).

The Energy Security, Innovation & Sustainability initiative, led by James Owens, former Chairman and CEO of Caterpillar, Inc.; D. Michael Langford, National President of the Utility Workers Union of America; and, Shirley Ann Jackson, President of Rensselaer Polytechnic Institute, united industry, labor and academia to present a blueprint for America's energy future to the private sector and to the incoming president ahead of the 2008 election.



Energy Security, Innovation & Sustainability Initiative

2003

2004

2005

2006

2007

2008

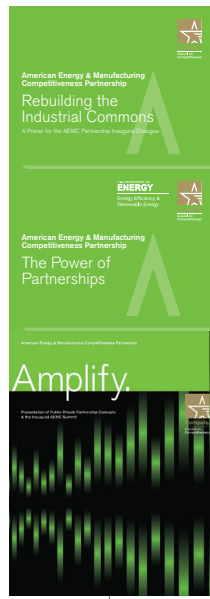
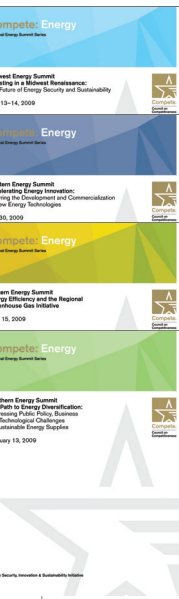
2009

National Innovation Initiative



The National Innovation Initiative catalyzed an ambitious, private-sector led innovation action agenda, emphasizing talent, investment and infrastructure.

At the vanguard of the movement to build an American manufacturing renaissance, the U.S. Manufacturing Competitiveness Initiative—led by Susan Hockfield, President of MIT; George Miller, Director of Lawrence Livermore National Laboratory; and James Quigley, former CEO of Deloitte Touche Tomatsu, established an ambitious agenda to bolster America's manufacturing sector—an agenda which continues to inform public policy in and beyond Washington.



AEMC Partnership

2010

2011

2012

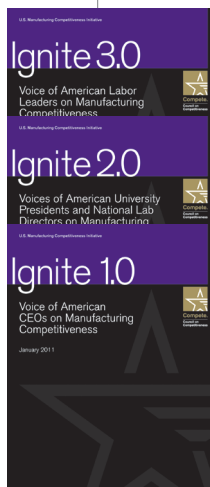
2013

USMCI

2014

2015

2016



The EMCP vision will be achieved through an ambitious agenda built around three core streams of work, leveraging the strength of the Council and its membership:

- Convene and energize national leadership
- Benchmarking, research & analysis
- Advocacy and outreach

Setting the Stage

Throughout history, great leaps in productivity and prosperity at the heart of national competitiveness have come through the emergence, adaptation and adoption of new processes, materials and technologies; the discovery of trade routes and the opening of new markets; and breakthroughs in how organizations leverage talent.

Innovation—the intersection of invention and insight, leading to the creation of social and economic value—is the life-blood of the global economy and the catalyst behind these trends.

Innovation is deeply embedded in America's DNA. From birth, our nation has been most fundamentally about exploration, opportunity and discovery, about new beginnings, about setting out for the frontier.

Today, America finds itself facing a new, promising frontier shaped by two powerful transformations working in tandem:

- The generational re-emergence of advanced and highly productive manufacturing capacity in the United States.
- The increasing abundance of innovative, sustainable, affordable and domestically-sourced energy.

If American leaders act now to create the private and public sector strategy to optimize our entire society to leverage both transformations, the nation will create an unparalleled competitive advantage—the catalyst for a new wave of productivity and prosperity.

From 2002-2010, the U.S. manufacturing sector reduced its energy intensity by 16.7 percent.

EIA, 2010 Manufacturing Energy Consumption Survey

The Energy Revolution

In 2008, at the launch of its Energy Security, Innovation, and Sustainability Initiative (ESIS), the Council declared, “the cost of energy is clearly impacting the competitiveness of the United States. But the story does not end there. The economic toll exacted by maintaining the current state of U.S. energy, as well as the prospective windfall for ending it, has not been adequately captured or communicated in the context of national competitiveness.”

Through the ESIS initiative, the Council's more recent U.S. Manufacturing Competitiveness Initiative (USMCI), and many other efforts spanning the last 3 decades, the Council and its members have contributed to a tectonic shift not only in how the United States consumes energy—with energy intensity levels steadily flattening and even declining, and improving relative to our competitors in Europe and Asia—but also in how our public and private sector leaders conceive of energy as an input to manufacturing and the competitiveness equation. From the

Administration to State Houses to small and large businesses across the country, energy productivity initiatives have bloomed, and service industries to meet this new demand have grown around them—creating jobs, and making our nation’s industrial and energy sectors more resilient, productive and sustainable.

Shifting technology, economic and geopolitical factors, coupled with breakthroughs in technology research and development at America’s world class universities and national laboratories, have yielded an unprecedented abundance of recoverable oil and gas, and are leading to significant growth in America’s deployment of renewable energy and energy efficiency technologies. American energy strength and independence—once distant aspirations—are now within our grasp, with huge implications for America’s global political, strategic and economic leadership.

The Manufacturing Rebirth

America’s manufacturing sector is a key driver—and beneficiary—of these advances in energy technology, research and development. The U.S. manufacturing sector is the most diverse end-use sector in terms of energy services required, the sources of energy used, and the technologies needed to produce, consume and manipulate it. The Council’s USMCI identified critical research, innovation, and policy trends contributing to the re-emergence of America’s high-value, advanced and productive domestic manufacturing sector.

Major innovation cycles must be generated at a continually accelerating rate to sustain growth and avoid stagnation or collapse.

Bettencourt, et al, Proceedings of the National Academy of Sciences, 2007

Manufacturing is central to the American economic recovery and the future of U.S. global competitiveness. Contributing approximately 12 percent of U.S. gross domestic product and directly employing 12 million people—and supporting another 5.4 million—the U.S. manufacturing sector punches far above its weight: for every dollar spent on manufacturing, another \$1.37 is added to the U.S. economy—the highest multiplier of any sector in the United States.⁴ The manufacturing sector accounts for 60 percent of U.S. engineering and science jobs, and for more than two-thirds of all U.S. R&D spending.⁵ It supplies nearly 65 percent of U.S. exports,⁶ and accounts for nearly 18 percent of the world’s manufacturing output.⁷

4 National Association of Manufacturers, using data from the Bureau of Labors Statistics and Bureau of Economic Analysis, 2015.

5 National Science Foundation, Business R&D and Innovation Survey, 2008.

6 Council on Competitiveness, “2013 Global Manufacturing Competitiveness Index,” 2013.

7 Congressional Research Service, “U.S. Manufacturing in International Perspective,” February, 2014.

Capitalizing on the convergence of a distinctly modern breed of energy abundance—characterized by new generations of research, talent, and technology—with America’s re-emergent manufacturing sector will demand sophisticated and informed decision-making by business leaders and policy makers.

