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RESULTS OF
INDUSTRY CONSERVATION
PROJECT DATA REVIEW

T.O. 15

Prepared for:

Office of Conservation and Solar Applications
Division of Industrial Energy Conservation
U.S. DEPARTMENT OF ENERGY

Contract: ~~EY-76-C-03-1225~~

ATO 3-76CS40114

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January 23, 1978

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SECTION I

INTRODUCTION

This report summarizes results of the combined efforts of the Division of Industrial Energy Conservation (INDUS) and several independent reviewers to perform an evaluation of the existing and proposed INDUS energy conservation RD&D projects. The review panel was comprised of competent technical professionals, with knowledge of various industry technologies, who would perform meaningful and critical analyses of each of 55 selected INDUS hardware demonstration projects. The purpose of conducting this project review was to obtain several independent evaluations of the capital cost, energy savings and operating costs for each project which would be used to upgrade the original proposal data currently in the threshold system. More importantly, the panel members' assessments would be used to improve upon the highly subjective market penetration and risk analysis data. The Threshold Project Evaluation and Risk Analysis methodologies were used as the medium for providing quantitative assessment of the data presented by each project manager.

As each project manager presented the background material for his own projects, the panel would openly discuss the specific qualitative and quantitative problems and benefits which seemed apparent from the presentation. Two distinct contributions to improving the process of evaluating these projects were evident from this review process. The discussion following each project manager's presentation proved to be in itself a frank and revealing forum which provided the INDUS project and branch managers with unbiased and informative

opinions about the scope and direction of their projects and, in some cases, suggestions about areas where efforts should be redirected to achieve greater impact.

The second contribution of this exercise consists of quantitative assessments of each project provided by the review panel which have been compiled in this document. For each project with which a panel member was familiar, a set of capital costs, energy saving, and market penetration data was submitted, and a risk analysis was to be performed on every project. Because not every reviewer was knowledgeable about each technology presented, a complete set of data is not compiled for each project.

EEA reviewed all the input threshold and risk analysis data, including the original proposal data currently in the threshold system, and interpreted and compiled the results in Section II of this report. EEA was also asked to critically review both the project manager's presentation and the original proposal data, and provide its own quantitative and qualitative estimate for each project.

Section III contains summaries of the risk analyses performed on each project, including each reviewer's assessments of the pre- and post-research commercial, institutional, and technical components of risk.

BACKGROUND

From June 27 through June 30, 1977, the Division of Industrial Energy Conservation sponsored a series of project review sessions at the Hyatt Regency Hotel in Washington, D.C.

The participating panel members who were expected to provide independent assessments of the technical merits and scope of each INDUS demonstration project are presented in Table I-1.

Since the Threshold Evaluation and Risk Analysis methodologies were to be used as the input medium for soliciting the panel members' independent estimates of the project data, the first three hours of the first session were spent on briefing the panel on how to use the methodologies and on the significance of each of the inputs they would be required to provide.

Each of the INDUS project managers was required to prepare his own briefing materials for the panel. The distribution of existing threshold analysis input data to the panel members was discouraged in order to avoid biasing their evaluations. The presentations were generally limited to one-half hour for each project, consisting of the project manager's presentation in the first twenty minutes, with the last ten minutes reserved for group discussion.

Although some project managers were better prepared than others, the presentations were frequently punctuated with enthusiastic discussions with topics ranging from the quantitative characteristics of the project being reviewed to the appropriateness and scope of the Federal research program.

The panel members were instructed to perform their evaluations as soon as possible following each presentation, preferably on the same day. When an individual was not familiar with the quantitative aspects of a particular technology, he was not required to complete a threshold evaluation. In all cases, however, it was felt that sufficient information would be available for each panel member to perform a risk analysis on each project.

TABLE I-1

LIST OF PANEL MEMBERS

Panel Member	Affiliation
Jack Overman	Hittman Associates
Chuck Malloy	Hittman Associates
Howard Hagler	Resource Planning Associates
Hank Vaccaro	Resource Planning Associates
Rich Hammer	Booz, Allen, and Hamilton
Smith Wood	Booz, Allen, and Hamilton
Paul Ackerman	Booz, Allen, and Hamilton
Paul Jensen	Idaho National Engineering Laboratory (INEL)
Dick Farman	Idaho National Engineering Laboratory (INEL)
Al Streb	Division of Industrial Energy Conservation (DOE)
John Rossmisl	Division of Industrial Energy Conservation (DOE)
William Veno	Energy and Environmental Analysis, Inc. (EEA)

Although the deadline for submitting the completed evaluations was set at two weeks from the last day of the presentation, six weeks passed before all participating panel members responded.^{1/}

CONCLUSIONS

It was evident from the reactions of the panel on the first day of the presentations that it would be unlikely that each reviewer could perform knowledgeable evaluations of all INDUS by the INDUS RD&D program, no individual reviewer could be expected to be familiar with every project. Possible exceptions to this generalization are Jack Overman from Hittman, and Paul Jensen and Dick Farman of Idaho National Engineering Laboratory, all of whom had previously evaluated many of the projects.

In view of this constraint, the original expectation of receiving independent evaluations of each project from all panel members was revised to expect threshold data from only a few. It was felt, however, that the backgrounds of the panel members might be sufficiently diverse to enable each to contribute more or less equally in providing evaluations for those projects with which they are particularly familiar.

Since the risk analysis is based on a more subjective assessment of the commercial, institutional, and technical factors influencing a project's prospects for commercialization, it was felt that sufficient information would be provided to the panel

^{1/} Under prior agreement with INDUS, the panel members from Booz, Allen, and Hamilton were not required to submit any evaluations. Church Mallory, from Hittman, participated only on the first day of the presentations and similarly did not submit evaluations.

during the presentations so that a risk analysis could be performed on each project.

It is evident from the threshold data and risk evaluations presented in Sections II and III of this report that the panel members did not respond quite as planned. Several panel members did not provide threshold evaluation data for any projects, while others, such as Overman and Rossmeissl, provided evaluations for nearly all projects. Most reviewers did perform risk analyses on all the projects and, except for a slight bias introduced by consistently low scores from one or two panel members, the results are roughly consistent.

After being asked to participate in the review, in addition to compiling all the results, EEA consulted a wide variety of sources in industry, academia, government, and trade associations to evaluate the project data presented. EEA attempted to reconcile data from these outside sources and the technology characterization data from the Market oriented Program Planning Study (MOPPS) with the original proposal data. The results of EEA's independent analysis of the INDUS projects are presented with those of the other panel members in this report. The background data prepared by EEA to document its evaluations is presented in the Appendix.

In addition to the quantitative evaluations performed by the panel, the discussions which accompanied each project manager's presentation were felt to be an additional benefit of this exercise. The project managers had an opportunity in this forum to receive a critical assessment of the scope and direction of their projects. Frequently, the suggestions made by the panel were felt to be very useful and the project managers promised to incorporate many of them into their planning.

RECOMMENDATIONS

The review was generally considered by all participants to be a useful exercise which should be conducted again in the future. It was felt, however, that a slightly different format should be employed whereby one or two project managers present fewer projects, and the backgrounds of the panel members should be more closely matched to the projects being presented. It was a good idea to withhold copies of the existing threshold data from panel members because evaluations of those few projects for which such data was provided were definitely influenced by this information.

Although a panel review conducted in this manner is still very useful, it would be much more effective to solicit a greater commitment from the panel members to spend time outside the presentation sessions to evaluate the projects in more detail.

In summary, the guidelines which EEA recommends to be followed in conducting subsequent project reviews are:

- Try to evaluate smaller groups of projects, perhaps conducting separate reviews for each project manager,
- Select a small panel whose members have backgrounds more compatible with the technologies being evaluated,
- Solicit a commitment from the panel to study each project in greater detail outside the group session,
- With a more manageable number of projects, a second, shorter, follow-up review can be conducted which will enable the reviewers to consider their colleagues' opinions and provide a second input, if desired.

SECTION II

THRESHOLD EVALUATION DATA SUMMARIES

This section contains the detailed summaries of the threshold evaluation data prepared by the panel members for each project. The information contained herein is compiled by project manager and contains the following information for each project:

- (1) A Panel Review Summary text which describes and compares the data submitted by each reviewer,
- (2) A summary table containing all the data estimate provided by each reviewer, in addition to the original proposal data.

The Panel Review Summaries contain detailed discussions of the data submitted by the reviewers, contrasting those inputs which differ from each other or from the original proposal data. As is evident from these summaries, EEA performed a detailed evaluation of each technology, consulting various industry and government sources and the Market Oriented Program Planning Study (MOPPS) data wherever appropriate.

Each project summary contains a recommendation section which, to the extent possible indicates what action should be taken to resolve apparent inconsistencies or otherwise redirect the project efforts so as to most effectively utilize the Federal research program to increase the prospects for successful commercialization. The summary tables also contain footnotes as necessary to describe how particular data values have been developed and what assumptions were used.

In addition to the Panel Review Summaries, a single Project Summary sheet has been prepared for each project manager which briefly depicts the evaluation status of all of his projects.

PROJECT SUMMARY - John Rossmeissl

Project	Evaluation Status	Comments
MECHANICAL DEWATERING	No evaluation	Project withdrawn.
FUEL SAVING SYSTEM/POST PAINT	Good project	High potential energy savings and environmental benefits.
CEMENT BLOCK CURING	Good project	Excellent economics; product reliability and technology transfer should be the primary areas for OIC research support.
HIGH EFFICIENCY ELECTRIC ARC WELD	Good project	Economically attractive but research might be better utilized in other welding energy conservation areas.
HEADBOX FOR PAPER	Review not yet completed	
HYPERFILTRATION	Review not yet completed	
ALTERNATIVE TO NATURAL GAS CURING	No evaluation	Project withdrawn.
TEXTILE PROCESS MODIFICATION	No evaluation	Project withdrawn.

PANEL REVIEW SUMMARY
Mechanical Dewatering

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PANEL REVIEW SUMMARY
Fuel Saving Paint System

Discussion:

All reviewers appeared to agree on the magnitude of the capital costs and energy savings for this project. The value of the energy saved varies slightly for each respondent according to the price of natural gas assumed. The original proposal estimated \$.72/MMBTU, while Overman and EEA used \$1.20/MMBTU.

A market of 400 units was indicated by the project manager and, since the economics of this technology make it very attractive, there is expected to be a strong penetration of this market, although, perhaps not as fast as the original proposal data indicates. The use of paint fumes to replace natural gas as a fuel not only offers energy savings, but also helps to eliminate a severe pollution problem by reducing the fumes lost to the atmosphere through the furnace stack.

Recommendations:

Since the technology is not technically complicated, and because the economics appear to be excellent, the ERDA role in this program appears to be primarily technology transfer. Efforts should be directed towards identifying all similar opportunities for applying this technology in other market areas.

DEMONSTRATION OF FUEL SAVING SYSTEM
FOR PAINT CURING

John Rossmeissl

	Original Proposal	Overman	Streb	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	580,000	725,000	750,000	725,000
Installation cost (\$/unit)	112,000			
Installation time (years)	1			
Annual energy savings				
gas (Btu/unit)	$.39 \times 10^{12}$	$.362 \times 10^{12}$	$.362 \times 10^{12}$	$.362 \times 10^{12}$
oil				
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	281,000	434,000	362,000	434,400
Useful life (years)	20	15-20		
Scrap value (%)	1			
Acceleration (years)	2	3	2-3	3
Total market				
1977 (units)		400	400	400
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980	2		10	7
1985	200		180	50
1990	300		350	100
2000				200

PANEL REVIEW SUMMARY
Cement Block Curing

Discussion:

All panel members agreed with the project manager on the capital cost and potential market size of the technology. The energy savings estimated for this project ranged from 1,300 to 2,140 million BTUs per kiln, with a corresponding variation in operating cost savings estimates ranging from \$936 to \$4,000, respectively. There is general agreement, however, that the energy savings is split nearly evenly among oil and gas fired plants. EEA estimated that the value of 1,300 million BTUs split evenly between oil and gas is roughly \$2,470. Overman estimated that the energy savings would be 60 percent greater than the original proposal, based on rough calculations of total industry energy consumption and a market size of 7,000 kilns.

