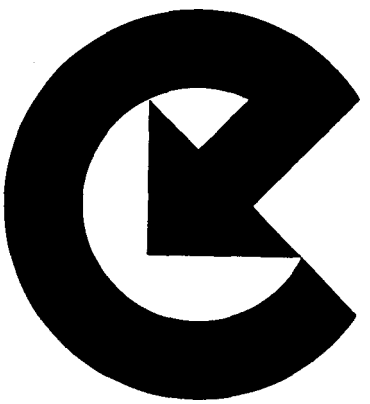
INDUSTRIAL ENERGY CONSERVATION

Energy Efficiency Report

FACT SHEET

June 1975



Federal Energy Administration
Conservation and Environment
Office of Industrial Programs

Prepared in cooperation with
U.S. Department of Commerce

Fact Sheet

Industrial Energy Conservation

The Nation's industrial sector consumes over 40% of the total national demand. We now face political and economic restrictions on the flow and distribution of energy producing materials from abroad. Because abundant energy supplies are crucial to a flourishing economy, more efficient measures are being sought to enhance the efficiency of energy use in industrial processes and in the goods produced by American manufacturers, thus conserving energy and reducing demand for expensive foreign oil.

In order to increase energy efficiency, FEA co-sponsored the current voluntary industry Energy Conservation Program with the Department of Commerce which had begun efforts to encourage energy conservation in early 1973. The industry Energy Conservation Program involves joint FEA/DOC communication with industry and their representatives to develop methods of reporting and monitoring energy data. The overall program plan calls for a voluntary mutual effort on the part of government and industry. Initially FEA and Commerce are working with the top six energy-intensive industries; this list will shortly be expanded with the addition of four more industries. Energy conservation reporting and monitoring methods for the aluminum, cement, chemicals, petroleum refining, paper, and steel industries have been developed through government cooperation with the industry trade associations. The objectives of the industry/government energy conservation program are:

-- identify the conservation potential with each of the major energy consuming industry groups;

-- identify and work to remove constraints on industry's ability to reduce energy demand;

-- work with trade associations to evaluate energy usage, determine jointly with them the feasible industry-wide short and long run energy conservation goals and encourage higher priorities for energy saving investments;

-- obtain data through monitoring program to inform the public of progress in industrial conservation; and

-- identify and develop government and industry policy initiatives that will spur energy conservation efforts.

The Department of Commerce, in another part of this program, has selected a group of 40 industries, which also use large amounts of energy, to work with in achieving similar goals.

In the joint program, meetings and workshops have been held with over 100 industrial firms and 10 trade associations representing the bulk of production capacity within these industries to assess their energy conservation programs and goals for reduction of energy use. Follow-up meetings at Cabinet and Chief Executive Officer level have been held and top-level management commitment obtained to implement industry and company-wide energy conservation programs. Agreement with industry for monitoring and reporting of energy conservation progress and achievements within these industries in cooperation with appropriate trade associations has also been obtained.

Preliminary findings indicate potential additional energy savings per unit of output of as much as 15% are attainable by 1980 through greater application of conservation practices and through improved technology, processes, and equipment.

The Voluntary Energy Conservation Program that FEA-Commerce and participating firms have agreed upon consists of two parts:

(1) An Energy Management Program which should benefit industry as a whole, individual companies and plants within that industry; and

(2) A reporting system which furnishes data to the Federal Government to enable government policy makers to develop rational energy policies and programs.

One of the major agreements of the program is the monitoring and periodic reporting of energy conservation progress. In the initial energy conservation reports the surveys, conducted by industry trade associations, revealed the following energy efficiency improvements from the 1972 baseline period:

	Energy Efficiency Improvement	1980 Goal
Aluminum Association(1)	3.4%	10%
American Iron & Steel Institute	2.7%	10%
American Paper Institute(1)	2.5%	10%
American Petroleum Institute	7.8%	15%
Manufacturing Chemists Association	7.5%	15%
Portland Cement Association	1.6%	10%

(1) 1973 vs. 1972 baseline; all others are 1974 vs. 1972 baseline

Sample populations included in the trade association surveys covered between 60 and 90 percent of the respective industries, in terms of industry-wide sales or capacity. Diversity of products, processes and survey methods do not allow a valid direct comparison between industries. But the data do give an indication of the success of each industry relative to its own conservation target for 1980.

