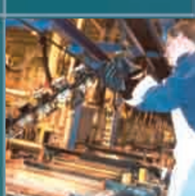
Energy Trends in Selected Manufacturing Sectors:

Opportunities and Challenges for Environmentally Preferable Energy Outcomes







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4. Barriers to Environmentally Preferable Energy Outcomes

Insights

Based upon our research—including the data sources we reviewed and the perspectives and insights provided to us during interviews with internal and external stakeholders—this analysis (1) identifies general categories of barriers (financial, technical, institutional, and regulatory) to environmentally preferable energy outcomes in industrial manufacturing sectors; (2) notes that regulations and their underlying legislation do not necessarily take into consideration the potential for an adverse impact on energy efficiency or clean energy improvement; (3) discusses ways in which regulations—issued by EPA or other agencies—may thus create barriers to energy efficiency and clean energy improvement; and (4) identifies specific regulatory requirements that may impact opportunities around cleaner fuels, increased Combined heat and power (CHP), equipment retrofit/replacement, process improvement, and research and development (R&D).

4.1 Overview of Barriers

As discussed in Chapter 3 of this report, including each sector's table of *Best Case Scenario Opportunities*, there are a number of key opportunities for promoting environmentally preferable energy outcomes within each of the 12 sectors. These opportunities—reducing energy-related emissions through use of cleaner fuels, or by increasing energy efficiency through combined heat and power technologies, equipment retrofit or replacement, process improvement, or R&D involving energy-efficient technologies and processes—can be inhibited by a number of barriers. Thus, the next step is to examine what the barriers are to implementing these opportunities.

Based upon our research—including the data sources we reviewed and the perspectives and insights provided to us during interviews with internal and external stakeholders—we identified a number of different types of barriers that can impact energy efficiency and clean energy investments. These include, but are not limited to, nonregulatory barriers (i.e., financial, technical, and institutional constraints) as well as regulatory barriers. Section 4.2 briefly discusses the nonregulatory barriers to provide context for the consideration of regulatory barriers. Section 4.3 then provides a more detailed discussion of regulatory barriers, as the purpose of this analysis is to facilitate the development of policy approaches that EPA can employ to address regulatory barriers and promote energy efficiency and clean energy improvement in select manufacturing industries.

4.2 Nonregulatory Barriers

4.2.1 Financial Barriers

Primary and secondary research identified a number of financial barriers to environmentally preferable energy outcomes associated with financial and human capital investment, fuel cost differentials, and the broader economic circumstances facing one or more sectors. Sector representatives interviewed for this analysis indicated that such cost barriers are among the most important factors constraining energy efficiency and clean energy investments.

Competing Capital Needs

Given scarce capital resources, the greatest investment priorities are typically for equipment that (1) maintains or increases production and product quality or (2) is necessary to meet regulatory requirements (i.e., for equipment required to comply with environmental or worker safety regulations). Discretionary investments for energy efficiency or clean energy projects must often compete with these higher-priority investments.

Stringent Investment Hurdles

Energy efficiency and clean energy investments may also face more stringent investment hurdles than other types of capital investment (i.e., shorter payback periods; evaluating alternatives on the basis of up-front costs rather than lifecycle costs). Companies evaluate capital investments in terms of which ones offer the highest return on investment (ROI). Energy efficiency investments may be viewed less favorably than other investments, since energy is an input that does not necessarily increase production capacity or productivity, improve product quality, increase worker safety, etc. This is particularly true in the case of new technologies that may entail greater risks in implementation. The American Forest & Paper Association (AF&PA) indicated that managers typically want to see an ROI of 25 to 30 percent on an energy efficiency investment.[305] According to a 2004 study by the National Commission on Energy Policy, "business managers routinely forego efficiency opportunities with payback times as short as 6 months to three years—effectively demanding annual rates of return on efficiency investments in excess of 40-100 percent."[306]

Slow Turnover of Capital

If firms have made a substantial investment in equipment that has a long service life, they are likely to continue using such equipment until the end of its useful life before replacing it with a more energy-efficient technology. In industries like cement and forest products, existing energy-intensive equipment such as kilns and boilers have long lifetimes and require substantial amounts of capital to replace, which slows the rate of investment in more energy-efficient technologies. Such barriers are exacerbated when industry production is stagnant or declining and there is no expansion of production capacity, or when the industry is already at risk due to global competition and other economic conditions. This is the case for many of the industries addressed in this report, including aluminum, forest products, and segments of the chemical industry.