Although this technology applies to both oil and gas fired facilities, price differentials between the two fuels do not significantly affect the apparent economic attractiveness of the technology. Using \$1.20/MMBTU for gas and \$2.60/MMBTU for oil, the \$1,700 initial capital cost will be paid back in 1.1 years and .5 years, respectively.

All reviewers believed that technology transfer would be a major obstacle to commercialization of the curing process modification. EEA questions if the new process might alter the current 24-hour block curing cycle or reduce the flexibility of plants to match the seasonal demand.

Recommendations:

Although this technology appears to be economically attractive even under conservative estimates of energy prices and savings potential, OIC should examine potential problems related to manufacturer's uncertainty over product quality. Economic advantage alone may not be sufficient to ensure the commercial success of this technology.

CEMENT BLOCK CURING

John Rossmisl

	Original Proposal	Overman	Vaccaro	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	1,700	1,700	1,700	1,700
Installation cost (\$/unit)				
Installation time (years)	1			
Annual energy savings				
gas (Btu/unit) ^{1/}	1300 x 10 ⁶	1070 x 10 ⁶	700 x 10 ⁶	650 x 10 ⁶
oil		1070 x 10 ⁶	700 x 10 ⁶	650 x 10 ⁶
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	936	4,000		2,470 ^{2/}
Useful life (years)	10			
Scrap value (%)				
Acceleration (years)	10	5	3-5	3-5
Total market				
1977 (units)	7,250	7,000	7,000	9,000 ^{3/}
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)	1			1
1980	2,451			1,500
1985	6,901			3,000
1990	7,191			4,500
2000				

1/ Approximately equal split between oil and gas plants.

2/ Based on \$1.20/MMBTU gas and \$2.60/MMBTU oil.

3/ Estimated 1,300 cement block plants with six to eight kilns per plant.

PANEL REVIEW SUMMARY

Efficient Arc Weld Power Supply

Discussion:

The panel members generally accepted the project manager's data for a 300 amp cyclomatic arc welder. The adjusted project data reflect lower capital costs and a shorter useful life than in the original proposal. The energy savings remain about the same, but the reviewers estimated that the value of these savings would differ. The original proposal indicated a \$220 operating cost savings, Overman estimated \$300, and EEA calculated \$272 savings (based on \$3.43/MMBTU for electricity).

Streb estimated the total market of 750,000 units would increase 10 percent annually. EEA believed that a two percent annual growth was more reasonable, and estimated a much slower penetration rate.

Recommendations:

The proposal appears economically attractive with a payback period of less than three years. The panel members generally felt that while the commercialization potential of this technology is good, other welding energy conservation projects may offer higher energy savings. They suggested that a PON be issued to help identify other conservation opportunities in the area of welding energy conservation.

EFFICIENT ARC WELD POWER SUPPLY

John Rossmeyssl

	Original Proposal	Overman ^{1/}	Streb	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	1,000	600	600	600
Installation cost (\$/unit)				
Installation time (years)	1			
Annual energy savings				
gas (Btu/unit)				
oil				
coal				
electricity				
(at 10,000 Btu/kwh)	76×10^6 ^{2/}	79.3×10^6	79.3×10^6	79.3×10^6
Operating cost (\$/unit)	220	300		272
Useful life (years)	11	8		8
Scrap value (%)				
Acceleration (years)	7			
Total market				
1977 (units)	500,000	750,000	750,000	750,000
1980			10%	2%
1985			Annual	Annual
1990			Growth	Growth
2000				
Market penetration				
1977 (units in use)				10
1980	50,000			40,000
1985	200,000			90,000
1990	325,000			200,000
2000				

- 1/ A second evaluation of a 300 amp Arc Air Welder with a captial cost of \$1,200 and 52.5×10^6 BTU/year energy savings is not shown on this sheet.
- 2/ Derived from 215×10^6 BTU/year for a conventional welder and 139×10^6 for the new technology. Energy cost savings come from the differences in operating cost of conventional arc welders (\$615) and the new technology (\$395).

REVIEW PANEL SUMMARY
Headbox for Papermaking

Comments:

The review of the Headbox for Papermaking project has not been completed and will be included in the final report.

HEADBOX FOR PAPERMAKING

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY

Hyperfiltration

Comments:

The review of the Hyperfiltration project has not been completed and will be included in the final report.

Reserved for page 2 of Hyperfiltration

HYPERFILTRATION

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Alternatives to Natural Gas Curing

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PANEL REVIEW SUMMARY

Textile Process Modification

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PROJECT SUMMARY - Jerry Collins

Project	Evaluation Status	Comments
BLENDED CEMENT	Good project	Revising to a one-year retrofit improves the rate of return; high potential energy savings; research is appropriately focused.
PAPER PULP CHARACTERIZATION	Good project	Reviewer's questions should be resolved.
GLASS CONGLOMERATES	Project Re-view Incomplete	
PAPER PULP SLUDGE DRYING	Good project	With current fuel prices the proposal is economically attractive.
ACETYLENE FROM COAL	Project Re-view Incomplete	
FLAT GLASS CULLET REDUCTION	Project Re-view Incomplete	
POLYPROPYLENE TO FUEL	Good project	Attractive economics; Federal support may be unnecessary.
RDF IN CEMENT KILNS	Inconsistent data	Operating cost savings and market potential are disputed; project revisions may lead to an unfavorable evaluation.
WASTE TIRE PROPOSALS	No evaluation	Project area is being redefined.
LUBE OIL RECOVERY	Project Re-view Incomplete	
ANEROBIC DIGESTION	No evaluation	Project withdrawn from consideration.
GLASS SEWER PIPES	Inconsistent data	Reviewers question energy savings and market potential.

PANEL REVIEW SUMMARY

Blended Cement

Discussion:

EEA estimates a one-year installation period for plant retrofit. The four-year installation time in the original proposal refers to the construction period for an entire plant. Since the one-year period corresponds to a retrofit application, the installation time should be reduced.

The original data was based upon a 20 percent substitution of fly ash or slag, reducing energy consumption in cement production from 6.62×10^6 to 5.28×10^6 BTU/Ton. Overman's energy savings were based upon an 8 percent substitution and a conventional energy consumption of 6.0×10^6 BTU/Ton. Using these energy savings, Overman calculates operating cost savings at an average energy price of \$1.20 MMBTU.

Overman overestimates the total market size for blended cement at 800 million tons. The Portland Cement Association data indicates that slightly less than 80 million tons of cement are produced annually in the United States.

Recommendations:

Revising the installation time appears to be the only change required on this proposal. The proposal data is reasonable and the project appears to be focusing on obstacles to implementation.

	Original Proposal	Overman	EEA	
<u>SUBSTITUTE SYSTEM DATA</u> 1/				
Capital cost (\$/unit)	85			
Installation cost (\$/unit)				
Installation time (years)	4		1	
Annual energy use				
gas (Btu/unit)	2.44×10^6			5.52×10^6 (total all fuels)
oil	0.89×10^6			
coal	1.95×10^6			
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	8.65	9.98		
Useful life (years)	20			
Scrap value (%)	0			
<u>CONVENTIONAL SYSTEM DATA</u>				
Capital cost	80			
Installation cost				
Installation time	4		1	
Annual energy use				
gas	3.05×10^6			6.0×10^6 (total all fuels)
oil	1.12×10^6			
coal	2.45×10^6			
electricity				
Operating cost	10.85			
Useful life	20			
Scrap value	0			
Acceleration (years)	5			
Total market				
1977 (units)	86×10^6	800×10^6	80×10^6	
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)	6.8×10^6			
1980	21.3×10^6			
1985	30.0×10^6			
1990	34.0×10^6			
2000				

1/ Project evaluated on basis of cost and energy savings per ton of Portland Cement produced.
Market measured in millions of tons.

PROJECT REVIEW SUMMARY
Paper Pulp Characterization

Discussion:

The reviewers generally echoed the capital costs and energy savings of the original proposal. However, EEA could not confirm or refute the proposal energy benefits because the source of the information presented was not clearly specified.

As Overman indicates, the value of the energy saved by this process, computed using 1977 energy prices, is considerably higher than that estimated in the original proposal. If the energy savings and capital cost figures are accurate, this technology could prove to be extremely attractive with a high rate of return on investment.

Rossmeyssel estimated a much slower market penetration for paper characterization. EEA questioned if the market should be based upon existing processes or additional recycling. The total potential market for retrofit is reasonable, but additional recycling would depend upon many other economic and institutional constraints.

Recommendations:

OIC should seek a better definition of the energy benefits of paper pulp characterization, and the value of the energy savings. If the project proves to be as economically attractive as promised, then OIC should determine if the private sector might not develop this technology on its own.

	Original Proposal	Overman	Rossmeissl	Vaccaro
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	100,000	110,000	110,000	110,000
Installation cost (\$/unit)	10,000			
Installation time (years)	1			
Annual energy savings				
gas (Btu/unit)				
oil	20×10^9	20×10^9	20×10^9	20×10^9
coal	25×10^9	25×10^9	25×10^9	25×10^9
electricity (at 10,000 Btu/kwh)	27×10^9	27×10^9	27×10^9	27×10^9
Operating cost (\$/unit)	85,000	182,110		
Useful life (years)	10	10		
Scrap value (%)	10	0		
Acceleration (years)	10			
Total market				
1977 (units)	500		350	
1980				
1985			700	
1990			750	
2000			850	
Market penetration				
1977 (units in use)				
1980	0			
1985	200		20	
1990	500		100	
2000			500	

PROJECT REVIEW SUMMARY
Glass Conglomerates

Comments:

The review of the Glass Conglomerates project has not been completed and will be included in the final report.

GLASS CONGLOMERATES

Comments:

The review of the Glass Conglomerates project has not been completed and will be included in the final report.

PANEL REVIEW SUMMARIES
Pulp Paper Sludge Drying

Discussion:

The panel members generally accepted the capital cost and energy savings estimates provided by the project manager as the original data. Streb and Rossmeissl examined the project in terms of the incremental additional capital cost and energy savings of a retrofit application for conventional paper plants already owning an incinerator.

The energy price estimates used in the original proposal data were updated by EEA to reflect current 1977 figures. While there are approximately 500 plants in the pulp and paper industry which could utilize this technology, the project manager indicated that only 200 are expected to be able to retrofit with the new process economically. Hence, EEA has estimated the market size to be considerably smaller than the original proposal data.

Recommendations:

Assuming the capital cost and energy savings potential of this project are estimated accurately, the size of the potential market for the technology should be the only area of concern. Otherwise, the technology appears to be economically attractive and should achieve successful commercialization.

PULP PAPER SLUDGE DRYING

Jerry Collins

	Original Proposal	Streb 1/	Rossmeissl 1/	EEA
<u>SUBSTITUTE SYSTEM DATA</u>				
Capital cost (\$/unit)	3 x 10 ⁶	1 x 10 ⁶	1.1 x 10 ⁶	3 x 10 ⁶
Installation cost (\$/unit)				
Installation time (years)	2			2
Annual energy use		200 x 10 ⁹ (all fuels)		
gas (Btu/unit)				
oil				
coal			200 x 10 ⁹	
electricity (at 10,000 Btu/kwh)	110.5 x 10 ⁹			110.5 x 10 ¹²
Operating cost (\$/unit)	296,400 ^{2/}			379,000
Useful life (years)	16			16
Scrap value (%)				
<u>CONVENTIONAL SYSTEM DATA</u>				
Capital cost	1.85 x 10 ⁶			1.85 x 10 ⁶
Installation cost				
Installation time	1			1
Annual energy use				
gas				
oil	312 x 10 ⁹			312 x 10 ⁹
coal				
electricity	11.2 x 10 ⁹			11.2 x 10 ⁹
Operating cost	653,400			850,000
Useful life	16			16
Scrap value				
Acceleration (years)	3			
Total market				
1977 (units)	500		500	200
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980	15		5	10
1985	100		100	40
1990	200		150	80
2000			300	

1/ Streb and Rossmeissl specified the incremental capital costs and energy savings potential for a retrofit project.

2/ Was originally presented erroneously as \$29,640.

PANEL REVIEW SUMMARY

Acetylene From Coal

Comments:

The review of the Acetylene From Coal project has not been completed and will be included in the final report.

Reserved for page 2 of Acetylene from Coal

ACETYLENE FROM COAL

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY

Flat Glass Cullet Reduction

Comments:

The review of the Flat Glass Cullet Reduction project has not been completed and will be included in the final report.

