SOLAR ENERGY CONFERENCE

FINAL REPORT

May 24, 1977

The U. S. Energy Research & Development Administration

Under Contract NOEE-77-A-02 4360 A000-1

DISCLAIMER

ABSTRACT

A one-day multi-state, Midwest Solar Energy Conference was held in Dearborn, Michigan, on May 24, 1977. A major conference objective was to generate increased manufacturing interest and design activity in the production of components, materials, and systems for solar energy applications. The attendees included 450 specialists in manufacturing, engineering, architecture and development having potential interest in solar energy utilization. This exceeds the target figures by 100 percent. The mix of attendees was also excellent. There were 107 representatives of manufacturing companies, 90 architects and engineers, 44 from construction, 48 public officials, and 29 from schools and community colleges.

There were eleven press people, including major television, newspapers, magazines, and feature writers. A highlight of the exhibits was a visit by CBS TV-2, one of Detroit's largest stations. They featured the solar exhibits on two to three minutes of prime time during the evening news.

Four physical exhibits were set up at the conference.

The overall rating of the seminar by attendees was very high with 95 percent rating it either "excellent" or "good" and five percent "fair." Feedback questionnaires were filled out by 250 of the attendees. Ninety-two percent of attendees rated the conference either "very useful" or "fairly useful." More than two hundred question cards were received from the floor and all were discussed. Approximately one in three of those with company affiliations said they would work on increased business or company involvement with solar.

INDEX

ATTENDANCE

Attendance at the Solar Energy seminar was over 450 and exceeded the target figures by 100 percent. (The proposed target figures were 150 to 250). The mix of attendees was also excellent when measured against the target groups as indicated in the proposal (Exhibit A).

There were 107 representatives of manufacturing companies, including every major manufacturer in Michigan. The largest companies were represented by several people from various states, divisions, and technical interests. In addition to these there were 15 specialized solar manufacturing and service firms.

Architects and engineers totaled 90. This is an especially impressive figure when one considers the professional time taken from the busy season and the payment of a registration fee. It probably indicates both a high level of interest in solar energy among this group and an effective communications program in reaching them.

There were 44 from construction companies and housing development - 11 from plumbing and heating.

Public officials totaled 48 including many from city and county departments, several state agency officials and several legislative staff members.

Schools and community colleges totaled 29, excluding University staff.

There were 13 utilities representatives which is good representation considering that only a few companies operate in the region.

There were eleven press people, including major television, newspapers, magazines, and feature writers.

Financial institutions were lightly represented at 7 which reflects the focus of the program.

There were 48 attendees who identified themselves as home owners, housewives, or whose affiliation was not clearly identified. A complete list of attendees is attached as Exhibit B.

SOLAR SEMINAR ATTENDANCE

Affiliation	Attendance
Manufacturing Industry	107
Architects & Engineers	90
Public Officials	48
Housing Construction & Development	44
Schools & Community Colleges	29
Solar Companies	15
Commercial Services	13
Utilities	13
Plumbing and Heating	11
Financial Institutions	7
Press	11
Home owners, Housewives or Miscellaneous	48
Speakers, Staff and Guests	35
TOTAL	451

Pre-Publicity and Press Coverage

Two press releases were distributed. The University of Michigan Information Services called several key press contacts to alert them, and mailed press releases and brochures. They handled press requests for speaker background and interviews and referred press requests for technical information and complimentary registrations. Press notices of the seminar contributed to attendance.

Coverage of the event itself was good. Feature articles are still being prepared for such publications as Iron Age one month following the seminar. Television coverage was outstanding, especially for the exhibitors and the keynote speakers.

Brochure Mailing

Conference brochures (Exhibit C) were mailed to selected lists of target attendees in midwestern states. The mailings were concentrated in Michigan, Ohio, and Indiana, with broader coverage to more distant states for some groups. For example, architects, utilities, and savings and loan institutions were mailed in several midwestern states (Michigan, Ohio, Indiana, Illinois, Pennsylvania, and New York) whereas plumbing and heating and several classes of manufacturing companies were limited to two or three states.

Mailing lists were purchased selectively. For example, they were picked on the basis of volume of business done in some categories. In other cases, the number of states covered on the available lists was considered along with the expected distance that the attendee category might be able to travel to attend a seminar of this type.

Mailings were made to the following categories of prospective attendees:

Architects	MI, OH, IN, IL, PA, WI
Banks	MI, OH, IN, IL
Building Inspectors	MI, OH, IN, IL
City Governments	MI, OH, IN, IL
Community Colleges	MI
Community Planners	MI, OH
Glass Contractors	MI, OH
Heating Equipment Manufacturers	MI, OH, IN, IL
Home Builders	MI, OH, IN
Mechanical Contractors	MI, OH, IN
Mobile Home Manufacturers	MI, OH, IN

Plumbing and Heating Contractors	MI, OH
Plumbing Manufacturers	MI, OH, IN, IL
Plywood Manufacturing	MI, OH, IN, IL
Prefab Building Manufacturing	MI, OH, IN, IL
Savings & Loan Associations	MI, OH, IN
School Administrators	MI
State Legislators	MI
Swimming Pool Construction Companies	MI
Utilities (Chief Executives)	MI, OH, IN, IL

Presentations

A recording was made of all papers presented as well as discussions of questions. The recordings were transcribed and those sections which could communicate without accompanying slides were edited. Most of the presentations used numerous slides of graphs, tables, and pictures, and therefore, the taped records alone were not meaningful in these cases.

The question of a possible publication from the seminar was reviewed and it was determined that it would not be practical to use the tapes as a basis for a publication for several reasons. The presentations were made in capsulized form due to the time limitation of the briefing procedure. Therefore, the tapes did not produce language suitable for editing to publication completeness and quality. The exceptional number of slides with relatively little continuity text in the tapes would leave a great deal of extra writing for speakers to do. There was no previous agreement to go back to the speakers for additional work and there was not a provision in the budget to compensate speakers for additional writing.

For these reasons a decision was made to forego any follow on proposal for a publication.

The keynote speeches were more complete and have been edited. Copies are attached as exhibit D.

Displays

Four physical exhibits were set up at the conference. These were supervised at all times by personnel of the exhibit sponsors and were visited by conference attendees during registration, breaks, lunch, and at adjournment. In addition, many individuals took personal breaks from the main conference to visit the exhibits.

A highlight of the exhibits was a visit by TV-2, one of Detroit's largest stations. The television crews spent an hour at the conference and featured the exhibits on two to three minutes of prime time during the evening news.

Exhibitors

1. Owens Illinois, Toledo, Ohio
   A mobile solar exhibit set up in the parking lot.
2. Champion Homes, Dryden, Michigan
   A solar heating unit set up in the lobby and in the parking lot.
3. Daystar Energetics, Birmingham, Michigan
   Working display in lobby.
4. Refrigeration Research, Brighton, Michigan
   Functional display in lobby.
5. Michigan Solar Association, Ann Arbor, Michigan
   Table with handouts in lobby.

Management Seminar Check List

A check list of staff functions and responsibilities for the day of the seminar was prepared in advance and reviewed with the staff. A copy of this check list is enclosed (Exhibit E) as a record of the level of attention to detail.

A precise time schedule was prepared and distributed to speakers (Exhibit F). A timing-control light was used throughout the day to keep speakers on schedule by using green, amber, and red signals.

SEMINAR EVALUATION BY ATTENDEES

Seminar evaluation questionnaires (Exhibit E) were distributed to attendees with the request that they be filled out and returned to the staff or a "ballot box" at the door. Sixty percent of the questionnaires were filled out and returned.

Questions 1, 2, and 3 - Evaluation and Suggestions for Improvement

Overall rating of the seminar by attendees was very high with 95 percent rating it either "excellent" or "good" and five percent "fair." Feedback questionnaires were filled out by 250 of the attendees. Ninety-two percent of attendees rated the conference either "very useful" or "fairly useful," (32 percent and 57 percent respectively). Seven percent said that is was of "relatively little use" and less than one percent said it was of no use to them. Suggestions for improvement included requests for attendance lists, more technical handouts, copies of speeches, and more physical exhibits. There were several requests for fewer speakers and more time for questions from the floor. (Note: more than two hundred question cards were received from the floor and all were discussed. However, most of the discussion was scheduled rapidly at the end of the seminar.)

There were 21 requests for more technical detail and 7 for less technical detail which may indicate some balance on this issue.

There were a few requests for a non-smoking area although the air quality was quite good considering the size of the group. There were 9 requests for more light for note taking during slide presentations.

4. Topics for Future Briefings

Suggestions for future briefings were spread widely over 26 different issues. Specific problems and details of installation and use of solar systems led the list of suggestions. Cost effectiveness, payback, and solar economics were in the second group of requests. Each of the following items were requested by more than ten attendees: discussion design details, solar energy conversion to electricity (photovoltaic cells), heat pumps, solar hardware, history, and performance of specific installations.

5. Follow-Up Activities Requested

One third of those at the seminar specifically requested follow-up distribution of papers or publications. Twelve percent requested source lists or bibliographies for available technical data. Ten percent requested notification of other programs, newsletters, or solar publications. There were three requests for more information on government assistance programs.

There were several requests for annual briefings on solar subjects, or one day sessions periodically through the year. A few requested lists of names and addresses of attendees.

6. Specific Actions to be Taken by Attendees as a Result of This Briefing

Apparently the level of enthusiasm to do more in the solar field was very high at the end of the seminar. Approximately one in three of those with company affiliations said they would work on increased business or company involvement with solar.

"Locate areas where Dow Chemical may participate in this developing industry."

"Recommend active product involvement by Ford Motor Company."

"As product planning manager of Ford Glass Division, I intend to make a proposal for indepth corporation study."

Twenty-nine persons said they would consider, or go ahead with personal home solar applications.

Thirty-nine said they would do further intensified study or research in solar applications.

INDUSTRIAL DEVELOPMENT DIVISION

Institute of Science and Technology
Telephone 313-764-5260

The University of Michigan
2200 Bonisteel Boulevard
Ann Arbor, Michigan 48109

EXHIBIT A

January 13, 1977

Mr. Lawnie Taylor, Chief
Technology Transfer Branch
Division of Solar Energy
ENERGY RESEARCH AND DEVELOPMENT AGENCY
Washington, D. C. 20545

Dear Mr. Taylor:

In accordance with discussions between Mr. Charles Hayes of the Technology Transfer Branch and Mr. Michael Conboy of our staff, we are pleased to submit the attached proposal to conduct a Midwest Solar Energy Conference in Michigan in Spring 1977.

The Industrial Development Division has made a commitment to solar energy information dissemination. During the next several years we plan to emphasize the technology and the industrial growth potential of solar equipment, materials, and services.

For your background information, the Industrial Development Division has conducted approximately sixty conferences and seminars on topical technology during the past fifteen years. The Division has produced forty publications during that period, many resulting from the conferences.

In our solar technology dissemination efforts, we would be pleased to work with the Technology Transfer Branch of the Division of Solar Energy. This would seem to be a logical and mutually advantageous situation.

If you have questions about the proposal or our group, please contact us. We will look forward to hearing from you.

Sincerely,

D. N. Smith
Director

DNS/sa
Enclosures
cc: Mr. Charles Hayes

PROPOSAL

TO CONDUCT A MIDWEST SOLAR ENERGY CONFERENCE AND PROVIDE FOR FOLLOW-UP AND EVALUATION OF RESULTS

Submitted to

Energy Research & Development Agency
Division of Solar Energy/Technology Transfer Branch

by

Donald N. Smith, Director

Industrial Development Division
Institute of Science & Technology
The University of Michigan

Donald N. Smith

January 13, 1977

ABSTRACT

A one-day multi-state, Midwest Solar Energy Conference is proposed for Spring 1977 to be held in the southeast Michigan area. The target attendees would be approximately 150 to 250 specialists in manufacturing, engineering, architecture and development having potential interest in solar energy utilization. A major conference objective would be to generate increased manufacturing interest and design activity in the production of components, materials, and systems for solar energy applications.

