

October 20, 2009

Barriers to energy efficiency investments and energy management in the U.S. industrial sector

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Much of the current debate surrounding the climate and energy bills in Congress has centered on the industrial sector. Manufacturers and lawmakers are concerned that greenhouse gas regulations imposed on the industrial sector could unduly increase costs for manufacturing production and force some U.S. industries to move overseas.

A recent study by McKinsey & Company² found that the manufacturing sector has a large amount of no- or low-cost opportunities to reduce greenhouse gas emissions, mostly through implementation of energy efficiency projects. McKinsey found that the manufacturing sector could reduce its emissions by over 30 percent through these opportunities. These findings are consistent with what ACEEE has found over the past two decades. Why, then, hasn't the industrial sector made these investments that can help reduce energy costs, lower emissions, and stay globally competitive and sustainable for the long term?

The barriers to investment in energy efficiency infrastructure and energy management are complex, as ACEEE has noted in recent testimony to the Senate Energy Committee.³ While some of the barriers are longstanding hurdles, the recent economic downturn has affected the manufacturing sector in a more profound way than has been seen in other sectors of the economy.

Beginning in the second quarter of 2008, manufacturing output in the U.S. began to decline as the economy began to slow. U.S. industries experienced a sharp drop in production as demand for manufactured goods dropped precipitously in the last quarter of that year. Industrial firms are now hibernating in an attempt to survive the economic winter. They need the cash to preserve their manufacturing capacity and to retain the trained workforce necessary to return to operation when demand for manufactured goods recovers.

Some may ask why industry does not invest in energy efficiency now, while their plants are shut down and staff is not otherwise occupied. The reality is that if plants shut down, firms stop generating cash flow, and in the current economic environment, no one knows when consumer demand for manufactured goods will return. Because of this uncertainty, most firms are in no position to invest.

As ACEEE's Senate Energy Committee testimony⁴ from last spring noted, when the economy recovers, the manufacturing sector will find itself in need of significant investment in new manufacturing capacity, and will face the need for a trained workforce. This renewed investment in expanded and modernized manufacturing capacity will represent a unique opportunity not seen in over a generation. To accomplish this, however, the knowledge and skilled workforce necessary to support a more sustainable industrial base must be put in place now, before industry is fully ready to invest. This infrastructure will take several years to implement fully, but it will be imperative in order for manufacturing firms to modernize, especially since we have underinvested in this infrastructure over the past decade.

Energy efficiency programs have had difficulty penetrating the industrial sector in large part due to the heterogeneity of the sector, and the fact that industrial and manufacturing firms are first and foremost focused on

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² McKinsey & Company, 2009, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?*, <http://www.mckinsey.com/client/service/ccsi/greenhousegas.asp>.

³ Testimony of R. Neal Elliott before the U.S. Senate Committee on Energy and Natural Resources hearing on the *Restoring America's Manufacturing Leadership through Energy Efficiency Act of 2009* (S. 661) March 26, 2009, http://aceee.org/tstimony/032409_senate_RNE.pdf.

⁴ Elliott, 2009 op. cit.

