Energy Efficiency Potential in the State of Iowa

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ABSTRACT

The study is an estimate of the potential for energy savings in Iowa. It concentrated on using the National Energy Modeling System to determine the market potential for energy savings in the residential and commercial sectors. A base case using the *Annual Energy Outlook 2000* was developed and sensitivities run based on the Clean Energy Futures study. For the industrial sector, the results of surveys on motor and drive system efficiency potentials were used to calculate the economic potential for savings.

The major residential end-uses affected were space cooling (20% savings by 2020) and water heating (14%.) The study did not include changes to the building shell (e.g., increased insulation) or residential lighting improvements. Nevertheless, the residential sector's market potential for electrical energy savings was calculated to be 5.3% of expected electrical use by 2020. In the commercial sector, the study considered voluntary market-based policies for some technologies. The most notable savings were in ventilation (12% savings by 2020), lighting (12%), refrigeration (7%), water heating (6%), and space heating (5%). The industrial survey of motor drive system improvements found that motor systems represent roughly 40% of electrical use within the industrial sector and that programs could improve their efficiency by 14%, saving 6% of total industrial electricity.

Because of this study, the Iowa Utilities Board required utilities in the state to conduct detailed technology assessments to update their energy efficiency plans. Utilities redoubled their efforts to better use their existing programs, concentrating on performance contracting and new commercial designs.

Introduction

Iowa has a long history of being active in the promotion of energy efficiency. Over the years, the state has collected funds for energy-related programs through surcharges on electricity and gas rates. Examples of programs funded include low-income heating assistance, energy efficiency programs, and renewable energy development. Future funding in these areas is being debated, as to both the amount and the allocation. One question that arises is what are the potential results of funding the different types of programs. What is the potential for energy efficiency or for renewable power, and what would be accomplished given the amount of funding provided?

In 2000, the Iowa Energy Center recognized that more information was needed on the amount of energy that could be saved through program or policy changes. The state was in the midst of reviewing the use of the surcharges, as well as considering legislation on power plant siting and the issues surrounding electricity restructuring. The Center commissioned this study to provide an initial estimate of the potential for energy efficiency programs in Iowa. Because the state was considering changes in electricity surcharges or power plant siting, the study concentrated on electric energy savings, although natural gas savings were also studied. The full study was completed in Spring 2001 and is reported in *The Potential for Energy Efficiency in the State of Iowa* (Hadley 2001).

Due to funding and analytical limitations, savings in buildings (commercial and residential) were limited to include improvements to space conditioning as well as lighting or other appliances, but not building shells. Industrial savings could include improvements to motors and drives or changes to industrial efficiency. Inclusion of other efficiency improvements would naturally increase the total amount of savings beyond what this study showed.

Estimates of potential energy savings available in a given population of facilities generally distinguish between different conceptual approaches (McElhaney and Jallouk 1999). These can be summarized as follows:

- **Technical potential** denotes energy savings that can be achieved by applying proven energy efficiency technologies to all available opportunities for their use in the population, regardless of the relationship between implementation and cost.
- **Economic potential** denotes energy savings that can be achieved through a subset of the technically feasible efficiency improvements that meet specified economic criteria. Energy efficiency measures should pass an economic screen (incremental cost versus avoided energy and capacity savings) with a "societal test" benefit cost ratio of greater than 1.20 to allow for administrative costs to conduct the program.
- **Market potential** denotes the energy savings that can be achieved by a subset of economically cost-effective measures that analysts believe the market can deliver during the time horizon of the analysis.

Supply-side constraints on the achievement of economic potential include the lack of awareness of energy efficiency measures and design practices among engineers, and conflicting economic incentives for manufacturers or distributors who are principally interested in equipment sales. On the demand side, constraints arise from the competing priorities for capital expenditures and plant maintenance resources. Including these constraints in modeling the market potential provides a more accurate portrayal of final energy savings.