Attached are additional details on each industry.

THE ALUMINUM ASSOCIATION, INC.

Sample Conditions:

Period reported:	Year 1973 compared to base year 1972
Coverage:	Sample population covered in excess of 80% of shipments of the domestic U.S. aluminum industry engaged in the production of bauxite, alumina, and primary aluminum metal. Generally excluded are the secondary aluminum and aluminum foundry segments.

Data:

(1) 1972 (base period) total energy consumption = 908.6×10^{12} BTU
(2) 1973 total energy consumption = 974.8×10^{12} BTU
(3) 1973 energy consumption adjusted to 1972 energy efficiencies = $1{,}009.6 \times 10^{12}$ BTU
(4) Energy savings = $\frac{(3) - (2)}{(3)}$

$$= \frac{1009.6 \times 10 \text{ BTU} - 974.8 \times 10^{12} \text{ BTU}}{1009.6 \times 10^{12} \text{ BTU}}$$

$$= 3.4\%$$

(5) Total energy savings, relative to base period efficiencies = 34.8×10^{12} BTU

Commentary

The report covers only domestically produced primary aluminum metal, alumina and bauxite and domestically fabricated mill end products. The energy consumption required in the production of imported materials is not included.

Production levels increased in all categories of materials and products covered by the survey between 1972 and 1973. Meanwhile, the energy needed to produce each unit of output decreased. Total energy consumed for 1972 production quantities was 908.6×10^{12} BTU. In 1973 the industry used 974.8×10^{12} BTU to produce a greater output. But, if 1973's output were produced using the 1972 levels of energy efficiency, the total 1973 energy consumption would have been $1{,}009.6 \times 10^{12}$ BTU.

Thus, the effective net savings in 1973 was 34.8×10^{12} BTU (1009.6×10^{12} BTU - 974.8 x 10 BTU) which is equivalent to a 3.4% reduction in energy per unit of output.

Electric power is basic to the production of aluminum, accounting for about 70% of the industry's total energy consumption. The industry generated about 25% of its own electricity rather than purchase electricity from utilities; a substantially higher figure than found in the other industries. However, in 1973 there was both an increase in the overall use of electricity and an increase in their reliance on purchased electricity. Historically, the aluminum industry has reduced its energy use 50 percent from an average of about 12 KWH per pound in 1945 to 8 KWH. Newest plants use 6.5 KWH per pound and a new process could reduce requirements to 4.5 KWH.

AMERICAN IRON & STEEL INSTITUTE

Sample Conditions:

Periods reported:	Year 1974 vs. year 1973 and year 1973 vs. baseline year 1972.
Coverage:	Varies w/reporting period, but generally in the region of 85 to 90 percent of industry shipments.

Data: (Survey companies only)

(1)	1972 production (net tons)	84,049,000*
(2)	1973 production (net tons)	95,521,000*
(3)	1974 production (net tons)	96,888,000*

* adjusted to account for inventory addition in 1972 and withdrawals in 1973 and 1974 of 1.9, 4.0 and 3.38 million net tons, respectively.

(4) Total energy consumption 1972 = 2.724×10^9 million BTU
(5) Total energy consumption 1973 = 3.031×10^9 million BTU
(6) Total energy consumption 1974 = 3.073×10^9 million BTU
(7) 1972 energy efficiency (BTU/production) = 32.62 million BTU/net ton (4÷1)
(8) 1973 energy efficiency (BTU/production = 31.73 million BTU/net ton (5÷2)
(9) 1974 energy efficiency (BTU/production) = 31.72 million BTU/net ton (6÷3)

$$\text{Energy efficiency improvement (1972 to 1974)} = \frac{(7)-(9)}{(7)} = 2.76\%$$

Commentary

Overall energy efficiency, from the base year 1972 thru 1974, improved by 2.76%, based on data provided by AISI. Virtually all of that gain was achieved, however, between 1972 and 1973. The coal strike and other operating displacements in the 4th quarter 1974 adversely influenced total energy use and efficiency.