Economic Circumstances of the Industry

Firms are unlikely to invest capital in new equipment unless their long-term economic outlook is favorable. Many basic U.S. industries, such as aluminum, forest products, and segments of the chemical industry are not growing due to foreign competition and higher U.S. costs for labor and other variable costs. It may be difficult for these industries to justify large capital investments under current economic circumstances. It may also be more difficult to raise funding in equity markets if a sector is in decline or if investors do not perceive it as capturing value. Capital investment decisions regarding equipment replacement or retrofits may also be affected by resource-related constraints such as the extent of raw material reserves (e.g., the level of investment in equipment upgrades at cement plants may be based on the magnitude of remaining onsite limestone reserves).

Some sectors face increased energy consumption based on consumer demands. Food manufacturers have seen increased demand for ready-to-eat and fast-prepared foods, which consume more energy in processing. Customers of metal finishers and motor vehicle parts manufacturers are also demanding improved environmental performance through certifications such as ISO 14000. Such certification processes are often an important tool in identifying energy-savings opportunities, but they are also typically capital-intensive initiatives that may require expenditures on process modifications that take precedence over energy-related investments.

Resource constraints may also serve as a general barrier to energy efficiency and clean energy investment in certain sectors. As raw material inputs become more constrained for certain sectors (e.g., in petroleum refining, sources of light, sweet crudes, and in forest products, available land for harvesting), they may be forced to process lower-quality materials that have higher energy requirements.

Staff Resource Constraints

Firms may be unable or unwilling to incur the costs (in terms of staff time and effort) associated with evaluating the feasibility of an energy efficiency or clean energy opportunity and making the investment case to management decision-makers. AF&PA indicated that even for cost-effective and low-risk energy-savings opportunities, facility managers must typically develop an internal business assessment of the investment for approval by upper management decision-makers. The staff time and resources required to conduct such assessment may be a barrier to implementing the opportunity. Even greater internal resources may be needed to make the case for higher-risk investments in new technologies.[307]

Fuel Cost Differentials

As it relates to cleaner fuel opportunities, the substantially lower cost of coal (an emissions-intensive energy source) as compared with cleaner fuels such as natural gas is the primary constraint on environmentally preferable fuel-switching opportunities. In addition, the price of natural gas has historically been far more volatile, further diminishing its viability as a clean fuel opportunity. An expert who works with metal casting facilities noted that while oxygen injection increases combustion efficiency, oxygen is typically as expensive or more expensive than natural gas, diminishing the attractiveness of this opportunity.[308]

4.2.2 Technical Barriers

In many cases, a given energy efficiency or clean energy opportunity may not be viable to a sector or specific manufacturing facility given process, resource, quality control, or other constraints.

Some energy efficiency or clean energy opportunities are not well suited to a given industry's manufacturing process (e.g., CHP is not an attractive energy efficiency opportunity for electric arc furnace steelmaking, because the sector has relatively low demand for steam, and waste heat is difficult to recover). Process-related technical constraints may also affect the extent to which a given opportunity can be utilized (e.g., in cement manufacturing, use of waste fuels such as tires in kilns is constrained because the zinc content in tires slows down setting time). The manufacturing process diversity of other sectors (e.g., chemical manufacturing, metal casting) means that processes and technologies that work for some manufacturing facilities may not be applicable to other operations.

Other technical constraints relate to the ability of firms to implement an energy efficiency or clean energy opportunity given equipment configurations (e.g., type of boiler or burner in place), facility constraints (e.g., adequate space for new process equipment), supply constraints (e.g., price and availability of alternative fuels), and location-specific limitations (e.g., proximity to landfills as a source of landfill gas). Industries also face quality-control constraints related to manufactured product output. For example, an R&D opportunity for the metal finishing industry is the substitution of non-cyanide-based plating solutions for cyanide solutions. While some substitute processes reduce energy consumption in the metal finishing process as well as in waste treatment, viable alternatives remain impractical for a number of metals due to product quality issues.

4.2.3 Institutional Barriers

In some cases, institutional barriers associated with incentives and information flow constrain investment in energy efficiency and clean energy opportunities.

Incentive Constraints

Incentive constraints refer to industry characteristics that reduce incentives to invest in energy efficiency or clean energy opportunities. Even for the energy-intensive industries addressed in this report, energy costs are less significant than costs for labor and raw materials. Thus, energy efficiency opportunities may not be considered a fruitful area to pursue potential cost savings.

Historically, sectors such as food manufacturing have viewed energy as a fixed cost, which means that there is little incentive to pursue energy-savings opportunities. In some cases, energy costs may be paid by headquarters, while equipment purchasing decision-making happens at the facility level. If energy costs are outside the plant manager's incentive structure, he or she may have little reason to pursue investments in energy-efficient equipment. Conversely, facility managers may be reluctant to invest the time and effort in making the case for energy efficiency-related capital upgrades to corporate management, as such investments may not be perceived as integral to the business's profitability.