Simulation Using NEMS

We chose to use the widely recognized economic simulation model, the National Energy Modeling System (NEMS) for this analysis. The Energy Information Administration (EIA) developed this model to forecast national and regional energy supply and demand through 2020. The model allows a wide variety of parameters to be altered to determine their impact on overall fuel use. Examples include changes in equipment efficiencies, costs, fuel supplies, economic growth, and consumer preferences. Detailed information on the model can be found in the *National Energy Modeling System: An Overview 2000* (EIA 2000a).

NEMS models the major end-use sectors of the economy: residential, commercial, industrial, and transportation. Within the energy sector, it models the electricity sector, oil, gas, and coal production, and renewable energy. It separates the nation into nine geographical regions. Iowa is part of the West-North-Central region, which also includes Kansas, Nebraska, South Dakota, North Dakota, Minnesota, and Missouri.

The residential and commercial sectors are largely defined by the types of buildings used. The residential sector is split between single-family dwellings, multi-family dwellings, and mobile homes. The commercial sector is separated by the type of activities. NEMS models eleven different activities: assembly, education, food sales, food service, health care, lodging, large office, small office, mercantile & service, warehouse, and other. For each type of building NEMS maintains information on end-use service, fuel, equipment used, energy prices, customer purchasing preferences, age distribution of buildings, etc.

For each type of end-use service (heating, cooling, water heating, etc.) different technologies are available. The model maintains data on capital cost, efficiency, type of fuel used, purchase preference criteria, and dates of availability for each type of equipment. This allows the model to bring on new equipment and retire older equipment throughout the study period. To bring on new equipment it calculates the life cycle cost of each technology, and selects a mixture based on the relative cost of each. The life cycle cost includes the capital (or replacement) cost plus future costs of the energy needed discounted using an input discount rate. The rates are higher than just the cost of money to reflect customer resistance or insensitivity to ongoing costs versus initial cost. In addition, the model places limits on the amount of technology or fuel switching for various types of customers, based on historical survey data from *A Look at Residential Energy Consumption in 1997* (EIA 1999a) (RECS) and *A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures* (EIA 1998) (CBECS).

Major NEMS Studies

The NEMS model has been used for a number of studies by both EIA and others. The two of most relevance to this paper are the Annual Energy Outlook 2000 (AEO2000) (EIA 1999b) and the Clean Energy Futures (CEF) study (Interlaboratory Working Group 2000). We used the regional results from the AEO2000 as the baseline estimate of energy use for the Iowa region. We then applied some of the policies from the CEF study to understand the impacts of these energy conservation efforts on Iowa.

Every year the EIA releases a report that presents midterm forecasts of the energy supply, demand, and prices through 2020. They develop a reference scenario that includes expectations of future changes in demands, supplies, technologies, and prices. Only existing government policies are modeled. Sensitivities on economic growth, energy prices, and other factors are also examined. Energy prices are calculated internally based on oil and gas exploration technologies, coal mining practices, and power plant modeling, rather than as exogenous inputs. Short-term price fluctuations can be entered based on known data.

During 1999 and 2000, a major study was commissioned by DOE on the effects of possible policies to reduce energy use or emissions. The resulting report, *Scenarios for a Clean Energy Future* (also known as the CEF study) (Interlaboratory Working Group 2000) used an older, modified version of the NEMS model to integrate the analysis of policy impacts on the various sectors of the economy. Three main scenarios were developed: a Business as Usual scenario that was similar to the Annual Energy Outlook 1999 but with minor changes due to improved data; a Moderate scenario with policies that did not involve major cost burdens on the economy; and an Advanced scenario that included more far-reaching policies such as a carbon cap and trade system.

While we used some of the parameters from the CEF study, we did not use the full analysis. The CEF study concentrated on national results rather than regional impacts and did not report on the impact of policies specifically on Iowa or the upper Midwest. The modifications to the NEMS model for the CEF study were specific to the earlier NEMS version; some involved changes to the FORTRAN coding of the model while others just changed input data. We chose to select only from CEF parameters that involved changes to input data, rather than modify the algorithms within NEMS. Any modifications to the more recent NEMS by us would need to be validated against the official EIA version, which was beyond the scope of this study.