FLAT GLASS CULLET REDUCTION

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Polypropylene to Fuel

Discussion:

The reviewers were in general agreement regarding the \$2.0 million capital cost of this technology. Overman, however, cites a \$2.73 million capital cost with an installation time of one year, based upon data from the Technology Characteristics Sheets.

The reviewers differ on the energy saving and operating cost savings of polypropylene conversion. Overman, Streb, and the original proposal all claim from 3.6 to 4.0×10^{12} BTU/year savings, but Rossmeißl estimates that only one-third of this amount can be saved. Although the operating cost saving ranged from \$6.3 to \$1 million, due to various estimates of capital costs and energy and non-energy savings, even the lowest estimate of the savings would make an investment appear economically attractive.

The market for this technology is very regionalized to the Camden-Wilmington and Texas and Louisiana areas, and the number of units in the market is small. All the reviewers agreed that the total market is around eight to ten plants.

Recommendations:

Since the economics of this technology appear to be very attractive even when the lowest estimates of energy savings are assumed, it is definitely a favorable project to undertake.

POLYPROPYLENE TO FUEL

Jerry Collins

	Original Proposal	Overman	Streb	Rossmeissl
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	2×10^6	2.73×10^6	2×10^6	2×10^6
Installation cost (\$/unit)				
Installation time (years)	2	1		
Annual energy savings				
gas (Btu/unit)				
oil	3.6×10^{12}	3.6×10^{12}	4.0×10^{12}	1.2×10^{12}
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	4.3×10^6	6.3×10^6	2.0×10^6	1×10^6
Useful life (years)	15	20		
Scrap value (%)	10			
Acceleration (years)	6	1		
Total market				
1977 (units)	10	8		10
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980	1	1		1
1985	2	3		3
1990	3	6		6
2000		8		10

PANEL REVIEW SUMMARY
Co-Fire of RDF in Cement Kilns

Discussion:

All reviewers accepted the capital costs and installation time of the proposal. Streb and Rossmeissl estimated the substitution of RDF for other fuels at 20 percent, compared to the 40 percent substitution on the original proposal. EEA believes that 40 percent RDF is feasible. The calculation of operating cost savings should reflect the EPA's estimate of \$.50 to \$2.00 for transporting and preparing RDF. EEA estimates that a price differential of \$1.00/MMBTU may be possible for a limited number of cement plants.

Rossmeissl's data on total market size overstates the number of cement kilns. The Portland Cement Association reported that in 1976 there were 385 kilns in the United States.

Rossmeissl's market penetrations are approximately the same as the original proposal. EEA anticipates a smaller market, restricted to plants with high conventional energy costs which are situated near urban areas where a significant supply of low-cost RDF is available.

Recommendations:

Before further action on this proposal, OIC should perform a plant-specific analysis of the market potential for RDF substitution. The focus of this evaluation should be existing energy costs and the potential cost and availability of RDF.

CO-FIRE OF RDF IN CEMENT KILNS

Jerry Collins

	Original Proposal	Streb	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	1.7×10^6	1.7×10^6	1.7×10^6	1.7×10^6
Installation cost (\$/unit)	$.3 \times 10^6$			$.3 \times 10^6$
Installation time (years)	1			1
Annual energy savings				
gas (Btu/unit)	550×10^9	276×10^9	276×10^9	550×10^9
oil				
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	968,000			550,000 ^{1/}
Useful life (years)	30			
Scrap value (%)	5			
Acceleration (years)	5			5
Total market				
1977 (units)	350		444	175
1980			445	
1985			450	
1990			455	
2000			465	
Market penetration				
1977 (units in use)	1			
1980	5		1	4
1985	45		50	28
1990	85		100	38
2000			300	

1/ Based on a net savings of \$1.00/MMBTU for refuse derived fuel over gas.

2/ Smaller market estimate reflects those plants where RDF can be used at \$1.00/MMBTU cheaper than gas. For other plants the differential is not expected to be as large.

PANEL REVIEW SUMMARY
Waste Tires as Feed Stock

Comments:

This project is a composite of several tire proposals, including applications involving the direct combustion of waste tires and the production of carbon black. None of the three proposals reviewed by OIC have yet been funded, so this project area is still focusing on the most energy-efficient way to reuse scrap tires.

It appears that concern over the availability of scrap tires may retard the acceptance of some technologies where a firm supply of tires is required. Also, the value of some tire casings for retreading may override their use as a fuel.

The panel members reserved further comment on this project area until a more specific project is defined.

PANEL REVIEW SUMMARY

Lube Oil Recovery

Comments:

The review of the Lube Oil Recovery project has not been completed and will be included in the final report.

LUBE OIL RECOVERY

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY

Anerobic Digestion

Comments:

This project has already received a commitment for the first year of funding of a two-year study. It appears, however, that the project manager may recommend that further funding not be granted and the project terminated after the first year of effort.

PANEL REVIEW SUMMARY
Glass Sewer Pipes

Discussion:

There appears to be some inconsistency in the energy savings potential and the market size for this technology. The project manager indicated that there was a potential for saving 7 trillion BTUs of gas by converting to oil as the basic raw material for the production of styrene. Overall, however, there is not expected to be a significant net saving of energy in this process.

The plant size was specified as one-half million linear feet per year of pipe. Since the total 1973 national production of pipe equalled 166 linear feet, there should be 332 plants in the market place, each producing an average of one-half million linear feet annually. In contradiction, however, the original propose indicates that .1 trillion BTUs of natural gas can be saved per plant, and if 7 trillion BTUs of gas can be conserved by the industry, then there must only be 70 plants in the market-place.

Recommendations:

Clearly, there is some confusion about the actual market potential for this technology. DOE should clarify the energy savings potential of this technology and the size of the market before continuing funding on this project.

Although there is a relatively small amount of actual energy saved since this technology's primary benefit is fuel substitution, it does appear to be very attractive economically because the capital cost of the substitute technology is lower than that of the conventional.

	Original Proposal	Rossmeissl	Overman
<u>SUBSTITUTE SYSTEM DATA</u>			
Capital cost (\$/unit)	2.71×10^6	2.7×10^6	
Installation cost (\$/unit)	$.68 \times 10^6$		
Installation time (years)	1		
Annual energy use			7.0×10^{12} 1/ (All fuels)
gas (Btu/unit)	$.131 \times 10^{12}$	5.6×10^{12} 1/	
oil	$.82 \times 10^{10}$	1.4×10^{12}	
coal	$.246 \times 10^{11}$		
electricity (at 10,000 Btu/kwh)			
Operating cost (\$/unit)	2.8×10^6		
Useful life (years)	20		
Scrap value (%)	5		
<u>CONVENTIONAL SYSTEM DATA</u>			
Capital cost	4.8×10^6	4.8×10^6	
Installation cost	1.2×10^6		
Installation time	1		
Annual energy use			
gas	$.216 \times 10^{12}$		
oil	$.135 \times 10^{11}$		
coal	$.405 \times 10^{11}$		
electricity			
Operating cost	2.2×10^6		
Useful life	15		
Scrap value	3		
Acceleration (years)	4		
Total market			320
1977 (units)			
1980			
1985			
1990			
2000			
Market penetration			
1977 (units in use)			
1980	1	1	
1985	3	10	
1990	6	20	
2000		100	

1/ Energy savings industry-wide for 100 percent penetration.

PROJECT SUMMARY - Stan Clark

Project	Evaluation Status	Comments
MEAT PACKING MODIFICATION (HOT DEBONING)	Inconsistent data	The energy savings, operating cost savings, and market penetration must be refined.
NEW FERTILIZER PROCESS	Good project	Very attractive economically; OIC should resolve why industry is not expected to develop this technology on its own.
VACUUM BLANCHING	No evaluation	Initial project terminated; another project area being defined.
NITROGEN FERTILIZER	No evaluation	PON under preparation.
IRRIGATION-WATER CONSERVATION	No evaluation	PON under preparation.
FOOD STERILIZATION—GASPAK	No evaluation	Insufficient data.
POULTRY PROCESS	Project re- view incomplete	
LOW ENERGY FLUID FOOD PRODUCTION	No evaluation	Project still under development.
HEAT PUMP CROP DRYING	Project re- view incomplete	
WHOLE MILK STERILIZATION	Inconsistent data	Energy savings and capital costs need to be refined; consumer acceptance of produce is questioned by reviewers.
PROTEIN RECOVERY	No evaluation	Project withdrawn.

PANEL REVIEW SUMMARY

Hot Deboning

Discussion:

The project data originally presented to the review panel depicted a 52,000 head/year plant, which was consistent with the demonstration unit proposed as the result of this project. Figures from the Department of Agriculture indicate that of the 1665 total meat processing plants in the U.S. in 1976 , only 217 plants have an annual capacity greater than 50,000 head.

<u>No. Head Processed Annually</u>	<u>No. of Plants</u>	<u>Average Capacity/Plant</u>
< 1000	809	-----
1000 - 10,000	437	-----
10,000 - 50,000	202	-----
< 50,000	<u>217</u>	147,000
Total		1,665

Since these 217 plants account for approximately 75 percent of the total U.S. Production of 42 million head, there is sufficient reason for considering a scaled up plant capable of producing approximately 150,000 head per year. While a plant of this size would certainly compete for the major portion of this market, the capital cost, operating cost and energy savings data presented to the review panel referred to the smaller 52,000 head/year plant.

All panel members were in general agreement that the cost of the demonstration unit should be in the \$260,000 to \$360,000 range. The data presented by the project manager suggests that contrary to the original proposal data, there are energy savings in transporting and handling 30 percent less volume of beef per head in addition to the savings in refrigeration. There appears to be a consensus that the 30 percent reduction in refrigeration

amounts to an estimated 4.9×10^8 Btu savings in electricity, and the transportation savings (which are not well documented) are expected to provide an additional $20-25 \times 10^8$ Btu of oil savings per 52,000 head plant.

Even allowing the additional transportation energy savings as promised, the dollar value of the energy saved cannot prevent the economics from appearing marginal at best. An energy savings of \$7-8,000 per year does not offset the high capital cost of the technology.

The potential market for this technology appears to be in the range of 200-400 plants with a capacity of 10,000 to 150,000 head per year.

Recommendations:

Unless a scaled-up commercial plant can provide increased energy savings without a corresponding increase in capital cost, it appears that the unfavorable economics of this project will not ensure commercialization of the technology. It would be beneficial to confront the proposer with the issue of economics as well as re-examining the potential market anticipated for the technology.

HOT DEBONING

Stan Clark

	Original Proposal	Overman	Ross	EEA
<u>NEW SYSTEM DATA</u> 1/				
Capital cost (\$/unit)	200,000	260,000	350,000	360,000
Installation cost (\$/unit)	100,000			
Installation time (years)	1		9 months	1
Annual energy savings				
gas (Btu/unit)				
oil			2.48×10^9	1.96×10^9
coal				
electricity (at 10,000 Btu/kwh)	2.6×10^9	$.49 \times 10^9$	$.49 \times 10^9$	$.49 \times 10^9$
Operating cost (\$/unit)	260,000	1,681		6,780
Useful life (years)	10	10	10	10
Scrap value (%)	5			5
Acceleration (years)	7			7
Total market				217 (>50K Head)
1977 (units)		800	800	202 (10K-50K Head)
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980	20			5
1985	1,000			100
1990	4,000			200
2000				

1/ For 52,000 head/year plant.

PANEL REVIEW SUMMARY

New Fertilizer Process

Discussion:

The panel members generally concurred with the data presented by the project manager as indicated in the summary table. There appeared to be some inconsistency between the original proposal data and that presented in the review however. The energy savings claimed by the original proposal were roughly an order of magnitude lower than that indicated in the presentation. In both instances, however, the savings from reduced gas consumption in nitrogen production resulted in a very economically attractive investment.

The 1972 Census of Manufactures indicates that there were 76 establishments engaged in the production of nitrogenous fertilizer (SIC 2873) which consumed 212 trillion Btu's of natural gas. Based on these figures, it appears unlikely that the 160 unit market indicated in the original proposal is reasonable.

Recommendations:

Presuming the $.24 \times 10^{12}$ Btu/plant energy savings is correct, the energy savings and economic attractiveness of this project appear to be so favorable that it seems unlikely that the industry would not develop this technology on its own, especially when faced with the prospect of natural gas curtailment and/or price increases. DOE should make every effort to ascertain whether there is in fact an institutional barrier in this industry to new technology development exclusive of TVA.