But the world of industry is a very different place than in the beginning of past energy renaissances—coal in the 19th century, and oil in the 20th. Communication occurs at lightning speed. Businesses have transformed from vertically integrated behemoths into more specialized and increasingly complex ecosystems of designers, suppliers, producers, and systems integrators. Universities and colleges not only prepare the next generation of workers, but work directly with industry to design the next generations of products, tools, and services. Technology and automation capabilities are more ubiquitous, affordable, and accessible than ever before. These factors have led to tremendous growth in manufacturing productivity and dramatically accelerated the circadian rhythm of innovation. The re-alignment and convergence of these forces has profound implications for manufacturers, workers, researchers, investors, policymakers and consumers alike.

Framing Principles of the Energy-Manufacturing Economy

American manufacturing—the bedrock of the U.S. productive economy—is at the dawning of a transformation driven by an abundance of domestic energy, and a new generation of emerging energy technologies.

Building the rebirth of American manufacturing into a true renaissance demands a nuanced understanding—and consequent action—of energy applied to manufacturing, and of manufacturing applied to energy and of the factors driving this convergence. Leveraging decades of research and collaboration between the private sector, government and academia, America’s innovation ecosystem is delivering the next great leap in American industrial productivity. Recognizing the dynamics and trajectory of these two critical sectors, and their nexus, a core set of principles underpins the EMCP:

- 1. Over the next 50 years, American—and global—energy systems will undergo unprecedented changes and experience intense new pressures.** By 2040, global energy demand will increase by 56 percent from 2010 levels⁸, placing intense pressure on existing supplies and strategic reserves of conventional fuels, as well as on America’s energy generation, transmission and distribution infrastructure. While more than two-thirds of demand growth will come from developing countries, OECD countries will be subject to a more fragile and fractious international energy trading regime, threatening economic stability and national security.

⁸ U.S. Energy Information Administration. World Energy Demand and Economic Outlook. 25 July, 2013. <http://www.eia.gov/forecasts/ieo/world.cfm>

2. **Higher demand, stretched supply systems, and increased political, regulatory, and climate uncertainty will demand a more technologically advanced, agile and diversified energy portfolio.** As supply and demand conspire to tighten energy systems, and as threats ranging from international terrorism and cybersecurity to more volatile and less predictable climate patterns place our nation's economy—and in many cases, our lives—in the cross-hairs, the importance of an “intelligent” grid connected to a vast and diverse array of resilient and switchable energy sources and generating technologies will be crucial to American competitiveness and security.
3. **Building the 21st century innovation ecosystem America needs will deliver a new generation of economic opportunity and hone America's competitive edge in the global economy.** America's manufacturing base, skilled workers, research universities and national laboratories are poised to deliver the next generation of energy technologies. Current and projected domestic energy demand growth is an unprecedented market waiting to tap. America's financial community and entrepreneurial ecosystem are waiting for the right technologies and investment mechanisms to provide the capital and expertise necessary to carry new technologies across the valley of death and into full deployment.
4. **Manufacturing will define 21st-century energy systems, and new energy technologies and abundance will unleash a new generation of manufacturing growth and prosperity.** Manufactured goods, technologies and systems will define the 21st century energy landscape. As the marginal costs of recoverable conventional resources rise, demand is increasing for more sophisticated surveying, extraction and safety technologies. Generation technologies—

from clean coal to natural gas to nuclear to renewable systems—must advance in parallel to achieve greater efficiency and capacity factors, reduce costs and deploy at scale. Our homes, infrastructure, vehicles, businesses and factories are an enormous untapped market for new devices, materials, technologies and systems to generate, recapture, store, conserve, transmit and consume energy. In particular, manufactured technologies that extract, deliver, generate and efficiently consume energy will become the new “face” of American manufacturing.

5. **As innovators, investors and adopters, the private sector is the pivotal actor at the nexus of America's energy and manufacturing challenge and opportunity equation.** The private sector will harness and deploy hundreds of billions of dollars to build and upgrade our nation's energy and manufacturing infrastructure; to turn over inefficient equipment and outdated capital stock; and, to develop more energy efficient products and new energy-related services. The private sector must bring the fruits of basic and applied research into the marketplace—at large scale. The nation's research universities and national laboratories—the “crown jewels” of America's innovation ecosystem—must mobilize around this central but multi-faceted mission. And the private sector must work with educators and the labor community to train, retrain and employ much of the workforce essential to the transformation of our manufacturing system.

6. **Manufacturing is not a monolith, but a diverse ecosystem of distinct—though in many cases interconnected—industries, sectors, geographies and environments, each with their own challenges and opportunities.**
The fabric of America's manufacturing sector is a complex sphere of industries with distinct goals, needs, characteristics and challenges. Establishing strategic roadmaps for the manufacturing sector demands a holistic but nuanced approach. Cross-cutting issues and themes—from tax policy and regulatory frameworks to workforce development and R&D investment—will have differentiated impact across America's diverse industrial landscape.
7. **The private and public sectors—at all levels—must partner to set the enabling conditions to unleash the latent investment and innovative capacity of American enterprises.** The transformation of the U.S. energy system will entail a range of actions by the private sector in tandem with a suite of integrated and coordinated policy measures by government at the State and Federal levels. There is no single policy that will mobilize market forces to assure a successful build-out and resurgence of America's industrial sector.
8. **As American researchers lead the world in innovative technology, its public leaders must be at the vanguard of innovative energy and manufacturing policymaking.** Shifting to a sustainable and secure energy portfolio and ensuring a dynamic, vibrant and secure manufacturing sector demands a strategic and unprecedented marshaling of political will. The burden of coordinating and integrating our resources and setting America to the task of invention, innovation, production and deployment falls, in part, on our nation's policymakers—at the Federal, State, and local levels. To achieve the “all of the above” strategy necessary, America's political leaders, with guidance, advice and input from all stakeholders, must develop inclusive, comprehensive, and innovative policy mechanisms to synchronize research, investment, workforce development, and infrastructure deployment.

Council Leadership: Systems Integration for the American Economy

At the intersection of industry, academia, labor and the nation's pre-eminent national laboratories, the non-partisan Council is distinctively and strategically poised to address these challenges and to effectively communicate the recommendations of its membership to America's business and political leadership. Already at the vanguard of energy, manufacturing, talent and science and technology policy for nearly three decades, this initiative will leverage the Council's intellectual and membership capital as it merges its energy and manufacturing work streams.

Most recently, the Council's recommendations from *Make: An American Manufacturing Movement* resound in Washington, D.C. and outside the beltway, including the recently launched National Networks for Manufacturing Innovation in Additive Manufacturing, Next Generation Power Electronics, Digital Manufacturing and Design, and Lightweight Materials.

