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*for a sustainable future*

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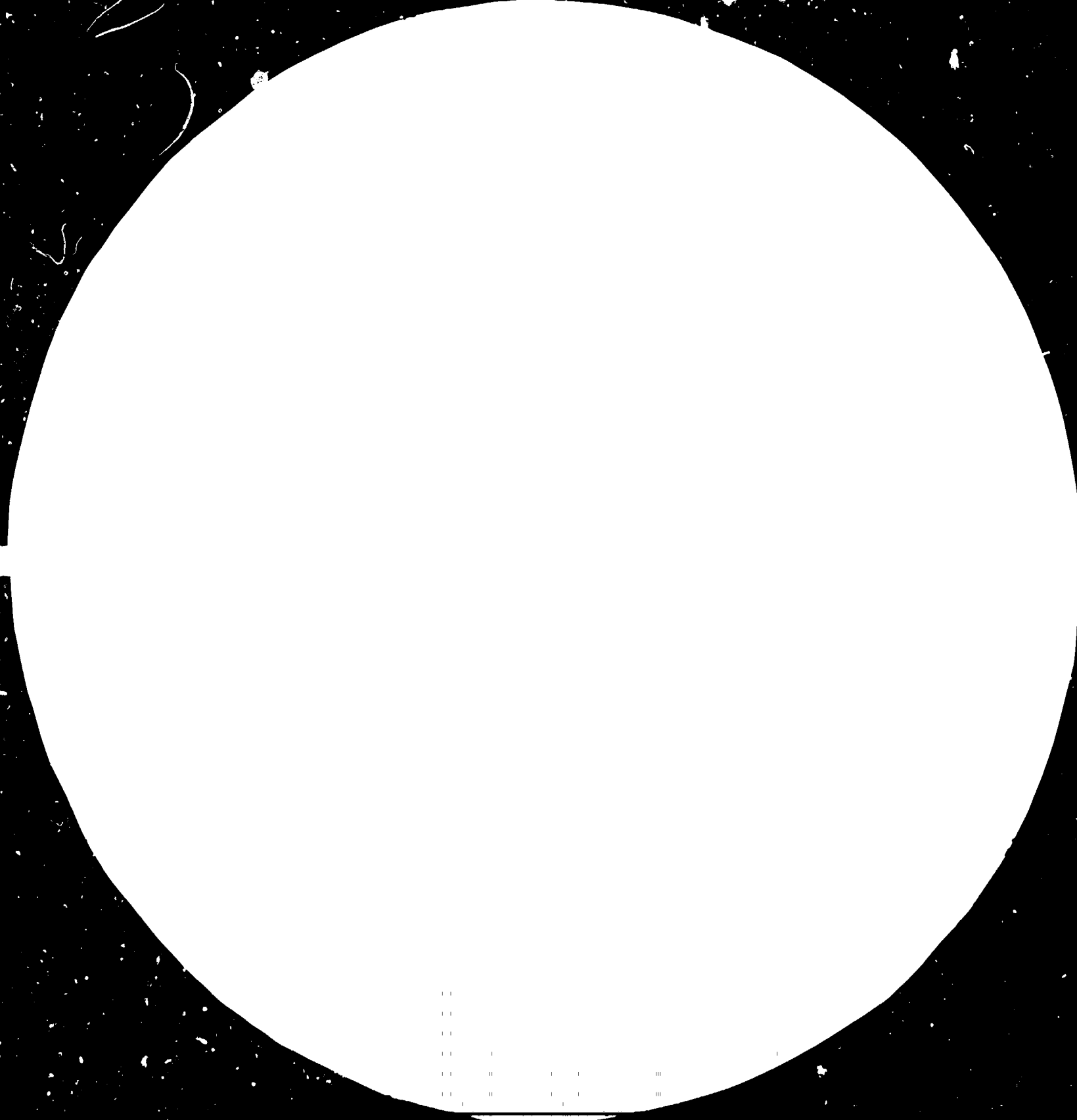
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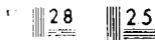




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MICROCOPY RESOLUTION TEST CHART  
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UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

ENGLISH

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DIRECTORY OF SOLAR RESEARCH INSTITUTES  
IN DEVELOPING COUNTRIES\*

Prepared by

INTIB - THE INDUSTRIAL AND TECHNOLOGICAL INFORMATION BANK

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INTRODUCTION

This is the second revision of a document originally published by UNIDO in 1982. The information contained in this document is based on questionnaires completed by institutes that had contributed previously as well as others that have become known to us in the meantime. Emphasis has again been given to indication by research institutes of areas in which they would like cooperation with similar institutes. The directory is thereby envisaged to promote international cooperation on solar research and commercialization of results of research. It is hoped that data provided in this directory will be used to promote contact and cooperation among institutions which may eventually lead to regional networks. UNIDO will be glad to assist in such networking efforts.

The information has been presented as provided by contributors on UNIDO's questionnaires circulated early in 1984 and during 1985. No standard terminology has been used regarding research activities except in the subject index preceding the data sheets where activities have been classified into accepted main categories of solar energy utilization. The questionnaires have also been fed into UNIDO's LINK data base for ease of updating the information as required.