NEW FERTILIZER PROCESS

Stan Clark

	Original Proposal	Overman	Rossmiessl	Vaccaro
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	40,000	40,000	40,000	40,000
Installation cost (\$/unit)	10,000			
Installation time (years)				
Annual energy savings				
gas (Btu/unit)	$.02 \times 10^{12}$	$.24 \times 10^{12} 1/$	$.24 \times 10^{12} 1/$	$.24 \times 10^{12} 1/$
oil				
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	30,000	289,000		
Useful life (years)	10	10	5-8	5-8
Scrap value (%)	10			
Acceleration (years)	5			
Total market				
1977 (units)	160	35	35	35
1980			38	39
1985			45	48
1990			52	58
2000			66	86
Market penetration				
1977 (units in use)			5	
1980	16		7	
1985	96		15	
1990	128		25	
2000			50	

1/ Based on revised data provided by project manager.

PANEL REVIEW SUMMARY

Vaccum Blanching

Discussion:

This project was terminated six months ago after showing little promise. The energy savings potential was low compared to the capital cost involved.

When presented with these results, the panel concurred with the project manager that the project should be redefined to study other alternative areas. The National Cannery Association was felt to be very capable to continue a study project in this area.

VACUUM BLANCHING

Stan Clark

	Original Proposal	
<u>NEW SYSTEM DATA</u>		
Capital cost (\$/unit)	100,000	
Installation cost (\$/unit)	10,000	
Installation time (years)	1	
Annual energy savings		
gas (Btu/unit)	59 x 10 ⁹	
oil		
coal		
electricity (at 10,000 Btu/kwh)		
Operating cost (\$/unit)	42,768	
Useful life (years)	10	
Scrap value (%)	5	
Acceleration (years)	7	
Total market		
1977 (units)	20,000	
1980		
1985		
1990		
2000		
Market penetration		
1977 (units in use)		
1980	200	
1985	2,000	
1990	10,000	
2000		

PANEL REVIEW SUMMARY

Nitrogen Fertilizer

Discussion:

This project is not completely defined as yet, but a PON is being prepared to look at process efficiency improvements to reduce the natural gas consumed in nitrogen fertilizer production. Therefore, the original proposal data may not be relevant for evaluating this project.

NITROGEN FERTILIZER

Stan Clark

	Original Proposal	
<u>NEW SYSTEM DATA</u>		
Capital cost (\$/unit)	600,000 ^{1/}	
Installation cost (\$/unit)	200,000	
Installation time (years)	1	
Annual energy savings		
gas (Btu/unit)	7×10^{11}	
oil		
coal		
electricity (at 10,000 Btu/kwh)		
Operating cost (\$/unit)	900,000	
Useful life (years)	10	
Scrap value (%)		
Acceleration (years)	6	
Total market		
1977 (units)	95	
1980		
1985		
1990		
2000		
Market penetration		
1977 (units in use)		
1980	1	
1985	44	
1990	88	
2000		

1/ 200-ton-per-day plant.

PANEL REVIEW SUMMARY

Irrigation System Efficiency

Discussion:

This project is not completely defined as yet, but a PON is being prepared. The emphasis in this PON should be placed on low energy consuming, low pressure delivery systems that operates at high efficiencies. Therefore, the data presented as the original proposal estimate may not be relevant for evaluating this project.

IRRIGATION SYSTEM

Stan Clark

	Original Proposal	
<u>NEW SYSTEM DATA</u>		
Capital cost (\$/unit)	400 ^{1/}	
Installation cost (\$/unit)	200	
Installation time (years)	1	
Annual energy savings		
gas (Btu/unit)	230 x 10 ⁶	
oil		
coal		
electricity (at 10,000 Btu/kwh)		
Operating cost (\$/unit)	165	
Useful life (years)	15	
Scrap value (%)		
Acceleration (years)	6	
Total market		
1977 (units)	120,000	
1980		
1985		
1990		
2000		
Market penetration		
1977 (units in use)		
1980	100	
1985	6,000	
1990	240,000	
2000		

1/ 250 HP Natural Gas Pumping System, operating 1,080 hours per year.

PANEL REVIEW SUMMARY

GasPak - Food Sterilization and Packaging

Discussion:

This project intends to study the GASPAK technology of gas exchange food processing and sterile packaging. Since the project is at a predemonstration stage of development, the panel members virtually unanimously concurred with the project manager that a threshold evaluation would be impractical at this early stage.

Several panel members did express their concern over apparent technological barriers to the commercialization of this technology. These problems were anticipated to center in the areas of packaging and marketing the end product. If successful however, the GASPAK technology could reduce energy consumption in food packaging and presentation to less than half of conventional methods.

	Technology Characteriza- tion 1/			
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NEW SYSTEM DATA

Capital cost	(\$/unit)	100,000
Installation cost	(\$/unit)	
Installation time	(years)	1
Annual energy savings		
gas	(Btu/unit)	22 x 10 ⁹
oil		
coal		
electricity		
(at 10,000 Btu/kwh)		44 x 10 ⁹
Operating cost	(\$/unit)	165,400
Useful life	(years)	20
Scrap value	(%)	
Acceleration	(years)	
Total market		
1977	(units)	
1980		
1985		
1990		
2000		
Market penetration		
1977	(units in use)	
1980		1
1985		400
1990		800
2000		3200

1/ Data is taken from MOPPS Technology Characterization Worksheet.

PANEL REVIEW SUMMARY
Poultry Process Technology

Comments:

The review of the Poultry Process Technology project has not been completed and will be included in the final report.

This page is reserved for page 2
of Poultry Process Technology

POULTRY PROCESS

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Low Energy Fluid Food Production

Discussion:

This project is a study of the potential for concentrating liquid foods other than thermal evaporation using steam. The project is not felt to have progressed sufficiently to permit a threshold evaluation to be performed at the present time.

PANEL REVIEW SUMMARY
Heat Pump Crop Drying

Comment:

The review of the Heat Pump Crop Drying project has not been completed and will be included in the final report.

Heat Pump Crop Drying (continued)

HEAT PUMP CROP DRYING

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Whole Milk Sterilization

Comments:

The review of the Whole Milk Sterilization project has not been completed and will be included in the final report.

This page is reserved for page 2 of Whole Milk Sterilization

WHOLE MILK STERILIZATION

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY

Protein Recovery

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PROJECT SUMMARY - Bill Williams

Project	Evaluation Status	Comments
HIGH TEMPERATURE RECUPERATORS	Good projects	Revisions in energy savings may reduce rate of return but technology remains very attractive; should OIC be funding five projects in this area?
REFIRE (ENERGY EFFICIENT INDUSTRIAL PARKS)	No evaluation	Project withdrawn.

PANEL REVIEW SUMMARY
Flue Gas Recuperators

Discussion:

While there are five recuperator projects either being funded or considered for funding, data was only available on two of the five applications. The first application concerns a \$50,000 unit which the original proposer claims will save 35 billion BTUs of natural gas annually. The panel members agreed with the project manager on virtually all data presented for this project. EEA, using the technology characterization data, estimated that the energy savings estimates should be less than half that of the project manager. Also, accounting for additional nonenergy operating costs, the recuperator used in this application would save only \$16,500 annually, assuming current natural gas prices of \$1.20/MMBTU. Even with this less than optimistic energy savings estimate, the technology shows a three year payback. Assuming, as the original proposal does, that gas costs \$1.50/MMBTU, the payback falls to 2.2 years. Assuming the original proposal data is accurate, the initial investment in the recuperator is paid back in less than one year.

The market indicated for this recuperator application by both sources is 25,000. Because of the anticipated increase in natural gas prices and the proven performance of the recuperators already in use in industry, a faster market penetration than that anticipated by the original proposer is likely .

The second recuperator application is a \$225,000 unit which is expected to save 59 billion BTUs annually. No data was available on the size of the market anticipated for this project. The project manager's estimate of a 1.8 year payback period on the investment was the basis for the operating cost saving estimate of \$125,000. However, in order to save this much, the value of natural gas saved would have to be \$2.12/MMBTU.

Flue Gas Recuperators - Page Two

While this price is not unreasonable for many applications, it is unlikely that the average current price for interstate delivered gas is that high. Clearly, though, for future applications this estimate is very appropriate.

Under this gas price assumption, the short payback period makes this recuperator application a very attractive investment. Our experience shows that most recuperator applications are similarly attractive which does lead to the question of why OIC is funding as many as five separate projects.

Recommendation:

Because there are so many recuperator projects being funded, it seems likely that the benefits of each subsequent project may be more and more marginal. OIC should endeavor to determine whether there are redundant benefits resulting from these projects which can be eliminated.

FLUE GAS RECUPERATION

Bill Williams

	Original Proposal	Jensen 1/ Streb	EEA 2/	
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	45,000	45,000	45,000	
Installation cost (\$/unit)	5,000	5,000	5,000	
Installation time (years)	1 year	6 months	1 year	
Annual energy savings				
gas (Btu/unit)	35 x 10 ⁹	35.2 x 10 ⁹	15 x 10 ⁹	
oil				
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	53,000	52,800	16,500 3/	
Useful life (years)	15	15	15	
Scrap value (%)				
Acceleration (years)	6	6		
Total market				
1977 (units)	25,000		25,000	
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980	500	500	1,000	
1985	5,000	5,000	10,000	
1990	10,000	10,000	20,000	
2000				

1/ Jensen and Streb both agreed with the proposal data from project manager.

2/ Data based on Technology Characterization Worksheet.

3/ Based on \$1.20/MMBTU natural gas and \$0.10 of additional operating and maintenance costs per million BTU saved.

PANEL REVIEW SUMMARY

Refire (Energy Industrial Parks)

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PROJECT SUMMARY - Jim Osborne

Project	Evaluation Status	Comments
BOILER FUEL CONTROL	Good Project	This technology will only be economically attractive to a restricted portion of the boiler market.
HEAT PUMP PROJECTS	Project Re-view Incomplete	
BRAYTON CYCLE GLASS PLANT	Good project	Market penetration estimates need to be refined, especially for applications outside the glass industry; economics are favorable although based upon preliminary data.
O ₂ ENRICHED COMBUSTION	No evaluation	Project withdrawn.

PANEL REVIEW SUMMARY
Boiler Fuel Control

Discussion:

The reviewers generally agreed with the capital costs of the original proposal and the panel presentation data, which ranged from \$100,000 to \$125,000.

EEA accepted the 50×10^9 BTU fuel savings, estimated as 5 percent of the energy consumed by a 200,000 lb./hr. boiler operating 4,500 hours per year. Overman and Rossmeissl assumed 37×10^9 BTU/year of fuel oil would be saved without specifying the source of the data. All reviewers estimated the operating cost savings to be slightly above the original proposal data. Operating cost savings ranged from \$69,250 in the original proposal to Overman's estimate of \$81,200. It is clear that the economic attractiveness of this technology varies, depending upon the size of the boiler and capacity utilization factor.

The size of the total market and the potential market penetration was an area of considerable disagreement. Rossmeissl and Overman anticipated a total market in 1977 of 8,511 units which would increase 70 percent by 1990. EEA expected the market for boiler fuel controls would be limited to 100,000 or 200,000 lb./hr. units utilized for more than 4,500 hours per year. Growth of this market would be very low because of anticipated selection of stoker coal on new units. Since single stack monitors are available, EEA expects only a 50 percent penetration of 7,100 units by 1990.

Recommendations:

Boiler fuel controls appear to have a very short payback period even assuming the lowest energy savings and highest capital costs. The market penetration of this technology is the area of greatest uncertainty, although it is likely to be less than the

Boiler Fuel Control (continued)

original proposal estimate. An important factor influencing market penetration is how the cost of achieving the incremental performance improvement using burner controls compares with a simpler stack monitor.

