

Availability and Use of Energy Data in an Environment of Industry Reclassification and Energy Market Reforms

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ABSTRACT

Two issues have placed additional constraints on industrial data availability and quality—industry reclassification from the Standard Classification System (SIC) to the North American Industrial Classification System (NAICS) and energy market reform.

The Energy Information Administration (EIA), the independent statistical agency within the U.S. Department of Energy, undertakes the Manufacturing Energy Consumption Survey (MECS) every 4 years. This paper shows how trends using the MECS data are affected by the reclassification, what trends are still possible, and points out the more permanent loss of coverage due to the reclassification of certain industries to the agricultural and commercial building sectors.

Next, the authors examine the effect of outsourcing electricity generation and the problems in measuring energy trends as a result of those changes. Resulting policy must reflect an adequate understanding of the shifts between the industrial sector and the electricity-supplier sector that may prove difficult to measure.

Lastly, discussion shows the effects of energy market reform on the availability and quality of both demand-side and supply-side energy data, including the issue of confidentiality of data in a competitive environment. EIA has taken steps to maintain the quality of the data for both the supply-side and demand-side. It may prove difficult, however, to maintain data availability and quality due to the emergence of new and different participants in restructured energy markets. The new participants may prove to be reluctant data providers.

Introduction

Energy data availability and quality are necessary ingredients into any analysis and modeling of energy issues such as energy efficiency and emissions. Without these ingredients any historical trend analysis cannot take place. The issue of having limited data needed for analysis and modeling has always been an issue. There never are “enough” data to meet the needs and wants of data users. As government data collection agencies face budget difficulties, the frequency of data surveys and censuses as well as the breadth of data variables collected have fallen. The frequency and availability of energy data collected for industry are no exception. Industry reclassification and energy-market reforms are placing further constraints on the ability to obtain the energy data needed as inputs into real world decision and policy making.

Most of the energy data available in the U.S. originates as a data product from the Energy Information Administration (EIA), the independent statistical agency within the U.S. Department of Energy. This paper’s main focus are the additional constraints placed on the collection of energy data and the steps EIA has taken to maintain the quality of the energy

data. Discussed first are the effects on energy analysis of the industry reclassification of the Standard Classification System (SIC) to the North American Industrial Classification System (NAICS). Also included is a discussion on the effects of the reclassification on the data products available from other Federal government agencies such as the U.S. Census Bureau and the Bureau of Economic Analysis that are an integral part of most analyses of energy issues. This discussion includes a study that may assist analysts when data are available by SIC or NAICS, but not both. Examples are presented that show the effect reclassification has on the ability to undertake detailed trend analysis.

Energy-market reform has influenced structural changes within manufacturing itself, such as outsourcing of the inputs into the production process. The paper examines the increase in the outsourcing of on-site generation by manufacturers. What was once counted as onsite generation may now be counted as electricity and steam receipts. In those cases, the fuels that were used to generate the electricity in past surveys would be excluded from consumption measures and the effect on output measures (i.e., value of shipments) would be uncertain. That uncertainty could cause problems for microanalysis, including analysis of carbon emission trends for individual manufacturers.

The paper then looks at the market reforms and their effects on the availability of data, especially data related to price. Included in the discussion will be the effects of market reform on the ability to collect not only utility supply-side data for manufacturers and other industrial customers but also demand-side data from the manufacturers themselves. In the new competitive market, when more data are needed than before, energy suppliers are reluctant to supply the data and respondents in the manufacturing sector have difficulty in supplying the data due to the complexity of the competitive energy markets. The paper includes a discussion of a study EIA undertook to obtain reportable data on the 1998 MECS that was misclassified and not reported in the 1994 MECS as a result of changing natural gas markets.

