

on

to

December 22, 1976

by

BATTELLE
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

NOTICE

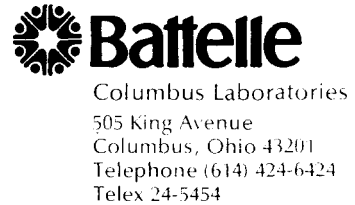
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December 22, 1976

Mr. Ramon Cilimberg
Technical Project Officer
Industrial Programs
Conservation and Environment
Federal Energy Administration
Washington, D.C. 20461

Attention: Contract No. CR-04-60609

Dear Mr. Cilimberg:

Summary Report: SIC 33

This letter transmits the final deliverable on the subject contract. It is titled "Summary Report on Development and Establishment of Energy Efficiency Improvement Targets for Primary Metal Industries: SIC 33", December 22, 1976.

In accordance with the contract, one copy has been sent to the appropriate Contracting Officer and three copies to the National Energy Information Center. The remainder of the 25 copies called for by the contract herewith are submitted to you.

The subject contract provided for delivery of a Revised Target Support Document by November 5. Because you instructed us to issue a summary report rather than the Revised Target Support Document and because delivery by November 5 was manifestly impossible because the public hearing was delayed until December 9, we call your attention to our written request to the Contracting Officer on December 17 for appropriate modifications in the contract.

Very truly yours,

A handwritten signature in dark ink, appearing to read "H. W. Lownie, Jr.", written in a cursive style.

H. W. Lownie, Jr.

HWL:suh

cc: Contracting Officer (1)
Attention Contract No. CR-04-60609
Procurement Division
Federal Energy Administration
Washington, D.C. 20461

National Energy Information Center (3)
1200 Pennsylvania Avenue, NW
Washington, D.C. 20461
Attention: Nancy Nicoletti
Room 1407

DEVELOPMENT AND ESTABLISHMENT OF
ENERGY EFFICIENCY IMPROVEMENT TARGETS FOR
PRIMARY METAL INDUSTRIES: SIC 33

by

H. W. Lownie, Jr., D. J. Maykuth, T. J. McLeer, J. G. Kura,
John Varga, Jr., and W. I. Griffith

I. PURPOSE OF DOCUMENT

Legislative

The Energy Policy and Conservation Act (EPCA), Public Law 94-163, dated December 22, 1975, was enacted to promote increased efficiency in use of energy by American industry. In part, the Act directs the Administrator of the Federal Energy Administration (FEA) to set an energy efficiency improvement target for each of the 10 most energy-consumptive industries. The Act defines the term "energy-consuming industry" as a two-digit classification in the Standard Industrial Classification (SIC) Manual.

Certain ground rules for establishing the energy efficiency improvement target were defined in the Act. It specifies that the target (1) shall be based upon the best available information, (2) shall be established at the level which represents the maximum feasible improvement in energy efficiency which such industry can achieve by January 1, 1980, and (3) shall be published in the Federal Register, together with a statement of the basis and justification for each such target.

The Act states that the target shall be based on an assessment of the technological feasibility and economic practicability of using alternative operating procedures or technologies. It also states that the Administrator shall take into consideration any special circumstances or characteristics of the industry for which the target is being set. The Act states that consideration be given to any actions planned or implemented by the industry to lower consumption of premium fuel such as natural gas and petroleum products.

FEA identified the primary metal industries, SIC 33, as one of the ten major energy-consuming manufacturing industries (Federal Register, March 23, 1976).

Technical

Battelle-Columbus was awarded a contract by FEA on April 6, 1976, to provide materials, personnel, and facilities to perform defined tasks to develop information suitable for the establishment of energy efficiency improvement targets for SIC 33.

SIC 33 includes establishments engaged in the smelting and refining of ferrous and nonferrous metals from ore, pig, or scrap; in the rolling, drawing and alloying of ferrous and nonferrous metals; in the manufacture of castings and other basic products of ferrous and nonferrous metals; and in

the manufacture of nails, spikes, and insulated wire and cable. This group includes the production of coke. Establishments primarily engaged in manufacturing metal forgings or stampings are classified in SIC 34. Establishments which produce iron and steel castings and which are also engaged in fabricating operations such as machining, assembling, etc, in manufacturing a specified product are classified in the industry of the specified product.

II. DRAFT TARGET AND SUPPORT DOCUMENTS

In the course of developing an energy efficiency improvement target for SIC 33, the following documents were prepared:

- (1) Volume I . Target Support Document: SIC 33.
June 21, 1976
- (2) Volume II. Appendixes. June 21, 1976.

After review by FEA, the foregoing were superseded by:

- (3) Volume I . Target Support Document: SIC 33.
August 13, 1976.
- (4) Volume II. Appendixes. August 13, 1976.

The two volumes dated August 13, 1976, constitute the major basis and justification for the proposed target for SIC 33.

Methodology

SIC 33 was disaggregated for study purposes into components such that each component included establishments with

reasonable commonality of processing techniques and products. A separate technological and economic analysis was then made of each component, not with the purpose of developing a proposed target for each component, but to provide technical and economic support for the overall target for SIC 33.