Purpose:

Through dissemination of information on solar technology and its industrial production potentials, Midwest manufacturers will be motivated to produce solar materials, components, and products. Professionals such as architects, engineers, and product planners, will be alerted to the specific potentials of solar energy as related to each of their fields. Developers of housing, commercial, and industrial building projects will be motivated to investigate the long-term cost implications of solar energy designs.

Scope of Work:

Objectives

The conference supplemented by its preliminary communication and follow-up actions will be designed to accomplish three things:

a. To advance the level of understanding of solar potentials and problems in the industrial process and related professional community in the midwest.

b. To increase interest in investment of time and money in solar equipment, production, and developments by midwest corporations and firms.

c. To improve demand for solar energy equipment in industrial processes, heating and cooling of homes and other buildings.

Strategy

The objectives of solar information dissemination and industry response, in terms of revised thinking and future investment, will be achieved through the following methods:

a. Interest will be aroused through a broad mailing and attendant publicity for a solar conference.

b. Direct communication during the conference will interest professionals, manufacturers, and developers.

c. Follow-up communications will be generated with conference attendees for evaluation of the programs and with those on the original mailing list for promotion of other solar activities and publications.

Statement of Work

A broad mailing (15,000) copies of an attractive and informative conference brochure will be made throughout three midwestern states. The brochure will be a promotional piece for creating interest in solar development as well as an invitation to attend the conference.

The conference will be organized featuring nationally known spokesmen for solar energy development and applications, and will include question and answer sessions designed to enhance audience participation. The information presented will be tailored to the specific interests of the conference attendees.

Among speakers tentatively planned for participation in the conference are George Löf, of Solaron, David Moore of DHUD, Henry Leck of Champion Homes, and Harry Fisher and David Fenton, both of whom are solar consultants in industrial applications. University speakers include Professors John A. Clark and Peters Oppermann.

The University of Michigan will employ a comprehensive follow-on plan including:

1. Contacting each attendee to ascertain what he needs to further his solar efforts.
2. Reviewing tapes to evaluate potential publications.
3. Encouraging attendees to contact the Industrial Development Division for additional solar information.

4. Coordinating requests for additional information with existing offices and information resources of ERDA.

5. Evaluating inputs to assess needs for:

   a. Additional seminars and short courses

   b. Preparing special monographs tailored to stated needs of audience

   c. If warranted, the setting up of a solar research center at The University of Michigan which in part will aid companies to develop and manufacture solar products.

Weeks from beginning of Project

2 3 4 5 6 * 7 8 9 10 11 12 * 13 14 15 16 17 * 18 * 19 20 21 22 23 24

nning-6 weeks →

Prepare program
Obtain speakers
Select date
Obtain site

Promotion →

1) Prepare brochure
2) Prepare mailing list
3) Make mailing
4) Press release

Final Plans →

1) Check response
2) Brief speakers
3) Obtain papers
4) Review site plans and arrangements
5) Arrange publicity

HOLD CONFERENCE DURING 18TH WEEK APPROXIMATELY →

Follow-up →

1) Prepare Evaluation
2) Summary Report
3) Evaluate possible publication

Management Approach:

The project and conference will be managed by the Industrial Development Division supported by the Conference Department of The University of Michigan. Mr. Donald N. Smith, Director of the Division, will be the principal investigator and will be responsible for the Conference. Under Mr. Smith's direction, this division has held sixty conferences and produced 40 publications during the past fifteen years.

The University Conference Department will assign a professional conference coordinator to the project and will assist with site selection, brochure preparation, recording, and follow-up.

Dr. John A. Clark, Professor of Mechanical Engineering at The University of Michigan and one of its leading advocates of solar energy for many years, will be Conference General Co-chairman.

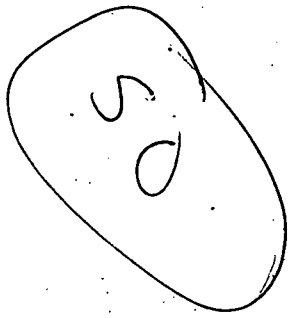
Robert Metcalf, Dean of the School of Architecture and Urban Planning, The University of Michigan, will be Conference Co-chairman.

Mr. Michael Conboy, Staff Consultant to the Industrial Development Division, will provide staff assistance for the project. Mr. Conboy was State Director of the Office of Economic Expansion in Michigan for nine years and is knowledgeable concerning midwest manufacturing industry and its growth potentials.

PRODUCTS AND SERVICES

The principal services to ERDA will be the complete administration and management of a Midwest Solar Energy Conference including preliminary planning and documentation and follow-up activities, including evaluation.

Products will include the conference brochure, copies of papers delivered, and a summary report of the conference. The question of a publication will be left open until after the conference and will depend on the quality of the presentations and the interest in them. Neither the scope of work nor the proposed budget include plans for a publication at this stage, although a decision to publish later is a distinct possibility.



BUDGET

Printing conference brochures	$1,100.00
Mailing brochures	900.00
Purchased professional services Assistance in planning, obtaining speakers, and managing conference	2,000.00
Speakers' honoraria	1,800.00
Speakers' travel costs	1,000.00
Miscellaneous costs Recording, reproduction	200.00
Total ERDA cost share	$7,000.00
University contribution	
Clerical staff	$ 900.00
Management cost	1,200.00
Total University contribution	$2,100.00
TOTAL BUDGET FOR CONFERENCE AND FOLLOW-UP	$9,100.00

EXHIBIT B

1974 SOLAR ENERGY CONFERENCE

MANAGEMENT BRIEFING

MAY 24, 1977

William R. Adcock
Southfield Public Schools
24661 Lahser Road
Southfield, Mi. 48034

LaMar Aker
Adker Plg. & Htg., Inc.
217 Bater Road
Coldwater, Mi. 49036

Catherine Akerley
4027 Oak Knoll
Pontiac, Mi. 48055

Dean Alexander
Michigan Valley Homes, Inc.
Eagle Electric
18297 W. Toledo Hwy.
Addison, Mi. 49220

Lyle Alexander
Oceana County Building Inspector
Box 449
Har, Mi. 49420

Charles R. Allison
Cincinnati Milacron
4701 Marburg Ave.
Cincinnati, Ohio 45209

S.S. Allyn *
Secretary
Ind. Dev. Div., IST
2115 IST-U of M
Ann Arbor, Mi. 48109

Todd Anuskiewicz
Michigan Energy & Resource Res. Asst.
1200 - 6th St. Suite 328
Detroit, Mi. 48226

John P. Argenta
Coquillard/Dolgner/Dundon/ Argenta
21840 West Nine Mile Road
Southfield , Mi. 48075

John Amrhein
Assoc. Material
1411 Glen
Muskegon, Mi. 49441

Edward J. Attard
Edward J. Attard & Assoc., Inc.
17011 Raupp Road
Melvindale, Mi. 48122

G.H. Azarbayejani
Bendix Corp. , Res. Labs
20800 10 1/2 Mile Road
Southfield, Mi. 48076

F.W. Bakker-Arkema* ©
Dept. of Agricultural Eng.
Michigan State University
East Lansing, Mi. 48823

William L. Baldner
Clifford N. Wright Assoc., Archit.
4066 W. Maple Road
Birmingham, Mi. 48010

John A. Bard
Walcon Corp.
4375 2nd St.
Ecorse, Mi. 48229

Wayne G. Basler
Guardian Industries Corp.
43043 W. Nine Mile Road
Northville, Mi. 48167

Melvin Bass
City of Ypsilanti
304 North Huron
Ypsilanti, Mi. 48197

Lloyd E. Bastian
Libbey-Owens-Ford Co.
1701 East Broadway
Toledo, Ohio 43605

Kenneth W. Beaudry *
Mgr. Engineering Services
326 E. Huron
University of Mi.
Ann Arbor, Mi. 48104

Carl R. Beck
Nu-Way Supply
403 W. Sheldon
Gaylord, Mi. 49735

L.L. Beck
Purdue University
2233 171st Street
Hammond, Indiana 46323

Gordon A. Belson
Sarvis Assoc., Inc.
258 Champion St.
Battle Creek, Mi. 49014

P.E. Bender
Ford Motor Co.
One Park Lane Blvd.
Parklane Tower-E, Suite 1000
Dearborn, Mi. 48126

Fritz Benson
Senator Wm. Faust, Sen. Maj. L.
720 Stoddard Bldg.
Lansing, Mi.

Gerald G. Bergman
Vice-President
Lurins Const. Co.
535 S. Reimer
Saginaw, Mi.

Irv Berk
Advance Energy Engineering
738 E. Kalamazoo St.
Lansing, Mi. 48912

Roger Betz
Iron Age Magazine
2600 Fisher Bldg.
Detroit, Mi. 48202

Fred Betzoldt
Betzoldt Building Products
112 Wildwood Circle
Tecumseh, Mi. 40286

A.G. Bickersteth
Manufactory, Inc.
P.O. Box 127
Goodrich, Mi. 48438

James R. Blakeslee
R. Alpern Assoc. Arch.
1604 Witherbee
Troy, Mi. 48084

Dave Blank
Solar Research DIU
Brighton, Mi. 48116

Paul W. Blume
12,714 Helen St.
Southgate, Mi. 48195

James R. Bone *
U of M
326 E. Hoover
Ann Arbor, Mi. 48104

Harold M. Book
Builder
15876 Beechwood Rd. Route #2
Findlay, Ohio 45840

Dennis A. Borugian, P.E.
Registered Prof. Engineer
25445 Leestock
Farmington Hills, Mi. 48108

Ed Bottum*
Solar Research Div.
25 N. 5th
Brighton, Mi. 48116

V.A. Bower
Mueller Brass Co.
1925 Lapeer Avenue
Port Huron, Mi. 48060

John E. Boyle
Boyle & Schey Builders
206 East Wallace Street
Findlay, Ohio 45840

H. Robert Bradner
Hancock-Wood Electric Coop.
2451 Grant Road Box 188
North Baltimore, Ohio 45872

Wayne G. Bredvik
Architect
Louis G. Redstone, Assoc.
20932 Mada
Southfield, Mi. 48075

Robert C. Breen
Western Michigan Univ.
Industrial Education
711 Steers
Kalamazoo, Mi. 49008

Arthur A. Brennan
City of Rochester
400 Sixth Street
Rochester, Mi. 48063

Donald Brogan
City of Southfield
26000 Evergreen
Southfield , Mi. 48076

Felix H. Brown
Owens-Illinois, Inc.
P.O. Box 1035
Toledo, Ohio 43666

Lawrence P. Brown
Preston Solar Designs
760 Gibbs Dr.
Ithaca, Mi. 48847

Thomas R. Browne
Owner:Thomas B. Browne Assoc.
499 West Norton Ave.
Muskegon, Mi. 49444

W.D. Brown
Retired Engineer
6328 Dakota Circle
Birmingham, Mi. 48101

Adele Brzuszek
26741 Woodmont
Roseville, Mi. 48066

Emil J. Brzuszek
26741 Woodmont
Roseville, Mi. 48066

Jeane W. Burnham
MDSH Testing & Research
5220 Pontiac
Ann Arbor, Mi. 48105

Kenneth P. Burns*
DRDA, U of M
North Campus
Ann Arbor, Mi.