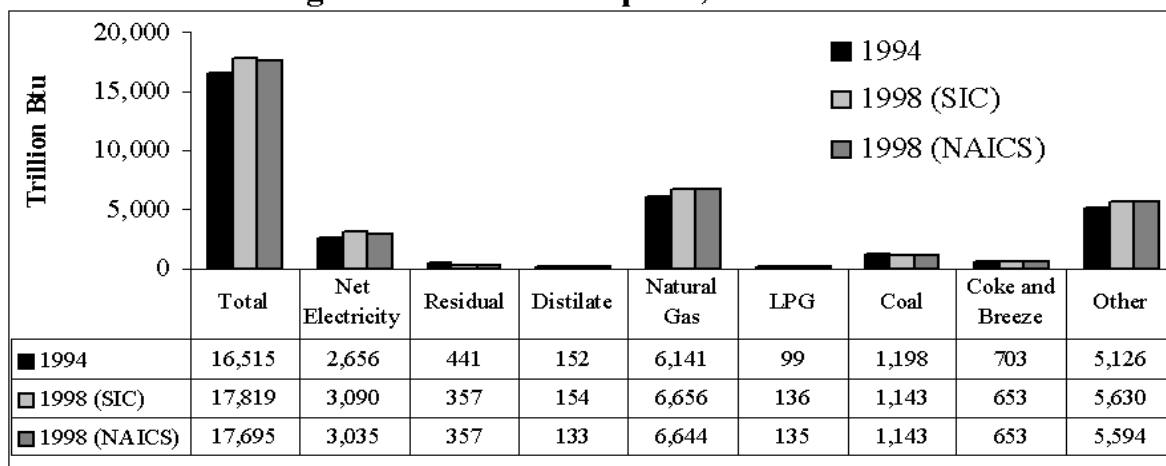
Industry Reclassification

With the signing of the 1994 North American Free Trade Agreement between the U.S. Canada, and Mexico, a new classification system was needed so that comparable statistics on an industry-by-industry basis were available for each of the countries, one that reflected production processes. The NAICS, developed jointly by the countries, can be updated as changes take place as has happened with the growth of the information sector and new computerized technologies.

With industry reclassification, beginning with the 1998 MECS, data from the MECS loses some of its historical comparability dating back to 1985. Data for more than two-thirds of all 4-digit SIC's will still be derivable from the NAICS system. Some industries are not changed and some new industries are defined as a part of an old classification. However, other industries are being changed where historical comparisons will be impossible. As part of the 1998 MECS, bridge tables between the SIC and the NAICS were produced but only on the two-digit SIC basis, with 10 selected 4-digit industries, and only at the national level. All other data from the MECS were released under the NAICS. Starting with the 2002 MECS, only the NAICS-based data will be published.

As seen in Figure 1, at the aggregate level, for all energy and by energy source, there seems to be only a small difference in the 1998 SIC estimates and the 1998 NAICS

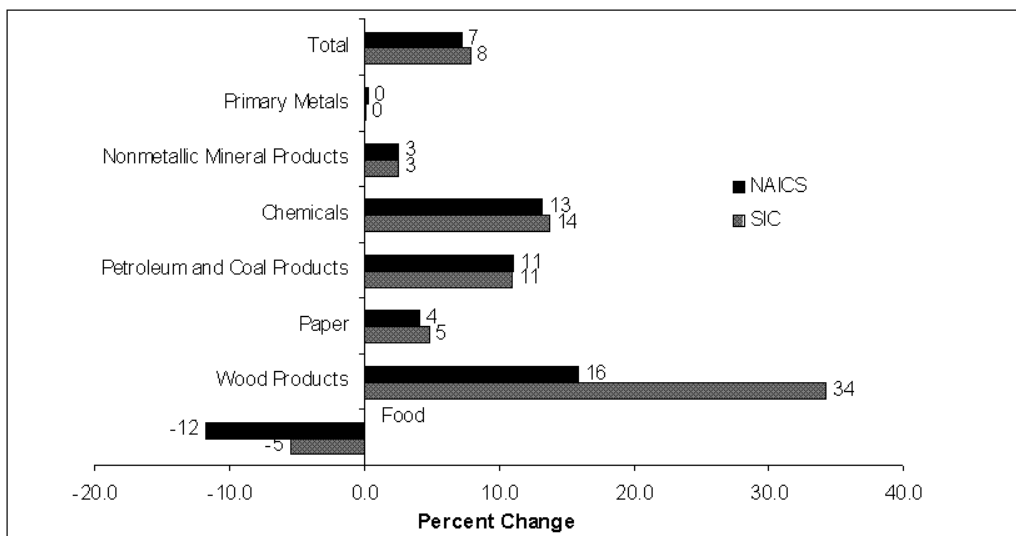
Figure 1. Fuel Consumption, 1994 and 1998



Sources: Energy Information Administration, 1994 and 1998 Manufacturing Energy Consumption Surveys.

estimates. This shows that there has been very little reclassification into and out of the manufacturing sector—most of the reclassification has been within the sector. Therefore, comparisons between NAICS estimates and SIC at the aggregate manufacturing level should produce suitable results for most historical analyses. However, comparisons between NAICS and SIC estimates at the next lower level of aggregation do show considerable differences, but not in all cases.