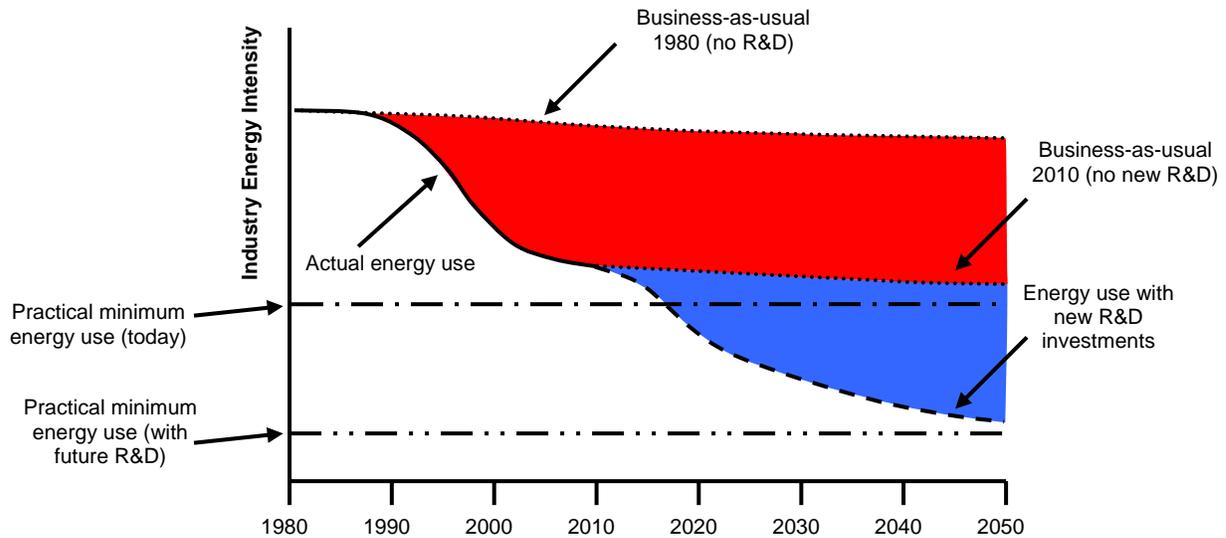
producing manufactured goods, and not necessarily on saving energy. While energy waste is certainly a cost to industrial companies—and a cost that most companies would like to reduce—it is often mistakenly considered peripheral to the company’s operations, beyond what can be controlled. In many cases, decisions about energy use and capital are not made by the same people. Therefore, substantial capital investment in more energy efficiency technologies may not occur, even if a facility or shop manager understands its value. As the current recession continues to impact capital markets and long-term industrial investment decisions, encouraging investments in energy efficiency will continue to prove difficult.

ACEEE research indicates that the infrastructure and capacity needs for investment in industrial energy efficiency fall into four key categories:

1. Need for new technologies, products, and processes

Industrial energy efficiency requires new technologies and processes that use less energy—and which are often safer and more productive than the older technology—enabling new market product development. While technologies already exist that can make incremental improvements to industrial energy intensity, to achieve major reductions requires new technologies that can reduce the practical minimum intensity of manufacturing processes (as shown in *Figure 1*). Developing these new technologies requires focused funding on both crosscutting and industry-specific R&D. Additionally, R&D should be seen as an ongoing commitment required to ensure further energy efficiency gains.

Figure 1. Stylized Graph of Energy Intensity Reductions Achieved by Materials Manufacturers Due To Partnership with ITP Since 1990



This commitment requires consistent funding to continue to push the boundary of energy efficient manufacturing, especially in light of greenhouse gas emissions reductions targets, while also supporting the development of the next generation of scientists and engineers necessary to undertake future R&D. The Department of Energy’s (DOE) Industrial Technologies Program (ITP) has been the primary federal entity supporting manufacturing R&D in partnership with industrial stakeholders. This program has been recognized as one of the most successful federal R&D efforts operating today. However, in recent years support for the program’s R&D funding has faltered—as shown in *Figure 2*—particularly for the industry-specific R&D funding, which has been the most effectual initiative because it can achieve the transformations shown in *Figure 1*. Unfortunately, the manufacturing R&D pipeline is now largely empty, as a peer review of ITP recently noted.⁵ This poses a challenge to the transformation of manufacturing because experience with the ITP R&D activities have shown that it can take seven to ten years for results from R&D to reach a plant floor.

⁵ Savitz, et al., 2009, *DOE Industrial Technologies Program 2008 Peer Review*, http://www1.eere.energy.gov/industry/about/pdfs/itp_peerreview_report2008.pdf.