Concurrently, the Council's portfolio of initiatives and influence in the energy sector has never been more relevant than it is today. Building upon the Energy Sustainability, Innovation and Security Initiative, which delivered a 100-Day Energy Action Plan to the incoming administration ahead of the 2008 election, the Council continues to drive conversations across the country and at the Federal level. Today the Council is facilitating tangible outcomes in the areas of energy innovation, technology and produc-

tivity through the American Energy and Manufacturing Competitiveness (AEMC) Partnership. This 3-year, joint effort with the U.S. Department of Energy's Clean Energy Manufacturing Initiative (CEMI) leverages dialogues, summits and the creation of public-private partnerships to enhance U.S. competitiveness in manufacturing energy technologies and strengthens its foundations through increased energy productivity.

These two areas of our nation's economic and social fabric—manufacturing and energy—are deeply interconnected. America's ability to compete in the global economy, to rebuild the middle class, and to steward its natural resources and environment demands coordinated, thoughtful policy solutions, leveraging America's innovation ecosystem, workforce, technology, and business and policy-making communities.

The Energy and Manufacturing Competitiveness Partnership Agenda

The Energy and Manufacturing Competitiveness Partnership, will unite its members' focus around the shifting global energy and manufacturing landscape, and how energy transformation and demand is shaping industries critical to America's prosperity and security. It will address the salient questions facing the American economy writ large: How are sectors across the economy leveraging new energy resources, technologies and processes to increase margins and expand operations? How are America's research universities and national laboratories - the crown jewels of our innovation ecosystem - balancing the disruptive opportunities presented by fundamental research with continuous demands for applied research and development? How are businesses signaling new and changing needs to labor markets?

The EMCP will go one great step further, however, tapping into its diverse membership of leaders from business, academia, the national laboratories, and the labor community to understand the discrete and distinct challenges critical sectors of the U.S. economy face in the energy-manufacturing convergence, and how decision-makers can bolster the critical pillars of competitiveness—technology, talent, investment and infrastructure.

Over the course of the three-year EMCP, the Council will develop an ambitious roadmap to focus national attention on energy, manufacturing and their intersection, and create a national energy and manufacturing policy agenda for America's political leadership. Through a range of activities and programs—from benchmarking and survey research to C-suite summits—the EMCP will deliver action-oriented opportunities for members of the Partnership to communicate critical priorities to decision-makers at the highest levels of government and industry. The

Partnership is especially designed to culminate with the delivery of a concrete 100-Day Energy and Manufacturing Action Plan ahead of the 2016 national elections, detailing and prioritizing the policies, tools and partnerships the 45th President and 115th Congress should leverage to unleash a sustainable manufacturing renaissance in the United States.

1. Convening and Energizing the Nation's Leadership

The Council is distinctly positioned to leverage its diverse, non-partisan membership and networks to convene the nation's thinkers, doers, and decision-makers and to share intelligence and build momentum for constructive, collective action. Past summits under the auspices of the USMCI, ESIS, and the landmark National Innovation Initiative, have generated partnerships, bipartisan legislation, and ideas that have returned vitality and energy to the nation's innovation, manufacturing and energy ecosystems. The EMCP will build on this tradition of impact and excellence, convening a series of dialogues, summits and conversation to push the U.S. energy and manufacturing competitiveness agenda to the forefront of the national policy discourse.

The Annual American Energy and Manufacturing Competitiveness Summit

The Council will build upon the annual AEMC Summit, which convenes more than 600 leaders from all sectors to address energy and manufacturing challenges and opportunities affecting U.S. prosperity, sustainability and security. The AEMC Summit will continue to be the premier platform for the national energy and manufacturing dialogue, and will build a critical mass of decision-makers to take concrete action.

C-Suite Sectoral and Regional Dialogue Series

The Council will launch a series of regional and sector-specific dialogues, convening executives and thought leaders from the private sector, academia, the research and labor communities, and government. A key tool in the systems integration toolbox, this format, pioneered by the Council through previous initiatives, will uncover and distill essential knowledge and pathways to leverage it into concrete actions and policy interventions. Dialogues will be hosted around the nation by members of the EMCP Steering Committee.

2. Benchmarking, Research and Analysis

For more than two decades, the Council's signature *Competitiveness Index* has set the bar for defining the dynamic drivers of competitiveness and understanding how countries perform across a range of indicators—and why. Concurrently, the Council spearheaded the creation of the Global Federation of Competitiveness Councils, an international body of similar organizations to share best practices and deepen innovation communities' understanding of the trends shaping competitiveness—including manufacturing and energy. The EMCP will support the Council's continued manufacturing and energy benchmarking agenda, providing members with key insights and business intelligence to guide investment decisions and long-term strategic planning.

Key Research Agenda: Sector Studies

At the heart of the EMCP's agenda of discovery and action are the Sector Studies - a series of deep-dive analyses of sectors critical to the U.S. economy. Manufacturing is not a single monolithic industry, but a diverse and horizontal ecosystem of industries with

distinct relationships to energy inputs, technologies, and consumers. Filling a void in national discourse and policy, these studies will examine industrial competitiveness through the lens of the energy-manufacturing nexus. They will identify the critical cross-cutting and distinct roadblocks—in technology, talent, investment and infrastructure—to leveraging America's energy abundance and innovation ecosystem and rebuilding national competitiveness on a strong foundation of manufacturing.

Throughout the EMCP, the Council—working alongside sector-workgroups led by members of the EMCP Steering and Advisory Committees—will approach each of these sectors with the nuance they demand to understand the complex challenges and opportunities they face—and develop the policy agendas each needs to ring in a new era of energy-driven manufacturing growth.

Key Publication: The *Global Manufacturing Competitiveness Index*

The EMCP will be the umbrella for the *Global Manufacturing Competitiveness Index (GMCI)*. Begun in 2010, in partnership with Deloitte, the Council leverages its competitiveness benchmarking history to drill deeper into complex drivers of and conditions in manufacturing sector. Based on CEO surveys of manufacturing firms around the globe, the GMCI aggregates and analyzes essential market intelligence and guides the understanding of policymakers and business decision makers. The 2013 GMCI expanded the CEO-survey and the number of countries included, a legacy the Council will build upon in the next iteration of the Index as part of the EMCP.

Advocacy and Outreach

Partnerships between and within sectors are innovation catalysts. Particularly in today's investment and budgetary climate, public-private partnerships play an increasingly critical role in our nation's ability to push forward America's economic agenda—from manufacturing and infrastructure to energy and education. The EMCP will deploy the Council's experience and leadership in this space to identify concrete areas where partnerships between members, and between members and other leaders and organizations from all sectors of society, can accelerate innovation, investment, and growth, and solve our nation's most pressing challenges.

100-Day Presidential Action Plan and National Energy & Manufacturing Summit

The Council, with the full backing of the Steering Committee, will refine and deliver—ahead of the 2016 election—a distinct policy roadmap, building upon the findings of the EMCP dialogue series and sector studies. Identifying near-term policies and actions, as well as long term priorities, this Action Plan will serve to inform and shape the agenda of the 45th president and the 115th Congress. The Council and Steering Committee will continue to deliver on the agenda outlined in the Action Plan through strategic engagements with the White House, Congressional leadership and key figure across State and Federal governments.