FEA established 1972 as the base year from which the target was developed. For each component, flow sheets and energy balances were derived for 1972 from the best available data. The most reliable data turned out to be those supplied by companies and trade associations within the industry and from prior studies by Battelle and other contractors for FEA and other Federal agencies. Available data included numerous inconsistencies and omissions, so that a high element of judgment was required in developing energy-use patterns and evaluating energy-conservation potential.

Conservation potential for the period 1972 to 1980 was developed for each component in detail using a three-tier format:

- (1) Technological considerations and evaluations established potential for energy conservation based solely on technological feasibility
- (2) Cost considerations and evaluations established potential for energy conservation based on a combination of technological feasibility plus economic practicability

- (3) Special circumstances beyond the control of the industry were evaluated and their expected effects were applied to the results of (2).

Although ultimately a quantitative exercise, constant attention was given to the particular characteristics of the establishments and products in SIC 33 and to the making of reasonable and informed judgments in situations where strict quantitative analysis was impossible. Some of the factors taken into consideration were as follows:

- High use of coal and coke in present technology, especially for the steel and iron foundry components
- Relative energy-intensiveness of operations, especially high in the reduction of ores and melting of metals
- "Housekeeping" types of conservation, involving relatively modest capital investment
- Conversions from natural gas to oil or electricity
- Yield of finished product as a percentage of metal produced or metal melted
- Availability of capital to an industry which is capital intensive and which historically has a relatively low return on investment

- Desire to maintain production and the penalties on rate of output during changeover periods to energy-conservative practices and equipment
- Increased use of scrap to minimize high-energy smelting needs
- Environmental-control problems and the need for SIC 33 establishments to meet regulatory requirements requiring energy and capital
- Availability of electricity as an energy source alternative to natural gas and oil
- Credibility on the part of SIC 33 establishments regarding the future of energy supplies and nature of Federal policies
- Government incentives to encourage establishments to invest in energy-conservative equipment. This study is based on the assumption that no new incentives will be provided.

Resulting Draft Targets

The apparent consumption of energy by SIC 33 in 1972 was about $4,246 \times 10^{12}$ Btu. If the industry operated in the target year (1980) at the same energy efficiency (units of output per Btu) as in 1972, because of anticipated growth in units of output the energy consumption in the target year would be about $5,167 \times 10^{12}$ Btu.

Based on the data and information available, and based solely on technological feasibility and economic practicability (without the influence of special circumstances), it is judged that SIC 33 could lower its consumption of energy in the target year to $4,456 \times 10^{12}$ Btu. This represents a conservation of 14 percent in energy use per unit of output from 1972 to the target year.

Special circumstances are defined as those beyond the control of establishments within SIC 33. The most significant is the need to comply with environmental-control regulations. Another is the declining grade of certain ores.

After consideration of special circumstances over which the industry has no control, it is judged that SIC 33 could lower its consumption of energy in the target year to $4,674 \times 10^{12}$ Btu. This represents a net conservation of 10 percent in energy use per unit of output from 1972 to the target year.

The SIC 33 conservation targets proposed above were determined by aggregating the conservation potential for each of 13 components that make up SIC 33. These components include all 26 SIC 4-digit classifications that comprise SIC 33. The identification of the components and their conservation potential are given in Table I-1.

The SIC 33 target computations are dominated by the steel-plant component, which is expected in 1980 to account

TABLE I-1. CONSERVATION POTENTIAL OF COMPONENTS OF SIC 33

Component	10 ¹² Btu in Target Year		
	At 1972 Efficiency	Technologically Feasible and Economically Practicable	With Consideration of Special Circumstances
Steel plants	3,753	3,245	3,413
Aluminum	741	639	646
Iron foundries	170	125	136
Copper	92	80	102
Ferroalloys	90	82	86
Nonferrous foundries	44	40	41
Steel foundries	53	43	45
Other primary nonferrous	62	55	56
Nonferrous processing	43	41	41
Misc. metal products	42	39	39
Secondary nonferrous smelting and refining	39	33	33
Primary zinc	29	26	28
Primary lead	9	8	8
Total SIC 33	5,167	4,456	4,674

for about 73 percent of total use of energy in SIC 33. With the inclusion of three other components (aluminum, iron foundries, and copper), about 92 percent of total expected use of SIC 33 energy is accounted for. Although each of the 13 components was analyzed individually to estimate its energy conservation potential, emphasis was placed on the four highest-ranking components. This was justified by sensitivity analyses which show, for example, that an error in estimation of 1 percent throughout the nine lowest-ranking components combined has only one-ninth the effect on the target of a 1 percent error in the steel-plant component. The combined energy conservation potential of the nine lowest ranking components can be understated or overstated by about 10 percent before the SIC 33 target is changed by 1 percent.