Historical Energy Use in Iowa

Iowa energy use can be broken down by source of power and by sector. Table 1 shows the 1997 energy use by source for the various sectors. Although electricity is a source of energy for each end-use sector, it is created by other, primary energy sources. For each end use (residential, commercial, and industrial), we show the actual electricity used and in the next to last row show the primary energy lost during conversion to make the electricity used (at 32% efficiency.) The Electrical column shows the mix of primary energy used to create the 123 TBtu of end-use electricity. The last column shows the total amount of primary energy used in Iowa.

Table 1. 1997 Iowa Energy Use by Fuel and Sector in Trillion Btus

Fuel\Sector	Residential	Commercial	Industrial	Transport	Electrical	Total
Petroleum	5	4	69	254	1	332
LPG	17	3	17	0	0	38
Gas	82	51	108	11	4	257
Coal	3	6	66	0	315	390
Nuclear	0	0	0	0	44	44
Electricity	40	31	53	0	0	123
Hydro	0	0	0	0	8	8
Other Renewable	5	1	49	5	0	60
Net Total	152	95	362	271	373	880
Electricity Conversion Losses	83	63	110	0	6[1]	256
Total	235	158	473	271	379	1,136

[1] Electricity imports value makes up difference between electricity generation and total end-use plus losses.
Source: EIA 1997

The RECS and CBECS energy use surveys, and consequently NEMS results used in this analysis, do not separate out information at the state level, but rather provide regional data. To approximate the values for Iowa, we found the ratio of energy use by fuel and sector for Iowa as compared to the total for all seven states in the West North Central region (North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, and Missouri) from the Combined State Energy Data System (EIA 1997). Applying the resulting percentages to regional energy use from NEMS gives the approximate values for Iowa.

Residential Sector

In order to understand the potential changes in energy use in the residential sector due to changes in the technologies or market, we ran four separate NEMS scenarios. First, the business-as-usual (BAU) case represents the AEO2000 results. Second, a voluntary programs (VP) case was run that reduced the discount rates used by consumers to compare future costs to upfront costs during purchase decisions. This method was used to simulate the impact of voluntary market programs that reduce either the risk or market barriers to consumers (e.g., Energy Star labeling, financing.) Third, we ran a minimum efficiency standards (MES) case that eliminated certain low efficiency technologies as choices in the future.

The discount rate determines the relative importance of initial costs and ongoing costs of equipment. A 20% discount rate implies that $100 savings a year from now is only worth $83 ($100/120%) today. Since energy-efficient equipment frequently has higher initial costs that are offset by future energy savings, the discount rate determines how important the energy savings are to the owner. In the BAU case, most appliances had discount rates for comparing initial and ongoing costs of between 36% and 391%. In the VP case, we lowered those discount rates to 15% or 20%. These latter values are from the CEF study and are based on extensive analysis by the laboratory teams (Interlaboratory Working Group 2000). The lowered rates had their largest impact on the energy use for electric water heaters, as high-efficiency heat pump water heaters became the preferred technology.

The minimum standards used for the eval halfuation are shown in Table 2. Air conditioning saw a large impact in average efficiency from applying minimum standards (Table 3). With the relatively small amount of cooling required in the West North Central region, high efficiency is less important and so low efficiency equipment maintains a relatively large market share with just the lower discount rates in the VP scenario. However, when minimum standards eliminate these low efficiency products, higher efficiency equipment are purchased and raise the average efficiency. Water heaters also see a large change, partly because of the standards and partly because of the lower discount rates.