Senator Bursley *
U.S. Senate
State Capitol Bldg.
Lansing, Mi. 48909

R. William Caldwell
Doan Resources Corp.
110 East Grove Street
Midland, Mi. 48640

Mr. & Mrs. Jeffrey E. Campbell
1781 Rathmor Rd.
Bloomfield Hills, Mi. 48103

James S. Carmean
Midwest Electric, Inc.
P.O. Box 10
St. Marys, Ohio 45885

C.C. Carn
Solaris Unlimited
1997 M-50
Tecumseh, Mi. 49286

Patricia Carn
Medical Electronics Assoc.
1997 E. Monroe Rd.
Tecumseh, Mi. 49286

John W. Carpenter
D & C Plbg. & Htg. Supply Co.
5161 Jackson Rd.
Ann Arbor, Mi. 48103

S. Dudley Carson
Commissioner-Public Property
City Hall 2 S. Main Street
Princeton, Ill. 61356

Edward L. Cass
Cass Const. Co.
10187 Helena Rd.
Harbor Beach, Mi. 48441

Peter S. Cedroni
Shelby Township
52700 Van Dyke
Utica, Mi. 48087

Bruce Chapin
Kleen-Thru-Maintenance Co.
22426 Foxcraft
Woodhave, Mi. 48183

Robert V. Chapman
Alexander Builders, Inc.
2684 Dutch Hollow Road
Elida, Ohio 45807

Al Christian
Home Builder
816 E. Shiawassee
Lansing, Mi. 48912

Granger K. Chui
Ford Motor Co.
Research Staff, P.O. Box 2053
Dearborn, Mi. 48121

C. David Church
Mich. Dept. State Hwys. & Trans.
P.O. Box 30050
Lansing, Mi. 48909

A.B.Ciuffetelli
Engineer-Automotive -Aeron.
2383 Cumberland Dr.
Troy, Mi. 48098

J.A. Clark, Prof.*
331 W. Eng., U of M
Ann Arbor, Mi. 48109

Thomas R. Clark
Kerr Mfg. Co.
28200 Wick Rd.
Romulus, Mi. 48174

Thomas Coffey @
Jim Coffey & Son Plumbing
4254 Page Ave.
Michigan Center, Mi. 49254

Eloise Cohen
620 Oxford Rd.
Ann Arbor, Mi. 48104

M. Conboy, Staff Conslt. *
Ind. Dev. Div., IST
2103 IST- U of M
Ann Arbor, Mi. 48109

Dave Consolver
Bureau of Prison
Federal Correctional Institution
Milan, Mi.

Edward L. Connor
Auburn Electric Inc.
2901 Auburn Rd.
Auburn Heights, Mi. 48057

Gerald Conrad
1262 N. Shiawassee
Owosso, Mi.

Morris Cooper
Mor-Eze Co., Inc.
2318 W. 11 Mile Road
Berkley, Mi. 49072

George Crane
Crane Development Co.
15 Moorland
Grosse Pointe, Mi.

D. James Crawfis
Marr, Knaff, Crawfis Assoc.
1485 Lexington Ave
Mansfield, Ohio 44907

Charles Crissy
AERoque
4274 Indian Trail
Jackson, Mi. 49201

L. Crockett, Program Mgr.*
Ind. Dev. Div. IST
2114 ISTO U of M
Ann Arbor, Mi. 48109

Chris Cudia
11500 Lambs Rd
Memphis, Mi. 48041

John Czarneicki
Energy Info. Project
Wayne State University
Detroit, Mi. 48202

Karnig Dabanian
P.E.
21900 Beech Daly
Flat Rock , Mi. 48134

H.F. Damon
John Widdicomb Co.
863 Orchard Ave, S.E.
Grand Rapids, Mi. 49506

Dr. Dennis E. Darling
Western Michigan Univ.
Industrial Education Dept.
1607 Grand Avenue
Kalamazoo, Mi. 49007

Dave Davidson
7483 E. Victoria Drive
Laningsburg,Mi. 48848

Mary Davidson
7483 E. Victoria Drive
Laningsburg, Mi. 48848

L.L. Davis
Walbro Corp.
Cass City, Mi. 48726

John Degiulio
Degiulio Industries, In.
23666 Park Street
Dearborn, Mi. 48124

Michael R. Degiulio
Degiulio Industries, Inc.
23666 Park Street
Dearborn, Mi. 48124

Charles Demos
Chausse Manuf.
5835 Martin
Detroit, Mi. 48210

Jay Diedzic
Detroit Edison
14500 Prospect #131
Dearborn, Mi. 48126

Linda M. Deschere
Michigan Consolidated Gas Co.
#1 Woodward Ave
c/o 15th Floor Guardian Bldg.
Detroit, Mi. 48226

Thomas James Dinley @
North American Realty
610 Cypress
Big Rapids, Mi. 49307

James Doorh
Western Michigan University
Industrial Education Department
100 Western Ave Apt. N-7
Kalamazoo, Mi. 49007

Robert H. Dougherty
Chrysler Corp.
403 Edmund
Royal Oak, Mi. 49073

Jeffrey Dowdy
Clawson Tank Co.
525 E. Elmwood
Clawson, Mi. 48017

Donald L Dowling
Kentwood Public Schools
4479 Kalamazoo Ave. S.E.
Kentwood, Mi. 49508

Carl Drazic
Solar Research Div
Brighton, Mi. 48116

Dennis F. Dundon
Coquillard/Dolgner/Dundon/Argenta
21840 West Nine Mile Road
Southfield, Mi. 48075

Arnold P. Durecki
Plant Engineering and Const.
General Motors Corp.
485 W. Milwaukee Ave.
Detroit, Mi. 48202

George H. Durie
Durie's A.C.
5272 Marlborough
Detroit, Mi. 48224

Raymond DuRussell
Quality Insulation Co.
11341 Emder
Davisburg, Mi. 48019

Edwin O. Dwyer
Monroe County Community College
1555 South Raisinville Road
Monroe, Mi. 48161

Harmon Earegood
Pres., Earegood Htg. & Plbg.
4139 Seidel
Saginaw, Mi.

James L. Easterley
T.M.P. Assoc. Inc.
P.O. Box 289
Bloomfield Hills, Mi. 48013

David D. Eden @
Plant Manager
Hanawalt Road
Monticello, Indiana 47960

Dorothy Edwards
Homemaker
2885 U.S. 12, East
Niles, Mi. 49120

Robert B. Edwards
Manufacturer, NIBCO Inc.
500 Simpson Ave.
Elkhart, Ind. 46514

Marty Eichinger
927 N. Walnut
Lansing, Mi. 48915

J. Elden
Forrester & Wehrle Inc.
1660 Smith Rd.
Toledo, Ohio 43612

Howard S. Ellman
Louis Redstone Architects
25106 W. Eight Mile Rd. A:12
Southfield, Mi. 48034

Laszlo L. Elody
Chrysler Corp.
6668 Salem Rd.
Plymouth, Mi. 48170

Douglas J. Emery
Behler-Young Co.
4100 Clay Ave.
Grand Rapids, Mi. 49508

David W. Fenn
T.C. Architects
1650 West Market St.
Akron, Ohio 44313

D. Fenton * @
Sverdrup & Parcel, Inc.
800 North 12th Blvd.
St. Louis, Mo. 63101

Jack V. Findlay
Chevrolet-Nodular Iron Cast Plt.
2100 Vet. Mem. Hwy.
Saginaw, Mi. 48605

H.C. Fischer *
Energy Div.
Oak Ridge National Lab
P.O. Box X
Oak Ridge, Tn. 37830

Roger F. Fischer
Michigan Public Service Com.
750 W. Merrell
Jackson, Mi. 49203

Michael P. Flanagan
Huron Valley Schools
2390 Milford Rd.
Milford, Mi. 48042

Vernon Flegel
Normal Wood Products, Inc.
P.O. Box 2044
Midland, Mi. 48640

Jerry H. Fluegge
Ford Motor Company
2000 Rotunda Dr., Rm. 2020, Bldg. 5.
Dearborn, Mi. 48121

Dick Ford *
Owens-Illinois
Toledo, Ohio

T. Forrester
Forrester & Wehrle Inc.
1660 Smith Rd.
Toledo, Ohio 43612

Malcolm L. Fox
Michigan Magnetics, Inc. (I.E.E.E.)
203 W. 3rd. St.
Vermontville, Mi. 49096

Mr. George Francis @
Chief Engineer, Saginaw Prod. Corp.
68 Williamson
Saginaw, Mi. 48606

Robert E. Frazer
The Dayton Power and Light Co.
P.O. Box 1247
Dayton, Ohio 45401

Dale French
R.C. Byce & Assoc.
487 Portage
Kalamazoo, Mi. 49006

Russell Frid
Southfield Public Schools
24665 Lahser
Southfield, Mi. 48075

David Friedrichs
Co-op Auto of Washtenaw
2232 S. Industrial Hwy.
Ann Arbor, Mi. 48104

Dick Fulghum
Heick & Ralph Assoc. Int.
26847 Grand River
Detroit, Mi. 48240

Don Gaddes
Michigan Valley Homes
18297 W. Toledo Hwy.
Addison, Mi. 49220

Steve Galey
City of Ann Arbor Housing Rehab.
100 N. 5th Ave.
Ann Arbor, Mi. 48104

William Galbraith @
11500 Lambs Rd.
Memphis, Mi. 48041

Cory Galvin
Synowa Building & Const.
127 Manor Way
Rochester, Mi.

Ken Gamble
H.E.L.P. Co.
2506 Pontiac Dr.
Sylvan Lake, Mi. 48053

Chip Garber *
Champion Homes
Ann Arbor, Mi.

Nicholas N. Gasko
Integral Engrg. & Mfg. Corp.
27303 W. Eight Mile Rd.
Detroit, Mi. 48240

Tyler Gazecki
Justus Company
Box 91515
Tacoma, Washington

Jaime Giangrande
Vice Pres- Ace Mfg. Co., Inc.
401 N. Griffin
Grand Haven, Mi. 49417

Jeffry Giangrande
Pres.- Ace Mfg. Co., Inc.
401 N. Griffin
Grand Haven, Mi. 49417

James D. Gibbons
Coquillard/Dolgner/Dundon/Argenta
21840 West Nine Mile Rd.
Southfield, Mi. 48075

Thomas Gladfelter
Heick & Ralph Associates Intl.
26847 Grand River
Detroit, Mi. 48240

Wesley Godfrey
State House of Reps.
Office of the Speaker
Lansing, Mi.

Wendelin Goetz
U Of M
939 Dewey St. #205
Ann Arbor, Mi. 48104

Leslie F. Goings
Technical Teacher
Henry Ford Comm. College
30155 Richland
Livonia, Mich. 48150

Robert T. Golden
Jack Benjamin Inc.
2727 Vernier
Troy, Mi. 48098

Owen Goslin
P.O. Box 137
Cross Village, Mi. 49723

Alan F. Gove
City Engineer, City of Plymouth
201 S. Main St.
Plymouth, Mi. 48170

Bill N. Graham
The Toledo Pressed Steel Co.
397 Phillips Ave.
Toledo, Ohio 43612

Thomas Grady
Energy Savers
506 La Prairie
Ferndale, Mi. 48220

A.J. Graumlich
Prestolite Electrical Division
511 Hamilton Street
Toledo, Ohio 43694

Pamela Green
General Motors
46680 Franks Lane
Utica, Mi. 48087

Donald Greenbury
Pres.- Arrowsmith Tool & Die
23811 Telegraph Rd.
Southfield, Mi. 38034

James E. Griffin Jr.
Alternate Energy Systems Co.
c/o Lumber & Millwork Inc.
3741 St. Aubin Ave.
Detroit, Mi. 48207

Fred Gruber
Monroe County Comm . Coll.
1555 South Raisinville Rd.
Monroe, Mi. 48161

Raymond A. Gunther
Plant Engineering & Const.
General Motors Corp.
485 W. Milwaukee Ave.
Detroit, Mi. 48202

Henry Guthard
Straub, VanDine, Dziurman
2681 Buckingham
Birmingham, Mi. 48008

Haldeman Marina
Betatronics
1435 Univ. Terrace Apt. 733
Ann Arbor, Mi. 48104

Lee Halstead
Realtor
2736 E. Grand
East Lansing, Mi. 48823

William Hampshire
City of Pontiac
91 N. Saginaw St.
Pontiac, Mi. 48058

Bror Hanson
Solargy Corp.
17914 E. Warren
Detroit, Mi. 48224

L.T. Harbeck, Assoc. Res. Sci. *
Ind. Dev. Div., IST
2112 IST - U of M
Ann Arbor, Mi. 48109

Randy Harmson
Energy Administration
Law Building 4th Floor
Lansing, Mi. 48913

William H. Harper
Fanning/Howey Assoc., Inc.
540 East Market St.
Celina, Ohio 45822

Eugene R. Harris
Plant Engineering & Const.
General Motors Corp.
485 W. Milwaukee Ave.
Detroit, Mi. 48202

Barney R. Hartman
King Realty
128 Taylor St.
Wellington, Ohio 44090

David L. Harman
1337 Wilmot #9
Ann Arbor, Mi. 48104

Tom Harvey
Scientific Advances, Inc.
1375 Perry Street
Columbus, Ohio 43201

Gordon Haskins
Barker Manufacturing Co.
730 E. Michigan Ave.
Battle Creek, Mi. 49016

Edward J. Hayes
Kelsey-Hayes Co.
38481 Huron River Dr.
Romulus, Mi. 48174

(C)

Homer Hedges
Copper Range
Ontinagon, Mi.