BOILER FUEL CONTROL

	Original Proposal	Overman	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	111,000	100,000	100,000	111,000
Installation cost (\$/unit)	14,000			14,000
Installation time (years)	1	3 months	3 months	1
Annual energy savings				
gas (Btu/unit)	25. x 10 ⁹			25 x 10 ⁹
oil	25. x 10 ⁹	37. x 10 ⁹	37 x 10 ⁹	25 x 10 ⁹
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	69,250	81,200	75,000	80,000
Useful life (years)	20	15	15	20
Scrap value (%)				
Acceleration (years)	4	5	5	4
Total market				
1977 (units)		8511	8511	7100
1980	35,000	9648	9648	(little growth)
1985		11800	11800	
1990		14425	14425	
2000		21564	21654	
Market penetration				
1977 (units in use)				
1980	2000		10	1100
1985	17000		500	1500
1990	35000		2000	3550
2000			10000	

PANEL REVIEW SUMMARY
Heat Pump Projects

Comment:

The review of the Garrett Air Research, MTI and Westinghouse Heat Pump projects are not complete and will be included in the final report.

Heat Pump Projects - Page Two

Heat Pump Projects - Page Three

Heat Pump Projects - Page Four

GARRETT AIR RESEARCH--RANKINE HEAT PUMP

The data summary for this project is being prepared and will be included in the final report.

LLHR HEAT PUMP--MTI

The data summary for this project is being prepared and will be included in the final report.

WESTINGHOUSE HEAT PUMP

The data summary for this project is being prepared and will be included in the final report.

PROJECT REVIEW SUMMARY

Brayton Cycle Turbine

Discussion:

As is evident from the project data summary, all the panel members accepted the capital costs and energy savings estimates provided by the project manager. EEA used slightly higher 1977 delivered energy prices to calculate the operating cost savings.

Overman and Rossmeissl anticipated a ten-year acceleration, while EEA concurred with the five-year acceleration in the original proposal.

The total market size and penetration rate suggested by Rossmeissl reflects applications outside the glass industry. The original proposal data and EEA estimate a 50 percent penetration of 400 glass plants by 1990.

Recommendations:

The economics of this technology look favorable at this point. However, considering the early stages of development, the energy savings may be optimistic.

BRAYTON CYCLE TURBINE

Jim Osborne

	Original Proposal	Overman	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	415,000	265,000	265,000	415,000
Installation cost (\$/unit)		150,000	150,000	
Installation time (years)	1	1	1	1
Annual energy savings				
gas (Btu/unit)	12×10^9	12×10^9	12×10^9	12×10^9
oil	12×10^9	12×10^9	12×10^9	12×10^9
coal				
electricity (at 10,000 Btu/kwh)	73×10^9	73×10^9	73×10^9	73×10^9
Operating cost (\$/unit)	250,000	250,000	250,000	296,000
Useful life (years)	20	20	20	20
Scrap value (%)	10	10	10	
Acceleration (years)	5	10	10	5
Total market				
1977 (units)		1/	1/	
1980		2,200	2,200	
1985		2,500	2,500	
1990		2,700	2,700	
2000		3,200	3,200	
Market penetration				
1977 (units in use)				
1980			10	
1985	50		200	50
1990	200		500	200
2000			2,500	

1/ Overman and Rossmeissl included estimates of aluminum, steel, and other industrial markets in addition to glass.

PANEL REVIEW SUMMARY
O₂ Enriched Combustion

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PROJECT SUMMARY - Al Streb

Project	Evaluation Status	Comments
FOAM FIBER TECHNOLOGY	Good project	Economically very attractive, but DOE should seek to refine preliminary project data.
METALS EXTRACTION	No evaluation	Project withdrawn.

PANEL REVIEW SUMMARY
Foam Finishing Technology

Discussion:

Based on data presented by the project manager, the panel members and EEA expected that the capital cost of this technology might range from \$30-50,000. All the panel members agreed that a 50 percent reduction in energy consumed in fabric drying would save approximately 50 billion BTUs per range, where there are 3,450 ranges currently adaptable to this technology.

All reviewers estimated that the technology is not likely to be accelerated by more than three or four years by the additional Federal funding. The panel members were in general agreement with the project manager that the total market for foam drying is larger than the original proposal estimated.

Recommendations:

While the technology looks very promising, the reviewers were concerned that certain technical problems could be overcome, such as the removal of the foam from the fabric and range. DOE should also attempt to determine more accurately the size of the potential market and the acceleration expected for this technology.

FOAM FINISHING TECHNOLOGY

Al Streb

Market Acceleration: The acceleration in the original proposal data is overestimated. It is expected that the ERDA program will accelerate the commercialization of this technology no more than three to four years.

Comments: This proposal looks very promising, but ERDA should ensure that the research program is directed to eliminate the potential technical problems in foam removal from the fabric and to ensure product quality.

FOAM FINISHING TECHNOLOGY

Al Streb

	Original Proposal	Overman	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	50,000	35-50,000	35-50,000	50,000
Installation cost (\$/unit)	15,000			
Installation time (years)	1	3 months	3 months	1
Annual energy savings				
gas (Btu/unit)	25 x 10 ⁹	48.5 x 10 ⁹	50 x 10 ⁹	48 x 10 ⁹
oil				
coal				
electricity (at 10,000 Btu/kwh)	1 x 10 ⁹			
Operating cost (\$/unit)	50,000	58,000		57,600
Useful life (years)	15	5		5
Scrap value (%)	10			
Acceleration (years)	15	4	3	3
Total market				
1977 (units)	674		3,400	3,400
1980			3,500	
1985			4,000	
1990			5,000	
2000			5,500	
Market penetration				
1977 (units in use)				
1980	1		100	100
1985	50		2,000	1,000
1990	250		4,000	2,500
2000	350		5,000	3,500

PANEL REVIEW SUMMARY
Metals Extraction

Comment:

This project has been withdrawn by DOE and will not be evaluated in this task.

PROJECT SUMMARY - Ralph Sheneman (Continued)

Project	Evaluation Status	Comments
IMPROVED RADIANT TUBE FURNACE	No evaluation	Project withdrawn.
EXTERNAL DESULFURIZATION	No evaluation	Feasibility study will be performed.
FUEL-FIRED SCRAP HEATER	No evaluation	Little information available; study being performed.
SLOT FORCE FURNACE	Good project	Technology remains economically attractive even under reviewer assumptions; energy savings and market penetration should be reevaluated.

PANEL REVIEW SUMMARY

Moving Beam Furnace

Comment:

The review of the Moving Beam Furnace project has not been completed and will be included in the final report.

Moving Beam Furnace (continued)

MOVING BEAM FURNACE

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Cupola Furnace Modification

Comment:

The review of the Cupola Furnace Modification project has not been completed and will be included in the final report.

CUPOLA FURNACE MODIFICATION

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Coal in Aluminum Remelt

Comment:

The review of the Coal in Alumimum Remelt project has not been completed and will be included in the final report.

COAL IN ALUMINUM REMELT

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Continuous Cast Steel

Comment:

Since this project was withdrawn by OIC, after the panel presentation, there will be no discussion of the project data prepared by the panel members and EEA.

CONTINUOUS CAST STEEL 1/

Ralph Sheneman

	Original Proposal	Overman	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	6.25×10^6			10×10^6
Installation cost (\$/unit)	1.25×10^6			2.5×10^6
Installation time (years)	3			3
Annual energy savings				
gas (Btu/unit)		2.4×10^{12}		
oil	3.5×10^{12}		2.4×10^{12}	2.4×10^{12}
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	7.18×10^6	2.88×10^6		6.24×10^6
Useful life (years)	20			30
Scrap value (%)	5			5
Acceleration (years)	5			5
Total market				
1977 (units)	40			40
1980				
1985				
1990				
2000				
Market penetration				
1977 (units in use)				
1980			1	
1985	20		2	5
1990	40		3	20
2000			5	40

1/ Withdrawn from consideration by OIC.

PANEL REVIEW SUMMARY

Aluminum Smelter Modification

Discussion:

The project manager indicated that the cost of modifying an aluminum smelter cell has not yet been determined. Since the original proposal had estimated the retrofit cost per cell to be \$165,000, EEA elected to use this figure until an improved estimate could be provided.

Both Overman and EEA estimated the electricity savings per cell to be lower than the original proposal. Overman's estimate is based upon a 25 percent reduction in energy consumed, or a savings of 2 kwh per pound of aluminum. Based on technology characterization data, EEA estimated the energy savings at 2.5 kwh/pound of aluminum. Comparing the operating cost savings corresponding to these energy savings to the high retrofit cost per cell, the technology appears to be marginal, showing a pay-back of almost five years.

Estimates of the market size range from 20,900 cells to 29,000 cells in 1977. Both Rossmeissl and EEA estimate the penetration of this market to be slower than the original date.

There appears to be some confusion concerning the physical life of the cells. The original proposal estimates an eight-year life, while the technology characterization data cites a 30-year life.

Recommendations:

Since the economic viability of this technology crucially dependent upon the retrofit cost and physical life of the cells, OIC should endeavor to determine these values with greater certainty.

ALUMINUM SMELTER MODIFICATION

Ralph Sheneman

	Original Proposal	Overman	Rossmeissl	EEA
<u>NEW SYSTEM DATA</u>				
Capital cost (\$/unit)	125,000			125,000 ^{1/}
Installation cost (\$/unit)	40,000			40,000
Installation time (years)	3			1
Annual energy savings				
gas (Btu/unit)				
oil				
coal				
electricity (at 10,000 Btu/kwh)	18 x 10 ⁹	7.9 x 10 ⁹		10 x 10 ⁹
Operating cost (\$/unit)	109,000	27,200		34,300
Useful life (years)	8			2/
Scrap value (%)	1			1
Acceleration (years)	6			6
Total market				
1977 (units)	20,000	20,000	28,800	20,000
1980			29,000	
1985			30,000	
1990			32,000	
2000			36,000	
Market penetration				
1977 (units in use)				
1980			1	500
1985	10,000		2,000	2,000
1990	20,000		10,000	10,000
2000			30,000	20,000

1/ Used while awaiting updated figures.

2/ Estimates range from 8 to 30 years.

PANEL REVIEW SUMMARY
Electric Arc Furnace

Comments:

The project manager indicated that this technology was still being evaluated in a preliminary study, so further evaluation was not performed.

PANEL REVIEW SUMMARY
Direct Reduction of Aluminum

Discussion:

None of the panel members provided data estimates on direct reduction of aluminum. EEA's estimates are based primarily on the Technology Characterization Worksheets. Although the capital costs and energy savings differ almost by a factor of two, both sets of data appear to be based upon a 300,000 ton/year plant. Taking each set of input data separately, the technology appears to be a very attractive investment with a two-year payback.

The technology characterization data estimated a larger market size and a long lifetime than the original proposal.

Recommendations:

Clearly, with the two sets of data estimates differing so greatly, OIC should attempt to reconcile the discrepancies before committing substantial funding. In the worst case, if the lowest estimates of energy savings were achieved only at the highest estimates of capital cost, the project would only be marginally attractive and its commercialization potential would diminish.

DIRECT REDUCTION OF ALUMINUM

Ralph Sheneman

	Original Proposal	EEA 1/	
<u>NEW SYSTEM DATA</u>			
Capital cost (\$/unit)	300 x 10 ⁶	150 x 10 ⁶	
Installation cost (\$/unit)			
Installation time (years)	3	3	
Annual energy savings			
gas (Btu/unit)			
oil			
coal			
electricity			
(at 10,000 Btu/kwh)	38 x 10 ¹²	23.7 x 10 ¹²	
Operating cost (\$/unit)	140 x 10 ⁶	81.3 x 10 ⁶	
Useful life (years)	30	40	
Scrap value (%)			
Acceleration (years)	10		
Total market			
1977 (units)	20	60	
1980			
1985			
1990			
2000			
Market penetration			
1977 (units in use)			
1980			
1985	1	1	
1990	6	5	
2000		50	

1/ Data for a 300,000 ton/year furnace as specified in the Technology Characterization Worksheet.

PANEL REVIEW SUMMARY

Waste Heat from Slag

Comment:

The review of the Waste Heat from Slag project has not been completed and will be included in the final report.

WASTE HEAT FROM SLAG

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY
Nitrogen-Based Carburization

Comments:

There is very little information available concerning this project. The project manager indicated that the full industry potential for this technology is an annual savings of 10 trillion BTUs of natural gas. Overman estimated the value of the natural gas saved annually for the entire market to equal \$12 million (assuming \$1.20/MMBTU).

Since there is no additional information available with which to evaluate this technology, further analysis was not undertaken.

