

Testimony of
The Honorable John Engler
President & CEO
National Association of Manufacturers
Washington, DC

Before the
House Science and Technology Committee

Hearing on
“America COMPETES: Big Picture Perspectives on the Need for Innovation,
Investments in R&D and a Commitment to STEM Education”

Wednesday, January 20, 2010

Introduction

Chairman Gordon, Ranking Member Hall, and distinguished members of the Committee: thank you for inviting me to testify on “America COMPETES: Big Picture Perspectives on the Need for Innovation, Investments in R&D and a Commitment to STEM Education.”

I am the President and CEO of the National Association of Manufacturers (NAM), the nation’s largest industrial trade association, representing small and large manufacturers in every industrial sector and in all 50 states. We are also a member of the Task Force on American Innovation¹, whose mission it is to support basic research in the physical sciences and engineering. I am pleased to testify on behalf of our nation’s manufacturers and all those who wish to preserve our nation’s competitiveness and prosperity, on a critical issue – reauthorizing the America COMPETES Act.

I want to thank you, Mr. Chairman and Ranking Member Hall for championing and supporting the America COMPETES Act. Although the America COMPETES Act was signed in 2007, only recently did it achieve the funding necessary to fulfill its commitment to America.

I can tell you that the programs authorized in the America COMPETES Act are working to strengthen innovation in the U.S. manufacturing sector, and are helping us to build a stronger workforce. Today, I would like to highlight four programs that are of significant interest to America’s manufacturers. They are federal funding for basic R&D; the Advanced Research Projects Administration for Energy (ARPA-E); science, technology, engineering and mathematics (STEM) education, and the Hollings Manufacturing Extension Partnership (MEP).

¹ <http://www.InnovationTaskForce.org/>

The Connection Between Federal R&D and Innovation in Manufacturing

Technology and the ability to translate innovation into products and services that meet the needs of businesses and consumers bolster the United States' economy and our standard of living. Just as technology is key to strong economic growth and U.S. global competitiveness, manufacturing is key to technological advancement. No one sector has played a more important role in developing new technologies than manufacturers. Similarly, manufacturers lead the way in adopting new technologies to maximize efficiency and productivity.

Despite these advances, international competition continues to grow and America's advantage in developing new technology can no longer be taken for granted. In order for the U.S. to maintain its competitive edge, it must promote forward-looking policies that encourage technology, and by extension, the U.S. economy. Our global competitiveness, in part, depends upon two important goals: encouraging growth in technology sectors that benefit U.S. manufacturers, and incentivizing manufacturers to further embrace advances in technology that will strengthen and secure the place of American manufacturers in the global economy.

The public sector plays a critical role in innovation. Over the past 60 years, government-funded research has contributed to major breakthroughs in science and technology. Through the Manhattan Project, we harnessed the atom; through NASA,² we unleashed space travel; through ARPA,³ we grew the Internet; and through SEMATECH,⁴ we shrunk the microchip.

Federally-funded R&D is what sets the United States apart from the rest of the world, but it is a distinction that we can lose. In 2008, the U.S. spent \$116.5 billion on federally funded R&D, facilities and fixed equipment – or 2.62% of its Gross Domestic Product (GDP).⁵ In the same period, China's government invested \$52.4 billion in R&D (about 1.49% of GDP, up from \$29.4 billion in 2005). This does not include R&D expenses at labs owned by foreign companies. If China continues a ratio of R&D spending of about 1.5% of GDP for 2009, its research will total about \$72 billion.⁶ However, China has one of the fastest-growing research budgets in the world, and by 2020 the government's goal is to invest 2.5% of GDP annually in research, which will cause China to rank third in the world in terms of total annual investment.⁷

² [National Aeronautics and Space Administration](#).

³ [Advanced Research Projects Agency](#) was the forerunner of DARPA, the Defense Advanced Research Projects Agency, an agency of the United States Department of Defense responsible for the development of new technology for use by the military.

⁴ [SEMATECH](#) (SEmiconductor MANufacturing TECHnology) is a non-profit consortium that performs basic research into semiconductor manufacturing, created to solve common manufacturing problems and regain competitiveness for the U.S. semiconductor industry that had been surpassed by Japanese industry in the mid-1980s.

⁵ [Federal R&D Support Shows Little Change in 2008.](#) National Science Foundation, *Info Brief*, September 2009.

⁶ ["Engineering & Research"](#), Plunkett Research, website visited January 14, 2010.

⁷ Ibid.