Figure 2. Percent Change in Total Fuel Consumption 1994-1998: Comparison Between SIC and NAICS



Source: Energy Information Administration, 1994 and 1998 Manufacturing Energy Consumption Survey.

Figure 2 shows comparisons between 2-digit SIC industry groups and the analogous 3-digit NAICS subsectors. The Food and Wood Product industry groups have been the most

affected by the reclassification. Under NAICS, the Beverage industry, originally classified in the Food industry group, has been reclassified into the Tobacco and Beverage NAICS subsector. The Lumber industry was reclassified from the Wood industry group and moved into the Agricultural Sector. Most of the largest energy-using industry groups, such as Primary Metals, Chemicals, and Paper, have remained mostly intact. This is fortunate for the energy analyst as these industries greatly contribute to the overall energy demand for manufacturers.

Even though, there is comparability between the SIC and NAICS estimates for most of the energy used, it still is important to determine how other industries may be comparable, if at all. In light of the reclassification, EIA looked at the differences between the SIC and

Table 1. Percent of Fuel Consumption under SIC in NAICS (1998)

SIC DESCRIPTION	SIC Code	NAICS DESCRIPTION	NAICS Code	Percent of SIC in NAICS
Food and Kindred Products	20	Food	311	107.1
Tobacco Products	21	Tobacco mfg	312	24.1
Textile Mill Products	22	Textile Mills/Textile Product Mills	313+ (314)/2	102.6
Apparel and Other Textile Products	23	Apparel/Textile Product Mills	315+(314)/2	45.4
Lumber and Wood Products	24	Wood Products	321	115.9
Furniture and Fixtures	25	Furniture and Related Products	337	89.8
Paper and Allied Products	26	Paper	322	100.5
Printing and Publishing	27	Printing and Related Support	323	168.4
Chemicals and Allied Products	28	Chemicals	325	100.5
Petroleum and Coal Products	29	Petroleum and Coal Products	324	99.9
Rubber and Miscellaneous Plastics Products	30	Plastics and Rubber Products	326	97.2
Leather and Leather Products	31	Leather and Allied Products	316	112.5
Stone, Clay, and Glass Products	32	Nonmetallic Mineral Products	327	100.0
Primary Metal Industries	33	Primary Metals	331	99.8
Fabricated Metal Products	34	Fabricated Metal Products	332	92.7
Industrial Machinery and Equipment	35	Machinery	333	130.5
Electronic and Other Electric Equipment	36	Computer and Electronic Prod. /Electrical Equipment, Appliances, and Components	334-335	79.8
Transportation Equipment	37	Transportation Equipment	336	86.3
Instruments and Related Products	38	NO GOOD FIT		
Miscellaneous Manufacturing Industries	39	Miscellaneous	339	56.8
			Total	100.7

Source: Energy Information Administration, Manufacturing Energy Consumption Survey 1998

NAICS-based data, and developed an imperfect comparability methodology that may be used across time. First, we developed a crosswalk using the Census Bureau's value of shipment data and compared 4-digit SIC with 6-digit NAICS. Using the value of shipments crosswalk as a guide, EIA developed a crosswalk to be used when attempting historical analysis using MECS data. The value of shipment data crosswalk is more robust than the crosswalk using just the MECS data. Any comparisons of 4-digit SIC to 6-digit NAICS are very problematic. The MECS data do not have the level of detail available for all of the 6-digit NAICS and 4-

digit SIC industries. Because of the necessity of confidentiality, disclosure analysis results in some of the data being withheld. Therefore, only a crosswalk of 3-digit NAICS to a 2-digit SIC could be developed (Table 1).

Historical data are available only for those industries that remained unmodified or can be converted cleanly into NAICS. Table 1 shows those industries: paper, chemicals, nonmetallic, primary metal, and petroleum. The table also shows where analysis should not be undertaken. Other comparisons may be made by combining different NAICS industry groupings and compare with one SIC industry.