The vast bulk of energy used in steel production comes from coal (about 60%), and natural gas (about 20%). But the relative use of both coal and natural gas diminished from 1972 thru 1974, while reliance upon petroleum products increased somewhat.

Energy Source	% of Total Consumption 1972	1973	1974
Coal	63.1%	62.2%	60.6%
Natural Gas	21.8	20.0	20.3
Petroleum Products	6.9	8.0	8.7
Purchased Electricity	4.2	4.4	4.4
Coke, oven gas & other	4.0	5.4	6.0
	100%	100%	100%

AMERICAN PAPER INSTITUTE

Sample Conditions:

Periods of reporting covers October, November and December of 1974. Initial population included 740 pulp, paper and paper board mills. 300 responses were received. Not all reports received contained all of the desired information. Respondent populations indicated in tables under data.

Data:

TABLE 1

REPORTED PURCHASED ENERGY USE PER TON-FOURTH QUARTER 1974

1974 MONTH	No. of MILLS	Production of Dried Pulp, Paper & Board (000 short tons)	Proportion of Industry's Production (%)	Purchased Energy (billion BTU's)	Purchased Energy/Ton of Output (million BTU's)
October	254	3,666.8	61	63,767.1	17.4
November	232	2,960.2	55	55,658.8	18.8
December	236	2,619.4	59	55,774.0	21.3

TABLE 2

COMPARISON OF PURCHASED ENERGY PER TON AND CAPACITY UTILIZATION RATES

1974 MONTH	Purchased Energy Per Ton (million BTU's)	CAPACITY UTILIZATION RATES PAPER	PAPERBOARD
October	17.4	96.5%	90.4%
November	18.8	92.5%	83.9%
December	21.3	80.5%	59.0%

TABLE 3

ESTIMATED TOTAL CONSUMPTION OF PURCHASED ENERGY

1974 MONTH	TOTAL PRODUCTION OF DRIED PULP, PAPER & PAPERBOARD (000 short tons)	TOTAL PURCHASED ENERGY CONSUMED (billion BTU's)
October	5,970	104,578
November	5,396	101,299
December	4,423	94,258

TABLE 4

COMPARISON OF PURCHASED ENERGY CONSUMPTION PER TON OF OUTPUT 1972-1973-1974

PERIOD	PURCHASED ENERGY PER TON (million BTU's)	CHANGE FROM 1972 ANNUAL AVERAGE
Year 1972	20.1	
Year 1973 (smaller sample)	19.6	- 2.5%
October 1974	17.4	-13.4%
November 1974	18.8	- 6.5%
December 1974	21.3	+ 6.0%
4th Quarter 1974 (weighted)	18.9	- 6.0%

Commentary

Data generated and reported on fuel consumption is based on monthly data aggregation (to account for seasonal variations) among the number of companies indicated in Table 1. The quarterly survey for the 1974 period places severe limitations on the reliability of the data as a measure of consumption; however, when properly adjusted for seasonal and other displacements, the level of energy consumption provides a reasonable estimate of trend. Factors which inhibit energy conservation are anomalies in seasonal air temperature, and changes in capacity utilization. Lower capacity utilization reduces energy efficiency significantly.

Base year data was derived from 88% of the industry's pulp capacity and 83% of its paper and board capacity. Annual averages computed for 1973 are based on smaller industry sample than for 1972. Given the element of uncertainty implied by variations in the sample sizes, a shorter current year measurement period, and the disparities of company annual consumption averages with monthly energy consumption rates, the 4th quarter weighted annual average indicated a positive trend in energy efficiency improvement by approximately 6%.

AMERICAN PETROLEUM INSTITUTE

Sample Conditions:

Period reported - July 1-Dec. 31, 1974 compared to base year 1972 period 7/1-12/31.
58 companies representing 89.5% of the U.S., P.R., and V.I. refinery capacity were surveyed; 37 companies responded.