In order to ensure that ground-breaking achievements continue, it is critical that policy-makers both authorize and appropriate adequate funds for important government research agencies such as the National Science Foundation (NSF), the Department of Energy, the National Institute of Standards and Technology (NIST) and NASA. The America COMPETES Act put these key research agencies on a glide path to doubling their 2006-funding levels by 2016. The America COMPETES Act needs to be reauthorized to ensure that this goal does not fall to the wayside. As I mentioned earlier, only recently have sufficient funds been appropriated to fulfill our commitment to the COMPETES Act, funding that has come through the American Reinvestment and Recovery Act, the 2009 Omnibus Appropriations Act, and the pending passage of the FY'10 appropriations bills. We are greatly encouraged by the President's commitment to fulfilling the promise of the America COMPETES Act by his pledge to double the funding for these important research agencies through the President's Plan for Science and Innovation.⁸

The increase in NSF funding to \$7 billion in 2010, or 8.5 percent more than the 2009 enacted level, will support many more researchers, students, post-doctoral fellows and technicians contributing to the innovation enterprise. The 2010 DoE Office of Science Budget of \$4.9 billion, 3.5 percent more than the 2009 enacted level, will help us improve our understanding of climate science, continue the U.S. commitment to international science and energy experiments, and expand Federal support at the frontiers of energy research. And the 2010 Budget of \$652 million for NIST's intramural laboratories will improve NIST's research capabilities by providing high-performance laboratory research and facilities for a diverse portfolio of basic research in areas such as health information technology, the digital smart grid, and carbon measurements. Separately, the 2010 Budget also sustains NIST's external programs, including \$125 million in 2010 (a \$15 million increase over the 2009 enacted level) for the Hollings Manufacturing Extension Partnership (MEP) to enhance the competitiveness of the nation's manufacturers.⁹

Federal R&D Funding: Creating Jobs, Now and in the Future

The funds authorized by America COMPETES and released by the Recovery Act are going to help basic R&D create jobs in two ways: building infrastructure necessary to do cutting edge science, and funding grants that will help spur innovation. Infrastructure building includes completion of "bricks and mortar" projects at national laboratories, procurement of commodities for major Federally-funded research programs, purchases of modern scientific instrumentation associated with ongoing grants at universities and investments in both the scientific workforce and "green energy" initiatives. Short term, infrastructure building means that construction projects can begin in local areas, creating manufacturing and construction jobs and economic

⁸ See "[The President's Plan for Science and Innovation, Doubling Funding for Key Basic Research Agencies in the 2010 Budget](#)," Office of Science and Technology Policy, Executive Office of the President, May 7, 2009.

⁹ Source: [Office of Management and Budget, Budget of the United States Government FY 2010](#).

benefits now. Long term, the science done at these new facilities may bring about whole new industries, which will in turn create new jobs and economic benefits – as well as enhancing innovation, public safety and environmental protection – well into our future.

Economists can easily determine job creation numbers from physical infrastructure programs; determining job creation from federally funded R&D research projects is a bit more speculative. However, from these research projects industries are created, products are produced, Americans are employed, savings are realized, and our future is strengthened.

For instance, when the laser was first created using basic research from the Department of Defense, it was dubbed “a solution looking for a problem.” However, through other federally sponsored research programs, applications were discovered and advances made; today, the laser is a critical component to the U.S. military, to health care, to consumer and business electronics, and especially to the manufacturing industry. It is just one example of how basic research – which may begin with no specific technology or product in mind – can lead to important discoveries, life-changing inventions, and economic growth.

The benefits that can be reaped from federally funded research from the NSF, NIST and DOE Office of Science also produce ancillary benefits in areas that are critical to the American manufacturing sector, such as the economic health of the United States, health care, and energy consumption. Here are a few examples:

Economic Development: According to a joint analysis by the Commerce Department's Bureau of Economic Analysis and NSF, if R&D spending were treated as investment in the U.S. national income and product accounts, U.S. GDP would have been nearly 3 percent higher each year between 1959 and 2004. In 2004 alone, the U.S. GDP would have been \$284 billion more with the R&D satellite account.¹⁰

Health Care: The life expectancy of Americans rose from 47 to 78 between 1900 and 2009, largely due to advances gained from Federal biomedical research conducted with National Science Foundation, National Institute of Health, and Centers for Disease Control funding.

Energy Consumption: Buildings are the largest energy users in the United States. Federal research at agencies like the Department of Energy focused on emerging technologies for components, such as heating, cooling, ventilation, and refrigeration could lead to energy savings of 3.3 quadrillion BTU, or the equivalent to up to 200 million tons of coal.

Because of the America COMPETES Act, the Recovery Act and the 2009 Omnibus Appropriations bill, research grants are being awarded that will create jobs, foster innovation, and help revolutionize current industries and perhaps create new industries. Below is a sample

¹⁰ See [“Toward Better Measurement of Innovation and Intangibles.”](#) BEA Briefing, Ana M. Aizcorbe, Carol E. Moylan, and Carol A. Robbins, January 2009.

of the dollar amounts of some of the grants that are now flowing into key research states.