EIA is not alone in trying to develop methodologies usable to bridge the gap from SIC to the NAICS. All of the major Federal statistical agencies that are the source data providers for the U.S. Bureau of Economic Analysis (BEA) either have changed to the NAICS or plan to complete full implementation by 2004. In 1999 and 2000, the U.S. Census Bureau first released data on the NAICS basis from the 1997 Economic Censuses including the Census of Manufacturing (CM). BEA will publish estimates of the National Income and Product Account on the NAICS basis as soon as there is full implementation of NAICS by the statistical agencies, especially the U.S. Census Bureau, the Bureau of Labor Statistics, and the Internal Revenue Service. Most industry energy analysis incorporates energy prices, gross domestic product, or other economic measures. At the present time, deflators to convert nominal economic measures to real measures on the NAICS basis are not available and SIC-based deflators are being used instead.

Researchers and analysts will likely continue to use the data available, even if it is imprecise. It is important for analysts to consider the caveats whenever SIC- and NAICS-based data are part of any historical analysis. They need to incorporate the caveats into their analysis in a manner in which the policy and decision makers will duly consider them. Otherwise, by ignoring the data uncertainties, they could make faulty decisions.

The Manufacturing Sector and Electricity Generation

The previous section discussed reclassification effects on analysis as entire establishments have become reclassified into different manufacturing industries or, in some cases, have been reclassified into or out of the manufacturing sector. Another problem that is beginning to affect trend measurements is the reclassification of *parts of* establishments. In manufacturing, combined heat and power (CHP) accounts for the lion's share of onsite generation. Over the past 10 years, independent power producer CHP generation has been increasing while CHP generation in the industrial sector¹ has been staying constant or, most recently, declining (Figure 3).

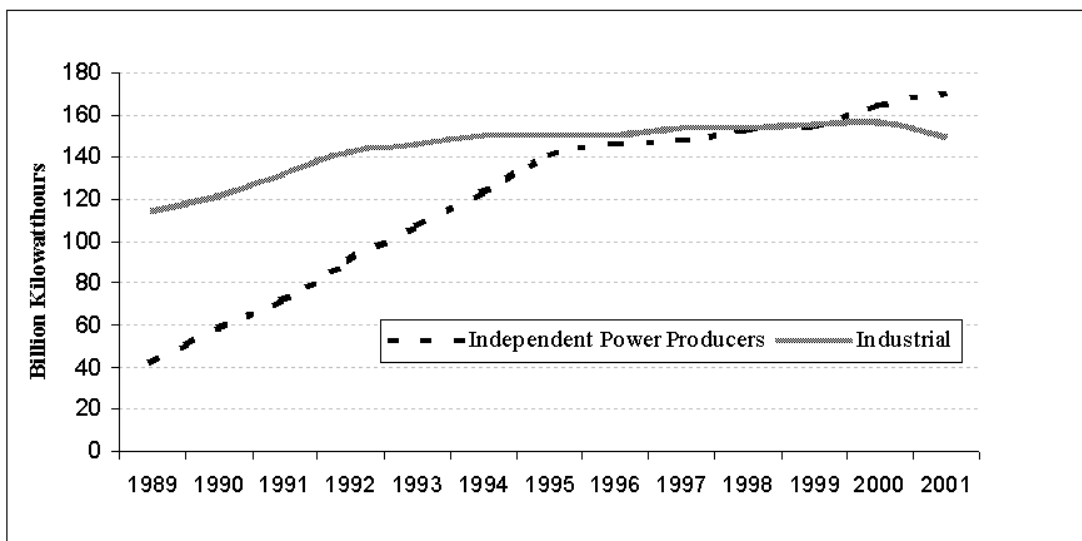
Previous reports (Adler and Margreta 2001; Energy Information Administration 2002b) reported that net demand for electricity in 1998 was 1,025,149 million kilowatthours, an increase of 12 percent from 1994. However, somewhat unexpectedly, onsite generation remained relatively unchanged from 1994. Put another way, onsite generation actually accounted for a greater proportion of demand for electricity in 1994 than in 1998 (approximately 15.5 percent in 1994 to 13.5% in 1998).

While the 1998 MECS was in progress, analysts discovered that there were cases of manufacturing establishments that had previously operated onsite generation facilities that

¹ The industrial sector includes agriculture, mining, and construction as well as manufacturing. Most sales data in EIA do not distinguish among the subsectors of the industry sector.

they had since sold. Many then purchased the electricity and steam back from the facility that they had once owned. That may help to explain a doubling of reported purchased steam on the MECS, from 243 trillion Btu in 1994 to 490 trillion Btu in 1998. One explanation is that manufacturing establishments no longer felt capable or willing to operate onsite generation facilities that competed with other company resources to perform their primary function of

Figure 3: Net Generation at CHP Plants by Sector, 1989-2001



Source: Energy Information Administration, 2003.

manufacturing. Conversely, under the economic outlook brought about by electricity restructuring, potential outside operators now found those plants more attractive to own or otherwise have a financial interest.