John Heeckt
2316 Hewitt
Hamtramck, Mi. 48212

Michael Heilmann*
Rep. Senator Don Riegle
5637 Allen Rd.
Allen Park, Mi. 48101

D.C. Hejnal
Commonwealth Assoc., Inc.
209 E. Washington Ave.
Jackson, Mi. 49201

Jerry Hensey
7-Up
12201 Beech-Daly Road
Detroit, Mi. 48239

Wm. Hessell
New Haven High School
57700 North Gratiot Ave.
New Haven, Mi. 48048

Peter K. Hickman
Brazeway, Inc.
P.O. Box 749
Adrian, Mi. 49221

Darwin E. Hile
Darwin E. Hile, Builder
1437 East Sandusky St.
Findlay, Ohio 45840

Joe Hoadley
Washtenaw County
408 Pauline
Ann Arbor, Mi. 48103

Harold G. Hoffman
The Toledo Pressed Steel Co.
397 Phillips Ave.
Toledo, Ohio 43612

Thomas W. Hogan
Dexter/Midland
207 W. Park Ave., Apt. 201
Libertyville, Illinois 60048

Herbert J. Holmquist
Energy Research Co.
P.O. Box 532
Flint, Mi. 48503

David E. Holt
554 W. Barnes Lake Rd.
Columbiaville, Mi. 48421

Robert B. Honer
Diecast Corp.
P.O. Box 784- 522 Hupp Ave.
Jackson, Mi. 49204

David W. Hopkins
410 Golfcrest Dr.
Dearborn, Mi. 48124

Philip Horan
Chevrolet Central Office
30007 Van Dyke
Warren, Mi. 48090

Zorian Horodysky
City of Cleveland
601 Lakeside Ave.
Cleveland, Ohio

Edward Horvath
City of Trenton
Building & Engineering Dept.
2800 Third
Trenton, Mi. 48183

Pat Hoyle
G.M. Proving Ground
Milford, Mi. 48042

W. Hudson, Pres. *
Independent Living, Inc.
5715 Buford Highway
Atlanta, GA 30340

Ben Huffstodt
Manager-Utilities
City Hall 2 S. Main Street
Princeton, Ill. 61356

William Hughes
Chevrolet-Detroit Forge
8435 St. Aubin
Detroit, Mi. 48212

Christopher Ifeadi
Madison-Madison, Int'l.
1900 Euclid Ave.
Cleveland, Ohio 44115

Frederick Jacobites
Jacobites & Schultz
6600 Highland Rd., Suite 11 D
Pontiac, Mi. 42054

Mark Jaffee
Forrester & Wehrle Inc.
1660 Smith Rd.
Toledo, Ohio 43612

Raymond Jameson
Hancock-Wood Elec. Coop.
2451 Grand Rd. Box 188
N. Baltimore, Ohio 45872

R.K. Janquart
Hamill Mfg. Co
61166 Van Dyke Rd.
Washington, Mi. 48094

Darwin Jarman
Hastings Mfg. Co.
750 Coats Grove Rd.
Hastings, Mi. 49058

Duane Jarman
D.J. Electric
222 S. Jefferson
Hastings, Mi. 49058

Michael C. Jerome
City of Clawson
779 Langley Blvd.
Clawson, Mi. 48017

David Johnson
Dow-Chemical Co.
52 Bldg.
Midland, Mi. 48640

Mary Ann Johnson
Housewife
4584 Comanche
Okemos, Mi. 48864

R.G. Johnson
Manufactory, Inc.
Box 127
Goodrich, Mi. 48438

Robert K. Johnson
Vice Pres, Citizens Savings & Loan
1000 Tiffin Ave, Box 87
Findaly, Ohio 45840

Brian P. Judge
29629 Everett
Southfield, Mi. 48076

Bob Kaczorowski
American Motors
7911 Radcliffe
Detroit, Mi. 48210

Ronald C. Karzmar
Brooks & Perkins, Inc.
17515 Nine Mile Road
Suite 750, Honeywell Center
Southfield, Mi. 48075

Martin Kasprzyk
The Carborundum Co.
Box 1054
Niagara Falls, N.Y. 14302

Mick Katz (Daniel) @
M.K. Mechanical
2021 Court St.
Saginaw, Mi. 48602

J.T. Katz, Dir. *
Institute of Sci. & Tech.
6102 IST- U of M
Ann Arbor, Mi. 48109

L. David Kellett
Builder
91 W. Long Lake Rd.
Bloomfield Hills, Mi. 48103

Harold Kellman *
Investment Advisor
1803 Village Green
Ann Arbor, Mi. 48105

Ed Kelly *
Mich. Solar Energy Assoc.
A & D, U of M
Ann Arbor, Mi.

Gary Kempf
Ayres, Lewis, Norris, & May
3983 Research Park Dr.
Ann Arbor, Mi. 48104

Charles Kennison
Fanning/Howey Assoc., Inc.
540 East Market St.
Celina, Oh. 45822

Dennis King
Straub, Van Dine, Dziurman,Arch.
1441 E. Maple Rd. # 303
Troy, Mi. 48084

J. King, Prof* @
1247 Art & Arch, U of M
Ann Arbor, Mi. 48109

Dale Kirchner
Branch Mgr., Citizens Savings & Loan
1000 Tiffin Ave
Findlay, Oh. 45840

Bob Kirkpatrick
6275 Clark Rd.
Bath, Mi.

Richard Knight
Arch. Richard Knight
155 Wimbleton
Birmingham, Mi. 48008

Prof. Peter Knobloch
Univ. of W. Ontario
Sen of Bus Ad.
London, Ontario

Joe Kolder@
Austin Engineers Inc.
26001 Telegraph Rd.
Southfield, Mi. 48076

David Kondle
8681 Stull Rd.
Grass Lake, Mi. 49240

G.W. Kopkau
Hamill Mfg. Co.
61166 Van Dyke Rd.
Washington, Mi. 48094

(C)

Dave Kopin
Mich. Solar Products
420 So. Lynch Ave.
Flint, Mi. 48503

Donald B Koth
Ford Motor Co.
9344 Mapletree
Plymouth, Mi. 48170

William Kraemaer
Mich. Con. Gas Co.
1 Woodward Ave.
Detroit, Mi. 48226

Arthur Kramer
Advance Energy Engineering
738 E. Kalamazoo St.
Lansing, Mi. 48912

Marian Krzyzowski *
Industrial Development IST, U of M
Ann Arbor, Mi. 48109

Ruth Krzyzowski *
Industrial Development IST U of M
Ann Arbor, Mi. 48109

Andrew J. Kujawa
Pre-architecture W.M.U.
110 Oak St.
Brighton, Mi. 48116

Kumar Kulkarni
Barker Mfg. Co.
730 East Mich. Ave.
Battle Creek ,Mi. 49016

Gary Kupsoff
1408 Northlawn
Birmingham, Mi. 48009

Joseph Kurdziel
Kurdziel Iron Industries
2625 Winston Rd.
Rothbury, Mi. 49452

Buzz La Boenty * @
Owens-Illinois
Toledo, Ohio

David L. Lamer
Energy Advisory Service
Board of Water and Light
123 W. Ottawa
Lansing, Mi. 48933

Rudy Landi
Coquillard/Dolgner/Dundon/Argenta
21840 West Nine Mile Road
Southfield, Mi. 48075

W.E. Lane
L & L Products, Inc.
74100 Van Dyke
Romeo, Mi. 48065

Rep. Larson *
Box 119
Lansing, Mi. 48901

Alvah E. Lassila
Jamesbury Corp.
640 Lincoln St.
Worcester, Mass. 01608

Philip Latona
Jack Benjamin Inc.
20182 Vermander
Mt. Clemens, Mi. 48043

Werner Laurenovic
Bureau of Prison
Federal Correctional Inst.
Milan, Mi.

Sam Lazaris
2515A Hoover Rd.
Warren, Mi. 48079

A.N. Lazarou
4858 Beacon Hill
Birmingham, Mi. 48010

Milton Lebenbom
Mackinac Realty, Inc.
511 Woodward Ave.
Detroit, Mi. 48226

H. Leck
Champion Homes
5573 E. North St.
Dryden. Mi. 48428

Creighton Lederer
Bldgs. & Safety Eng. Dept.
City of Detroit
401 City-County Building
Detroit, Mi. 48226

Lee Leffingwell
Pendell Pub. Co.
BOx 1666
Midland, Mi. 48640

Larry M. Lentner
SME Chapt. 79
1025 Barton Dr., Apt. 212
Ann Arbor, Mi. 48105

Gary Lessel @
L & H Plumbing Con., Inc.
7838 Perry Lk. Rd.
Clarkston, Mi. 48016

Ted Lewandowski
Wickes Engineered Mt"ls.
1621 Holland
Saginaw, Mi. 48601

Herbert Lewis
29330 Bermuda
Southfield, Mi. 48076

William Lichty
General Motors Insitute
General Motors Inst., 1700 W. 3rd
Flint, Mi. 48502

Khai Hwan Lim
Madison-Madison, Intl.
1900 Euclid Ave.
Cleveland, Oh. 44115

Ronald Lincoln
Architect
Zinder Engineering, Inc.
2000 Green Rd.
Ann Arbor, Mi. 48105

Victor Lindberg
Ford Motor Co.
24439 Winona
Dearborn, Mi. 48124

H. Linkner
Kelsey-Hayes R & D Center

Freemont Lobbestael
Gallup Silkworth
2141 S. State St.
Ann Arbor, Mi. 48105

Dave Lockwood
Burris, Lockwood & Tangeman-Arch.
140 Fairfax Rd.
Marion, Ohio 43302

G.O.G. Lof, Prof. *
Dir., Solar Energy Appl. Lab.
Colorado State Univ.
Ft. Collins, Co. 80532

Robert Loffingwell
Wicker Engineered Mat'ls.
1621 E. Holland Ave.
Saginaw, Mi. 48601

S.M. Lomakoski @
Hydraulic Tubes & Fittings, Inc.
215 N. Main St.
Almont, Mi. 48003

Arvo Looke
Chrysler Corp.
21453 Birchwood
Farmington, Mi. 48024

David C. Lorion
Land Sales Reg. Consult.
319 Lake Ave. Box 472
Roscommon, Mi. 48653

Gordon R. Lotts
Eberle M. Smith Assoc.
950 W. Fort St.
Detroit, Mi. 48226

Dean P. Loveless
Loveless and Assoc. Engineering
267 Harvest Lane
Frankenmuth, Mi. 48734

Bruce Lowery
Seidman & Seidman
700 Union Bank Plaza
Grand Rapids, Mi. 49503

Darrell Lucas *
Press
638 S. Harvey
Westland, Mi. 48185

Dr. Lester Lundsted
BASF Wyandotte Corp.
1419 Biddle Ave
Wyandotte, Mi. 48192

Carl E. Lynema
C. and E. Service Co.
427 54th St. S.W.
Grand Rapids, Mi. 49508

Larry T. Lynott
Justus Co. P.O. Box 91515
Tacoma, Wa. 98491

Donald J. McBlain
Student
908 North York
Dearborn, Mi. 48128

Ervin J. McCarthy @
McCarthy Construction Co., Inc.
5143 Cass Elizabeth Rd.
Pontiac, Mi. 48054

Ralph McGivern
Delta College
4020 Elm Ct.
Midland, Mi. 48640

Charles Mclhlangey
U.S. Coin Laundries
5301 S. Telegraph
Dearborn Hts., Mi. 48185

Howard McMullen
Tamarack Plbg. & Htg.
622 Warner Road
Saline, Mi. 48176

T. McNamara *
General Services Admin.
219 South Dearborn
Chicago, Il. 60604

Thomas W. MacClure
1607 Snyder Rd.
East Lansing, Mi. 48823

Vince Maiorana
Ford Motor Company
Rm. 622, American Rd.
Dearborn, Mi. 48121

Haldeman Marina
1435 Univ. Terrace #733
Ann Arbor, Mi. 48104

Donald L. Marshall
General Motors Insitute
1700 West Third Ave
Flint, Mich. 48502

George R. Matherote
Owens - Illinois Inc.
Box 1035
Toledo, Ohio 43666

J. Douglas Mathieson
The Engineering Society of Detroit
100 Farnsworth
Detroit, Mi. 48202

Robert Matthew
City of Harper Woods
19617 Harper Ave.
Harper Woods, Mi. 48225

Lawrence Mawhinney
City of Flint-Heating Inspect.
1101 S. Saginaw
Flint, Mi. 48502

J. Clark Mayclin
Investment Building Corp.
Metro Bldg., Suite 220
202 W. Berry St.
Fort Wayne, Ind. 46802

Herman Meilinger *
Boroughs Corp.
Wayne, Mi.