Leadership

C-Suite Level Steering Committee

A C-suite Steering Committee will frame the partnership, pose the critical questions driving the work, provide direction, and develop the action agenda. Co-Chairs Jeff M. Fettig, Chairman and CEO, Whirlpool Corporation; Mayo Shattuck, III, Executive Chairman, Exelon Corporation; Subra Suresh, President, Carnegie Mellon University; and Dr. William Goldstein, Director, Lawrence Livermore National Laboratory will lead the Steering Committee.

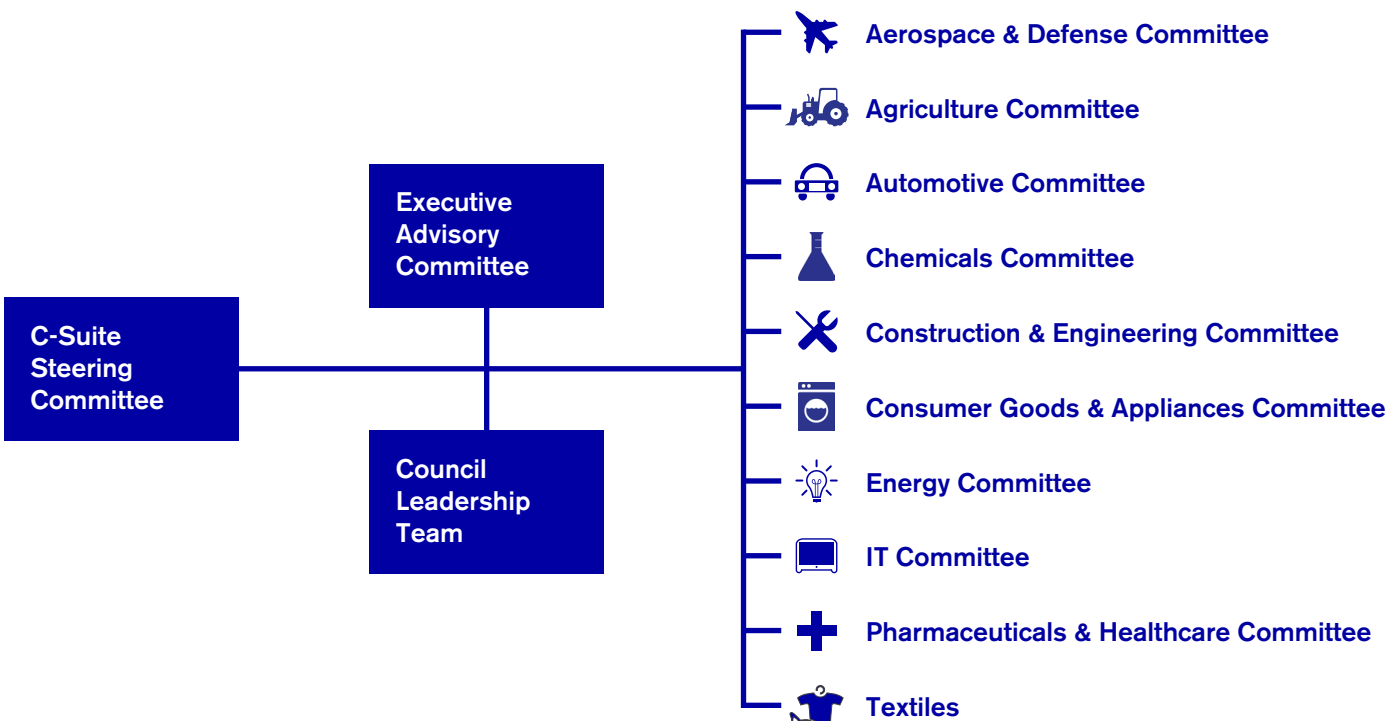
The Steering Committee members will also chair Sector Groups, providing leadership opportunities to members and to guide the Council's implementation of the Steering Committee's recommendations. Critical Sector Groups may lead deep competitiveness assessments of the sectors identified for further study. The figure below offers an example of the structure this sectoral-based approach could take.

Executive Advisory Committee

A diverse and expert Executive Advisory Committee will help shape the substantive aspects of the EMCP, as well as provide ongoing counsel and support to the Steering Committee and Council. Steering Committee members will have the opportunity to designate a "delegate" to represent them on the Advisory Committee. Both the Council and Steering Committee members will also be able to nominate and vote on additional expert Advisors to the Partnership.

Council Leadership Team

Led by Council Executive Vice President William Bates, the Council's leadership will work directly with the Advisory Committee members and with each Sector Committee to execute the day-to-day operations, event planning, and research of the Partnership.



Sector Studies

At the heart of the EMCP, the sector studies will be an ambitious deep dive into the forces converging at the meeting point of changing energy systems and technologies and the United States' most critical manufacturing sectors. The sectors proposed here for deeper analysis represent the vanguard of America's manufacturing ecosystem—the companies, institutions, workers, goods and services that drive the U.S. economy. Though not an exhaustive inventory of America's productive economy, these sectors will be the engines of America's innovation-based advanced manufacturing economy in the decades to come. Identifying the shared challenges and opportunities in technology, talent, investment and infrastructure is crucial to building high-impact business strategies and policy interventions. And, understanding the distinct roadblocks faced by each of these sectors is essential intelligence for decision-makers at all levels to ensure that actions, policies, and regulations effectively contribute to their competitiveness.

Through dialogues, original research, surveys, and collaborative working groups leveraging the leadership of the Partnership's Steering and Advisory Committees, the EMCP will identify the salient questions and challenges facing the energy-manufacturing nexus within these sectors, and potentially others as identified by the Steering Committee. Seeking input from leaders throughout the private sector, academia, the research and scientific community, NGOs and government, will focus the Partnership's work through the Council's framework of technology, talent, investment and infrastructure:

Technology

- What role are energy abundance and innovation playing in increasing the productivity and competitiveness of American manufacturing? What innovations are occurring—or are urgently needed—for manufacturers to leverage natural gas, renewables, and efficiency technologies to improve their competitiveness in the global marketplace?
- How is demand for new energy technologies and sources (natural gas, biofuels, batteries/storage, renewables, and efficiency technologies) impacting innovation, manufacturability, and business outlooks for domestic technology manufacturing?
- How are energy and technology regulatory regimes impacting the competitiveness outlook of U.S. manufacturing across these sectors? What regulations and policy interventions could enhance innovation and accelerate the development and deployment of energy technologies and greater industrial energy productivity?

Talent

- What skills will define the 21st-century energy and manufacturing economy? How is the private sector communicating needs to educators and students?
- What domestic skill shortages and talent deficits hinder America's ability to achieve the full potential of the new energy economy?
- What formal, alternative, and continuing education platforms must be established or strengthened to ensure a robust talent pipeline and domestic workforce in these sectors?

