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IEA STEEL R AND D STUDY

FINAL REPORT

MAY 31, 1979

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95F
Gordian Associates, Inc.
711 Third Avenue
New York, N.Y. 10017

Task 5 of
Contract EC-77-C-04-5076

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Circulation

- A. Streb, DOE, Washington (10)
DOE Contract Specialist
DOE/TIC Oak Ridge
- R. Shennaman, DOE, Washington
- H. Lacey, AISI Washington

SUMMARY OF CURRENT STATUS

Following a recent IEA meeting of steel industry experts held in Stockholm in May 1979, a number of specific projects have been recommended as forming the basis for a cooperative program of R and D oriented to energy saving in the making of iron and steel. A timetable of work leading up to another meeting (October-November 1979) has been agreed, and this includes the development of detailed project descriptions, as well as the drafting of a proposed implementing agreement with its technical annexes.

In summary, five working areas have been identified:

1. surface inspection
2. surface conditioning
3. heat recovery
4. energy conversion and combustion
5. material properties

A total of about 20 projects have been suggested, and it is hoped that sufficient detail will be provided on most of these to allow an acceptable implementing agreement to be developed within the next six months.

A. INTRODUCTION

Efforts to initiate a cooperative R and D program under the auspices of the International Energy Agency began about two years ago. At that time (January 1977), an experts meeting was held in Stockholm, hosted by the National Swedish Board for Technical Development (STU). Several topics for possible R and D were discussed, but no specific projects were identified. Subsequently, a study was carried out in the U.S. and Europe to determine the degree of interest in setting up an "international research center" to undertake R and D projects leading to increased energy efficiency in iron and steel production. This study was completed in mid-1978 and resulted in the decision not to pursue the idea of a new organization and associated research facilities, but to continue with the efforts to develop an "implementing agreement", under the IEA, for a research program using existing organizations and laboratories.

At the end of 1978 and early in 1979, approaches were again made to steel industry representatives in the US, Canada and Europe to solicit their recommendations for research projects. Several specific projects were suggested, and the level of interest was sufficient to justify the holding of another experts meeting in Stockholm in May 1979. It was the intention of this meeting to compile a definitive list of projects to be contributed to a cooperative IEA program, and to obtain the basic agreement of the experts on the form of a proposed implementing agreement.

As part of Contract EC-77-C-04-5076, Gordian Associates assisted STU, the lead agency responsible for initiation of IEA industrial conservation programs, in defining the work to be performed prior to calling the experts meeting, and also assisted in preparations for the meeting itself.

The next section of the report summarizes the experts discussions and recommendations.

B. IEA EXPERTS MEETING, MAY 1979

The meeting was held in Stockholm from May 14 to 17, 1979, hosted by STU. The meeting was attended by a total of 30 representatives from the IEA secretariat and seven countries -- Austria, Belgium, Canada, Japan, Sweden, the United Kingdom and the United States. The meeting included various discussion sessions, and a visit to the MEFOS Research Center at Lulea, Sweden.

As part of the introductory session, the Gordian representative presented the findings of the prior study, and also discussed the IEA R and D program recently initiated on energy conservation in cement manufacture. The cement program provides a good example of a cooperative research effort related to industrial energy use. With this example in mind, the experts discussed all the projects suggested by the various countries and organized them into five "working areas":

1. surface inspection
2. surface conditioning
3. heat recovery
4. energy conversion and combustion
5. material properties

Within these areas, over 20 projects were suggested and an attempt was made to provide a detailed scope of work for each one. In some cases this was possible, but many of the projects require further clarification.