That development may have implications for future measurement of onsite generation, depending on the extent to which it is occurring. It will be important to characterize strictly the sector under consideration. For example, when looking at the manufacturing sector as strictly defined by the Census and MECS, one might see CHP declining as a percentage of electricity demand. In fact, the level of cogeneration may be increasing as a whole but would be shifting sectors. The newly classified plants may still owe their existence to the manufacturing plants that they adjoin but would have to be considered outside of manufacturing. Eventually, the generating entities that split off from the manufacturing plants would make economic decisions based on the demand for electricity, not manufactured products.

An examination of MECS microdata was undertaken recently for the purpose of trying to determine whether these sales can be deduced using data already collected. The examination showed that the ratio of onsite generation to total electricity demand changed very little if at all for most establishments that can be matched. However, there were quite a few establishments that increased their generation ratio, which would indicate an acquisition of CHP units if any such changes were made. Although comparing generation ratios of two years of data may lead to useful edits, measuring the potential shift of generation away from the industrial sector into the power generation sector will probably require more direct

approaches. For that reason, the 2002 MECS will contain questions designed to address the shift. The following questions are excerpted from one of the MECS questionnaires:

15. Since January 1, 1999 has your establishment sold or leased CHP/cogeneration units to any other establishment(s)? {If “no”, skip to Question 19}.
16. In 2002, did your establishment receive any electricity from the other establishment(s) referred to in Question 15?
17. Approximately what percentage of the electricity reported in Question11 {total purchases from nonutilities} was purchased from the establishment(s) referred to in Question15?
18. Approximately what percentage of the electricity reported in Question13 {total transfers} was transferred in from the establishment(s) referred to in Question 15?

A similar set of questions appears for steam and hot water. The answers to these questions should provide more direct measurement of how much industrial electricity cogeneration has shifted to the power generation sector. Without those questions, it may be possible to measure the decrease in the industrial sector and the increase in the power generation sector, but associating the changes with a measurable shift will be extremely difficult. If government and the private sector institute policies and strategies designed to mitigate the production of greenhouse gases, it is even more important to be able to accurately measure the change in CHP generation.