Informational Constraints

In addition to lacking a systematic approach to energy management, firms may also lack leading-edge information on energy-efficient technologies, or have inadequate internal resources to seek out and evaluate such information. An expert on the metal finishing industry indicated that, within the industry, there is generally a low level of technical capability in this area, with firms relying heavily on equipment suppliers for expertise.[309] In other cases, energy efficiency expertise may be compartmentalized among technical experts, without adequate distribution at the decision-making level of the firm. Sometimes decisions about equipment replacement must be made quickly to limit production interruptions. In such cases, if more efficient technologies have not been identified, replacement decisions may be less than optimal. This problem is compounded by the fact that much industrial capital stock is long lived.

In other cases, informational constraints may be related to an excess of information, especially where there are insufficient staff resources to devote to sorting through a mass of technical assessments to identify which technologies offer the best opportunities for a given manufacturing operation. At least one sector (aluminum) indicated that while there is an enormous amount of technical information available regarding R&D for energy-efficient technologies, it does not seem that this information is optimally coordinated and disseminated across government, the private sector, and academia. Such lack of coordination may limit implementation of newly developed technologies and processes.

4.3 Regulatory Barriers

It is clear that for manufacturing industries, nonregulatory barriers are often the dominant factor inhibiting investment in energy efficiency and clean energy opportunities. Though it is critical to acknowledge the importance of such barriers, the purpose of this analysis is to facilitate the development of policy approaches that EPA can employ to address regulatory barriers and promote energy efficiency and clean energy improvement in select manufacturing industries. This emphasis is appropriate given the role of EPA's Office of Policy, Economics, and Innovation in developing and coordinating cross-agency policy approaches to improving the environmental performance of entire sectors. The focus on regulatory barriers is also appropriate given the purview of other federal agencies working to promote energy efficiency and clean energy opportunities—for instance, DOE's Industrial Technologies Program, which establishes collaborative public-private partnerships to facilitate new technology R&D.

Our assessment of sector energy consumption and National Emissions Inventory data in Chapter 3 indicated that across multiple sectors, major areas of opportunity for improved environmental performance with respect to energy use lie with increased efficiency in electric and thermal energy generating systems, particularly through increased CHP and increased boiler efficiency. Alternatives to fossil fuels also represent key opportunities for some sectors, such as biomass fuels in the forest products industry and waste fuels in cement manufacturing. Thus, our discussion of regulatory barriers focuses on key ways in which regulations may contribute to less environmentally preferable energy outcomes in these areas:

- Regulations may fail to fully reward the environmental benefits associated with an energy efficiency opportunity, allowing energy efficiency to be evaluated on an equivalent basis with other pollution control strategies such as add-on controls.
- Regulations may lack procedural flexibility that facilitates pursuit of energy efficiency or cleaner fuel opportunities, particularly in areas where permitting changes are required to implement an opportunity.
- Notwithstanding their environmental, health, and safety benefits, regulations affecting industrial manufacturing sectors frequently have implications in terms of energy consumption. The rulemaking process may not consider and address such implications in a consistent way.
- Regulations or policies may contribute to unfavorable market conditions for energy efficiency or cleaner fuels opportunities.

As discussed in Chapter 1, this analysis relies primarily on readily available public information, limited interviews with representatives from the regulated community, and inputs from various stakeholders, including industry and regulators. The examples of regulatory barriers discussed in the following sections are not intended to be a comprehensive list of all of the regulatory barriers potentially affecting the sectors included in this analysis, but rather are intended to illustrate key regulatory barriers that affect the most promising energy-related environmental improvement opportunities discussed in this report. Also, it is important to note that these barriers are not new, and many entities at the federal, state, and local level currently have initiatives underway to address them. Our discussion of Policy Options in Chapter 5 will provide some examples of regulatory initiatives at the federal level aimed at addressing these issues.

Regulations May Not Account for Environmental Benefits of Energy Efficiency

Energy efficiency is a form of pollution prevention that leads to decreases in energy-related criteria air pollutant and greenhouse gas emissions through reduced fuel usage. However, some environmental regulations do not fully account for the environmental benefits of energy efficiency and do not provide adequate mechanisms for recognizing or rewarding the emissions reductions that accrue from more efficient fuel use. In particular, input-based standards that establish emissions limits based on heat input (e.g., pounds of pollutant emitted per Btu of delivered fuel) or pollutant concentrations at the outflow (parts per million (ppm)) do not differentiate between more and less efficient fuel usage.[310] Input-based standards—which may be used in permitting regimes as well as in establishing emissions allowances under cap-and-trade systems—do not provide a true indication of environmental performance, as there is no accounting for the amount of energy produced from fuel inputs. By failing to account for the environmental benefits associated with increased energy efficiency, such standards fail to create appropriate incentives for investment in energy-efficient technologies.