Basic R&D Grants Awarded in 2009		
<i>Key Research States</i>	<i>NSF Grants¹¹</i>	<i>DoE Science Grants¹²</i>
California	\$123,408,737.00	\$2,047,728.00
Florida	\$20,566,109.00	\$861,016,154.00
Michigan	\$28,774,164.00	\$1,845,900.063.00
New Mexico	\$14,246,392.00	\$515,748,207.00
New York	\$70,452,823.00	\$1,484,014,258.00
Ohio	\$16,937,358.00	\$1,049,588,217.00
Pennsylvania	\$40,507,260.00	\$866,859,442.00
Tennessee	\$20,874,951.00	\$1,618,015,504.00
Texas	\$45,126,031.00	\$1,326,722,160.00
Wisconsin	\$9,546,100.00	\$623,992,686.00

ARPA-E and the Future of American Manufacturing

As this country and the manufacturing economy seek to remain competitive in an ever-evolving global marketplace, we must avail ourselves of every opportunity to drive economic growth, bolster our domestic energy resources and protect the environment. In order to secure these opportunities, significant and consistent investments must be made; we cannot let American ingenuity and innovation become a success story in other countries.

I commend the House Science Committee for recognizing the importance of supporting high-risk, high-reward projects by bringing the Advanced Research Projects Agency – Energy (ARPA-E) online. As the Director for ARPA-E, Arun Majumdar, notes in his open letter of December 15, 2009, “the nation that successfully grows its economy with more efficient energy use, a clean domestic energy supply, and a smart energy infrastructure will lead the global economy of the 21st Century.”¹³ ARPA-E is designed to ensure that the U.S. can do just that.

The NAM has long advocated that, in order to move this country forward, we need a fundamental transformation in how we produce, distribute, and consume energy. This transformation should start with a shift in how we view and approach energy research. While quality research is successfully conducted by U.S. manufacturers and the DoE, a new approach is needed that will expedite the development and deployment of technological innovations. This approach should leverage the vast intellectual capital throughout our country that we hope will lead to market success, the building of the necessary infrastructure and high paying jobs. This is the goal of ARPA- and it presents a unique platform to integrate innovative industry, research and development, and yield results.

¹¹ Source: [National Science Foundation](#), January 14, 2009.

¹² Source: [U.S. Department of Energy](#), January 14, 2009.

¹³ <http://arpa-e.energy.gov/public/dir-ltr.pdf>.

The NAM was pleased to see that ARPA-E released its first funding opportunity announcement in May 2009. After the unprecedented response, award agreements are now being finalized. Additionally, ARPA-E has announced the launch of its second round of opportunities for a total of \$100 million. Knowing that demand for ARPA-E resources is so significant, the NAM looks forward to working with this Committee to ensure that the Agency is reauthorized and its funding remains at levels that will continue to support high-risk, high-reward projects and technological innovation.

The goals are simple—reduce our reliance on foreign sources of energy, improve the energy efficiency of all economic sectors, slow and reduce greenhouse gas emissions; and maintain US technological leadership in the world and in the development and deployment of energy technologies. Long term, this research will form the foundation of new R&D investments that meet the size and complexity of the challenges facing the energy sector.

Preparing our Next Generation Manufacturers by Improving Education

Strong Science, Technology, Engineering, and Math (STEM) education is the foundation for a technical workforce, and provides the fundamental skills necessary for a vibrant and competitive manufacturing economy. Improving the quality of K-12 STEM education and creating stronger educational pathways for graduate students in these fields, as supported in the America COMPETES Act, will provide employers with candidates that possess the necessary educational base to drive innovation in the manufacturing industry.

However, far too often our policies and investments related to the STEM skills begin and end with a focus on high science and math academic theory. For manufacturers, it is the application of science, technology, engineering, and math skills in real world workplaces that is critical to developing this nation's technical workforce and preparing an educated and skilled manufacturing workforce for the 21st Century.

It is in this area where we are experiencing a tangible skills gap. In a recent study by the Manufacturing Institute and Boston Consulting Group, over 1000 manufacturing executives identified a skilled educated workforce as the single most critical element of innovation success.¹⁴ In turn, they reported that innovation is the single most critical element of business success. So, if manufacturers require an educated and skilled workforce for business success, job creation, and the ability to compete in a global market, we must ensure we have the policies and investments in place to train our future workforce in critical STEM skills. The fundamentals developed with a strong STEM education program are not only for use as a pathway to advanced science research. No company can take R&D to market without the ability to produce the product. Strong STEM skills create a competitive business environment by contributing to skills on the production line as well as in the research lab.