Market Reform

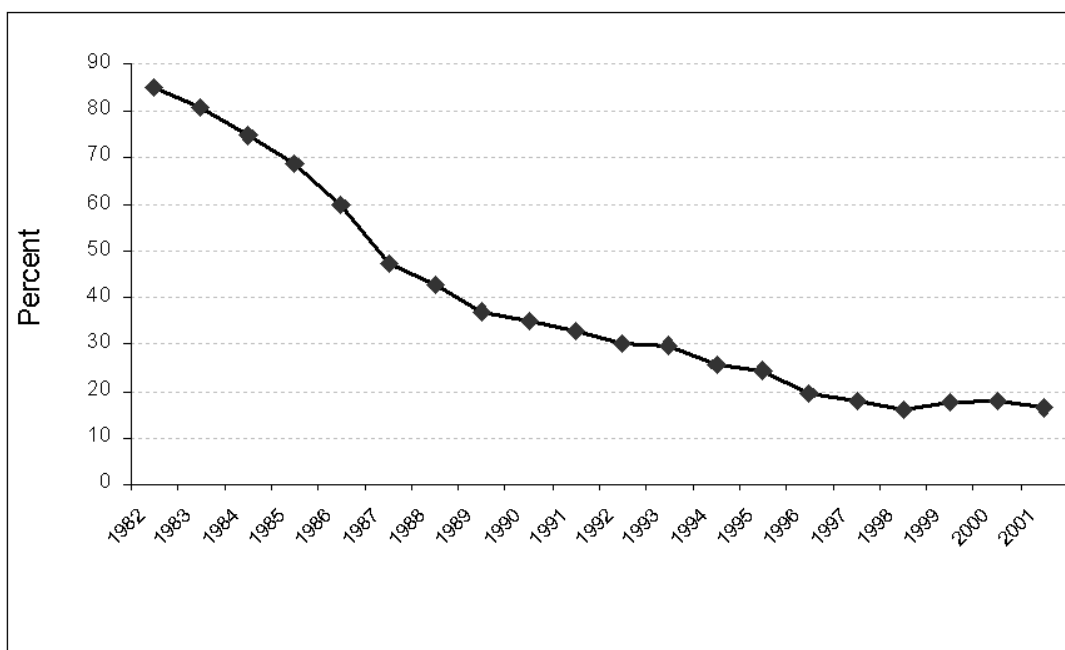
Supply-Side Data

Prior to energy market reform, both the electricity and natural gas industries were vertically integrated where financial flows were linked to physical flows. EIA’s survey frames for natural gas and electricity utilities were easily developed and maintained. The survey frames changed very little between data collections. In this environment, EIA could survey the electricity and natural gas utilities and obtain the supply and prices for all the natural gas and electricity used in each of the sectors. After market reform, data are not available from a single source. Now new players such as brokers and marketers have entered the picture, making it more difficult and costly for EIA to obtain the supply-side data, especially prices. The full cost of energy is divided among suppliers, marketers, distributors, and possibly others, so it is difficult to get all the components of price. Price data are very important, especially so in an unregulated market. Prices and their components need to be monitored and well understood as they are among the most prominent ways policymakers and advocates evaluate the effects of restructured energy industries on energy consumers.

The first energy market to undergo reforms was the natural gas market. In 1985, the Federal Energy Regulatory Commission (FERC) issued Order 436, which allowed interstate pipeline companies to become open-access transporters (EIA 2003). Figure 4 shows a rapid decline in the availability of price data as increasing numbers of industrial customers bought natural gas directly from the wellhead. These customers arranged the purchase, either through a third-party such as a broker an in-house energy purchaser.

EIA developed methodologies to address the data collection issues for the natural gas industry such as the use of focus groups and subject matter expert reviews to determine the data requirements (Hutzler 2002; Freedman and Rutchik 2002). Presurvey design visits were made to utilities and marketers. Two models were then developed for the potential surveys, the biller and marketer models. The EIA-905 “Monthly Gas Biller Survey” was chosen since it was assumed that the biller would have all the data and would supply it. Cognitive testing was used to test this new survey questionnaire.² The results of the cognitive testing did not support the assumption of data availability from the natural gas biller and so, instead, EIA decided to have a monthly natural gas marketer survey and integrate the data with EIA’s existing monthly survey of delivery companies. The EIA-910 Monthly Natural Gas Marketer Survey has been approved by the Office of Management and Budget to collect data from marketers in selected States that have active customer choice programs—Georgia, Maryland,

Figure 4. Percent of Industrial Natural Gas Deliveries in the U.S. Represented by Price



Source: Energy Information Administration, Natural Gas Monthly (January 2003).

New York, Ohio, and Pennsylvania. At the present time, studies are underway to determine the most efficient methodology to obtain natural gas prices from industrial customers, even possibly going to the customers themselves for the prices of natural gas.

After electricity restructuring, the effects of the changing electric power industry increased the need for additional data as EIA obtained new data users such as marketers, brokers, risk managers, etc. EIA needed to address these new and diverse data needs and at the same time, EIA needed to develop a computer system to efficiently and accurately collect and edit the data and use the Internet to collect the data.

² The cognitive approach is where respondents participate in one-on-one structured interviews and verbally discusses the “thinking” process while answering the interviewer’s survey questions.

As with the natural gas data requirement process, EIA used focus groups and expert reviews to ascertain the data requirements in the new restructured environment. Focus groups of data providers such as investor-owned utilities, municipals, and nonutilities were involved to ascertain the availability of data. Other focus groups involved data users such as the Federal government agencies, State government offices, congressional staff, and the media in order to ascertain data needs as a result of the changing market structure. Indeed, the comments from the focus groups shows not only the difficulty of collecting the historic electricity data that EIA has always collected, but also the increasing need for other data. For example, State officials commented that they want EIA's assistance in obtaining price data of unregulated energy sales. They will not have any way to monitor these themselves. Other comments discuss the need for data on consumer behavior. In the past investor-owned utilities have undertaken these types of studies. In a competitive market, they may not undertake the studies and even if some continue to do so, they may not share the analysis with the Public Utility Commissions. As market uncertainty increases, the need for more data rises as data confidentiality rises as well. In the new competitive environment the willingness to share company data with others declines.