The prospects for an IEA implementing agreement were discussed. There are two basic forms, both of which are based on task-sharing programs whereby participants agree to contribute to a cooperative research program by performing defined tasks (research projects) and providing the results of their work to all other participants. This type of program is in contrast to cost-sharing, in which participants

contribute to a common pool of money, which is then used to pay for the conduct of a particular project. The two types of implementing agreement are the "umbrella" form, through which the contracting parties agree to work together to develop research programs which are later defined in separate Annexes to the agreement. The contracting parties to the main agreement may agree to work on one or more of the Annexes, choosing to participate only in those Annexes of specific interest to them. The "umbrella agreement" is relatively easy to expand by the addition of new Annexes without the formality of developing a completely new implementing agreement each time, and without requiring formal signature each time.

The other type of agreement is that represented by the cement program, in which the contracting parties agree to contribute to the work program and have the right to share the results of all work performed within the program. Since there are differences in the extent to which task results are shared in the two types of agreement, prospective participants in the steel R and D program have been asked to consider both types and to comment (to STU) on the form in which they recommend the implementing agreement to be drawn up.

The meeting report has recently been distributed by STU: acting on behalf of the DOE, Gordian assisted in the writing of all sections of the report and the development of the work schedule for the next few months. Exhibits A and B of this report are derived from the meeting report:

Exhibit A: Attendance List

Exhibit B: Project List

C. PLANS FOR FURTHER ACTION

In order to proceed towards the signing of an implementing agreement, the following action was agreed by the meeting participants:

- (1) Review the meeting report and correct as necessary.
- (2) Comment on the two types of implementing agreements and recommend the type of agreement believed most appropriate for the steel R and D program.
- (3) Develop detailed project descriptions for listed projects, where not previously supplied.
- (4) Develop project descriptions for any new proposals.

All comments and the project descriptions are to be forwarded to STU in Stockholm. For its part, STU has agreed to formulate a draft implementing agreement based on the recommendations of potential participants, and to draft technical annexes based on project descriptions supplied by the contributing organizations. STU will circulate drafts of the agreement and annexes in accordance with the proposed timetable,

Exhibit C.

For the U.S., the action plans imply the following:

- (1) Review of the meeting report and comments by DOE. By end July.
- (2A) Provision by DOE of recommendation on the type of implementing agreement desired. By end July.
- (2B) Review and comment by DOE on draft implementing agreement to be circulated by STU. Prior to next meeting.
- (3) Development of detailed project descriptions by DOE, under the headings:

Title

Participating company/agency

Description of background and present status

Technical and economic parameters to be investigated

Specific scope of work

Time schedule

Cost

Source of funds

Expected results and potential applications

Anticipated energy savings

Possible U.S. projects were stated to be:

Surface inspection development program

High temperature heat exchangers and recuperators

Dry coke quenching

Scrap preheating

By end July,
(where possible)

The next meeting is planned for October/November 1979, and is to be held at the IEA headquarters in Paris.

EXHIBIT A

LIST OF PARTICIPANTS

AUSTRIA

Holleis, Günter

A4010 LINZ, Postfach 2
Voest-Alpine AG

BELGIUM

Solle, Léon

Université Catholique de Louvain
2, Place du Levant
B 1348 LOUVAIN LA NEUVE

CANADA

Hansson, Ulla

Canadian Embassy
Box 16129, S-103 23 STOCKHOLM

Jones, Denis

Ferrous Industry Energy Research
Association, c/o Dofasco,
HAMILTON, Ontario

JAPAN

Akamatsu, Kyūichi

Central Research Laboratories
(Hasaki Research Centre)
Sumitomo Metal Industries Ltd
16, Sunayama, Hasaki-Machi,
Kashima-Gun, Ibaraki-Ken

Aoyama, Shin-ichiro

Technical Development Department
Nippon Steel Corporation
2-6-3 Otemachi, Chiyoda-ku
TOKYO