As manufacturers, we take pride in measurable successes. Just-in-Time inventory management and Six Sigma process management defines how manufacturers look at business. It is therefore important to the manufacturing sector that modifications to the education system have quantifiable advantages. While many education and workforce reforms can take many

¹⁴ [*The Innovation Imperative in Manufacturing*](#), The Manufacturing Institute, Boston Consulting Group, 2009.

years to have an impact, some reforms yield results much more quickly. For example, there is a direct statistical correlation between quality of workforce and innovation performance.¹⁵ Stated more directly, quality input means quality output. We need to ensure that we continue to train workers with the right skills to keep pace with the increasingly technical demands of the productivity-oriented manufacturing sector.

The P-16 program outlined in the America COMPETES Act takes a step towards integration of the skills needed by employers and education systems calling for education alignments with the private sector. Driving students towards advanced degrees in STEM areas is critical for competitive success; however, so is continuing the education for those who may not follow the traditional educational path. Preparing students and transitioning workers with applied STEM education to real world skills is just as important, and engages a sector of the workforce without a four-year college or graduate degree.

A portable skills certification system¹⁶ developed and recognized by broad industry partners, and implemented in high school and local two- and four-year college programs, moves the integration to the next level. When academic and technical programs are aligned with industry needs and standards, students gain recognized credentials and companies gain skilled workers. By creating more STEM pathways for secondary and post-secondary education, and aligning education with industry-recognized skills credentials, the United States can create the kind of manufacturing workforce that will facilitate ever-needed product and process innovations in an evolving global business climate. In fact, the recently introduced H.R. 4072, The America Works Act, sponsored by Rep. Minnick and co-sponsored by Rep. Dahlkemper who sits on this Committee, takes programs like these and prioritizes them within current educational programs.

The Hollings Manufacturing Extension Partnership: Bringing High-Tech to Small Manufacturers

Another key program in the America COMPETES Act that has received increased funding is the Hollings Manufacturing Extension Partnership (MEP). The MEP is a nationwide network of not-for-profit centers that provide small- and medium-sized manufacturers with services ranging from process improvements and worker training, to business practices and information technology.

Small manufacturing enterprises – defined by the Federal government as companies with fewer than 500 employees – are critical to the U.S. manufacturing base as well as to the national economy. Over 99 percent of American manufacturers are smaller companies, and these manufacturers account for two-thirds of manufacturing employment and half of the value of all domestic production. Faced with steep downward cost pressures as a result of the global business environment, efficiency and innovation are critically important to these companies. The MEP provides small- and medium-sized manufacturers affordable access to technical expertise, so that they can create more high-paying manufacturing jobs – despite today’s daunting economic cost pressures.

¹⁵ Ibid.

¹⁶ Nationally portable, industry-recognized certifications validate that workers have the skill sets necessary to perform in a manufacturing environment and provide flexibility for the employee to take those skills anywhere in the marketplace, while also providing a streamlined hiring process for the employer.

MEP's mission is to support, strengthen, and grow U.S. manufacturing. To do this, it provides customized and direct assistance to manufacturers through its nationwide network of MEP centers, with nearly 392 locations across the country, and more than 1600 field staff working every day with companies in their plants and offices. The nation's manufacturers, thanks to MEP assistance, have streamlined their plant operations and improved their bottom-line – and as a result, have been able to create opportunities for growth via new sales, new markets, and new products. In 2008, MEP served 31,961 manufacturers.¹⁷

The impact of the MEP program on the U.S. economy is truly impressive. In FY'07 alone (from projects completed in 2007), the MEP helped to:

- create or retain more than 57,000 jobs;
- deliver \$1.44 billion in cost savings annually;
- generate more than \$10.5 billion in sales; and
- stimulate more than \$2.19 billion in economic growth.¹⁸

Thanks to the vision of this Committee, Congressional Leadership, and the Administration, the MEP program received increased funding this year, authorizing and appropriating \$122 million for its parent agency, the National Institute of Standards and Technology. Unfortunately, due to an uncertain economy, the future of this important program is in jeopardy. The NAM greatly supports the NIST MEP as it is a program that consistently reaps an enormous return on investment for our economy and fosters the next generation of American manufacturers.

Conclusion

Chairman Gordon, Ranking Member Hall, and other members of the Committee, thank you for the opportunity to testify today and represent our nation's manufacturing industries. We strongly support the reauthorization of the America COMPETES Act as the small investment in its critical components – doubling federal R&D funding for the NSF, NIST and DoE Office of Science, reauthorizing ARPA-E, strengthening STEM education, and renewing our commitment to the Hollings Manufacturing Extension Partnership – will reap considerable returns by helping to create jobs today, and ensure our economic security in the future.

¹⁷ Source: [NIST MEP Website](#), January 14, 2009.

¹⁸ See [“Making a Difference for America's Manufacturers,”](#) NIST MEP Publication, February 11, 2009.