NITROGEN-BASED CARBURIZATION

Ralph Sheneman

	Overman	Streb	
--	---------	-------	--

NEW SYSTEM DATA

Capital cost (\$/unit)

Installation cost (\$/unit)

Installation time (years)

Annual energy savings

gas (Btu/unit) 10×10^{12} 10×10^{12}

oil

coal

electricity

(at 10,000 Btu/kwh)

Operating cost (\$/unit) 12×10^6 ^{1/}

Useful life (years)

Scrap value (%)

Acceleration (years) 5

Total market

1977 (units)

1980

1985

1990

2000

Market penetration

1977 (units in use)

1980

1985

1990

2000

1/ Based on estimated natural gas price of \$1.20/MMBTU.

PANEL REVIEW SUMMARY

Fuel Cell Anode/Copper Winning

Comments:

This project was withdrawn from consideration by the project manager and will not be evaluated.

PANEL REVIEW SUMMARY

Dry Coke Quenching

Discussion:

EEA and Rossmeissl used the panel presentation data to update the dry coke quenching proposal. Both reviewers' estimated much lower energy savings than the original proposal. The revised energy savings are based upon improved coke quality and steam generation in the dry quenching process.

Rossmeissl and EEA generally accepted the capital costs and useful life of dry coke quenching. EEA estimated a slightly larger total market for the technology which is based upon average United States coke production from 1973 to 1977.

EEA estimated a higher energy savings potential from improved coke quality, based upon a savings of 40 lbs. of coke per ton of iron produced. Assuming 12,500 BTU are required to produce a pound of coke, the coke savings equals .833 trillion BTUs per plant.

$$\begin{aligned}\text{Coke BTU Saving} &= \frac{40 \text{ lb. coke}}{\text{ton iron}} \times \frac{1.67 \text{ tons iron}}{\text{ton coke}} \times \frac{12,500 \text{ BTU}}{\text{lb. coke}} \times \\ &\quad \frac{10^6 \text{ tons coke}}{\text{plant}} \\ &= .833 \times 10^{12} \text{ BTU/plant.}\end{aligned}$$

Rossmeissl estimated a savings of 31 trillion BTUs from improved coke quality for a total of 50 plants. Thus, his estimate of the per-plant coke savings is slightly smaller at .62 trillion BTUs.

EEA and Rossmeissl estimate the operating cost savings to be in the \$3.2 to \$3.6 million range.

Dry Coke Quenching (continued)

Recommendations:

The revised energy savings of the dry coke quenching proposal decreases the economic benefits by about half, and raises the payback period to almost six years. The industry response to this technology, if the energy savings cannot be improved, will probably hinge upon emission control features. If the quenching process enables a coke plant to avoid the cost of additional pollution-abatement equipment, the economic picture is greatly improved. Otherwise, the project does not appear to offer very significant economic incentives for investment by industry.

DRY COKE QUENCHING

Ralph Sheneman

	Original Proposal	Rossmeyssl	EEA
<u>NEW SYSTEM DATA</u>			
Capital cost (\$/unit)	18 x 10 ⁶	20 x 10 ⁶	18 x 10 ⁶
Installation cost (\$/unit)			
Installation time (years)	1		1
Annual energy savings			
gas (Btu/unit)			
oil 1/	2.4 x 10 ¹²	.8 x 10 ¹² 3/	.8 x 10 ¹²
coal 2/	1 x 10 ¹²	.62 x 10 ¹²	.833 x 10 ¹²
electricity (at 10,000 Btu/kwh)			
Operating cost (\$/unit)	6.31 x 10 ⁶	3.6 x 10 ⁶	3.2 x 10 ⁶
Useful life (years)	18		18
Scrap value (%)	1		1
Acceleration (years)	3		
Total market			
1977 (units)	37	50	60
1980			
1985			
1990			
2000			
Market penetration			
1977 (units in use)			
1980	1		
1985	3		3
1990	7		20
2000			35

1/ Oil savings from steam generation in quenching process.

2/ Energy savings from improved coke quality--higher heat value.

3/ Rossmeyssl's original data was based on savings of oil and coke for the entire 50-plant market.

PANEL REVIEW SUMMARY
Blast Furnace Gasifier

Comment:

The review of the Blast Furnace Gasifier project has not been completed and will be included in the final report.

This page is reserved for Blast Furnace Gasifier

BLAST FURNACE GASIFIER

The data summary for this project is being prepared and will be included in the final report.

PANEL REVIEW SUMMARY

Improved Radiant Tube Furnace

Comments:

Because this technology is already being developed by industry, there is no need for DOE support. The panel members recommended dropping it from consideration and looking at fluidized bed combustion instead.

PANEL REVIEW SUMMARY
External Desulfurization

Comments:

The project manager indicated that a proposal had not yet been received for this project, but that it was dependent upon the development of the Blast Furnace Gassifier technology. The question of whether Blast Furnace Gassifier will actually produce reject Nitrogen will be addressed in a feasibility study of this technology. Therefore, further evaluation of External Desulfurization was not undertaken.

PANEL REVIEW SUMMARY
Fuel-Fired Scrap Heater

Comments:

This project will evaluate the economics of a cupola and BOF versus an electric arc furnace in the forging of steel. The technology appears to offer as much as a 50 percent reduction in fuel input, but the capital cost may be prohibitively high. This evaluation will attempt to determine the answers to these questions.

Because little additional information is available at present and since the economics of the technologies are the principal determinant of their potential for commercialization, the panel members concurred that the economics and the energy savings potential of both technologies be evaluated in a preliminary study.

PROJECT REVIEW SUMMARY

Slot Forge Furnace

Discussion:

Both Overman and EEA expect that the energy savings of this technology will be smaller than those claimed by the original proposal. EEA estimated that an individual furnace would consume 1.1×10^6 BTU/ton for an estimated 4,500 tons per year. Overman assumed the same savings per ton, but for a larger 5,000 ton per year throughput. The energy savings are estimated by both reviewers to be 2.4×10^6 BTU/ton for each furnace. There are an estimated 20 furnaces in an average plant.

While Overman indicated the energy savings were in gas, EEA suspects this is an unintentional error and the savings should have been in oil.

EEA and Rossmeissl agree that the market penetration would be slower than the original proposal indicates, since the economic attractiveness of this technology is not as great.

Recommendations:

The estimates provided by both Overman and EEA indicate that this technology is not likely to be as attractive an investment as the original proposal data suggests. The reviewers' data indicates, however, that the payback on this investment will range from two to three years, which is still very favorable.

Further refinement of the potential energy savings and market penetration potential should be the focus of future ERDA evaluation.

SLOT FORGE FURNACE

Ralph Sheneman

	Original Proposal	Overman	Rossmeissl	EEA
<u>SUBSTITUTE SYSTEM DATA</u>				
Capital cost (\$/unit)	50,000	75,000	75,000	75,000
Installation cost (\$/unit)				
Installation time (years)	1	1		1
Annual energy use				
gas (Btu/unit)		$.55 \times 10^{10}$		
oil	1.12×10^{10}			$.5 \times 10^{10}$
coal				
electricity (at 10,000 Btu/kwh)				
Operating cost (\$/unit)	29,000	6,600		13,000
Useful life (years)	12	20		10
Scrap value (%)	10			10
<u>CONVENTIONAL SYSTEM DATA</u>				
Capital cost	22,000	20,000		22,000
Installation cost				
Installation time	1			1
Annual energy use				
gas		1.75×10^{10}		
oil	2.8×10^{10}			1.58×10^{10}
coal				
electricity				
Operating cost	72,500	21,000		41,000
Useful life	12	20		10
Scrap value	10			10
Acceleration (years)	5			
Total market				
1977 (units)	8,100	8,000	8,000	
1980			8,200	
1985			8,800	
1990			9,300	
2000			10,000	
Market penetration				
1977 (units in use)	1		1	1
1980	1,100		100	100
1985	8,100		2,000	2,000
1990			4,000	4,000
2000			8,000	

SECTION III

RISK ANALYSIS SUMMARY

The risk analysis data submitted by the reviewers are summarized in this section. The pre-and post-research commercial, institutional, and technical probabilities of success estimated by each reviewer are summarized with the corresponding risk-adjusted rates of return on one sheet. The nominal rates of return for each project, presented in this section, are based upon the original proposal threshold data. Since the threshold data for many projects is likely to be revised, causing the nominal rate of return to change, EEA has prepared footnotes describing the expected impact of these changes on the risk analysis for each project. These footnotes are included on the bottom of each of the risk summary sheets.

On a separate page for each project, EEA has provided a graphical display of the range of pre-and post-research probability of success estimates for each reviewer, together with the average of all reviewers.

The minimum acceptable rate of return for a technology increases as the risk (or probability of failure) increases, as shown in Figure III-1. Since this threshold curve relates a specific rate of return to a probability of failure, a particular project's nominal rate of return can be translated into a threshold (or minimum) probability of success. For example, a project having a nominal rate of return of 35 percent, such as shown in Figure III-1, must have a post-research probability of success ($1 - \text{probability of failure}$) of at least 68 percent. Project X, in this instance, is represented as having achieved a post-research probability of success of 80 percent, so it is likely to be successfully commercialized.

FIGURE III-1

This concept of establishing a threshold probability of success corresponding to each project's nominal rate of return is reflected in the graphical portrayal of the risk results for each project. The threshold probability of success for each project is presented as a dotted line on each chart and corresponds to the point on the private sector threshold curve at which the project is just beginning to meet the minimum acceptable probability of success.

Since the value of this threshold is dependent upon each project's nominal rate of return, various changes anticipated in a project's capital and operating costs will cause this threshold value to change. EEA's assessments of the expected effect of these changes on the threshold value are presented as footnotes on the risk summary sheet.

Preceding the risk summary sheets for each project manager is a graph showing the average of the reviewer's risk analysis for each project. Since these average risk analyses are also dependent upon the nominal rate of return from the original project data, the relative position of these projects may change. Also, it should be noted that the review panel average risk analyses are often influenced by exceptionally low scores of one, and sometimes two, reviewers. It is evident from the individual risk summary sheets that Hagler's and Overman's risk evaluations were generally lower than those provided by most other reviewers.

Nominal
Rate
of
Return

FUEL SAVING SYSTEM/POST PAINT

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----						
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL	NOM	BASE	POST
ORIGINAL DATA	0.86	0.87	0.79	0.59	0.98	0.98	0.99	0.96	25.80	7.99	23.71
OVERHAN	0.43	0.45	0.49	0.09	0.92	0.86	0.92	0.72	25.80	0.14	12.58
STREB	0.92	0.97	0.95	0.84	0.97	0.98	0.97	0.92	25.80	17.67	21.62
ROSSMEISSL	0.81	0.68	0.70	0.39	0.98	0.92	0.99	0.89	25.80	3.10	19.98
VACCARO	0.92	0.97	0.93	0.83	0.97	0.99	1.00	0.95	25.80	17.15	23.06
EEA DATA	0.83	0.95	0.77	0.61	0.92	0.95	0.95	0.84	25.80	8.57	17.36
AVERAGE	0.80	0.82	0.77	0.56	0.96	0.95	0.97	0.88	25.80	7.09	19.49

- The reviewers did not concur on any single area of concern, but most believe that Federally supported research would greatly enhance the probability of successful commercialization.
- Since a PON is being written for the paint process, the reviewer evaluations presented here may not be relevant to evaluation of this project.

Fuel Saving System/Post Paint

John Rossmeissl

Probability of Success 10 20 30 40 50 60 70 80 90

CEMENT BLOCK CURING PROCESS - SCI SERV

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.92	0.86	0.97	0.76	0.97	0.93	0.99	0.89	35.28	19.34	27.39
OVERMAN	0.54	0.49	0.37	0.10	0.78	0.69	0.88	0.48	35.28	0.20	6.82
STREB	0.81	0.99	0.83	0.66	0.95	0.99	0.95	0.90	35.28	14.06	28.13
ROSSMEISSL	0.72	0.78	0.89	0.50	0.97	0.91	0.98	0.87	35.28	7.71	25.97
VACCARO	0.75	0.93	0.92	0.64	0.86	0.97	0.98	0.82	35.28	12.95	22.56
EEA DATA	0.91	0.91	0.90	0.74	0.99	0.99	0.98	0.97	35.28	18.28	33.14
AVERAGE	0.77	0.83	0.81	0.57	0.92	0.91	0.96	0.82	35.28	10.03	22.84

- Rossmeissl and EEA anticipated greater economic benefits than the original proposal. These changes could lower the threshold probability of success and increase the attractiveness of the technology without Federally sponsored research and development.