The focus groups and industry experts served as excellent guides in redesign efforts, which led to the de-emphasis of ownership classification and its replacement with generation class (i.e., generation of electricity only and generation of power and thermal energy using CHP). Results of this study led to the decision that the categorization of utility and nonutility, in use since 1989, was no longer meaningful, since many integrated utilities have spun off their generating capacity either as a separate entity or as a sale to another company entirely. EIA decided to create two new facility categories instead: electric generators only (either utilities or nonutilities) and combined heat and power (CHP). Additionally, fuel used for electricity generation had been obtained from natural gas suppliers, petroleum marketers, or coal distributors. In the future, fuel used for electricity generation would be obtained directly from the generating companies purchasing the fuel.

As in the case of market reform in the natural gas industry, electricity prices are difficult to obtain using the usual survey forms as electricity sales are separated from distribution. Therefore, new approaches to data collection were needed to address this new situation. EIA has decided that existing EIA electricity forms will also be sent to wholesale and retail marketers. Frames are now being developed for those marketers. However, as with the natural gas industry, marketers can register but not necessary sell electricity at this time. Mergers, joint ventures, births, and deaths of companies all lead to unstable survey frames that are costly to develop and are time consuming to maintain.

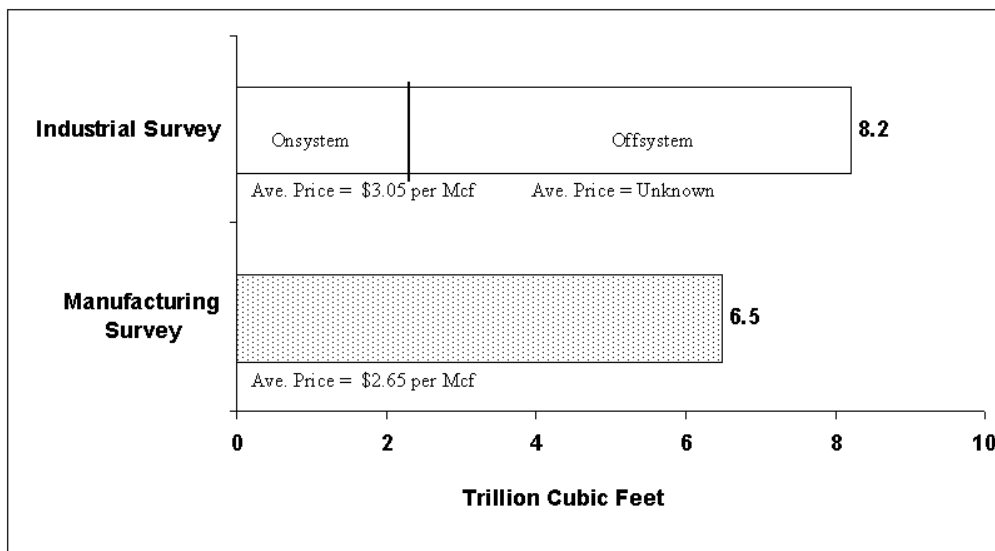
EIA's efforts to maintain quality supply-side data is an ongoing process as markets are continually changing. At the present time, both electricity and natural gas studies are continuing as the U.S. is still on the road to full competitive energy markets.

Demand-Side Data

Natural gas supplier-misclassification. As shown in Figure 4, most of the industrial sector purchases their natural gas from other than their local distribution company (LDC). The LDC only delivers the gas, which makes it easy for EIA to obtain the amount of natural gas purchased, but difficult to obtain natural gas prices from the nonLDC suppliers. However, since the first survey in 1985, respondents in the MECS have been asked for the

establishment's total consumption and expenditures for natural gas. From consumption and expenditure data, average prices are calculated for each establishment. In the 1991 MECS, EIA attempted to obtain the breakdown between natural gas obtained from LDC's and nonLDC's by asking for the quantities and expenditures from LDC, transmission pipelines, and "Other" including brokers.

Figure 5. Manufacturing Purchases and Industrial Deliveries of Natural Gas and Average Prices, 1994



Mcf = Thousand Cubic Feet

Notes: Industrial Sector includes agricultural, constructing and mining also; onsystem natural gas is where the utility sold the gas to the customer; offsystem is where the natural gas was purchased from a nonutility.

Sources: Energy Information Administration, 1994 Manufacturing Energy Consumption Survey and *Natural Gas Monthly* (July 1997).