Michael Melford
Weskonson Co. (Bldr.)
142 N. Center
Northville, Mi. 48167

John Mogk *
Pres. MERRA
328 Exec. Plaza
Detroit, Mi. 48226

Leslie Mollon @
Brooks & Perkins, Inc.
17515 W. Nin Mile Rd.
Suite 750, Honeywell Center
Southfield, Mi. 48075

Dr. Joon S. Moon
Cellasto Corp.
1236 Watson Rd.
Ypsilanti, Mi. 48197

Lyndol Moriarty
Fanning/Howey Assoc., Inc.
540 E. Market St.
Celina, Ohio 45822

Michael D. Morris @
Martin Marietta Chemicals
9279 Erdman Rd.
Onekama, Mi. 49675

Jerry Moulton
Solaris Unlimited
1997 M-50
Tecumseh, Mi. 49286

Rep. John Mowat *
State Capitol
Lansing, Mi. 48909

August Mueller *
Conference Dept.
350 S. Thayer
Ann Arbor, Mi. 48104

Barbara Munn
736 E. Long Lake
Bloomfield Hills, Mi. 48013

Robert Munn
736 E. Long Lake
Bloomfield Hills, Mi. 48013

Jesus Murillo
Quality Insulation Co.
1536 Kirkway Hills
Bloomfield, Mi. 48013

George Murray
The Detroit Edison Co.
2000 Second Ave.
Detroit, Mi. 48226

Mr. John Nagy
Plant Mgr., Saginaw Prod. Corp.
68 Williamson
Saginaw, Mi. 48601

James Niedzielski
Fenton Machine Tool
200 Alloy Dr.
Fenton, Mi. 48430

Robert Nevel
Monroe County Comm. College
1555 South Raisinville Rd.
Monroe, Mi. 48161

Charles Newton
Liberty Tree Homes
24625 Beierman
Warren, Mi. 48091

Patrick Norton
Laundry
32105 Woodbrook
Wayne, Mi. 48184

W.A. Oberdick, Prof. *
1230 Art & Arch, U of M
Ann Arbor, Mi. 48109

Stewart Oldford
Stewart Oldford & Sons, Inc.
4648 Laurel Club Circle
West Bloomfield, Mi. 48033

A.P. Oppermann, Prof. *
2150 Art & Arch, U of M
Ann Arbor, Mi. 48109

Henry Orbach
Wayne Cty. Comm. College
4612 Woodward Ave.
Detroit, Mi. 48201

Stephen Osborn
M.S.H.D.A.
401 S. Washington
Lansing, Mi. 48909

Thomas Ott
Mich.-Wisc. Pipeline Co.
1 Woodward Ave.
Detroit, Mi. 48226

J.J. Owens
Commonwealth Assoc., Inc.
209 E. Washington Ave.
Jackson, Mi. 49201

Harvey Painter
Addison Prod. Co.
215 Talbot St.
Addison, Mi. 49220

Robert G. Paul
Pres.- Leigh Prod. Division
64th Ave.
Coopersville, Mi. 49404

Elaine Pawlowski
Bendix Research Lab.
20800 Civic Center Dr.
Southfield, Mi. 48076

Robert Pearce
Pearce Boiler & Eng.
5385 E. Outer Dr.
Detroit, Mi. 48234

Kenneth Penrose
Chrysler Corp.
3543 Veronica
Sterling Hts., Mi. 48077

Donald Pelz
ISR- U of M
5025 ISR
Ann Arbor, Mi. 48104

Peter Pfeiffer
11051 Runyan Lake Hts.
Fenton, Mi. 48430

Terry Plaxton
Kes-Com Builders
7276 Glascott
W. Bloomfield, Mi. 48033

Robert Pratt
Detroit Edison Co.
30980 Pearridge
Farmington Hills, Mi. 48018

Arthur Pohutsky
Pioneer Estates
5031 Hampshire
Utica, Mi. 48087

Donald Price
1125 Birk Ave.
Ann Arbor, Mi. 48108

Elwyn Price
Atlantic Richfield Dist.
2654 Main St.
Newfane, N.Y. 14108

William Prine, A.I.A.
Architect
709 Federal Ave.
Saginaw, Mi. 48607

Marv Proxmire
Liberty Tree Homes
122 E. 9 Mile Rd.
Ferndale, Mi. 48220

Harold Prueter
Oxford-Lake Orion Glass
416 S. Broadway
Lake Orion, Mi. 48035

Millard Pryor
Pryor & Co.
715 Spring Valley Dr.
Ann Arbor, Mi. 48105

John Purcell *
Energy Research & Dev. Agency
Chicago, Ill.

Adelard Raby III
Monroe Cty.Comm. College
1555 S. Raisinville Rd.
Monroe, Mi. 48161

Judy Radosa
Tripe 'R' Homes
14962 M-52
Chesading, Mi. 48616

Raymond Radosa
Triple 'R' Homes
14962 M-52
Chesading, Mi. 48616

Jack C. Ramsay
Active Homes Corp.
7938 S. Van Dyke
P.O. Box 127
Marlette, Mi. 48453

P.G Rapley, Admin. Asst. *
Ind. Dev. Div, IST
2113 IST U of M
Ann Arbor, Mi. 48109

Joe Rarus
Auto Research Enterprise
2555 Henryruff, Lot 59
Inkster, Mi. 48141

Daniel Raschke
Investment Bldg. Corp.
Metro Bldg. - Suite 220
202 W. Berry St.
Fort Wayne, Ind. 46802

Gus Redmond
Pres., R & S Inc.
410 E. 5th St.
Royal Oak, Mi. 48067

Rick Redmond
Redmond & Sons, Inc.
410 E. 5th St.
Royal Oak, Mi. 48067

Harold Reminder
City of Ypsilanti
304 N. Huron
Ypsilanti, Mi. 48197

M.J. Richman, VP *
Urban Investment & Dev. Co.
845 N. Michigan Ave.
Chicago, Il. 60611

Frank Ridgway
Bendix A & M Div.
721 Springfield St., Box 1127
Dayton, Ohio 45401

M.J. Ritsema
Commonwealth Assoc., Inc.
209 E. Washington Ave.
Jackson, Mi. 49201

P. Richard Rittelmann *
Burt, Hill, Assoc.
610 Mellon Bank Bldg.
Butler, Pa. 16001

Durward Ritter
1396 Blaine
Brighton, Mi. 48116

Alejandro Rivera @
Room L-175
Engineering Center
30003 Van Dyke St.
Warren, Mi. 48090

James Robertson
1309 Washtenaw Ave. Apt. #4
Ann Arbor, Mi. 48104

N.P. Rockwell
5625 Crabtree Rd.
Birmingham, Mi. 48010

Frank Rockwell
9800 Baude Dr.
Brighton, Mi. 48116

Charles Roelant
Monroe County Comm. College
1555 S. Raisinville Rd.
Monroe, Mi. 48161

Christopher Rooney
Rooney, Musser & Assoc.
S. Main St.E, W Sandusky St.
Findlay, Ohio 45840

Giles Ross
Prof., Mech. Eng. Dept.
General Motors Institute
Flint, Mi. 48502

Irving W. Rozian
M-V Consulting Service
Also: MERRA
2211 Jackson Rd.
Ann Arbor, Mi. 48170

Edison Rugumayo *
Mich. State Univ.
Agric. Eng. Dept.
E. Lansing, Mi. 48823

Ravinder Sackder
U of M, Eng. Serv.
326 E. Hoover
Ann Arbor, Mi. 48109

Robert Sampson
ERIM SEMTAP
Box 618
Ann Arbor, Mi. 48107

Irvin Sattinger
Envir. Res. Inst. of Mich.
Box 618
Ann Arbor, Mi. 48107

R.L. Saunders
AEROQUIP Corp.
3827 Deerfield Dr.
Jackson, Mi. 48201

Herbert Sawchuk
Wayne Cty. Comm. College
4612 Woodward
Detroit, Mi. 48201

Gene Schey
Boyle & Schey Bldrs.
835 Summit St.
Findlay, Ohio 45840

Bradley Schaper
Pioneer Estates
5031 Hampshire
Utica, Mi. 48087

Ervin Schilke
Macland Plumbing & Htg. Inc.
636 W. Greenwood Rd.
Alger, Mi. 48610

Marion Schilke
Macland Plumbing & Htg. Inc.
636 W. Greenwood Rd
Alger, Mi. 48610

Wayne Schmidt
Fanning/Howey Assoc., Inc.
540 E. Market St.
Celina, Ohio 45822

Robert Schwartz @
Robt. Schwartz & Assoc. Arch.
121 Dartmouth Dr.
Midland, Mi. 48640

Jack Scrivens
Oakland Hills Bldg. Co.
28652 Cumberland
Farmington Hills, Mi. 48024

Com. Lenton Sculthorp
Mich. Public Serv. Com.
6545 Mercantile Way, Box 30221
Lansing, Mi. 48910

Edward Sczesny @
Guardian Industries Corp.
43043 W. Nine Mile Rd.
Northville, Mi. 48167

Charles Sech
Charles Sech Assoc., Inc.
206 S. Main St.
Ann Arbor, Mi. 48108

James Shane
Ferris State College
Construction Dept.
Big Rapids, Mi. 49307

Ernest Shaw
Van Buren Intermed. School Dist.
701 S. Paw Paw St.
Lawrence, Mi. 49064

Robert Shaner
H.E.L.P. Co.
43543 Goldberg
Sterling Hts., Mi. 48078

David Sherman
Battle Creek Assn. of Home Bldrs.
309 W. Michigan Ave.
Marshall, Mi. 49068

Peter Sherman
B.C. Assn. of Home Builders
309 W. Michigan Ave.
Marshall, Mil 49068

William Shiels, Arch.
4066 W. Maple Rd.
Birmingham, Mi. 48010

Ronald Sibson
Brazeway, Inc.
P.O. Box 749
Adrian, Mi. 49221

Robert Sierks
Active Homes Corp.
7938 S. Van Dyke, Box 127
Marlett, Mi. 48453

Ken Simmons
New Haven H.S.
57700 N. Gratiot Ave.
New Have, Mi. 48048

Dale Sikkenga
Rothbury Hdwe.
7909 Mich. Ave.
Rothbury, Mi. 49452

Garry Singel
G.M. Singel Co., Plbg. Contr.
6529 Fredmoor
Troy, Mi. 48098

Donald Slankster
Slankster Const.
37936 Wendy Lee
Farmington Hills, Mi. 48018

Roger Slykhouse, P.E.
2221 W. Leonard
Grand Rapids, Mi. 49504

Tom Slykhouse
3080 E. Gordonville Rd. Route 10
Midland, Mi. 48640

D.N. SMith, Director *
Ind. Dev. Div., IST
2116 IST U of M
Ann Arbor, Mi. 48109

Mark Smith *
2123 Stephen Terrace
Ann Arbor, Mi.