Cement Block Curing Process - SCI Service

John Rossmeissl

Probability of Success 10 20 30 40 50 60 70 80 90

HIGH EFFIC ELEC ARC WELD POWER SUPPLY

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.88	0.10	0.98	0.09	0.92	0.42	0.99	0.38	54.75	0.23	6.48
OVERMAN	0.35	0.78	0.45	0.12	0.75	0.78	0.83	0.48	54.75	0.53	10.84
STREB	0.89	0.92	0.92	0.76	0.89	0.92	0.95	0.78	54.75	29.38	31.42
ROSSMEISL	0.68	0.78	0.67	0.35	0.97	0.89	0.98	0.85	54.75	5.45	38.06
VACCARO	0.79	0.95	0.93	0.70	0.83	0.95	0.95	0.74	54.75	24.42	28.27
EEA DATA	0.94	0.95	0.77	0.68	0.95	0.95	0.95	0.87	54.75	23.56	39.78
AVERAGE	0.75	0.75	0.78	0.45	0.88	0.82	0.94	0.68	54.75	9.27	23.51

- Streb, Vaccaro, and EEA believe that this technology could be commercialized even without Federal support.
- The other reviewers anticipated great increases in the probability of success, but disagree on whether the project would meet the private sector threshold.

High Efficiency Electric Arc Weld Power Supply

John Rossmeissl

Probability of Success 10 20 30 40 50 60 70 80 90

HEAD BOX FOR PAPER

The data for this project is not complete and will be included in the final report.

Head Box for Paper

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer	Private Sector Threshold								
Hagler									
Overman									
Jensen									
Streb									
Rossmeissl									
Farman									
Vaccaro									
EEA data									
Reviewer Averages									

HYPERFILTRATION - CLEMSON UNIV

The data summary for this project is being prepared and will be included in the final report.

Hyperfiltration - Clemson University

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

Nominal
Rate
of
Return

Jerry Collins

* Infinite nominal rate of return due to capital cost savings,

BLENDING CEMENT

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.76	0.72	0.92	0.50	0.99	0.99	0.99	0.99	20.00	4.37	19.46
HAGLER	0.31	0.43	0.54	0.07	0.65	0.83	0.92	0.50	20.00	0.06	4.33
OVERMAN	0.54	0.63	0.96	0.32	0.80	0.73	0.99	0.59	20.00	1.64	6.17
STREB	0.81	0.99	0.83	0.66	0.95	0.99	0.95	0.90	20.00	7.97	15.95
ROSSMEISSEL	0.78	0.70	0.78	0.43	0.92	0.88	0.78	0.64	20.00	3.08	7.36
EEA DATA	0.69	0.86	0.83	0.50	0.92	0.99	0.99	0.92	20.00	4.22	16.45
AVERAGE	0.65	0.72	0.81	0.41	0.87	0.90	0.94	0.76	20.00	2.83	10.74

- The reviewers identified commercial and institutional factors as the primary obstacles to increased use of blended cement.
- By correctly regarding this project as a retrofit application, the installation time will decrease to one year and cause the nominal rate of return to increase, thereby lowering the private sector threshold.

Blended Cement

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

PAPER PULP CHARACTERIZATION

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.60	0.97	0.70	0.41	0.95	0.98	0.92	0.86	48.39	6.54	34.86
HAGLER	0.10	0.68	0.54	0.04	0.54	0.86	0.78	0.36	48.39	0.03	5.11
OVERMAN	0.41	0.75	0.28	0.09	0.58	0.97	0.61	0.35	48.39	0.21	4.62
ROSSMEISL	0.78	0.78	0.57	0.35	0.99	0.82	0.96	0.79	48.39	4.68	28.47
VACCARO	0.67	0.83	0.69	0.38	0.63	0.83	0.79	0.41	48.39	5.63	6.69
EEA DATA	0.72	0.91	0.88	0.57	0.84	0.95	0.98	0.78	48.39	14.14	27.94
AVERAGE	0.55	0.82	0.61	0.31	0.76	0.90	0.84	0.59	48.39	3.47	15.10

- The reviewers generally expected commercial feasibility factors to be a major barrier to commercialization, both before and after the Federal research program.

Paper Pulp Characterization

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

GLASS CONGLOMERATES - CORNING GLASS WORK

The data summary for this project is being prepared and will be included in the final report.

Glass Conglomerates - Corning Glass Works

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Data for this project will be prepared and included in final report.

Hagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

PULP PAPER SLUDGE DRYING

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.88	0.78	0.78	0.54	0.97	0.97	0.92	0.86	24.99	6.41	17.95
OVERMAN	0.35	0.10	0.10	0.00	0.83	0.37	0.76	0.23	24.99	0.00	0.99
ROSSMEISSL	0.78	0.78	0.78	0.48	0.90	0.82	0.83	0.61	24.99	4.92	8.47
VACCARO	0.86	0.88	0.69	0.52	0.93	0.93	0.90	0.78	24.99	5.78	14.32
EEA DATA	0.88	0.83	0.86	0.62	0.91	0.93	0.92	0.77	24.99	8.62	14.11
AVERAGE	0.75	0.67	0.64	0.43	0.91	0.80	0.87	0.65	24.99	3.89	9.67

- If the current 1977 energy prices were used to compute the nominal rate of return instead of the original proposal data, the project would be rated closer to the private sector threshold.

Pulp Paper Sludge Drying

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

ACETYLENE FROM COAL

The data summary for this project is being prepared and will be included in the final report.

ACETYLENE FROM COAL

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

The data for this project will be prepared and included in the final report.

FLAT GLASS CULLET REDUCTION

The data summary for this project is being prepared and will be included in the final report,

Flat Glass Cullet Reduction

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

The data for this project will be prepared and included
in the final report.

POLYPROPYLENE TO FUEL - PROCEDYNE CORP

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.72	0.54	0.54	0.21	0.95	0.92	0.97	0.85	83.25	2.58	58.16
OVERMAN	0.49	0.54	0.54	0.14	0.84	0.89	0.88	0.66	83.25	1.07	33.05
STREB	0.86	0.89	0.78	0.61	0.92	0.92	0.92	0.78	83.25	27.26	48.51
ROSSMEISSL	0.54	0.75	0.78	0.31	0.95	0.82	0.91	0.71	83.25	6.35	38.75
VACCARO	0.93	0.93	0.90	0.78	0.99	0.97	0.98	0.96	83.25	48.25	75.86
EEA DATA	0.71	0.95	0.90	0.61	0.89	0.94	0.97	0.81	83.25	28.07	52.08
AVERAGE	0.71	0.77	0.74	0.44	0.92	0.91	0.94	0.80	83.25	13.71	50.06

- All reviewers predicted that this technology would exceed the private sector threshold. Streb, Vaccaro, and EEA submitted risk assessments that suggest the technology could be successfully marketed without Federal support.
- While the reviewers did not concur on the major problem areas, most predicted a significant increase in the probability of success due to Federal support.

Polypropylene to Fuel - Procedyne Corporation

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

CEMENT KILN WASTE AS FUEL

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.28	0.54	0.78	0.12	0.95	0.97	0.97	0.89	29.20	0.26	22.65
OVERMAN	0.10	0.10	0.10	0.00	0.54	0.63	0.60	0.20	29.20	0.00	0.83
STREB	0.92	0.89	0.72	0.60	0.92	0.92	0.89	0.76	29.20	9.30	15.91
ROSSMEISL	0.78	0.78	0.78	0.48	0.92	0.82	0.87	0.66	29.20	5.75	11.45
VACCARO	0.55	0.77	0.99	0.42	0.89	0.87	0.99	0.78	29.20	4.33	16.71
EEA DATA	0.65	0.83	0.95	0.51	0.77	0.96	0.95	0.71	29.20	6.56	13.65
AVERAGE	0.55	0.65	0.72	0.36	0.83	0.86	0.88	0.67	29.20	2.93	11.85

- Half the panel members expect this technology to surpass the private sector threshold. However, EEA has concluded that operating cost savings in the original proposal did not include the purchase of refuse-derived fuel. Including this cost will lower the nominal rate of return and increase the private sector threshold.

Refuse Derived Fuel Co-fired in Cement Kilns

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

LUBE OIL RECOVERY - BERG

The data summary for this project is being prepared and will be included in the final report.

Lube Oil Recovery - Berc

Probability of Success 10

20

30

40

50

60

70

80

90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

GPC SEWER PIPE

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----						
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL	NOM	BASE	POST
OVERMAN	0.10	0.10	0.10	0.00	0.43	0.50	0.58	0.13	*****	*****	*****
STRED	0.78	0.87	0.78	0.53	0.83	0.89	0.83	0.62	*****	*****	*****
ROSSHEISSL	0.78	0.78	0.83	0.51	0.78	0.86	0.88	0.59	*****	*****	*****
VACCARD	0.67	0.83	0.89	0.49	0.89	0.93	0.93	0.77	*****	*****	*****
EEA DATA	0.68	0.67	0.83	0.37	0.82	0.73	0.92	0.55	*****	*****	*****
AVERAGE	0.60	0.65	0.69	0.38	0.75	0.78	0.83	0.53	*****	*****	*****

- The panel members generally predicted that the impact of government support upon the probability of success would be relatively slight.

GPC Sewer Pipe

Jerry Collins

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Note: Private sector threshold can not be shown because the capital cost savings of this technology prevent a rate of return calculation.

Hagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

Nominal
Rate
of
Return

AVERAGE RISK ANALYSES
FOR ALL REVIEWERS

MEAT PACKING MODIFICATION

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.54	0.78	0.92	0.39	0.78	0.89	0.97	0.68	53.58	6.56	22.58
OVERMAN	0.10	0.10	0.10	0.00	0.41	0.54	0.43	0.10	53.58	0.00	0.29
STREB	0.91	0.89	0.86	0.70	0.92	0.92	0.92	0.78	53.58	24.22	31.22
ROSSMEISSL	0.78	0.78	0.78	0.48	0.86	0.82	0.83	0.59	53.58	10.56	16.51
VACCARD	0.69	0.93	0.96	0.62	0.69	0.95	0.98	0.65	53.58	18.31	20.33
EEA DATA	0.83	0.88	0.96	0.70	0.96	0.95	0.99	0.91	53.58	24.18	43.58
AVERAGE	0.64	0.73	0.76	0.48	0.77	0.85	0.85	0.62	53.58	10.54	18.35

- The dollar value of energy savings in the original proposal appears to be overstated. Since the threshold probability of success is inversely related to nominal rate of return, decreasing the operating cost savings of hot deboning will increase the threshold probability of success and make the project appear less favorable.

Hot Deboning - Meat Packing Modification

Stan Clark

Probability of Success 10 20 30 40 50 60 70 80 90

NEW FERTILIZER PROCESS

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.49	0.78	0.78	0.30	0.87	0.92	0.92	0.74	38.50	2.63	19.69
OVERMAN	0.10	0.10	0.10	0.00	0.68	0.72	0.92	0.45	38.50	0.00	6.62
STREB	0.88	0.86	0.78	0.60	0.92	0.92	0.95	0.81	38.50	12.23	23.99
ROSSHEISSL	0.78	0.78	0.78	0.48	0.90	0.82	0.78	0.58	38.50	7.59	11.36
FARMAN	0.96	0.97	0.95	0.88	0.99	0.98	0.99	0.98	38.50	29.04	37.19
VACCARD	0.92	0.93	0.96	0.82	0.97	0.95	0.99	0.92	38.50	25.05	32.20
EEA DATA	0.83	0.93	0.73	0.57	0.94	0.97	0.94	0.85	38.50	11.09	27.02
AVERAGE	0.71	0.77	0.73	0.52	0.90	0.90	0.93	0.76	38.50	9.08	21.08

- The majority of reviewers predicted the new fertilizer technology would surpass the threshold probability of success.

New Fertilizer Process

Stan Clark

Probability of Success 10 20 30 40 50 60 70 80 90

VACUUM BLANCHING

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.83	0.77	0.76	0.48	0.95	0.93	0.95	0.84	25.19	5.01	16.98
AVERAGE	0.83	0.77	0.76	0.48	0.95	0.93	0.95	0.84	25.19	5.01	16.98

- The current proposal has been dropped and the project scope is now being redefined.