Iwasaki, Tsuyoshi

Embassy of Japan
Gärdesvägen 10, 115 27 STOCKHOLM
tel. 08-630440

Shinoda, Seiichi

Energy Control Department
Nippon Kokan K.K.
1-1-2 Marumouchi Chiyoda-ku
TOKYO

SWEDEN

Collin, Rolf	Tekniska Högskolan 100 44 STOCKHOLM 70
Fors, Jan	SIKOB AB, Ingenjörscentrum, 191 78 SÖLLENTUNA
Grip, Carl-Erik	Swedish Steel, 951 88 LULEÅ
Hardell, Rune	SIKOB AB, Ingenjörscentrum, 191 78 SÖLLENTUNA
Hedlund, Serni	Sandvik AB, Fack 811 01 SANVIKEN
Kinbom, Gunnar	STU, National Swedish Board for Technical Development S-100 72 STOCKHOLM 43 tel. 08-7445100
Lindblad, Birgitta	Jernkontoret, Box 1721 111 87 STOCKHOLM
Nilsson, Per	Bergstrand Kvalitetskontroll Box 382, S-631 25 ÖSTERSUND
Nordin, K.O.	Avesta Jernverks AB AVESTA
Notini, U.	Mörbyhöjden 9, 162 32 DANDERYD
Orrling, Bengt	Mefos, Metal Working Research Plant Box 812, 951 28 LULEÅ
Robinson, Thomas	Studsvik Energiteknik AB Fack, 611 82 NYKÖPING
Schippel, Falke	STU, National Swedish Board for Technical Development S-100 72 STOCKHOLM 43
Strandell, Per-Olof	Tekniska Högskolan 100 44 STOCKHOLM 70
Thordén, Birger	STU, National Swedish Board for Technical Development S-100 72 STOCKHOLM 43
Ulvönäs, Staffan	STU, National Swedish Board for Technical Development S-100 72 STOCKHOLM tel. 08-7445100
Westin, Bengt	Svenskt Stål AB, BÖRLÄNGE

UK

Taylor, Philip

Energy Technology Support Unit
(For Department of Energy)
Building 156
AERE, Harwell, OXFORDSHIRE

USA

Hörvath, Vincent

Bethlehem Steel Corporation
Homer Research Laboratories
Bethlehem, PA 18015

Sheneman, Ralph L.

USA Department of Energy
Industrial Programs /Conservation & Solar
Applications: Mail Stop 2221 C
20 Massachusetts Ave NW, Washington DC 20540

Tunnah, Barry

Gordian Associates Inc.
711 Third Avenue
NEW YORK, N.Y. 10017

IEA

Kramer, Bernd

International Energy Agency
2, rue André Pascal
F 75 775 PARIS CEDEX 15

EXHIBIT B
PROJECT LIST

During the course of the meeting between 20 and 25 projects or areas of interest were discussed by the delegates. After some discussion, and detailed review in a number of cases, a total of 19 projects (or potential projects) were identified in five general working areas:

Surface inspection	4
Surface conditioning	1
Heat recovery	7
Energy conversion and combustion	5
Material properties	2
	<u>19</u>

The following list provides a summary of the basic information received, and it is clear that some proposals have been reasonably well defined, while others require further effort to define to the level necessary for incorporation in a draft Annex to an Implementing Agreement.

(From the Meeting Report)

PROJECT LIST

<u>AREAS /PROJECTS</u>	<u>SCOPE OF WORK</u>	<u>COST</u>	<u>DURATION</u>	<u>STATUS</u>	<u>AUSTRIA</u>	<u>BELGIUM</u>	<u>CANADA</u>	<u>JAPAN</u>	<u>SWEDEN</u>	<u>U.K.</u>	<u>U.S.A.</u>
Surface inspection											
S.1 Ultrasonic methods (Studsvik)	Instrument development & testing	300.000 \$	2 yrs	Lab. studies begun	I	I	I	I	P	I	I
S.2 Eddy Current Meth. (Bergstrand)	Test production prototype	250.000 \$	1-2 yrs	Preliminary tests complete	I	I	I	I	P	I	I
S.3 Optical and other methods (Japan)	Plant-scale testing/demonstration		< 2 yrs	Field testing in progress	I	I	I	P*	I	I	I
S.4 Development program (US?)	Selection of most-promising techniques	2 mill. \$	2 yrs	To start September	I	I	I	I	I	I	P*
Surface conditioning											
SC.1 Hot grinding (Mefos)				To start 1980				I*	P*	I	I