Table 2. Minimum Residential Efficiency Standards from CEF

Technology	Efficiency	Start Date
Clothes washers	Horizontal axis	2006
Gas water heaters	0.60 EF	2004
Electric water heaters	0.95 EF	2004
Room air conditioners	10.5 SEER	2010
Central air conditioners	13 SEER	2006
Elec. air-source heat pumps	13 SEER/7.6 HSPF	2006

Table 3. Percentage Change in Average Efficiency of MES Case versus BAU Case

	2010	2020		2010	2020
Main Space Heaters			**Water Heaters**		
Electric Heat Pumps	8.9	10.4	Electric	18.2	39.9
Space Cooling			Natural Gas	3.7	6.6
Electric Heat Pumps	14.3	16.0	**Other Appliances**		
Cent Air Conditioners	13.8	36.8	Refrigerators	0.1	0.2
Room Air Conditioners	1.6	11.1	Freezers	0.4	0.6

Table 4 shows the amount of energy used in trillion Btu for the major end-use services under the different cases. Energy use between the VP and BAU cases, and between the MES and BAU cases, show that energy use for space cooling and water heating were most affected, dropping by 1.34 TBtu and 3.47 TBtu, respectively. These two were largely influenced by efficiency improvements in the electric versions of the technologies, although gas-fired water heaters also showed savings. (Some of this gas savings is due to conversions from gas to electricity.) The VP case by itself lowered energy use most dramatically in the water heating end-use. Clothes drying and freezers saw small improvement (<2%). Total energy savings were 1.4% from the BAU case. Electric space heating showed a 1% reduction in energy use (through improvements in heat pumps) but since it has such a small space heating market share, the impact is small. Overall, electric savings totaled 2.91 TBtu (5.3%) and gas savings 2.13 TBtu (2.4%).

Table 4. Iowa 2020 Residential Energy Use from BAU, VP, and MES Cases

Technology	BAU	VP	VP minus BAU		MES	MES minus BAU	
	Tbtu	TBtu	TBtu	%	TBtu	TBtu	%
Space Heating	82.6	82.5	-0.05	-0.1	82.5	-0.05	-0.1
Electric	4.5	4.4	-0.05	-1.2	4.4	-0.05	-1.0
Gas	66.7	66.7	0.0	0.0	66.7	0.0	0.0
Distillate	3.3	3.3	0.0	0.0	3.3	0.0	0.0
LPG	8.1	8.1	0.0	0.0	8.1	0.0	0.0
Space Cooling	6.5	6.5	-0.04	-.5	5.2	-1.34	-20.5
Electric	6.2	6.2	-0.04	-.6	4.9	-1.34	-21.6
Gas	0.3	0.3	0.0	0.0	0.3	0.00	0.0
Water Heating	24.4	22.6	-1.87	-7.6	20.9	-3.47	-14.2
Electric	3.9	3.1	-0.79	-20.2	2.7	-1.25	-32.0
Gas	18.5	17.4	-1.07	-5.8	16.4	-2.12	-11.5
Distillate	0.1	0.1	0.0	1.1	0.1	0.00	-3.8
LPG	1.9	1.9	0.0	-0.2	1.8	-0.10	-5.0
All Residential	157.8	155.6	-2.16	-1.4	152.7	-5.13	-3.3
Electric	54.5	53.4	-1.08	-2.0	51.6	-2.91	-5.3
Gas	89.3	88.2	-1.08	-1.2	87.2	-2.13	-2.4
Distillate	3.4	3.4	0.0	0.0	3.4	0.0	-0.1
LPG	10.6	10.6	0.0	0.0	10.5	-0.10	-0.9

A savings of 2.9 trillion Btus of electricity equals 850 GWh. At 5.5¢/kWh (the 2020 price) this represents savings of $47 million per year. The amount of electricity saved represents the output of a 150 MW power plant. In addition, a savings of 2.1 TBtus of natural gas, at $5.74/Mbtu (the price in 2020) means savings of $12 million per year.

Two policy implications arise from these results. First, voluntary programs for higher efficiency air conditioning or heat pumps will not make a large impact on energy use. Because of lower cooling loads, savings from higher efficiencies are less likely to offset higher equipment costs and discourage adoption. Programs that advance heat pump water heater show the most promise to reduce energy use.

Commercial Sector

In Iowa, the commercial end-use sector represents 11% of total end-use consumption (Table 1). This is the smallest of the four end-use sectors. It can be further separated by the type of commercial activity, where the largest activity has to do with mercantile/service businesses. As with the residential sector, space heating makes up the bulk of energy use in the sector, most of it from natural gas.