Vacuum Blanching

Stan Clark

Probability of Success 10 20 30 40 50 60 70 80 90

POULTRY PROCESS

The data summary for this project is being prepared and will be included in the final report.

Poultry Process

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data for this project will be prepared and included
in the final report.

Hagler

Overman

Jensen

Streb

Rossmelissl

Farman

Vaccaro

EEA data

Reviewer Averages

ELECTRIC HEAT PUMP - GRAIN DRYING

The data summary for this project is being prepared and will be included in the final report.

Electric Heat Pump - Grain Drying

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Hagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

The data summary for this project is being prepared and will be included in the final report.

WHOLE MILK STERILIZATION

This data summary for this project is being prepared and will be included in the final report.

Whole Milk Sterilization

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

The data summary for this project is being prepared and will be included in the final report.

RECUPERATORS

PROBABILITY OF SUCCESS

REVIEWER

RATE OF RETURN

	-----BASE-----				-----POST-----						
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL	NOM	BASE	POST
ORIGINAL DATA	0.82	0.95	0.89	0.69	0.97	0.98	0.99	0.95	62.05	27.01	55.58
OVERMAN	0.10	0.10	0.10	0.00	0.60	0.54	0.54	0.17	62.05	0.00	1.26
ROSSMEISSL	0.78	0.78	0.78	0.48	0.81	0.82	0.83	0.55	62.05	12.23	16.61
EEA DATA	0.81	0.95	0.89	0.69	0.94	0.97	0.95	0.87	62.05	26.95	45.34
AVERAGE	0.63	0.70	0.67	0.46	0.83	0.83	0.83	0.64	62.05	11.28	22.73

Recuperators

Bill Williams

Probability of Success 10 20 30 40 50 60 70 80 90

Nominal
Rate
of
Return

BOILER FUEL CONTROLS

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.91	0.93	0.82	0.69	0.94	0.95	0.94	0.83	34.20	14.87	22.88
HAGLER	0.91	0.97	0.92	0.81	0.96	0.99	0.97	0.92	34.20	21.28	28.31
OVERMAN	0.54	0.54	0.54	0.16	0.86	0.86	0.78	0.58	34.20	0.55	10.33
STRED	0.88	0.92	0.78	0.64	0.92	0.93	0.89	0.77	34.20	12.59	19.19
ROSSMEISL	0.78	0.78	0.67	0.41	0.92	0.86	0.94	0.74	34.20	4.69	17.68
VACCARD	0.77	0.91	0.91	0.64	0.87	0.91	0.94	0.74	34.20	12.51	17.42
EEA DATA	0.88	0.95	0.90	0.76	0.93	0.95	0.98	0.87	34.20	18.51	25.00
AVERAGE	0.81	0.86	0.79	0.58	0.91	0.92	0.92	0.78	34.20	10.37	19.67

- The panel members generally agreed that there was a high probability of this technology being successfully commercialized. The greatest improvement was anticipated in the areas of commercial and technical feasibility.
- While most panel members believed that the technology passed the private sector threshold, there are indications that the energy savings may be even greater than the original proposal estimated. This would reduce the private sector threshold and make the project appear even more favorable.

Boiler Fuel Controls

Jim Osborne

Probability of Success 10 20 30 40 50 60 70 80 90

RANKINE HEAT PUMP FOR STEAM GENER

The data summary for this project is being prepared and will be included in the final report.

Ranking Heat Pump for Steam Generators

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

The data summary for this project is being prepared and will be included in the final report.

HIGH TEMPERATURE HEAT PUMP

The data summary for this project is being prepared and will be included in the final report.

High Temperature Heat Pump

Probability of Success 10

20

30

40

50

60

70

80

90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Bagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

HEAT RECOV USING BRAYTON CYCLE TURBINE

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.72	0.86	0.47	0.29	0.92	0.97	0.85	0.76	54.92	3.59	29.55
OVERMAN	0.10	0.10	0.10	0.00	0.54	0.54	0.54	0.16	54.92	0.00	0.88
STREB	0.78	0.78	0.78	0.48	0.78	0.86	0.92	0.62	54.92	10.82	18.89
ROSSMEISL	0.78	0.78	0.78	0.48	0.98	0.82	0.89	0.72	54.92	10.82	26.32
EEA DATA	0.85	0.95	0.70	0.57	0.94	0.95	0.89	0.80	54.92	15.67	33.83
AVERAGE	0.65	0.70	0.57	0.37	0.83	0.83	0.82	0.61	54.92	5.85	18.35

- All but one of the reviewers expected that the post-research probability of success will surpass the private sector threshold, primarily because of a significant improvement in technical feasibility.

Heat Recovery Using Brayton Cycle Turbine

Jim Osborne

Probability of Success 10 20 30 40 50 60 70 80 90

FOAM FIBER TECHNOLOGY

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.72	0.63	0.70	0.32	0.93	0.86	0.88	0.70	46.71	3.68	20.83
HAGLER	0.91	0.94	0.95	0.81	0.96	0.97	0.97	0.91	46.71	29.20	37.52
OVERMAN	0.10	0.54	0.21	0.01	0.70	0.89	0.73	0.46	46.71	0.00	8.38
ROSSMEISSE	0.63	0.73	0.77	0.35	0.97	0.86	0.88	0.73	46.71	4.60	23.05
VACCARO	0.95	0.88	0.82	0.68	0.98	0.93	0.99	0.91	46.71	19.70	37.54
EEA DATA	0.79	0.93	0.69	0.51	0.94	0.95	0.95	0.85	46.71	10.46	32.55
AVERAGE	0.68	0.78	0.69	0.45	0.91	0.91	0.90	0.76	46.71	7.79	25.22

- Most of the reviewers indicated that the overall probability of success for this technology would be significantly improved by the Federal program.

Foam Fiber Technology

Al Streb

Probability of Success 10 20 30 40 50 60 70 80 90

Nominal
Rate
of
Return

MOVING BEAM FURNACE

The data su-mary for this project is being prepared and will be included in the final report.

Moving Beam Furnace

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmelssl

Farman

Vaccaro

EEA data

Reviewer Averages

CUPOLA FURNACE MOD - PENN STATE UNIV

The data summary for this project is being prepared and will be included in the final report.

Cupola Furnace Modification - Pennsylvania State University

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

COAL IN ALUMINUM REMELT - KAISER & ALCO

The data summary for this project is being prepared and will be included in the final report.

Coal in Aluminum Remelt - Kaiser & Alco

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data summary for this project is being prepared and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmeissl

Farman

Vaccaro

EEA data

Reviewer Averages

CONTINUOUS CASTING OF STEEL - ALLEGHENY

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.70	0.91	0.58	0.37	0.92	0.95	0.92	0.81	38.37	4.25	23.90
HAGLER	0.10	0.54	0.86	0.05	0.88	0.83	0.94	0.69	38.37	0.04	16.72
OVERMAN	0.54	0.10	0.54	0.03	0.95	0.78	0.89	0.67	38.37	0.01	15.57
STREB	0.88	0.87	0.63	0.48	0.92	0.92	0.83	0.71	38.37	7.55	17.88
ROSSMEISSE	0.78	0.78	0.67	0.41	0.86	0.82	0.96	0.68	38.37	5.26	16.27
EEA DATA	0.84	0.95	0.60	0.48	0.93	0.95	0.93	0.83	38.37	7.54	25.02
AVERAGE	0.64	0.69	0.64	0.30	0.91	0.88	0.91	0.73	38.37	2.70	19.03

- All reviewers indicated that the Federal RD&D program would substantially increase the probability of success of the continuous casting technology.

Continuous Casting of Steel - Allegheny

Ralph Sheneman

Probability of Success 10 20 30 40 50 60 70 80 90

ALUMINUM SMELTER MOD - KAISER & ALCOA

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.77	0.83	0.64	0.41	0.93	0.93	0.97	0.84	28.78	3.96	19.47
OVERMAN	0.10	0.21	0.10	0.00	0.71	0.60	0.54	0.23	28.78	0.00	1.09
STREB	0.88	0.96	0.54	0.45	0.88	0.99	0.92	0.81	28.78	4.97	17.92
ROSSMEISSL	0.78	0.78	0.78	0.48	0.90	0.82	0.89	0.66	28.78	5.67	11.40
EEA DATA	0.83	0.97	0.86	0.70	0.98	0.97	0.97	0.93	28.78	12.96	24.35
AVERAGE	0.67	0.75	0.58	0.41	0.88	0.86	0.86	0.69	28.78	3.95	12.72

- All reviewers expected Federal support to increase the probability of success, primarily by improving technical feasibility.

Aluminum Smelter Modification - Kaiser & Alcoa

Ralph Sheneman

Probability of Success 10 20 30 40 50 60 70 80 90

DIRECT REDUCTION/ALUMINUM - UNIV OF N Y

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.63	0.83	0.49	0.25	0.94	0.92	0.95	0.82	22.58	1.06	14.39
OVERMAN	0.10	0.10	0.10	0.00	0.71	0.63	0.70	0.31	22.58	0.00	1.72
EEA DATA	0.82	0.99	0.67	0.54	0.93	0.99	0.95	0.87	22.58	5.70	16.62
AVERAGE	0.52	0.64	0.42	0.26	0.86	0.84	0.87	0.67	22.58	1.17	9.19

- The reviewers expected large improvements in commercial feasibility and technical performance. Only the project manager and EEA expected the post-research probability to be near the private sector threshold.

Direct Reduction/Aluminum - University of New York

Ralph Sheneman

Probability of Success 10 20 30 40 50 60 70 80 90

WASTE HEAT FROM SLAG - MONSANTO

The data summary for this project is being prepared and will be included in the final report.

Probability of Success 10 20 30 40 50 60 70 80 90

Original Proposer

The data summary for this project is being prepared
and will be included in the final report.

Hagler

Overman

Jensen

Streb

Rossmeyssl

Farman

Vaccaro

EEA data

Reviewer Averages

DRY COKE QUENCHING

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
HAGLER	0.63	0.54	0.54	0.18	0.92	0.89	0.92	0.76	22.78	0.51	12.41
OVERMAN	0.35	0.10	0.43	0.02	0.83	0.79	0.78	0.52	22.78	0.00	5.28
STREB	0.81	0.97	0.92	0.72	0.83	0.99	0.97	0.80	22.78	11.14	13.73
ROSSMEISSL	0.78	0.78	0.78	0.48	0.82	0.82	0.91	0.61	22.78	4.49	7.50
EEA DATA	0.77	0.91	0.90	0.63	0.96	0.99	0.99	0.96	22.78	8.22	20.94
AVERAGE	0.67	0.66	0.72	0.41	0.87	0.90	0.91	0.73	22.78	3.09	11.28

- The panel's risk assessments indicate considerable disagreement about the impact of Federal research support. Only EEA predicts that the coke process will exceed the private sector threshold.
- Both EEA and Rossmeissl believe that the original proposal overestimates the annual savings of the new technology. If this is true, the threshold probability of success will imply that the project has less chance of successful commercialization.

Dry Coke Quenching

Ralph Sheneman

Probability of Success 10 20 30 40 50 60 70 80 90

SLOT FORGE FURNACE

REVIEWER	PROBABILITY OF SUCCESS								RATE OF RETURN		
	-----BASE-----				-----POST-----				NOM	BASE	POST
	COMM	INST	TECH	TOTL	COMM	INST	TECH	TOTL			
ORIGINAL DATA	0.28	0.76	0.10	0.02	0.95	0.98	0.99	0.94	89.36	0.02	77.08
OVERMAN	0.35	0.47	0.35	0.06	0.78	0.86	0.78	0.53	89.36	0.16	21.80
ROSSMEISSL	0.72	0.78	0.78	0.44	0.86	0.78	0.83	0.56	89.36	14.77	25.02
EEA DATA	0.68	0.86	0.77	0.45	0.90	0.91	0.87	0.71	89.36	15.13	41.68
AVERAGE	0.51	0.72	0.50	0.24	0.87	0.88	0.87	0.68	89.36	3.87	38.52

- All reviewers anticipated that the post-research probability of success would exceed the private sector threshold.
- This favorable evaluation is primarily the result of a nominal rate of return of 89.36 percent. The project data revisions suggested by Overman and EEA would decrease the nominal rate of return and thereby increase the threshold probability of success.

Slot Forge Furnace

Ralph Sheneman

Probability of Success 10 20 30 40 50 60 70 80 90