Data (barrel input)

(1) 1972 base period total energy consumption (weighted average)= 667 MBTU/bbL

(2) Energy consumption changes since 1972 due to processing adjustments, major capacity additions, and waste handling = 9 MBTU/bbL

(3) 1972 base adjusted to current operations (1+2) = 676 MBTU/bbL

(4) Energy consumption changes due to conservation steps implemented since 1972 = 52 MBTU/bbL

(5) Total measured energy consumption for the current reporting period = 624 MBTU/bbL

(6) Total input: 1972 base period 7.00 MbbL/da
current period 7.34 MbbL/da

(7) Stated average % reduction in energy/unit imput = 7.8% ((4)÷(1))

Commentary

Energy efficiency (Energy consumption/barrel of petroleum input) for the base year 1972 is 667 MBTU/bbL. Current operations at the level of 624 MBTU/bbL represent a 7.8% improvement in efficiency.

The % reduction in total energy consumption between 1972 and 1974 indicated by this efficiency improvement is on the order of 2.45%.

Despite process adjustments such as lead phaseout and higher octane requirements for unleaded gasoline, increased desulfurization demands due to tightened product specs and lower crude quality, and product mix changes which have tended to increase consumption, an overall net reduction in total energy consumption was achieved. Other factors influencing an increase in consumption are (1) major capacity additions and (2) processing of waste.

Implementation of active measures/steps aimed specifically at conservation provided the primary basis for the 52 MBTU/bbL energy savings in the interval 1972-74.

MANUFACTURING CHEMISTS ASSOCIATION

Sample Conditions:

Reporting period covers Jan. 1-Dec. 31, 1974 compared to known energy consumption in 1972.

26 companies participating

Data (BTU's Input):

1972 base period energy consumption	= 2512.0×10^{12}
1974 total energy	= 2322.6×10^{12}
1974 total production	= 280.0×10^{9} lbs.
1974 energy consumption required to meet OSHA and Environmental requirements	= 10.4×10^{12}
Percent energy reduction considering OSHA and environment requirements	= 7.54%
Percent energy reduction without OSHA and Environmental requirements	= 7.96%

Commentary

Energy conservation is presented in terms of wholesale reduction in consumption rather than energy efficiency ratios. The net level of energy savings experienced for all sources is shown to be 189.4×10^{12} BTU's.

Factors developing in the interval of consideration which caused an upward displacement in energy consumption includes ostensibly OSHA and EPA requirement. However, a net conservation 7.54% is recorded for the period. Overall energy consumption exclusive of the regulated changes is 7.96%. The percentage attrition in overall conservation due to the latter is 0.42%, the equivalent of 1.01×10^{10} ft^3 of natural gas or 17.9×10^{5} barrels of distillate oils.

PORTLAND CEMENT ASSOCIATION

Sample Conditions:

Participants - 167 companies representing 96 wet-process plants, 64 dry-process plants, 3 wet-and-dry process plants, and 4 clinker-grinding facilities; sample represents 88 million tons of clinker capacity, 97% of the industry's total.

Data:

Energy Consumption by Process

Process	BTU's		Production (10^3 Tons)		Efficiency Improvement (%)
	72	74	72	74	
Wet	347	349	43,091	43,477	.28
Dry	216	211	30,720	20,802	2.7
Other	15	14	1,847	2,058	19.2

Overall efficiency improvement 1.6%

Commentary

During the period 1972-74 significant changes were experienced in the quantity of the types of fuel used. Quantities of petroleum and natural gas fuels used declined 10.7% and 7.2% respectively; this reduction in energy consumption was partially offset by a 13.8% increased in coal usage. In all an improvement (i.e., decrease) in energy consumption of 4.0×10^9 BTU's (0.7%) was realized while production increased 0.9%. Many facilities converted from coal over this same time frame. Plant size is apparently important in a plant's overall energy efficiency; larger plants show a greater efficiency due to capacity utilization/economics of scale.

The industry continued its trend toward greater kiln fuel flexibility with the number of plants having a multi- fuel (gas/coal or oil/coal) capability increasing 16% from 1972 base. Average unit energy consumption for all surveyed plants declined 1.6%. This reduction in energy consumption is reflected on a process level by a 0.2% in wet-process plants and 2.6% in dry-process plants. 17% of the plants used 9.0 million BTU's/ton in 1974 vs. 21% in 1972.