Figure 2. Industrial Technologies Program Funding, 1998-2010

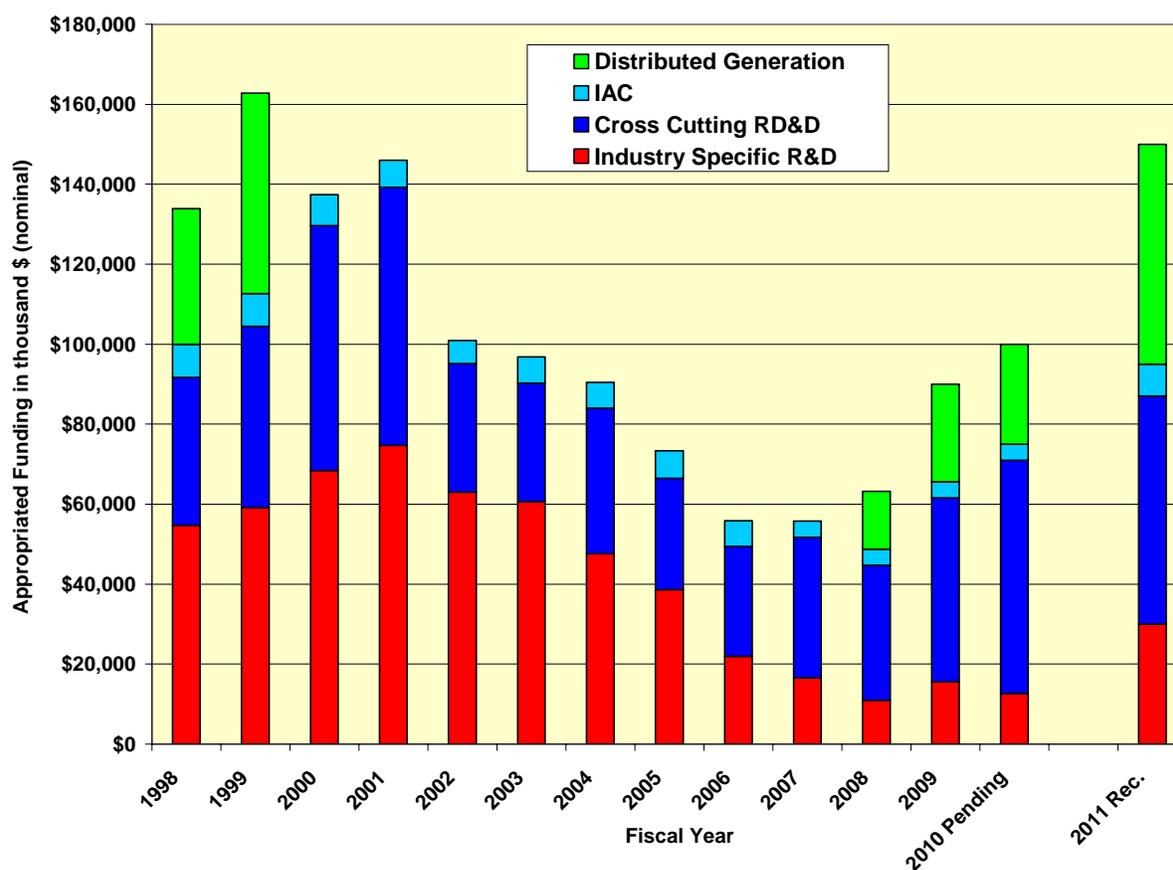


Figure notes:

- IAC and Distributed Generation funding are subsets of "Cross Cutting RD&D"
- One time funding, such as a \$50M appropriation for ICT and standards in 2009, is not included.
- 2011 ACEEE recommendation includes: \$30M for Industry Specific R&D, \$65M for Cross Cutting RD&D (including \$8M for the IAC program), and \$55M for Distributed Generation

2. Access to industry-specific technical expertise, assessments, and training for workers

ITP currently helps perform these necessary services, partnering with industrial stakeholders as noted in Dr. Elliott's testimony.⁶ While there is a wide variance across industries and entity sizes, many manufacturing facility operators are under the false impression that their facilities and operations are already as efficient as they can be. Often, the most effective way that they can be informed of the myriad efficiency opportunities available is to have an audit performed by a third party expert, or have employees specially trained to identify these opportunities themselves. Even facilities that have in-house energy managers can overlook efficiency opportunities, or find themselves unable to convince their supervisors that energy efficiency investments should be made.

As described in detail in a new ACEEE report,⁷ several states collect money through some form a public benefit fund and use the money to pay for industrial energy efficiency programs that are administered by local utilities or other state-administered entities. These programs are tasked with assisting in the identification and deployment of industrial energy efficiency investments, and are critical in reaching industrial customers that may not otherwise make such investments. Industry efficiency programs address the above-mentioned challenges by offering training and sector-specific technical assistance to industrial firms. Strengthening and

⁶ Elliott, 2009 op.cit.