Most equipment used to generate thermal or electric energy (boilers, turbines, many industrial process, and CHP applications) have historically been governed by input-based emissions standards.[311] An input-based standard does not differentiate between a more efficient boiler that produces more thermal energy from the same amount of fuel as a less efficient boiler. Though the more efficient boiler generates less pollution on an annual basis due to its lower fuel usage, input-based emissions limits have no mechanism for accounting for the difference in fuel usage between these two boilers, or rewarding more efficient fuel use.

In addition to contributing to general disincentives for energy efficiency investment, input-based standards are particularly problematic for CHP applications because they provide no mechanism for accounting for the two forms of energy output—electric and thermal—that are produced from a single fuel source, and thus offer little incentive for investment in CHP as a pollution control strategy.

As noted in the opportunity assessments in Chapter 3, industry representatives frequently cite the costs imposed by environmental regulations and associated permitting requirements as barriers to investment in energy-efficient equipment, such as the increased capital and operational costs associated with add-on pollution controls that do not increase productive output, or the administrative costs associated with permitting processes. To a large degree, input-based regulations penalize energy efficiency investments by failing to recognize and offer credit for their environmental benefits and requiring additional investments (i.e., through installation of pollution control technology) to create emissions reductions. Input-based regulations reduce compliance flexibility by not providing adequate mechanisms for sources to include energy efficiency as part of their pollution control strategy.

Regulations May Lack Procedural Flexibility

Many of the industry representatives consulted in connection with this analysis cited permitting barriers as inhibiting investments in energy efficiency or cleaner fuels opportunities. A facility may be reluctant to make a change that would require modification or review of an existing operational permit (for instance, under Title V of the Clean Air Act) or trigger a preconstruction permitting requirement under New Source Review (NSR). When energy efficiency or clean energy investments trigger the need for new permits or changes to existing permits, the result may be increased time required to implement a project, increased administrative burdens, or other adverse impacts on the project schedule. Particularly for facilities with limited staff resources, the potential for encountering permitting requirements may discourage pursuit of the opportunity.

Potential permit-related barriers include the following examples:

- Installation of new melting furnace technologies that entail new or expanded exhaust systems typically triggers state and local permitting requirements. Many smaller metal casting facilities would prefer to retrofit existing equipment than to install new technologies due to constraints on capital and personnel resources to address permitting requirements.[312]

- Due to concerns about the time and expense associated with an NSR permitting process, a motor vehicle assembly plant was dissuaded from undertaking a project that would have reduced energy use by eliminating a shift, as this change would have required the installation of additional permitted equipment to increase production during the remaining shift.[313]
- Increased use of alternate or waste fuels (e.g., process byproducts or waste oils, paints, or tires) may represent opportunities for sectors to reduce purchased fuel requirements. In addition, waste fuel use can potentially also represent opportunities for environmental improvement in cases where using waste fuels for energy content reduces total energy consumption by combining energy generation and waste disposal processes, or through more complete combustion than would be offered under alternate disposal mechanisms (for example, the higher combustion efficiency that is achieved in cement kilns as compared with most commercial incinerators[314]).

Permitting requirements are in place to ensure an appropriate level of environmental protection, and an environmentally preferable energy scenario would certainly not dispense with these protections. In the case of increased use of waste fuels, for example, such activity would have to represent a net environmental improvement over alternate mechanisms of disposal. However, there are opportunities for increased flexibility under existing regulations that could be enacted to promote the implementation of energy-related opportunities with demonstrable environmental benefits. In addition, the NSR process could be revised to better recognize energy efficiency and pollution both in the permitting process and structure and in the expression of the results through output-based permit limits.