Robert Smith
Citizens Saving
Tiffin, Ohio 44883

Bruce Soule @
Technology Inc.
335 N. Griffin
Grand Haven, Mi. 49417

R.M. Sowers
Ford Motor Co.
25500 W. Outer Dr.
Lincoln Park, Mi. 48146

Edward Spehar
SYBRON/Kerr Mfg. Co.
28200 Wick Rd.
Romulus, Mi. 48175

William Spurgeon @
Bendix Research Labs.
Bendix Center
Southfield, Mi. 48076

Clark Spyker
Teledyne Cont. Motors
General Products Div.
76 Getty St.
Muskegon, Mi. 49442

Charles Stark
Richard, Bauer, & Moorhead
1600 Madison Ave.
Toledo, Oh. 43624

Ray Steinmetz
33 E. Market St.
Tiffin, Oh, 44883

H. Franklin Stewart
Dow Corning Corp.
2200 W. Salzburg Rd.
Midland, Mi. 48640

Roberta Stewart
4024 Lowell Ct.
Midland, Mi. 48640

Susan Stock
Variety Die & Stamping Co.
17980 Waterloo Rd.
Chelsea, Mi. 48118

James Surhigh
4207 Dexter Rd.
Ann Arbor, Mi. 48103

Bernard Swift
HNO Packaging
15848 Glendale
Detroit, Mi. 48227

Charlie Swindell
JF's Plumbing Inc.
1101 Allen Dr.
Troy, Mi. 48084

James Swindell
JF's Plumbing Inc.
1101 Allen Dr.
Troy, Mi. 48084

Thomas Swope
Aeroquip Corp.
300 S. East Ave.
Jackson, Mi. 49203

Leo Synowa
Synow Bldg. & Const.
127 Manor Way
Rochester, Mi.

Edgar Talbot
Chief Bldg, Insp, City of Plymouth
201 S. Main St.
Plymouth, Mi. 48170

Norris Tangeman
Burris, Lockwood & Tangeman Arch.
140 Fairfax Rd.
Marion, Ohio 43302

John Tatar
Builder
21860 W. Outer Dr.
Dearborn, Mi. 48124

James Thomas
Parke, Davis & Co.
188 Howard Ave.
Holland, Mi. 49423

Steven Thomas
M.S.U.
Agric. Eng. Dept.
E. Lansing, Mi. 48824

Louis Thornton
Northwestern Electric Coop.
Box 391
Bryan, Ohio 43506

George Tiedeck
Tremco Inc.
1241 Kensington
Grosse Pointe, Mi. 48230

Barry Tilmann @
City of Ann Arobr, Housing Rehab.
100 N. 5th Ave.
Ann Arbor, Mi. 48104

John Titus
Richard Prince & Assoc, Arch.
3623 Douglas Ave.
Kalamazoo, Mi. 49007

Clyde Tobin
Dir. of Sales, Saginaw Prod.Corp.
68 Williamson
Saginaw, Mi. 48601

Mike Todosciuk
G.M. Proving Ground
Milford, Mi. 48042

Stan Toll
Star-Lite Insulating Glass Div.
Five Points Glass Co., Inc.
Akron, Ohio 44302

Charles Totton
Green Oak Township
10789 Silver Lake Rd.
South Lyon, Mi. 48178

Rick Trapp
33 E. Market St.
Tiffin, Oh, 44883

R.L. Underhill
Addison Products Co.
101 Railroad St.
Addison, Mi. 49220

P.S. Vachher
7702 Bircklan
Canton, Mi. 48187

Roger Valentine
Wellington Lumber
134 Grand Ave.
Wellington, Ohio 44090

Alan Van Antwerp
Ferris State College
Dept. of Physical Science
Big Rapids, Mi. 49307

Don Van Orden
State Building Co.
2602 Thomas St.
Flint, Mi. 48504

James Van Overloop
Lake Monterey Corp.
1585 E. Terrace N.E.
Grand Rapids, Mi. 49503

DR. A.B. Van Rennes
Bendix Research Labs.
Bendix Corp.
Southfield, Mi. 48076

Skip Van Wyk *
Mich. Solar Energy Assoc.
A & D, U of M
Ann Arbor, Mi.

Wayne Van Wylen
Lake Monterey Corp.
1585 E. Terrace N.E.
Grand Rapids, Mi. 49503

Neil Veigel
Shatterproof Glass Corp.
4815 Cabot Ave.
Detroit, Mi. 48210

William Viglione
Ford Motor Co.
50500 Mound Rd.
Utica, Mi. 48087

Eli Voydanoff
3616 Oakshire Ave.
Pontiac. Mi. 48054

Dennis Wahlstrom
Wahlstrom Const. Co.
18948 W. Warren
Detroit, Mi. 48228

R.H. Walpole @
Walbro Corp.
6242 Garfield
Cass City, Mi. 48726

Mike Walsh
35928 Union Lake Rd. #323
Mt. Clemens, Mi. 48043

Dr. Richard Ward @
Detroit Engineer Magazine
18226 Mack
Grosse Pointe Farms, Mi. 48236

Jane Warner
Chevrolet Engineering
Room 136-71, 30007 Van Dyke
Warren, Mi. 48090

A.W. Brian Watson
Mueller Brass Co.
1925 Lapeer Ave.
Port Huron, Mi. 48060

Ward Waynek
Reg. Civil Engr.
501 W. Baldwin
St. John, Mi. 48879

Michael Wegenga *
Ann Arbor, Mi.
(331 W. Eng., U of M)

Richard Wells
Bulldog Eng.
5385 E. Outer Dr.
Detroit, Mi. 48234

William Wheeler, P.E.
City of Ann ARbor Utilities Dept.
2000 S. Industrial Hwy.
Ann Arbor, Mi. 48104

Timothy Wiles
Wiles Masonry Inc.
238 Prospect ST.
Wellington, Ohio 44090

Rufus Wilkerson
Ford Motor
50,500 Mound Rd.
Utica, Mi. 48087

J.T. Wilson, Director *
Inst. of Sci. & Tech.
6117 IST, U of M
Ann Arbor, Mi. 48109

Homer Witzel
Dir., Product Planning
Product Planning, Deere & Co.
John Deere Rd.
Moline, Ill. 61265

Gary Wobler
Paulding Putnam Coop
R.R. 3
Paulding,Ohio 45879

John Woerpel *
Detroit News
Detroit, Mi. 48231

Bob Wood @ *
Day Star Energetics
6801 Telegraph Rd.
Birmingham, Mi. 48010

Robert Wood
Student
1336 N. University
Ann Arbor, Mi. 48104

Robert E. Wood
Ayres Lewis Norris & May
3983 Research Park Dr.
Ann Arbor, Mi. 48104

Clifford Wright
Clifford Wright Assoc., Arch.
4066 W. Maple Rd.
Birmingham, Mi. 48010

Mary Ann Wright
City of Detroit- Dept. of Health
Dept. of Pharmacy/Pharmacology
1151 Taylor
Detroit, Mi. 48202

George Yankers
7277 Hartel
Westland, Mi. 48185

Dempsey Yearout *
Press Photographer
638 S. Harvey
Westland, Mi. 48185

Eugene J. Yehl
Consumers Power Co.
212 W. Michigan Ave.
Jackson, Mi. 49201

Frank Yerrington
Oakland Univ.
2429 James K Blvd.
Pontiac, Mi. 48053

Sandra Yonder
Dept. of Commerce
Michigan Public Serv. Com.
Box 30221
Lansing, Mi. 48909

Chris Yuhn
General Motors Overseas Oper.
3044 W. Grand Boulevard
Detroit, Mi. 48202

James Zatolokin
610 Univ. Dr.
E. Lansing, Mi. 48823

Tom Ziems
Glassline Corp.
617 Front St.
Toledo, Oh, 43605

Werner Zirkelbach
Active Homes Corp.
7938 S. Van Dyke, Box 127
Marlette, Mi. 48453

CANCELLATIONS

R.C. Metcalf, Prof. *
Arch, Arch, & Urban Planning
2150 Art & Arch., U of M
Ann Arbor, Mi. 48109

Joseph Derringer
Investment Building Corp.
Metro Bldg- Suite 220
202 W. Berry St.
Fort Wayne, Ind. 46802

Laurence Masland
Planner
412 E. Huron Apt. C-3
Ann Arbor, Mi. 48104

Paul Ensign
Tranter Inc.
735 E. Hazel St.
Lansing, Mi. 48909

Edward Demmler
Peter Loftus Corp.
Chamber of Commerce Bldg.
Pittsburgh, Pa. 15206

E.H. Bessire
PrestoliteElectrical Division
511 Hamilton Street
Toledo, Ohio 43694

Michael W. Doherty
R.J. Tower Corp.
429 E. Grove
Greenville, Mi. 48838

G. Megginson
Kelsey-Hayes Research & Dev.

Robert P. O'Malley
Small Business Adm., U.S. Govt.
1441 L St. N.W.
Washington, D.C. 20416

James Elgass *
U of M Conference Dpt.
Ann Arbor, Mi. 48109

T.M. Atkins
Kelsey-Hayes Research & Devl
2500 Green Road
Ann Arbor, Mi. 48105

Collin W. Walls
Springfield Twp. Bldg. Sup.
650 Broadway
Davisburg, Mi. 48019

Lewis Benfield
Springfield Twp. Bldg. Insp. Sup.
650 Broadway
Davisburg, Mi. 48019

C.O.D. No-Shows

Francis Block
Bldg. Admin., Iosco Cty.
438 W. Lake St.
Tawas City, Mi. 48763

Frank Bowler
Builder
15624 Mt. Vernon
Southfield, Mi. 48075

Glen Clafton
Clafton & King Bldg. Corp.
27527 Joy Rd.
Westland, Mi. 48185

James Cummings
Cummings Plumbing & Heating
905 W. Washington
Jackson, Mi. 49202

Russell Ellison
Chrysler Corp.
24324 Woodland
Southfield, Mi. 48075

Charles Gallup
Gallup-Silkworth Co.
2141 S. State St.
Ann Arbor, Mi. 48105

W. Richard King
Salesman
3520 Piquette
Detroit, Mi. 48211

Rao Manyam
Manyam & Assoc., Inc.
7540 E. Greenleaf Ct.
Frankenmuth, Mi. 48734

Clark Most
Delta College
Univ. Center, Mil 48710

Ellen Nicdao
American Nat. Res. Co.
1 Woodward
Detroit, Mi. 48226

Darryl Ozias
Nautilus
30761 DeQuindre
Madison Hts., Mi. 48071

Thomas Petit
Chrysler Corp.
36371 Ellicot
Sterling Heights, Mi. 48077

Richard W. Quick
Mich.-Wisc. Pipeline Co.
1 Woodward Ave.
Detroit, Mi. 48226

Lawrence Ray
Dept. of Commerce
Mich. Public Serv. Comm.
Box 30221
Lansing, Mi. 48909

Bob Rusiecki
Bar Home Improvements
7515 Napoleon Road
Jackson, Mi. 49201

David Sklar
DSE
27500 Franklin Rd., Apt. 810
Southfield, Mi. 48034

David Summers
Kleen-Thru-Maintenance Co.
22426 Foxcraft
Woodhaven, Mi. 48183

Robert Townsley
Superior Properties Inc.
38235 Connaught Dr.
Northville, Mi. 48167

Jim Walsh
Oakland Comm. College
2417 James K
Pontiac, Mi. 48053

Marian Whittaker
Delta College
University Center, Mi. 48710

EXHIBIT C

SOLAR ENERGY KEY NOTE SPEECHES

SOLAR ENERGY CONFERENCE TRANSCRIPTS

First Speaker: John Clark

Perhaps President Carter's remarks a month or so ago have had an important bearing on the interest shown by this large turnout in the subject matter today. I think there may be one other reason though: who will ever forget the winter of 1976-77? Now, I'm not in a position to prove this to you this morning, but I think I probably could, given enough time. You remember those cold days in January that were just as bright as a bell? My guess is that the massive solar inputs to our various buildings and homes had a lot to do with our surviving as well as we did in the winter of 1976-77. It's winters like that one that remind us that when we deal with averages we must always keep in mind that sometime we're going to run into those minus three sigmas, that vary from the average as this winter did.

Let me also express greetings from the College of Engineering at the University at Ann Arbor, to all of you at this conference this morning. We have a number of goals and objectives that we'd like to achieve. We want to provide an up-date and an authoritative perspective on solar energy utilization, directed toward the problems of heating and cooling, and, in this case, primarily of buildings--residences and industrial buildings, and in industrial processes, as well, when our time will permit.