If expenditures could be obtained for each of the components, EIA could have at least benchmarked prices paid for LDC and nonLDC natural gas. In the 1991 MECS, EIA obtained a reasonable breakdown between LDC and nonLDC, when comparing MECS to that of industrial supply-side data published in EIA's *Natural Gas Monthly*. However, as the complexity of the natural gas market increased, the quality of the data pertaining to the breakdown between LDC and NonLDC natural gas in the 1994 MECS was not within EIA standards and so EIA did not publish the results.

As Figure 5 shows, natural gas prices were unavailable from nonLDC suppliers (off-system gas) and the average price of natural gas for all manufacturers was lower than the LDC (on-system) average price. These differences implied that manufacturers were purchasing from nonLDCs at lower prices. These results show the importance for MECS to obtain from establishments the expenditure and quantity data for both LDC and nonLDC natural gas purchases. As a consequence, EIA took steps to thoroughly examine the results of the 1994 MECS before the 1998 MECS was fielded. These steps included an intensive survey questionnaire redesign and cognitive testing of the new questionnaire.

EIA staff worked with an outside questionnaire design expert to redesign the MECS questionnaire for 1998 (Leach 1999). Decisions were made to drop the matrix format used in 1994 and adopt a booklet-style format while combining the questions with the instructions. As EIA made significant questionnaire content changes, especially in the questions

concerning natural gas purchases, EIA used the cognitive approach to test the questionnaire before fielding the 1998 MECS. Major finding for the natural gas section included: crucial terms were not being understood; there was confusion over what to include as natural gas, and there was a problem with the order of questions. As a result of the cognitive studies, terms were defined more in manufacturing-establishment terms than in energy-supplier terms and survey questions were reordered.

EIA was able to publish 1998 MECS LDC and nonLDC natural gas quantity and expenditure data for 1998, although there was a 16 percent divergence of the 1998 MECS data from the 1998 industrial supply-side data. A possible explanation may be that manufacturers are contracting with their LDC's subsidiary. The manufacturer may still consider the subsidiary their LDC. An example of that is in the Washington, D.C. area. WGL Holdings Inc. owns both Washington Gas (LDC) and Washington Gas Energy Services Inc. (nonLDC). Additionally, many companies have several establishments and are involved with long-term bulk supply natural gas contracting, sometimes with their LDC. The individual establishments pay for their share of the natural gas when delivered. These examples are only two of the many variations of supply purchases making it difficult to obtain natural gas price data. EIA will soon field the 2002 MECS and, again, will attempt to collect price and quantity natural gas data for both LDC's and nonLDC's.

Summary

Discussed first in the paper were the effects of the industry reclassification from the Standard Classification System (SIC) to the North American Industrial Classification System (NAICS). It was shown that trend analysis for industry groups, such as Primary Metals is almost unaffected by the reclassification, while for other industry groups, such as Food, it will be difficult to undertake trend analysis. Even more difficulty could be found at lower levels of aggregations, such as within the Chemicals subsector. Analysts of trends will have to contend with continued uncertainty in data classifications. The NAICS system, designed to be more responsive to the changing economy than the SIC, may change its classifications quite regularly. Maintaining the concordance between older and newer classifications will be the job of Federal statistical agencies. Understanding the implications of the uncertainties of the concordance will be part of the job for data users, analysts, and policymakers.

We examined the effect of industrial streamlining and electricity market restructuring on industrial CHP measurement. New 2002 MECS questions were presented as a solution for measuring the sector shift of manufacturing CHP to the electric power sector. Finally, market reforms and their effects on the availability of industrial data were explored, showing the methods EIA has implemented to deal with the problems on both the demand and supply-side of the energy equation. Those methods included focus groups, expert reviews, and cognitive studies.

As of December 2002, there were approximately 103 active marketers of natural gas. Six States have retail choice for all natural gas customers. Another eight states are in the implementation stage, with 8 States having either partial unbundling or pilot programs (EIA 2002a). As of February 2003, 18 States have active electric industry restructuring activities (EIA 2003). As competition grows in retail markets for natural gas and electricity, confidentiality is becoming an important issue and EIA data responders, supply-side and demand-side, will be increasingly reluctant to supply data. The tension between furnishing

accurate data to a Government agency and maintaining competitive advantage through maintaining confidentiality appears to be growing, especially among the electricity provider population. Competing political pressures may well determine if analysts and forecasters will soon have to contend with less direct survey data and more modeled estimates.

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