Regulatory Process May Not Consider Energy Implications

Regulations frequently have implications in terms of energy consumption and associated emissions, notwithstanding their environmental, health, and safety benefits. Examples follow:

- Hydrotreatment used to desulfurize diesel to meet EPA mandates for lower sulfur limits for on-road and off-road diesel is an energy-intensive process that will increase energy consumption at petroleum refineries. Further regulations to lower sulfur limits on home heating oil and residual marine fuel oil may also have similar impacts.
- Regulations requiring the installation of regenerative thermal oxidizers (RTOs) in the wood products industry have increased non-process-related consumption of natural gas. The new Plywood Maximum Achievable Control Technology will require additional RTO installations by October 2008.[315]
- The Occupational Safety and Health Administration's hexavalent chromium permissible exposure limit may increase energy use in the metal finishing industry due to increased use of protective equipment, including greater air monitoring equipment and special sanitizing showers for workers.
- Under the National Pollutant Discharge Elimination System, increased regulation of stormwater discharges could increase energy requirements for water treatment at shipbuilding and ship repair facilities, potentially increasing air emissions.
- Increased volatile organic compound regulations under the National Ambient Air Quality Standards have the potential to increase energy requirements for pollution control systems in multiple sectors.

In some cases, EPA has conducted an effective assessment of the energy-related impacts of proposed regulations as part of the rulemaking process. For example, EPA is undertaking an "energy impact" analysis of the Spill Prevention Countermeasures and Control regulations to determine their effect on energy use in various industries. This analysis is being done in coordination with DOE, the Small Business Administration, the Department of Transportation, and the Department of Commerce. This model might be used to inform other regulatory and nonregulatory efforts. Overall, there may be opportunities for closer consideration of energy-related impacts and a more systematic approach for evaluating such impacts during the rulemaking process.

Regulations May Contribute to Unfavorable Market Conditions

Regulations may also create disincentives for investment in energy-efficient technologies by failing to establish appropriate policy frameworks for promoting broader application of these technologies—either through policy actions that create disincentives for such investments or by failure to enact regulations that establish supportive conditions for investment. Examples of such barriers include the following:

- Recent changes made by the Federal Energy Regulatory Commission regarding implementation of Section 210(m) of the Public Utility Regulatory Policies Act eliminate the requirement that utilities purchase power from qualifying facilities in certain markets, potentially creating less favorable market conditions for onsite power generation.[316]
- New Internal Revenue Service guidance on the biomass tax credit (Section 45) decreased the value of the credit, potentially affecting the financial viability of increased biomass fuel usage.[317]
- Representatives from the iron and steel industry cited the need for greater mitigation of the economic, technical, and environmental risks associated with the use of new technologies. Specifically pertaining to regulatory liability, use of unproven technologies may entail risks associated with long-term liability under the Comprehensive Environmental Response, Compensation, and Liability Act.[318]

Other frequently cited barriers that fall into this category pertain specifically to the adoption of CHP and other distributed generation (DG) technologies. Many utilities create impediments to CHP through their rate structures and through time-consuming interconnection requirements. Such barriers are among the top concerns of organizations working to promote broader adoption of CHP technology like the United States Combined Heat and Power Association.[319]

Common utility rate practices that reduce the financial viability of grid-connected CHP opportunities include excessive rates for backup power, high standby connection charges, and exit fees. In deregulated markets, sources must still pay demand charges to access competitively supplied backup power, and transmission and distribution tariffs governing such charges may also set unfavorable rates.[320] Inequitable rate structures also affect adoption of other DG technologies such as fuel cells and renewable energy generation with biomass fuels or other renewable energy sources. The fact that regulatory agencies have in many cases not prohibited such practices represents an opportunity for policy change.

Interconnection requirements—the technical and procedural requirements associated with connecting a distributed generation technology to the grid—may also inhibit investment in CHP and other DG opportunities. Interconnection requirements vary locally as determined by the utility or entity governing the regional transmission infrastructure, and they are often time and labor intensive, particularly for smaller applications that may be required to meet the same standards as large generating units. To inhibit installation of CHP applications, some utilities have established extensive interconnection requirements such as pre-certification, high safety standards, and costly testing, making the interconnection process time intensive and costly for grid-connected CHP applications.[321] As interconnection requirements vary between jurisdictions, the lack of standardization also serves as a barrier to broader technology adoption (particularly for small units), as it inhibits mass production of DG technologies.[322] The lack of standardized and streamlined interconnection requirements that establish appropriate protocols for smaller versus larger DG applications also represents a regulatory barrier.

4.4 Conclusion

While barriers to broader investment in energy efficiency and clean energy opportunities often stem primarily from nonregulatory factors such as financial, technical, and institutional constraints, regulations can reinforce such barriers by not accounting for the environmental benefits of energy efficiency, by not offering appropriate incentives for investment, by making investment less feasible through a lack of procedural flexibility, and in general by contributing to unfavorable market conditions or failing to create more favorable market conditions for energy efficiency and clean energy technologies. Chapter 5 provides suggested policy options EPA could employ to remove or reduce the regulatory component of impediments to energy efficiency and clean energy investment.