Investment

- How are the tectonic shifts occurring across today's energy landscape—as the U.S. moves from “energy weak” to “energy strong”—changing the decision-making processes and competitiveness propositions for domestic and foreign manufacturers? And, what investments are U.S. manufacturers making in response to growing demand for new energy technologies, products, and services?
- How is America's energy abundance reflected in the competitiveness of sectors downstream from energy-intensive sectors of the economy?
- What hurdles do technologists, entrepreneurs, and firms across sectors face in commercializing promising technologies and deploying them on a market-scale? What new institutions, mechanisms, and knowledge-transfer systems must the investment community create to capture U.S. technology innovation and scale it domestically?

Infrastructure

- What investments in infrastructure—physical, educational, financial, and beyond—are necessary to fully exploit the opportunity of America's growing energy strength and innovation ecosystem?
- In efforts to optimize the nation's full energy potential—and consequent competitiveness—how can policymakers and the nation's business, research and labor communities come together to resolve conflicts hindering the build-out the nation's energy infrastructure, including pipelines, the grid, and new technology deployment?

These questions will provide the foundations of the sector studies, and be a backdrop to inform regional dialogues around the country, engaging all stakeholders to build an inclusive and strategic business and policy roadmap.

The following sectors are proposed for initial consideration, but may be amended or expanded upon by the Steering Committee. These sectors have been chosen for their intrinsic contributions to the American economy and security, their growth outlook, and the role that they play within America's vast innovation ecosystem. These industries are greater than the sum of their parts—each contributes to an innovation-driven value chain that enhances U.S. competitiveness, and must continue to be secured.

Each sector study will be shaped and informed by a Sector Working Group, led by members of the Steering and Advisory Committees of the EMCP. Leveraging the deep well of experience, knowledge and networks of the Partnership's membership offers an unparalleled opportunity to extract on-the-ground intelligence and ensure that the Partnership's work maps the uncharted territory across the landscape of these important sectors. An overview of those sectoral landscapes is provided in the following sections.

Aerospace and Defense



With a net trade surplus of 50 percent and more than \$320 billion in revenue, America's aerospace and defense sectors lead the nation in exports and is a foundation of regional economies in all 50 states.⁹ These advanced sectors are engines of manufacturing, with backlogs of orders totaling nearly \$500 billion—indicating a strong and stable demand future for the industry.¹⁰ Such long-term demand affords the industries the opportunity to take a longer outlook in planning to integrate new technologies and processes into both products and the manufacturing system, with considerable implications for energy productivity, costs and sustainability.

Facing pressures from an aging workforce to ascendant competitors in Europe and Asia, the aerospace and defense industries require a focus on developing new talent and deploying innovative technology to ensure the country's economic competitiveness and national security.

Separately, while defense spending is decreasing, it is shifting to a more agile and specialized suite of forces, able to meet new and emerging threats. Many of these threats demand innovative offensive, defensive and force-protection technologies to preempt next-generation security challenges.

Over the next decade, advanced materials, technologies, and processes—and the ability to standardize and deploy them on a broad scale—will define the competitiveness of these sectors. As airlines demand more energy-efficient fleets, as military capabilities demand more agile and long-range—and therefore fuel efficient—technologies and vehicles, and as both sectors continue to rely on energy-intensive raw materials from steel to carbon composites, manufacturers must out-innovate their global competition. And they must overcome challenges to the production of specialized and frequently energy-intensive design and manufacturing processes.

The U.S. aerospace and defense industry directly employs more than one million workers in scientific, technical, and manufacturing jobs in all 50 states and supports more than 2.5 million jobs in related fields.

Aerospace Industries Association

Agriculture



America's agriculture sector—including the related industries and value-add sectors that fuel it and depend upon it—is a case study in innovation-driven productivity and competitiveness. Since World War II, investment and R&D in agricultural science, technology, and land and resource management have increased the sector's energy productivity by nearly 100 percent, and made it one of the most labor-productive sectors of the American economy—and with a multiplier of 3.5 non-farm jobs for every low-skilled farm job, an engine of job creation.¹¹ Agricultural products and technologies remain a key component of American exports, and are a factor in the growth of the domestic service and manufacturing economy, supporting restaurants, tourism, apparel, furniture and design.

Collaboration between the private sector, government, labor and educational institutions has been key to this success. Technology innovations from John Deere's plow to education policies, such as the creation of America's land-grant university system, have driven meteoric growth in both output and productivity. Today, advanced fields such as biotechnology are accelerating the breeding process to squeeze yet greater efficiencies in labor, energy, and even nutrition and flavor to feed America.

⁹ Aerospace Industries Association. 2014 Year-End Review and Forecast. 2014.

¹⁰ Ibid.

¹¹ National Milk Producers Federation

Agriculture and related industries added \$789 billion to U.S. GDP in 2013. America's two million farms specifically add \$166.9 billion or 1 percent of the GDP.

U.S. Department of Agriculture

The average vehicle age in America grew to 11.5 years in 2015—a record high—and suggesting pent up demand for a new generation of vehicles may soon be unleashed.

Polk Research

However, America's 21st century agriculture sector faces serious challenges. Temperature and precipitation variability are impacting American agriculture and industry. More than 80 percent of the contiguous U.S. has experienced abnormally dry conditions since 2012, and nearly 65 percent have been designated in drought. In spring 2014, 100 percent of California—America's most agriculturally productive state—is in severe drought.¹²

Elsewhere, groundwater resources—including the massive Ogallala Aquifer, the life-blood of the Great Plains—have dwindled to historic lows. And in many parts of the country, agriculture competes with energy, construction and other sectors for water resources. As domestic energy production rises, society must balance competing needs for access to fresh water at the local, state, and national level.

Automotive



A distinctly American industry, the U.S. automotive sector and related suppliers and service facilities contributed nearly \$830 billion to the U.S. economy—approximately 5 percent of GDP—in 2012,¹³ and in 2013 marked five straight years of growth for only the second time since World War

II.¹⁴ American automakers and parts manufacturers and suppliers have emerged from the recession to add 250,000 new jobs.¹⁵ In recent years, leveraging favorable labor market conditions and America's abundance of low-cost affordable energy, foreign manufacturers from BMW to Volvo to Toyota have invested heavily in production facilities in the U.S.—for both domestic and export consumption. However, many challenges still remain.

In the coming decades, the American automotive industry—and the vast network of manufacturers that support it—must compete with ascendant foreign manufacturers for growth markets in Asia and South America, grapple with changing domestic consumer demand, and respond to new regulations and policies calling for greater efficiencies and cost-effective energy use.

To meet these demands, and maintain a leading edge in a highly competitive global environment, the U.S. automotive sector must continue to emphasize technology innovation. Alternative fuels and battery technologies, advanced materials, and high-tech interfaces between vehicles, drivers, and the Internet are increasingly defining the future of automobiles. Strategic road-mapping, investment, and collabora-

12 NOAA. National Climate Data Center, State of the Climate. 2014.

13 U.S. Bureau of Economic Analysis, GDP by Industry Accounts, 2012

14 "American Auto Sales Seen at Annual 16 Million With Profit," Bloomberg.com, September 16, 2013.