Of the commercial electricity use, lighting is the largest end-use, representing 38% of total electricity in 1997 (Table 5). The Other category within electricity includes cooking, transformers, traffic lights, exit signs, automated teller machines, telecommunications equipment, medical equipment, and other unidentified end-uses.

Two cases were run using NEMS for the Commercial sector. The BAU case based on the AEO2000 and a VP case where the discount rates were lowered within each business sector in line with the values identified in the CEF study.

Table 5. 1997 Iowa Commercial Electricity Use

End-use	TBtus	% of Total
Space heating	1.6	5%
Space cooling	2.6	8%
Ventilation	1.8	6%
Water heating	1.2	4%
Lighting	11.7	38%
Refrigeration	1.3	4%
Office Equipment	3.2	10%
Other	7.9	25%
Total	31.2	100%

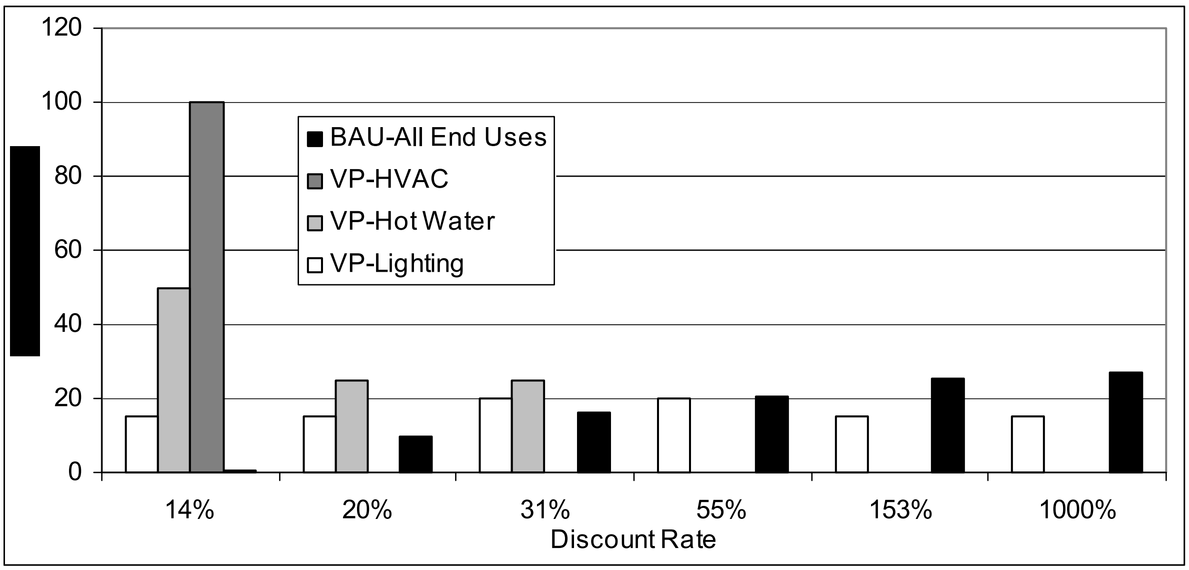
Within NEMS, each of the commercial sectors has a range of discount rates, representing the spectrum of preferences for businesses within that sector. As in the residential sector, the discount rate determines the relative importance of initial costs to ongoing cost savings of equipment. Some businesses may have a very short focus or be very risk-averse, leading to a high discount rate. Other firms may be more energy conscious, have longer time horizons, or be willing to take risks, leading to a low discount rate. As a consequence, a variety of equipment will be purchased for each sector.

As part of the analysis for the CEF study, the various market-related energy efficiency programs were converted to discount rate reductions and applied to the sectors. Lighting, water heating, and the heating, ventilation, and air conditioning (HVAC) end-uses were given different sets of discount rates, based upon the potential for success of different market programs such as Build America, Energy Star, or others.