⁷ Anna Chittum, Nate Kaufman and R. Neal Elliott. 2009. *Industrial Energy Efficiency Programs: Identifying Today's Leaders and Tomorrow's Needs*, <http://www.aceee.org/pubs/ie091.pdf>.

improving these programs, which are generally designed at the state level, is one of the best ways to assist industrial firms in making energy efficiency investments.

3. Availability of a trained and capable workforce

From operators to senior engineers and managers, the issue of workforce is a critical one to the future of the manufacturing sector, and one that seems to be growing direr each year. (This is also a key issue in the clean energy area more broadly, as an ongoing national lab study is exploring.⁸) Too many manufacturing employees are nearing retirement and our national educational system is not producing enough trained replacements. While much of the responsibility will lie with state educational systems, energy engineering needs are being addressed in part by DOE's *Industrial Assessment Centers* (IAC), another program that has been chronically under-resourced.⁹ An expansion of this program would represent an important step to addressing part of these workforce needs while also providing technical assistance to small manufacturers across the country. Beyond this program, an interagency effort to support state and local educational development of resources would help to address workforce issues.

4. Access to useful capital to make needed investments

While many manufacturing firms have access to capital to make infrastructure investments, many have been hesitant to invest in energy efficiency because of internal competition with other investment opportunities. While DOE has administered a loan guarantee program authorized by the *Energy Policy Act of 2005* to encourage manufacturers to invest in energy efficiency, few firms have in fact sought this funding. Many manufacturers have reported that the application process is overly complex and receiving loans is not helpful if firms do not have access to capital initially. Similarly, various economic and industrial development programs have not been fully utilized, perhaps because of a lack of awareness and the transaction costs associated with seeking the funding. Additionally, many of the opportunities for investment are either too large or too small to fit with available financing options.

In marked contrast, a recent solicitation for manufacturing energy efficiency, waste energy recovery, and combined heat and power (CHP) for \$156 million authorized by the *American Recovery and Reinvestment Act of 2009* has reportedly received over \$10 billion in proposals. This response clearly indicates that there is a significant demand for energy efficiency investments in manufacturing. It will be important to understand why this federal financing program has been widely successful, while other public financing efforts have proven less effective.

A crucial issue to understand is that the capital investment cycle that a manufacturing facility goes through may last between four and seven years, and it may take several years to develop an energy efficiency project. Investments in the industrial sector, therefore, need to take a longer-term perspective, since the benefits from efforts today may not be realized for some years, as is discussed in a recent ACEEE report.¹⁰ Investments made during the refit portion of the plant cycle can have a huge reduction in energy intensity at a very modest cost.

Many efficiency opportunities are also not necessarily associated with a conventional capital investment. A retrospective study by ACEEE suggested that the application of information and computing technology in industrial equipment may have represented as much as two-thirds of energy intensity improvements over the past two decades.¹¹ ACEEE feels that the extension of this capability to the process, plant, and even to the supply chain level could offer far greater opportunities for energy intensity reductions and productivity enhancements.

⁸ See presentation by Jane Peters, Research Into Action, Inc., and Charles Goldman, Lawrence Berkeley National Laboratory at Energy Efficiency as a Resource Conference, [http://www.aceee.org/conf/09ee/pdfs/\(1A_Peters\)EER2009_3.pdf](http://www.aceee.org/conf/09ee/pdfs/(1A_Peters)EER2009_3.pdf).

⁹ For more information see: <http://aceee.org/industry/iac.htm>.

¹⁰ R. Neal Elliott, Anna Monis Shipley, and Vanessa McKinney, 2008, *Trends in Industrial Investment Decision Making*, <http://aceee.org/pubs/ie081.pdf>.

¹¹ Anna Monis Shipley and R. Neal Elliott, 2006, *Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?*, <http://aceee.org/pubs/ie061.pdf>.

We know that there are significant opportunities to improve the energy efficiency of U.S. manufacturing, but we also understand some of the challenges facing the manufacturing sector. Many of these challenges have resulted from an underinvestment in the manufacturing sector both by industry and by the public sector. The key to rectifying this path will be to provide leadership on manufacturing—something that has been lacking in Washington for more than a decade. Now is the time to change this direction if we are to preserve and restore our manufacturing sector to health and sustained global competitiveness.

The American Council for an Energy-Efficient Economy is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection.

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