These, as you may have gathered from your own reading, are the processes that are expected to become most widely available in the near term in the field of solar energy. These are the ones that have already undergone a great deal of technical development and that, therefore, will be and are being applied on a fairly broad scale. We would also like to provide a summary status of opportunities, applications, problems, and potentials, primarily for Michigan and the North Central region of the country. We also want to identify as best we can, the role of solar energy in meeting the nation's energy needs.

We also have a number of exhibits out in the lobby, and these exhibits are for solar energy products that exist now and are being marketed in Michigan and in closely surrounding regions. There are also a number of brochures describing products that may not be in the exhibit itself. In addition, on exhibit in the parking lot there is Champion Homes' solar furnace, as well as another exhibit from Owens-Illinois, in Toledo, a company that manufactures a very fine collector.

Sometimes I get the feeling as I talk to people and read about solar energy in the newspapers that in many ways a public view of this very important process is somewhat like that of a philosopher, who, looking up into the sky, decided that probably the moon was the most important of all the celestial objects. His reasoning was that it's really at night when we need the light, and the moon is out at night and it provides us light when we

need it; whereas during the day, we have all the light we need, so what is the real role of the sun?

Now, in terms of products and services we have existing today (and some of the exhibits you see outside show this to be true), there is in fact, already, a growing and quite healthy solar energy industry. This year the total sales of products and services will probably be approximately $100 million in the United States alone. In the next few years--it's always hard to make a good projection--but say, by the 1980-1985 period, very likely this industry will grow to at least the billion-dollar range. And by the year 2000, although that is a long projection, it will increase another ten-fold.

So we have before us an opportunity of unusual proportions; it's probably going to be a rapidly growing industry, that will grow much more rapidly than the auto industry, going from a $100 million this year to $1 billion in perhaps five or ten years, to $10 billion by the year 2000. Now these are projections, based on what analysts expect to be a reasonable growth. Certainly the field is growing, the square feet of collectors--I don't have the exact figures in front of me--are almost doubling on the half-year basis; at any rate, the growth of these products is remarkable. At the same time, the various professional societies that may be involved, for example, the American Society of Refrigeration, Air-Conditioning and Heating Engineers are developing standards for this equipment, so that manufacturers of products will have standards to meet in their various product lines. These are all signs of

a growing and healthy industry, particularly in the field of solar energy utilization for heating and cooling.

Of course, we all know, I suppose, why we're interested in solar energy though there can be many different reasons. Certainly, the energy need of our nation, I think, is the single most overriding need of all. But energy means so many things to us. It is not only comfort in our homes, but jobs; it also means inflation--i.e., it may influence inflation--it means industrial growth and economic development. It involves the cost of living and the standards of living. And, probably, energy is another word for foreign policy, and, in the final analysis, very likely, energy might be another word for world peace and stability. Therefore, it is encumbent upon all of us that have an interest in the field to try to do the best we can to bring knowledge forward and to make it possible to utilize all forms of alternate energy as soon as we can.

Returning to solar energy, though, for now, let me identify some of the characteristics that I suspect you will recognize but perhaps haven't quite articulated in your own mind. I'm going to be sort of a salesman now for solar energy. Solar energy possesses some remarkable characteristics: To begin with, solar energy is at once clean and silent. Never has a beam of the sun ever besmirched anything except perhaps our backs as we lie too long in the sun. I've never heard a sunbeam. It's both clean and silent: for those of us concerned with the environment, there could be no more perfect source of energy than solar energy.

Though you may have reasons to wonder about this, solar energy is also abundant and widely available on the surface of the earth.

It's available in the sense that there is virtually no point on the terrestrial surface of the earth where there isn't a sufficient quantity of solar energy to be useful in some form virtually all months of the year. I'll have to exclude the polar regions during the solar arctic and antarctic nights, of course, but otherwise, energy is abundant; it's widely available geographically in that sense.

At the outer atmosphere, not on the terrestrial surface, but at the outer atmosphere, you may be surprised to know, the greatest amount of energy falling at any point on the surface of the earth is at the south pole on the winter solstice of December 21. There's quite a distance, of course, between the outer atmosphere at the south pole and the terrestrial surface, but still the energy falling at that point is the maximum, in any 24-hour period during the year.

Solar energy is also dependable. By that, I mean, it's statistically dependable. One of our problems today is to try to determine just exactly what that statistical dependence really is, but on the average, we know pretty well how much energy is going to fall to the terrestrial surface at virtually any point on the surface of the earth, and particularly, on the North American continent. One of the problems we have, though, is to

determine what is going to happen, let us say, on May 25, in Dearborn, Michigan, at 2 p.m. I don't know that we'll ever be able to tell you exactly how much energy is going to fall at that time, that specifically, but we have a long way to go and I'm sure we'll make great progress in the future in determining, say, probabilities, of the energy falling.

Today, however, we must design and build systems based largely on long-term averages of energy. These we know pretty well, and we base a lot of our thinking on the fact that the energy isn't that dependable, statistically dependable; and over a long period of time we can be quite certain that an amount of energy that we can in fact compute will fall on our surfaces. The energy, of course, can't be embargoed, it can't be cut off easily with technologies of any kind. So that's part of its dependability. Furthermore, and, finally, solar energy is inexhaustible--inexhaustible in respect to the age of the sun, which is something on the order of 30-40 billion years. When we're dealing with such an energy source, we simply can say it's inexhaustible.

Solar energy then has these characteristics: it's clean, silent, abundant, widely available, dependable, and inexhaustible. Sometimes solar energy is said to be free. I'm not sure if you believe that or not. But I think we'd probably have to say that today, solar energy, in its utilized form, isn't any freer than crude oil in the ground. There must be a capital energy investment in order to convert the sun's energy striking the terrestrial surface into a useful form, and at the moment that capital investment is something that we're working to bring to a low value.

The only thing I think we can say that is free about solar energy is that the transportation to point of use is without charge. I want now to show a few slides to give you an idea of the applications of solar energy for heating and cooling. I will also tell you something about the circuits that are used to convert the sun's energy to a useful form.

John Clark continued:

I think I might mention some of the local activities going on involving solar energy. The Michigan Solar Energy Association has recently been formed; it will be affiliated with the American section of the International Solar Energy Society. Ror Hanson of the Solargy Corporation and Ed Kelly of Sun Structures in Ann Arbor are here today and will be glad to talk to you about joining the Michigan Solar Energy Society. The Society will be processing information for various solar activities in the state, and activities involving solar energy in general. At lunchtime today, we have asked Dr. John E. Mogk of the Michigan Energy and Resource Association, sometimes called MERA, to talk to us about the solar energy research institute proposal, that MERA and the Bendix Corporation put together last winter. This has developed into some developmental activities for the North Central Solar Energy Research Laboratory, and we've asked Dr. Mogk to bring us up to date on how that will affect us.

In the United States there are something like 300 documented installations in 38 states for solar energy--heated, and in some cases, --cooled buildings. These are located in virtually every state east of the Mississippi, from the Gulf of Mexico to the Canadian border in the regions of the United States where there isn't much sunlight. But, every state, except, I think, West Virginia, has several solar-heated homes. Of course, in the Southwest, all the states from Missouri through the Southwestern region to Mexico also have solar systems, i.e., buildings with solar systems in them. In the state of Michigan,

you might be interested in knowing, there are 33 residences that are solar-heated and solar-cooled. Prominent among those is the Federal Building in Saginaw, about which we'll hear later this afternoon. Experimental systems have been installed at Smith Institute in Detroit and at the Walter and May Reuther Education Center at Onaway, Michigan. In the city of Flint, the first heating and cooling demonstration under HUD will be set up--a six-family dwelling, using the latest General Electric vacuum tube collectors and Arkla absorption units for cooling. This will be the first such dwelling in the state. It will be under construction by next year, and about a year from now, you will be able to visit it.

Perhaps you would like to know what a solar-heated house would be like in Michigan, say in this region of Michigan. Let me describe one for you, to give you a general idea. Let's take a three-bedroom single home, fairly well insulated, of about 1500 planned square feet. If we were to base the design of a solar system on the average solar and climatological data, we would find that to provide 50 percent of the average winter's heating load for that structure, including domestic water for the average size family that we'd find in a home like that, we would need a collector whose area would be somewhere between 450 and 500 square feet, or about 28-33 percent of the planned area. There we have an ordinary three-bedroom home in the southeastern Michigan area: 50 percent of the winter's heating required something like a third of the planned floor area in the size of the collector. Those collectors could be mounted

at an angle of about 60 degrees from the horizontal, so they would pick up the lowering sun from the periods of September to the end of April. That is, about the latitude plus 20 degrees approximately, another rule of thumb. The storage for that system would amount to something on the order of about 1000 gallons of water. That's about 8300 pounds of water, or about 134 cubic feet of water, which would occupy a cube 5 feet on each edge. If we chose to use an air system, which has much to be said in its favor in this area, we would use about 34,000 pounds of rock, that is, about 324 cubic feet, which would occupy a cube roughly 7 feet on an edge. That is a rough description of the solar equipment a 3-bedroom, 1500-square-foot house in Michigan would have to contain. The actual size of the collector and the actual size of the storage would depend on a somewhat detailed calculation. Of course we can't do that today; we do this on computers because of the vast amount of data that must be processed. However, for southeastern Michigan, the most economic optimum would fall reasonably close to the figures that I gave you. I would like to emphasize that we would always optimize these systems with much more detailed calculations than the rules of thumb provide. My guess is that we'd come within 10 percent of optimum if we were to computer-optimize the system.

Part of our activities at the University, and among most of you working in solar energy, is the development of computer programs that calculate a great many of these things, especially, the economic optimization point of design and operation. I said a lot about the size and the angles and so on, and you probably

want to know how much this is going to cost. Let me just say that, at the moment, solar energy is probably not competitive with regulated gas, but if we were to compete with direct resistance heating, or electrical heating, solar energy in virtually all portions of the United States is less expensive in terms of the total costs of these systems. As the costs of gas and oil inevitably will be reduced through innovative design and innovative manufacturing, we can expect that the solar systems, on life-cycle costing, a new idea we'll hear about later today perhaps, will become more and more competitive even with fossil fuels as time goes on. In western parts of the United States it is already true, in life-cycle costing on reasonable estimates of fuel escalation, that solar systems today are cost-effective compared with fossil fuels. So we must keep in mind that the cost of the systems would depend upon the competition of the fuel, and its economic trade-off point would depend upon escalation rates in the future of fuel costs. The system I described to you, though, on the three-bedroom house, probably runs (for a good system having a twenty-year reliable life) between $7,000 and $9,000. In this area if we had a cost increase of 10 percent per year for the next 20 years, that system would today be cost-effective on life-cycle costing.

Obviously, solar energy utilization is already underway in the United States, including Michigan. We have a very active industry; and we have speakers today who themselves are close to that industry, and they'll have a lot more to say about it. Thank you very much.

Professor Peters Oppermann

Speaking as an architect and as a representative from the College of Architecture and Urban Planning, I can state that there are substantial opportunities for members of the architectural profession. However, I'd rather call them responsibilities as opposed to opportunities, because I feel that the energy and material shortages we face today remove the freedom of choice from what we have to do from this point on. Architects, in fact, all design professionals, must re-order their priorities and place conservation and the use of alternative sources as primary in every decision. This should not imply just mechanical control of the thermal environment and the luminous environment of buildings, but in every decision that's made about a building, in its design, its construction and its use. Energy is consumed within buildings, but it's the character of the building itself that determines how much. Why architects? Because approximately one-third of the energy used in the United States is used in buildings for people. And as a result of that, architects have a very heavy responsibility in the energy area. Hopefully, clients will begin to mandate energy-consciousness and request that investigation of compatible and alternative systems be made for any building that's proposed. I may sound as if I'm addressing the question of energy conservation or energy-consciousness a little more than the primary subject of this briefing which is solar energy, but I am making a point. The point is that the installation of

solar systems to satisfy building user comfort needs is not enough. There has to be an equal commitment to total energy-consciousness--for any building that's going to be designed, constructed, and used. The use of solar systems is really unwise, and probably economically unfeasible, without considering energy-consciousness equally as strongly in the decision of design. The compatibility required is not primarily one of visual or structural character, but it's really a commitment, a philosophy. Design professionals in fact now have a new ethic, which includes alternative energy sources and conservation, which is getting stronger and stronger support from the marketplace.