The AEO2000 (and BAU scenario here and in the CEF) used generally high discount rate values for all end-uses (Figure 1). Over one quarter of customers had an equivalent rate of 10, or 1000%. This says that these customers place essentially no value on ongoing cost savings ($11 in savings next year is only worth $1today.) They would consider almost totally the first costs of equipment. Rates of 55% and 153% also are high enough to make ongoing energy savings a relatively unimportant aspect in the decision process as well. Just ten percent of customers have a discount rate of 20% or less.

In the CEF Moderate scenario and our VP case, all customers were assigned a discount rate of 14% for their HVAC equipment. Information, loans, or other market programs would lower their effective rate to this value. Water heating equipment would have a somewhat higher set of rates, with 50% of customers at the 14% discount rate, and 25% of customers at 20%and 31% respectively. Lighting discount rates would be more evenly spread over those available in the model. The CEF study teams developed these values based on extensive off-line analysis of the performance of various market programs.

Figure 1. Percentage of Commercial Customers Using Different Discount Rates



At these lower discount rates, more of the commercial entities purchase efficient equipment. Because of these efficiency improvements, energy use in the commercial sector drops 3.9% from the amount in the BAU case (Table 6). Electricity use drops 5.1%. The major electrical savings areas are in lighting (12.3%), ventilation (12.4%), electric water heating (9.3%), and refrigeration (7.5%). In terms of largest amount of energy saved, the major end-use saving is in gas space heating, followed by electric lighting and water heating. Some gas reductions may be due to conversions from gas to electricity.

Electrical savings of 2.1 TBtu translates into 605 GWh. Using the 2020 electrical price of 5.5¢/kWh gives a savings of $33 million. In addition, 2.3 trillion Btu of natural gas saved at a price of $5.74/MBtu gives a savings of $13 million.

If policies are to be targeted at electric uses, the major market opportunity is in commercial lighting. It is the largest end-use segment for electricity and offers the greatest potential for saving.

Table 6. Iowa 2020 Commercial Energy Use from BAU and VP Cases

Technology	Business as Usual TBtu	Voluntary Programs TBtu	VP minus BAU TBtu	VP minus BAU %
Space Heating	36.6	34.8	-1.81	-4.9
Electric	1.7	1.6	-0.09	-5.1
Gas	33.7	32.0	-1.72	-5.1
Distillate	1.3	1.3	0.00	-0.3
Space Cooling	3.6	3.5	-0.06	-1.8
Electric	3.0	2.9	-0.03	-1.0
Gas	0.6	0.6	-0.03	-5.5
Water Heating	11.0	10.3	-0.68	-6.2
Electric	1.2	1.1	-0.11	-9.3
Gas	9.4	8.8	-0.57	-6.1
Distillate	0.4	0.4	0.00	0.0
Ventilation	1.9	1.7	-0.24	-12.4
Lighting	12.1	10.6	-1.48	-12.3
Refrigeration	1.4	1.3	-0.10	-7.5
All Commercial	114.2	109.8	-4.41	-3.9
Electric	40.4	38.3	-2.06	-5.1
Gas	63.7	61.4	-2.34	-3.7
Distillate	2.5	2.5	0.00	-0.2
Other	7.4	7.4	0.00	0.0

Industrial Sector

Within Iowa, the industrial sector is the largest user of energy (Table 1). In 1997, industrial energy use was over 360 TBtu, 41% of the total end-use. There are a number of areas of potential savings. However, these must often be tailored to individual industry or business. In addition, if a business is relatively energy-intensive then energy costs are often a significant and visible element of cost. This leads the business to take an active role in limiting energy expenditures, without government programs. On the other hand, if an industry is not energy-intensive, then energy savings are a low priority. Concerns over competitive information and privacy can also lower the participation in state-run programs. For these reasons, energy savings programs are often less successful in the industrial sector than in the residential or commercial sectors.