III. PROPOSED TARGET

The proposed target of 10 percent for SIC 33 (after special circumstances) was published in the Federal Register for November 2, 1976, by FEA, at which time the public was advised of the availability of the draft target support documents for examination and comment. Public hearings on the draft target and documents were announced for and were held on December 9, 1976. At the hearings, statements were presented by persons representing four organizations: (1) The American Iron and

Steel Institute (AISI), (2) The Aluminum Association, (3) The American Mining Congress (AMC), and (4) The American Foundrymen's Society. These statements are part of the record of the Official Transcript of Proceedings. Each of these organizations had been cooperative during the study in providing Battelle with the best available data and with the viewpoints of their members regarding energy-conservation potential.

The AISI statement discussed the complexity of the issue, capital restraints, and the adverse impact of lower rate of production on energy requirements per ton as they relate to the steel-plant component of SIC 33. It was stated that AISI had in 1974 derived a target of 8 percent for their component prior to the influence of special circumstances, but that their present view is that a target of 4.3 percent is probable of attainment and that 7.4 percent is possible. This compares with a gross conservation potential of 13.5 percent for this component as established in the draft target documents. AISI supported its opinion with calculations and tables.

The AISI statement and resulting oral discussion at the hearing provided no new data that had not been available during the preparation of the draft target documents. The AISI detailed calculations and tables, however, did reflect opinions and judgments different on some points from the opinions and judgments used in the preparation of the draft target documents. Although the development of targets for the present purpose is quantitatively

based, ultimately the numerical value of a target based on the best data available in 1976 is influenced heavily by the opinions and judgments of those deriving the target. The concepts presented in the statement by AISI are reasonable, but their details regarding expectations must represent opinion rather than solid fact. After detailed examination of the written and oral statements of AISI, Battelle takes the position that the energy-conservation potential for this component as derived and expressed in the draft target support documents is as reasonable as the lower potential which AISI espouses.

The statement of The Aluminum Association (regarding the aluminum component of SIC 33) summarizes their energy-conservation efforts over the years and discusses factors that affect energy usage. With regard to the analyses presented in the draft target support document for the aluminum component, the statement says in part "The industry considers the approach used in developing programs that are technologically feasible and economically practical to be reasonable" and "The energy conservation projects outlined are acceptable". No data are presented nor suggestions made for a change in the conservation potential for this component as presented in the draft target support documents.

The statement of The American Mining Congress (regarding the copper component of SIC 33) points out that the energy

conservation potential in this component as derived in the target support document must not be confused with the target for all of SIC 33. Problems of the availability of capital and the energy requirements for environmental control as they pertain to this component are discussed. AMC states that "substantial reduction in the target appears called for". Supporting data are not provided, but are promised at a later date. The AMC reference to "the target" appears to be to the energy-conservation potential of the copper component, because the draft target documents do not derive a "target" for any individual component. The target derived for SIC 33 is relatively insensitive to the conservation potential of the copper component, because the copper component accounts for only 2 percent of the expected use of energy for SIC 33 in the target year (1980) after consideration of special circumstances. Review and analysis of the oral and written statements of The American Mining Congress leads to the judgment that they contain no new data or viewpoints justifying a change at this time in the target for SIC 33 as derived in the draft target support documents.

The statement of the American Foundrymen's Society comments on some of the specific characteristics and problems of the iron foundry, steel foundry, and nonferrous foundry components. No new data are presented and the statement is made that "overall target of a reduction of 10% in energy consumed per ton of product, industry-wide, appears reasonable".

As an overview, the four written statements plus oral statements at the hearings tend to indicate that energy conservation in this industry on a really intensive basis is relatively recent, and that quantitative analyses of many situations suffer from a scarcity of consistent and reliable data. Better data are being developed constantly at a substantial rate as establishments implement energy-conservation projects in increasing numbers. Thus, it is reasonable to expect that as better data become available, more meaningful targets can be developed with stronger supporting rationale. The four organizations that presented written statements have a history of close cooperation with FEA and the Department of Commerce in the field of energy conservation, and their statements reflect a strong intent to continue such cooperation, with continuing improvement to make their reporting procedures more meaningful and accurate.

IV. DISSEMINATION OF INFORMATION

Dissemination of information concerning this study and further motivation of the industry to implement conservation of energy would be facilitated by the following:

- (1) A press conference and press release to emphasize the high importance of SIC 33 as a consumer of energy relative to other manufacturing industries, and the dominant

position of the steel and the aluminum components within SIC 33

- (2) The preparation and presentation of talks highlighting the conservation progress that has been made in SIC 33, the opportunities for further conservation of energy, and the barriers (both technological and economic) to implementation, with emphasis on energy and dollar costs for environmental control
- (3) Studies to develop effective incentives by government to encourage establishments to conserve energy
- (4) Periodic reviews of the new data and information that are being and will be obtained from continuing studies and implementation, and periodic revision of the SIC 33 target as appropriate
- (5) An acceptable quantitative method for adjusting the target to encourage wider use of coal as a direct fuel. Although wider use of coal is encouraged in principle by FEA, wider use is accompanied by increased consumption of Btu's and on a quantitative basis appears to be counter-conservative when the present methods of computation are used

- (6) Improved, more standardized, and more understandable means for evaluating the economic practicability of energy-conservation practices and equipment. A unique method for doing this was introduced in this SIC 33 study, but requires further development.