To elaborate, let me use three words to describe my point about the responsibility I feel exists in any design professional's operation. The first word is optimization, which suggests to me that one tries to obtain the most favorable and efficient result in the case of building design, or the design of any energy-consuming device. Obtaining optimization of the building design includes the responsibility to use the best judgment in considering the choice of building site, the building form, building materials, building equipment, and building use. The objective should be to make the building perform as well as it possibly can from an energy-consumption standpoint, and let the mechanical equipment make up the rest. And as a piece of equipment which is designed to simply make up the difference that the building can't take care of, the systems supplied for the building should therefore be very small and very simple, to the extent possible. From

a solar standpoint, if solar represents a contribution to the overall operation of the building it would be a better solution, it would be a success, but only as a contribution to the total picture. In terms of economics, both life costs and initial costs have to be mutually considered, with emphasis placed perhaps even more on operating costs. Before, when a building was designed, the systems were selected on the basis of what the building needed, given its design. What we have to do now is turn that around and make our determination such that the environmental systems have equal status in the design process. The building has to be viewed as an interface between the exterior environment and the interior user environment. There also must be an increase in the decisions to renew old buildings rather than to build new ones. There is a certain amount of activity in the preservation area which begins to suggest that energy conservation as well as building conservation for historical purposes are compatible ideas. We need more to renovate or renew old buildings rather than construct new ones. This has to be done also on the basis of that older building being renewed to the point where it's not consuming more energy than it should. And particularly if we try to use the idea of retrofit of solar systems on existing buildings, the building has to be brought up to a point where it's compatible with that solar system before it's economical to presume that it's going to work well. Buildings that are already built and occupied constitute a huge potential market: I don't know the exact figures on how many buildings exist today

compared to how many will be built by the year 2000, but the simple numerical facts should indicate that the retrofit idea for solar and for other energy-conscious ideas, is a tremendous market for those of us who wish to pursue that. So in other words, optimization is simply good design, with a reinforcement of the fact that we have a very serious energy problem.

The second important word, evaluation, is perhaps the newest and least experienced aspect of architecture practice or any design practice. I'm not talking about postconstruction evaluation, preconstruction evaluation. From an energy standpoint it's not using merely more insulation or triple glazing or fewer windows, it's a detailed look at all of the parameters and their potential for dynamic combinations of currents. It's a testing of all of the variables and combinations described under optimization, including site, form, materials, equipment, and use. In fact the computer may be our only solution to making it possible.

As an example, let me discuss one understood and well-known aspect of the building envelope, the window. A window serves as a very good example of the variety of things that need to be considered in making a decision in design. In fact, the designer has to think of a glazed wall as an extremely versatile element of a building envelope. Some attributes are beneficial; and some are not so beneficial and cost us not only money but energy. A window provides daylight solar rays for radiation, and heat in the wintertime, which supplements the mechanical system. A window loses heat by transmission and gains heat by transmission

in the summer; it may provide for natural ventilation. It creates infiltration losses which are winter problems, and it creates infiltration gains which are summer problems. It provides you with contact with the outside, which is a very difficult value to quantify, it provides employment for window washers, and it even satisfies some people intent on elopement, not to say anything about cat burglars and peeping toms. The idea is that we need to look at all the components of building systems, particularly the building envelope, and be very careful about our design decisions with regard to those aspects of building, and make sure that we understand them well enough so that we can make good decisions about the compatibility of systems and the buildings that they satisfy. The question about how we assess these dynamic aspects of a wall or any part of a building, is a difficult one. What the design professions need is a new set of tools--and perhaps, as I mentioned, the computer provides that--to be able to make an assessment about all of the contributions, both positive and negative, to be better able to make design decisions about components of buildings. Developing better means of evaluation is going to be an increasing part of our day-to-day operation, and we're going to be doing it in larger and larger parts of our professional time. This leads to the third of the three words, multi-disciplinary.

The multi-disciplinary label is meant to suggest activity between professions, between engineers and other design professionals, but also activity within professions. We find

increasing numbers of people joining the architecture profession, particularly as academics, because of an interest in the challenge of preparing themselves to become active contributors in the areas of solar energy, energy conservation, and energy consciousness. They're becoming energy problem solvers, in my opinion, the only way to go. But my point is that a team effort is absolutely necessary to form proper and beneficial conclusions. In conclusion, I think we need to be and can be very optimistic about the future. I think we can accept the challenge before us, because the challenges are opportunities and those opportunities are great entries into the future. Thank you.

Professor George Löf: Solar Systems: What Types for Specific Climates

First I'd like to say that my topic, solar heating systems, will be dealt with broadly in terms of cooling and water supply. Nevertheless, I will not be touching on such things as electric power generation or agricultural application or a number of other topics broadly included under the title of solar systems. Some people are saying that solar energy is not going to be here until the next century, and others maintain that it's here now. Well, both are right. Solar powered electricity probably is something for the next century, but solar heat is here now, and I think we should try to be specific in what we're talking about.

I'd like to begin with an analogy that's perhaps a little oversimplified, but if you'll bear with me, let me pose a hypothetical question. Suppose a supplier of gasoline comes to you and offers to write a contract--to supply all the gasoline you're going to want for the rest of your life, at a fixed price of a dollar a gallon, the terms being that he will store it for you at no charge, he will deliver it to you, put it in your tank as long as you live, but you must buy every gallon from him at 1.00 a gallon. My first question is, would you take that kind of a deal?

Well, I don't know about you, but I would, because even though I know that I can get it cheaper at a filling station for a little while, I can get a bargain a few years from now.

They're already paying $1.50 a gallon in Europe and South America, and most other countries on earth. So I would know that in a few years, I would be getting my fuel cheaper than my neighbor. Well, that's in effect what one would do by putting a solar heating system on his house today in most of the United States. He would be paying something more, usually, for his heat today than by buying it from the utility company, but he is guaranteed his price of heat for the life of that system, 20 years, 30 years, whatever the life of the system is going to be. There's no way that the cost of that heat can go up. And a few years from now, when the neighbors are paying quite a lot more than he is, he's paying the money to the bank, i.e., he's paying off the loan on that system. His neighbors are paying it to the utility company. And his payments annually are considerably less than his neighbors'. Having presented that little analogy, let met proceed with a discussion of some of the types of solar heating systems, focusing on those that probably do have a climatic advantage. For some areas, some systems are likely to be more appropriate than others, although there aren't any boundaries at which you can say that a particular system won't work; there is considerable overlapping.

Slides

EXHIBIT D

SOLAR ENERGY SEMINAR CHECKLIST

		Responsibility of:
1.	Meeting room arrangements	Don/Larry H.
2.	Lunch room arrangements (head table to accommodate 15 speakers)	Pat
3.	Lunch room arrangements (flowers, place cards at speakers' table, microphone, etc.)	Pat/Sue
4.	Speakers' breakfast (7:15 A.M., North VIP Room, Fairlane Manor)	Don
5.	Signs for Conference	Pat
6.	Place cards for speakers - 2 sets, one for meeting room, one for lunch table	Pat/Sue
7.	Exhibit liaison	Jay/Don
8.	Speaker liaison	Mike/Larry C.
9.	Backup supplies (slide projector, extra pens/pencils, tape, etc.)	Pat/Sue
10.	Photographer - instructions, dismissal	Larry C.
11.	Transportation - speakers to airport as needed - check shuttle service by Hyatt to Metropolitan Airport	All Staff
12.	Handout material for display table (does not include packet to be distributed by Conference Dept. at registration)	Pat/Sue
13.	ERDA representative, pick up at airport, tour U of M and transport to Dearborn	Larry C.
14.	Press liaison	Larry C.
15.	Message desk - bulletin board	Sue
16.	Complimentary admittance (press, etc. not previously registered)	Pat
17.	Microphones (check to see working properly)	Don/Larry H.
18.	Program evaluation - distribute and pick up at end of conference	Mike/Don/Pat
19.	Tape entire meeting as backup to Conference Dept. taping	Larry H.
20.	Station wagon from pool (pick up about noon Monday; return by noon on Wednesday)	Larry C.
21.	Moderator - Notes to group	Mike

EXHIBIT E

SOLAR ENERGY BRIEFING
Tuesday, May 24, 1977

8:00	Registration - Lobby, Fairlane Manor
8:30	WELCOME: J. J. Martin, Associate Director, Institute of Science & Technology, The University of Michigan
	KEYNOTE:
8:50 - 9:15	John Clark, Professor, Mechanical Engineering, The University of Michigan
9:15 - 9:40	Peters Oppermann, Professor, Architecture and Urban Planning, The University of Michigan
9:40 - 10:20	SOLAR SYSTEMS - WHAT TYPES FOR SPECIFIC CLIMATES: George O. G. Löf, Director, Solar Energy Applications Laboratory, Colorado State University and Vice President of Research, Solaron Corp.
10:20 - 10:40	Break
	SOLAR HEATING AND COOLING APPLICATIONS - HOUSING:
	SINGLE-FAMILY HOMES:
10:40 - 11:00	Henry Leck, Champion Homes
	MULTIFAMILY-TOWNHOUSES:
11:00 - 11:20	Marvin Richman, Urban Investment and Development Company of Aetna Insurance
11:20 - 11:35	John Purcell, Energy Research and Development Agency
11:35 - 11:50	Questions and Answers
11:50 - 1:45	Lunch (Includes address by George Löf) Announcement - John Mogk, Director, Michigan SERI Program
	SOLAR HEATING AND COOLING APPLICATIONS IN BUILDING
	Willard Oberdick, Session Chairman
1:50 - 2:10	OFFICE BUILDINGS - Thomas McNamara, General Service Administration, Chicago
2:10 - 2:30	COMMERCIAL AND SCHOOL BUILDINGS - P. Richard Rittelmann, Burt, Hill, Associates
2:30 - 2:50	INDUSTRIAL BUILDINGS - William Hudson, Independent Living, Inc., Atlanta
	SOLAR ENERGY APPLICATIONS IN INDUSTRIAL PROCESSES AND BUILDINGS:
2:50 - 3:10	FOOD AND AGRICULTURAL PROCESSING Edison Rugumayo, Michigan State University
3:10 - 3:30	SOLAR-ASSISTED HEAT PUMPS FOR NORTHERN CLIMATES Harry C. Fischer, Union Carbide, Oak Ridge, TN
3:30 - 4:30	Questions and Answers for any speaker of the day (All speakers to front tables)
4:30	Adjourn

EXHIBIT F

THE UNIVERSITY OF MICHIGAN

SOLAR ENERGY BRIEFING SEMINAR

Fairlane Manor, Dearborn, Michigan
May 24, 1977

FEEDBACK QUESTIONNAIRE

Please take a minute to complete this questionnaire at the end of the briefing. Leave it with any staff member. Signing it is optional.

1. How would you rate the overall seminar quality?

   _____Excellent _____Good _____Fair _____Poor

2. How useful was this briefing for you?

Very	Fairly	Relatively	Of No
_____Useful	_____Useful	_____Little Use	_____ Use

3. Do you have any suggestions on how the seminar could have been improved?_____

   _____

4. What topic(s) would you like to have considered for future solar energy briefings?_____

   _____

   _____

5. What follow-up activities should we consider to help you or your firm? (Distribute papers, publications, other briefings, etc.)_____

   _____

6. What specific action, if any, do you expect to take as a result of attending this briefing._____

   _____

7. How did you find out about this seminar?

   _____I received the brochure directly

   I learned about it:

   _____through company channels _____from a work associate

   _____from a friend _____from a public announcement

   _____other_____

(Over)

8. Type of organization:

_____Manufacturing _____Research and development

_____Builder _____Service (Professional architect, engineer, consulting, etc.)

_____Utility _____Swimming pool construction

_____Agriculture _____Educational

_____Other (please specify)_____

9. (Optional) Name:_____

Title:_____

Company:_____

City:_____State:_____Zip:_____

NOTE: If you find it inconvenient to turn in the questionnaire at the end of this conference, please return it by June 1 to:

Industrial Development Division
The University of Michigan
2200 Bonisteel Boulevard
Ann Arbor, MI 48109