15 Alliance of Automobile Manufacturers. Driving the Economy Forward. 2013.

tion amongst automotive manufacturers, suppliers, laborers, and researchers will be crucial to the industry's success.

Chemicals



America's chemical industry, employing nearly 800,000 researchers, production employees, and other personnel, is a foundational sector of the U.S. economy.¹⁶ Providing critical materials and support to industries as diverse as automotive manufacturing, housing construction, and agriculture, the competitiveness of the chemical sector—supplying crucial materials to firms downstream in the manufacturing value-chain—is an economic bellwether.

“Following a decade of lost competitiveness, American chemistry is reemerging as a growth industry.”¹⁷ Estimates suggest an annual growth rate exceeding 4 percent for the rest of the decade, reaching more than \$1 trillion in annual revenues by 2018.¹⁸ In particular, the U.S. natural gas boom is transforming the U.S. from a high-cost, specialized producer into a competitive global producer of specialty and bulk chemicals, boosting exports and investment in the U.S. To meet demand, capital spending in the chemicals sector is at an all-time high—and rising. Estimates from the American Chemical Council anticipate more than \$60 billion in annual capital investment by 2018—more than double the level of investment at the beginning of the decade. As of December 2013, 135 new production projects have been announced, totaling \$90 billion in long-term investment.¹⁹

Challenges remain, however. As within many sectors, federal tax policies remain unfavorable to capital investments in the U.S., hindering even greater investments in domestic production facilities. Federal budgetary uncertainty and austerity have impacted public spending on innovation and R&D within the

sector. And, other regions are catching up—by 2018, capital investment in the United States' chemical sector will represent only 10 percent of global investments exceeding \$600 billion annually—much of it in developing economies.²⁰

As an energy-intensive sector, the abundance of natural gas—also a direct material input—will have far-reaching impacts on the competitiveness of the sector in the United States. Technology and process innovation will be key drivers of greater efficiencies and cost reductions, with broad implications for downstream industries.

Construction and Engineering



The next several decades will see a meteoric rise in new construction and building retrofit, driven by infrastructure investments in roads, pipelines, bridges, and the power grid, and by residential, commercial and industrial facilities across the United States and around the world. According to the Rocky Mountain Institute, more than 95 percent of commercial building stock will be replaced or overhauled by 2050.²¹

This tremendous turnover in building inventory—with similar trends anticipated in the residential and industrial spheres—raises challenges in terms of the loss of embedded energy in existing structures. But this generational shift also creates untold new opportunity to transform the energy consumption and efficiency of the built environment, and to drive a new generation of efficiency materials, technologies, and best practices in building and infrastructure construction and use.

To realize this potential, the industry must grapple with a domestic shortage of available, mobile labor with the mid- and high-skills critical to the project pipeline. Firms must attract talent from other industries and engage community colleges, apprenticeship programs and four-year degrees in building out the construction and engineering workforce.

16 “American Chemical Industry Situation and Outlook,” American Chemical Council, December 2013.

17 Ibid.

18 Ibid.

19 Ibid.

20 Ibid.

21 Rocky Mountain Institute, Energy Efficiency in Buildings, Supply Curves by End Use, 2050, 2013.

In particular, the changing demand in sub-sectors of construction and engineering means those skills shortages threaten to be a problem. Critical to the energy-manufacturing nexus, the sub-sector experiencing the highest demand for investment and construction at the moment is in the oil and gas market—a product of the U.S. energy boom. FMI estimates that by 2017, nearly 10 percent of the U.S. construction workforce will be working in the oil and gas sector, up from just 3.8 percent in 2008.²² Recognizing the shortage in skilled labor, the White House announced in early 2014 that the construction industry pledged to hire 100,000 military veterans over the next five years.²³

Policymakers, construction and engineering firms, and technology companies must work in concert to deliver the workforce, energy saving and generating technologies, and strategic policy interventions and incentives to secure an energy productive sector *and* an energy efficient built environment and infrastructure system.

Consumer Goods and Appliances



For much of the 20th century, the United States was the largest consumer economy in the world, and through the innovation and investments of companies like Whirlpool, General Electric, Westinghouse, and Johnson and Johnson, dominated the global consumer goods and appliances industry.

The rise of multinational corporations in the late 20th century, however, along with the ascendance of manufacturing economies in East Asia and the rebuilding of Western Europe's industrial sphere, have made this market increasingly competitive.

New trends—such as the integration of high-technology into product design and use, falling energy prices, and the rise of consumer economies in China, India, and the developing world—are presenting new

challenges to U.S. industry. The rapid integration of electronics and data-connectivity is changing the capabilities and design of products, how companies gather data, and how companies manufacture products. Concurrently, the rise of social media, mobile technologies and applications, and Internet retailing are changing how customers and retailers alike interact and provide feedback signals to manufacturers.

The consumer goods industry must increase its ability to adapt quickly—and continuously—to the empowered consumer. Companies must access and use consumer data analytics to create the more targeted and personalized products—and communicate their value to consumers.

As factories, workers, firms, and products become ever more “wired,” technology connectivity, big data, and the Internet can increase energy productivity in the manufacturing process, and reduce energy consumption throughout the lifecycle of products.

Increasingly, manufacturers are being forced to balance a regulatory environment mandating more efficient and products with consumer demands for more features, functionality, and design. Collaboration among researchers, stakeholders, and manufacturers across the innovation ecosystem will be crucial to meeting these dual mandates.

Energy



While energy is an economy-wide competitiveness linchpin, it is in its own right a formidable, diverse, and transforming industry itself. With one of the most complex supply portfolios, and the largest and most diverse economy in the world, the U.S. energy sector is an enormous driver of research, innovation, and manufacturing across a broad range of technologies and applications.

While the energy productivity of the U.S. economy has increased by more than 250 percent (unit of energy consumed per unit of GDP) since 1948,²⁴ the sheer scale of demand for energy has outpaced

22 FMI. “Skills Shortages in a Booming Market: The Big Oil and Gas Challenge. February, 2014.

23 The White House. “First Lady Michelle Obama Announces that the Construction Industry Will Hire 100,000 Veterans Over the Next 5 Years.” February 10, 2014.

24 Energy Information Administration, Annual Energy Outlook 2014.

gains in efficiency and shifts within the economy, resulting in a 200 percent rise in consumption over the same period. Current estimates anticipate a 30 percent increase in demand by 2040.²⁵

Consequently, the U.S. oil and gas sector is forecast to be one of the largest growth sectors in the American economy over the next decade. At the same time, efforts by both the public and private sectors to increase the development and deployment of clean energy technologies are accelerating at a record pace. This all-of-the-above strategy will be key to ensuring a reliable, affordable, and sustainable energy portfolio to drive the U.S. economy—especially its manufacturing sector.