One major area that has shown potential for energy savings programs is in the industrial drive and motor systems. Industrial motor systems represent the largest single end use of electricity in the American economy—23% of U.S. electricity consumption—and they present a very substantial energy-efficiency potential. Within Iowa, motors represent 43% of total industrial electricity use. Furthermore, motor systems are often used as a supporting operation to the creation of a business's product, rather than the focus of their activity. Consequently, systems may be purchased based on specs related to the product need with less thought towards the energy use of the motor system itself.

DOE's Motor Challenge Program has identified many industries with the potential to reduce electricity use through more efficient electric motors and process improvements. As part of the Motor Challenge program, a market assessment was undertaken to serve as a blueprint for the implementation of the Motor Challenge strategy. The market assessment involved on-site surveys of 265 industrial facilities. It documents that technologies offering a simple payback of 3 years or less can typically save businesses 11% to 18% of the energy used to drive motors (Xenergy, Inc., 1998). This survey provides information on the economic potential of the technologies rather than the market potential. Consequently, the amount of penetration by the new technologies into the market is not assessed.

The data from this survey was separated into the twenty most energy intensive SIC codes (McElhaney and Jallouk 1999). These can be applied to state-specific data to show the amount of energy used for motors in Iowa (Table 7). The percentage of total motor use shows which industries are the largest. The savings amounts and percentages show the potential for cost-effective motors.

Table 7. Iowa Industrial Motor Use and Potential Savings

SIC Code	Title	Industrial Motor Use GWh	Industrial Motor Use % of Total	Savings GWh	Savings % of Use
SIC 20	Food and kindred products	1,114	17%	138	12%
SIC 24	Lumber and wood products	283	4%	25	9%
SIC 26	Paper and allied products	982	15%	138	14%
SIC 28	Chemicals and allied products	1,351	20%	218	16%
SIC 30	Rubber and miscellaneous plastics products	580	9%	86	15%
SIC 33	Primary metal industries	1,373	21%	163	12%
SIC 35	Industrial machinery and equipment	161	2%	25	15%
SIC 36	Electronic and other electric equipment	179	3%	41	23%
SIC 37	Transportation equipment	289	4%	43	15%
Other	Other	380	6%	53	14%
Total		6,693	100%	930	14%

Potential savings are calculated at 930 GWh, or 14% of motor system electrical use. This is equivalent to 3.2 TBtu. Comparing this to the total electrical use by industry (Table 1), the potential savings from motor and drive system improvements is 6% of total industrial electrical use. Multiplying the savings by 5¢/kWh gives savings of $46 million per year. This value is higher than could be expected, both because industry typically pays less for electricity than residential or commercial sectors, and because this is technical potential savings rather than market potential, so only a fraction can be expected to be implemented. The four industries with the largest potential for savings are Food, Paper, Chemicals, and Primary Metals. Combined they represent 71% of the potential savings in the state. Any savings programs should likely focus on these industries.

Consequent State Initiatives

Because of this analysis, the Iowa Utility Board required that the state's utilities conduct an update of their technology assessments for their energy efficiency plans. The utilities have contracted with consulting firms to conduct a more detailed assessment of the technical potential for their territories. This work is currently underway. Once the utilities receive the information on the potential savings, the state will convene meetings with stakeholder groups to determine the best set of programs and the amount of market potential available. The utilities will then implement these programs.

The utilities have also redoubled their efforts in utilizing their existing programs. Alliant has increased its performance contracting work in the industrial sector, assisting with covering the risk premium paid to contractors after evaluation following a project's first year. Mid America has focused their attention on the design phase of new commercial facilities, in keeping with the different type of market they have compared to Alliant. There is a window of opportunity to work with architect/engineer firms after a project has been approved by the financiers but before final specs are completed. Energy efficiency can be incorporated into the building at the start, rather than having to be retrofit later.

Overall, there is a good potential for saving at least 5% of energy use in Iowa through a combination of market programs and standards, representing over $100 million savings per year. With the recent rise in energy costs, state residences and businesses have even greater incentive to save. Since this study was conservative in modeling different types of efficiency equipment, active state and utility programs should be able to achieve well over this amount, especially if applied to broader savings measures beyond just those studied.

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