* Tentative/possibility

P Proposed project

I Interest

PROJECT LIST

<u>AREAS /PROJECTS</u>	<u>SCOPE OF WORK</u>	<u>COST</u>	<u>DURATION</u>	<u>STATUS</u>
<u>Heat recovery</u>				
H.1 Fluid bed cooling	Construct and test full scale fluidised bed	2-3 mill.	4 yrs	Lab. tests completed
<u>High temperature heat exchangers and recuperators</u>				
H.2				I P* I I (P*)
H.3 Dry coke quenching				I I P*
H.4 Ceramic heat wheel				I I P*
H.5 Scrap preheating				I I P*
H.6 Heat recovery from slag				I I P* I I
H.7 Low temperature heat recovery				I I P* I I
<u>Energy conversion and combustion</u>				
E.1 Continuous gasification of coal	Scale-up and test continuous pilot plant operation; optimise yields	500,000	2 yrs	Batch tests completed
E.2 Coal injection with plasma burner	Feasibility evaluation, define scope of test phases	50,000	1 yr	Some preliminary testing done
E.3 Pyrolysis of low grade coals				P I

AUSTRIA	BELGIUM	CANADA	JAPAN	SWEDEN	U.K.	U.S.
I			P	I	I	
I			P*	I	I (P*)	
I	I		I	P*	T	
I	I		I	I	P*	
I	I	I	P*	I	T	
I	I	P*	I	I	T	
I	I	T*	P			
I	I	T*	P			
I	I	P				
		P				
		I				

* Tentative/possibility

P Proposal project

I Interest

PROJECT LIST

<u>AREAS /PROJECTS</u>	<u>SCOPE OF WORK</u>	<u>COST</u>	<u>DURATION</u>	<u>STATUS</u>	AUSTRIA	BELGIUM	CANADA	JAPAN	SWEDEN	U.K.	U.S.A.
E.4 Heavy fuel oil combustion	Field testing & optimization of atomization variables (Phase I)	50.000 \$	6 mo.	To start 5/79	P						
E.5 Blue flame burner	Burner testing on different fuels; scale-up and test in industrial applications (demonstration)			Basic lab. tests completed		P					
Mathematical modelling	(may be incorporated in existing combustion program)										
Material properties											
M.1 Continuous casting studies					I	I	I*			P	
M.2 Hot working and heat treatment		750.000 \$	4 yrs	Some work has started	I	I*	I*			P	

* Tentative/possibility

P Proposed project

I Interest

EXHIBIT C

PROPOSED TIMETABLE, IEA
ENERGY CONSERVATION IN THE IRON AND STEEL INDUSTRY

MAY-79	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC-79	1980
<u>IMPLEMENTING AGREEMENT</u> Circulate together with Meeting Report	Review period on form of Implem. Agreem. desired. Comments to STU	Revise and reformulate draft Impl. Agreem. as necessary	Distribution to potential final participants	Possible revisions	Circulation	Agree on final draft of Impl. Agreem. at meeting		
STU	Potential participants and IEA Secretariat	STU	STU	STU Participants IEA Secr.	All		IEA PROCEDURES	Signing of Implementing Agreement?
<u>ANNEX I</u> (or "Work Area I")	Develop comprehensive project descriptions and send all documents to STU	Draft Annex(es) and circulate to all IEA members	Review of final ver- Draft(s) sign and circulate			Agree on final draft of Annex(es) at meeting		
ANNEX II etc.	(as above)	Prospective participants	STU	All	STU	All	Planned deadline for circulation of materials for meeting (STU)	NEXT MEETING (IEA PARIS)
		Decision on next meeting. Issue invitations (STU) (base decision on responses to Impl. Agreem. and to level of project documentation received.)						