The energy sector is also key focus area for innovators, entrepreneurs, investors, and policymakers working to combat the impacts of global climate change. Already, America's investments in innovative energy technologies—including hydraulic fracturing processes that have unleashed the current boom in low-carbon natural gas—have resulted in a 10 percent drop in carbon emissions below 2005 levels.²⁶ Flexible regulatory and policy-mechanisms incentivizing innovation and market-based solutions to greenhouse gas reduction will be a new reality—and opportunity—for new technology investment in the coming decades. In particular, industry must respond to a changing regulatory environment, including recently proposed standards on emissions from power plants.

The public and private sectors must come together, with the nation's academic, research, and investment communities, to overcome impediments to innovation and commercialization. And—critically—policymakers

must build strategies to ensure that investments in innovation and R&D are captured and commercialized here in the United States.

Information Technology



Today's Information Technology (IT) sector is the brain of 21st century industry. Dominated by American firms, this sector holds the key to advances in data processing, device connectivity, systems management, modelling and simulation, and a broad range of activities central to the competitiveness and security of firms and nations.

With the advent of the Internet, recent decades have seen a boom in the IT related economy. Driven by its leadership role in IT R&D (the United States accounts for 55 percent of global IT R&D) and some of the strongest intellectual property laws and enforcement in the world, America's IT industry is without rival, adding more than \$600 billion in GDP to the United States economy.²⁷

The IT sector will play a fundamental role in America's bid to lead the world in energy technology manufacturing, and in increasing energy productivity throughout the private sector. Spending on IT within the energy and utilities industries has continuously grown and is expected to surpass \$71 billion in 2016.²⁸ Developments in big data, analytics, mobile technology, and cloud computing offer the energy sector gains in efficiency and reliability.

Concurrently, improved digital connectivity both within factories and throughout supply chains can lead to reduced time-to-market, higher quality products,

²⁵ Ibid.

²⁶ New York Times, "Trying to Reclaim Leadership on Climate Change," Justin Gillis and Henry Fountain, June 1, 2014.

²⁷ Bureau of Economic Analysis. GDP by Industry. 2013.

²⁸ TEKSystems. 2013 IT Workforce Snapshot. Drawing on Gartner Research.

better preventative maintenance, and overall enterprise optimization. Adapting cutting edge IT can offer US manufacturers a distinct competitive advantage.

Business and policymakers must work to ensure that programs exist to build out an IT workforce capable of delivering on these crucial energy-manufacturing needs, and that the R&D pipeline in both the public and private sector continues to fuel the IT innovation engine.

Concurrently, the IT sector itself faces distinct energy challenges. As business and personal computing is increasingly outsourced to “the cloud,” system-wide efficiencies may be gained by greater centralization of computer storage and processing power. But server-clusters—the backbone of the Internet—will face greater challenges in energy reliability, prices, cyber-security threats, and demand for notoriously energy-consumptive high-performance computer hardware and software.

Pharmaceuticals and Healthcare

+ America’s healthcare sector—spanning hospitals, pharmaceutical, bio-medical technology companies, and care services for the elderly, sick, and disabled—accounts for nearly 18 percent of GDP—more than any country in the world.²⁹ Though effectively achieving some of the best outcomes through cutting edge research, technology, and care, healthcare costs have taken center stage as a political, cultural, and economic issue. In the coming decades, with demand for care rising, and cutting edge research in pharmaceuticals and medical technologies leading, as well as the construction

and renovation of healthcare facilities, the industry writ large must identify opportunities to achieve greater efficiencies and cost-savings without sacrificing the quality of care and patient outcomes.

Energy and manufacturing are key drivers in opportunities and efforts to reduce healthcare costs and improve outcomes. Hospitals alone spend nearly \$6.5 billion on energy consumption,³⁰ and the pharmaceutical sector adds another billion³¹—with the majority of expenditures attributed to vast HVAC and cooling needs. Innovation in process design, equipment efficiencies, and specialized building envelope technologies in the medical sector will be key to reining in these costs.

The sectors also invest and expend energy heavily on access to and treating clean water and wastewater—critical, and heavily regulated, facets of the medical technology and pharmaceutical sectors.³²

The United States pharmaceutical sector is an especially vibrant competitiveness driver, conducting 80 percent of the world’s research and development in the field and accounting for 39 percent of global pharmaceutical production; global sales are expected to reach \$1.1 trillion in 2014. As an energy-intensive sector, the pharmaceuticals and biotechnology sectors have an opportunity to leverage new production processes, prototyping and testing technologies, and alternative fuel sources to hone its competitive cost-edge over competitors in Europe, India, and East Asia.

30 EPA–ENERGYStar. Healthcare: An Overview of Energy Use and Energy Efficiency Opportunities. 2014.

31 Lawrence Berkeley National Laboratory. Energy Efficiency Improvement and Cost Saving Opportunities for the Pharmaceutical Industry. March 2008.

32 Siemens. Evoqua Water Technologies. Water and Energy Conservation in the Pharmaceuticals Sector. 2014.

Textiles and Materials



America's textile industry—a pillar of America's industrial revolution—today demonstrates the rebirth of national competitiveness fueled by innovation, productivity—and a changing energy equation. After a century of migration from the industrial Northeast to the Midwest to the Southeast, and several decades of hasty and devastating relocation to conventional low-cost manufacturing countries, the U.S. textile sector is in the nascence of a renaissance, as once defunct plants across such the Carolinas, Georgia, Tennessee, and beyond are spinning up with the advanced manufacturing equipment and highly skilled operators—and benefitting greatly from abundant, affordable, and reliable energy. Textiles generated more than \$54 billion in revenues in 2012, and companies from South America to East Asia to Europe have announced plans to open new factories across the re-industrializing Southeast.³³

This trend is driven by a range of dynamic factors at the heart of American competitiveness. American apparel, carpet, and consumer goods firms, looking for greater quality control and more direct input into weaving and dyeing, and meeting consumer demand for rapid innovation, production, and delivery, are turning increasingly to domestic manufacturers to meet their needs. What's more, textile firms—an energy-intensive operation—and one intricately tied to materials refined from natural gas—are strategically positioned to reap the benefits of America's gas boom.

Still other domestic firms, research universities, and the nation's laboratories are capitalizing on cutting edge research and new demand for special material properties and capabilities—from increased breathability and waterproofing for outdoor enthusiasts to high tensile strength force protection fabrics for law enforcement and military to ever more advanced woven and non-woven materials finding their ways into the next generation of light-weight automobiles, trucks and even buildings.

The textile industry is an emerging bright spot in America's manufacturing enterprise, and upholds a proud lineage of America's manufacturing history. Expanding the success of the textile industry's reemergence demands thoughtful coordination between firms, research universities, organized labor, and state and local government to ensure that strategic investments in infrastructure, technology, and the workforce reflect the needs—and the great opportunity—in this field.

³³ USA Today. Textile Industry Comes Back to Life – Especially in the South. February 5, 2014.

Our Leaders

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Mr. Jeff M. Fettig
Chairman and CEO
Whirlpool Corporation



Jeff M. Fettig became Whirlpool Corporation's chairman and chief executive officer, effective July 2004. He served as president and chief operating officer and was first elected to the Whirlpool board of directors in June 1999.

Fettig joined Whirlpool in 1981 as an operations associate. He held a number of managerial positions in Operations, Sales, Planning and Product Development before being promoted to vice president, Marketing, KitchenAid Appliance Group in July 1989. In October 1990, he was named vice president, Marketing, for the Philips Whirlpool Appliance Group of Whirlpool Europe B.V., the company's European subsidiary, and he was named vice president, Group Marketing and Sales, North American Appliance Group, in October 1992. In 1994 he was named an executive vice president of Whirlpool and president, Whirlpool Europe and Asia.

A native of Tipton, Indiana, Fettig holds a bachelor's degree in finance and a master of business administration from Indiana University.

Fettig serves as lead director of The Dow Chemical Company Board of Directors. He serves on the Board of Directors of the Indiana University Foundation and on the Board of Governors for Boys & Girls Club of America. He is a member of Business Leaders for Michigan and the Business Roundtable Association.

Industry Co-Chair

Mr. Mayo A. Shattuck, III
Executive Chairman
Exelon Corporation



Mayo Shattuck is Chairman of Chicago-based Exelon Corporation, the nation's number one competitive energy provider. Prior to joining Exelon, Shattuck was the Chairman, President and Chief Executive Officer of Constellation Energy, a position he held from 2001 to 2012. Constellation

Energy was a Fortune 200 company that owned energy-related businesses, including a wholesale and retail power marketing and merchant generation business in North America.

Shattuck is immediate past Chairman of the Board of the Institute of Nuclear Power Operations (INPO) and is a member of the Executive Committee of the Board of Edison Electric Institute (EEI). He is also Co-Chairman of the Center for Strategic & International Studies (CSIS) Commission on Nuclear Policy in the United States and Executive Committee member of the Council on Competitiveness.

Shattuck is a member of the Board of Trustees of Johns Hopkins Medicine and Johns Hopkins University and is Chairman of the Board of Visitors of the University of Maryland, Baltimore County. He is the past Chairman of the United Way of Central Maryland (UWCM) campaign and is on the national board of The First Tee.

Shattuck has been widely recognized for his civic and professional leadership. Among his awards, he has received Loyola University's Business Leader of the Year; Ernst & Young's Master Entrepreneur of the Year, and Noble & Greenough's Distinguished Graduate Award. He has also received the Boy Scouts Distinguished Citizen Award, and was named the United Way of Central Maryland's Philanthropist of the Year.

University Co-Chair

The Honorable Subra Suresh
President
Carnegie Mellon University



Subra Suresh, the ninth president of Carnegie Mellon University, is an acclaimed scholar and seasoned administrator.

A distinguished engineer and scientist, Dr. Suresh is one of only 17 Americans with membership in all three National Academies – the Institute of Medicine (2013), the National Academy of Sciences (2012) and the National Academy of Engineering (2002) – and is the only current university president elected to all three.

Prior to taking the helm at Carnegie Mellon, Dr. Suresh served as director of the National Science Foundation, a \$7 billion interest, and the only government science agency charged with advancing all fields of fundamental science and engineering research and related education.

Under Dr. Suresh's leadership, the NSF hosted a 2012 Global Summit on Scientific Merit Review, which included participation of the leading science funding agencies from nearly 50 countries, and launched the Global Research Council to coordinate practices that enhance international collaboration in science.

Before joining the NSF, Dr. Suresh also served as the dean of the School of Engineering at the Massachusetts Institute of Technology.

Dr. Suresh received his bachelor of technology degree from the Indian Institute of Technology Madras, in first class with distinction; a master's degree from Iowa State University; and a doctor of science degree from MIT. He has also held faculty and research positions at the University of California at Berkeley, and at Brown University.

He has co-authored more than 250 journal articles, registered 25 patents and written three widely used books. More than 100 students, postdoctoral fellows and visiting scholars have been members of his research group, and many of them now occupy prominent positions in academia, industry and government worldwide.

Dr. Suresh is married to Mary (Delmar). They have two daughters, Nina and Meera.



National Laboratories Co-Chair

Dr. William Goldstein

Director

Lawrence Livermore National
Laboratory

Bill Goldstein is the 12th director in the history of Lawrence Livermore National Laboratory. He also

serves as president of Lawrence Livermore National Security. Goldstein leads a workforce of approximately 6,300 employees and manages an annual operating budget of \$1.5 billion.

As Lab director he shares the responsibility, along with the directors of Los Alamos and Sandia national laboratories, of providing the president, through the Secretaries of Energy and Defense, an annual institutional assessment of the state of the nuclear weapons stockpile in terms of safety, security and effectiveness, and whether confidence in the stockpile can be maintained without a nuclear test.

Goldstein has more than 29 years' experience at the Laboratory, serving in a variety of managerial roles. Prior to his appointment of director he was the deputy director for Science & Technology, tasked with leading the strategic deployment of the Laboratory's science and technology capabilities, taking line responsibility for the institutional roadmap portfolio, including the Laboratory Directed Research and Development Program, collaborative research with academia and private industry, and institutional planning activities. Prior to his appointment as deputy director, Goldstein served as associate director of Physical & Life Sciences.

He has been a strong contributor to stockpile stewardship. Goldstein led the creation of the Jupiter Laser Facility. Goldstein was a postdoctoral research associate at Stanford Linear Accelerator Center. He received his doctorate in theoretical physics from Columbia University, and a bachelor's in physics from Swarthmore College. He is a member of the American Physical Society and on the board of directors of the National Science Foundation Center for Biophotonics Science and Technology. He has received numerous awards and has authored or co-authored more than 70 papers in the fields of elementary particle theory, nuclear physics, atomic physics, X-ray physics and plasma spectroscopy.

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Founded in 1986, the Council on Competitiveness is a non-partisan leadership organization of corporate CEOs, university presidents, labor leaders and national laboratory directors committed to advancing U.S. competitiveness in the global economy and a rising standard of living for all Americans.

Dedicated to building U.S. prosperity, the Council plays a powerful role in shaping America's future by setting an action agenda to assess U.S. competitiveness, identify emerging forces transforming the economy, catalyze thought leaders who drive change and galvanize stakeholders to act.

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The key to U.S. prosperity in a global economy is to develop the most innovative workforce, educational system and businesses that will maintain the United States' position as the global economic leader.

The Council achieves its mission by:

- Identifying and understanding emerging challenges to competitiveness
- Generating new policy ideas and concepts to shape the competitiveness debate
- Forging public and private partnerships to drive consensus
- Galvanizing stakeholders to translate policy into action and change



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