We would like to thank those who have contributed to this directory and would welcome suggestions for improving it; corrections; or information on additional institutes who are interested in cooperative programmes in solar energy. It is intended to update this directory on a regular basis. A copy of the questionnaire is included at the back of this volume. For institutes not already contained herein this should be completed and returned to:

INTIB  
UNIDO's Technology Programme  
P.O. Box 300  
A-1400 Vienna  
Austria

SUBJECT INDEX

<u>Area of solar research</u>	<u>Institutes</u>
Active heating and cooling (space)	002, 006, 009, 023, 027, 029, 036, 039, 050, 051, 054, 055, 063, 064, 065, 067, 072, 073, 077, 081, 087, 092, 097, 109, 110
Collectors (flat plate and concentrating)	004, 007, 009, 010, 011, 027, 028, 029, 030, 036, 038, 041, 042, 047, 049, 062, 063, 073, 077, 078, 097, 102, 103, 107, 108
Desalination/Distillation	007, 009, 016, 022, 027, 028, 032, 033, 035, 045, 046, 049, 055, 056, 060, 064, 066, 067, 070, 071, 089, 098, 101, 102, 103, 107
Drying (crop, fish, timber etc.)	005, 006, 007, 009, 010, 011, 014, 016, 017, 018, 019, 022, 023, 026, 028, 033, 035, 038, 041, 044, 051, 055, 056, 057, 059, 060, 065, 066, 067, 070, 072, 073, 077, 078, 080, 089, 093, 096, 097, 098, 101, 102, 103, 107, 109, 114, 115
Greenhouse	005, 028, 047, 073
Industrial process heat	022, 027, 033, 038, 039, 110
Passive heating and cooling (space)	005, 007, 023, 028, 038, 039, 041, 046, 068, 070, 073, 078, 081, 086, 110
Photo-electrochemical conversion	029, 030, 031, 047
Photothermal conversion	002, 006, 009, 013, 029, 030, 034, 039, 053, 056, 073, 075, 092, 101, 102
Photovoltaic conversion (cells and systems)	001, 002, 004, 007, 008, 009, 013, 015, 021, 022, 025, 026, 027, 028, 030, 034, 042, 043, 044, 048, 050, 053, 054, 059, 060, 061, 073, 074, 075, 071, 081, 087, 088, 092, 095, 097, 099, 100, 102, 105, 106, 108, 111
Selective coatings	024, 028, 036, 056, 101, 102
Solar cooker	016, 019, 020, 022, 024, 026, 035, 037, 038, 070, 071, 089, 094, 095, 113, 115
Solar cooling and refrigeration	007, 009, 011, 015, 018, 022, 026, 027, 028, 029, 033, 035, 037, 048, 052, 056, 059, 062, 066, 072, 087, 097, 101, 102

Solar furnace	104
Solar materials	001, 028, 030, 031, 042, 069, 073, 076, 104, 111

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Area of solar research

Institutes

Solar pond	027, 035, 041, 082, 087, 097
Solar radiation measurements	004, 007, 009, 012, 015, 017, 027, 044, 046, 050, 059, 062, 066, 072, 081, 082, 088, 092, 097, 102, 112, 113
Solar still	019, 055
Thermal storage	002, 009, 028, 049, 078, 112
Water heating	009, 010, 016, 022, 023, 026, 028, 033, 035, 036, 037, 038, 044, 049, 050, 051, 054, 056, 065, 066, 070, 071, 073, 075, 076, 077, 079, 082, 084, 089, 090, 103, 115
Water pumping (pv and thermal)	007, 009, 022, 027, 037, 043, 044, 052, 063, 084, 087, 103, 114

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Related areas

Biomass/biogas	006, 007, 009, 010, 011, 012, 013, 014, 015, 017, 019, 022, 026, 027, 029, 033, 034, 037, 041, 043, 048, 053, 055, 058, 060, 061, 073, 078, 079, 081, 083, 084, 085, 093, 094, 100, 102, 109, 115
Wind energy	007, 009, 010, 011, 012, 013, 015, 022, 026, 027, 029, 033, 034, 038, 045, 046, 049, 050, 053, 061, 064, 079, 082, 083, 084, 093, 099, 102, 108, 114
Mini-hydro	007, 010
Geothermal	006, 053
Hydrogen generation	022
Wood stoves	007, 012, 015, 019, 041
Energy conservation	005, 007, 023, 028, 031, 068, 077, 082, 085, 086, 091, 093, 110
Information and documentation	015, 040, 103

ALGERIA

001. CENTRE DE DEVELOPPEMENT DES MATERIAUX - LABORATOIRE DES MATERIAUX SOLAIRES

2, Bd. Frantz Fanon  
BP 1017 Alger Gare  
Algeria

Telephone: 61 14 18

Telex: 52 245  
53 902

Director: A. Ould-Kaddour

Contact person: A. Ramdane, Chargé de Recherche

6 professional staff (5 PhD)

Government funded

Areas of research:

- Technology of single crystal silicon solar cells and of amorphous silicon solar cells
- Electrical, optical and structural characterization of these materials and cells
- Photovoltaic module encapsulation techniques
- Semiconductor detectors

Current projects:

- All areas as listed under 'Areas of research'

Joint research programmes carried out with:

- ENTE, Sidi-Bel-Abbes, Algeria

Suggested areas of co-operation with other research institutes:

- All areas as listed under 'Areas of research'



002. ENERGY CONVERSION DEVELOPMENT CENTER (C.D.C.E.)

2, Boulevard Frantz Fanon  
BP 1017 Alger - Gare  
Algeria

Telephone: 61 14 18

Telex: 53 902  
52 245 NAWAT DZ

Director: Boualem Tatah

Contact person: A. Boudiaf, Research Scientist

5 professional staff (2 PhD)

Government funded

Areas of research:

- Photovoltaic solar energy conversion
- Solar distillation
- Solar thermal systems
- Energy storage
- Solar cooling systems
- Solar heating systems

Current projects:

- Experimental photovoltaic plant, the electrification of a village (= 100 KWp)
- Energy storage systems
- Solar cooling systems :

003. STATION D'EXPERIMENTATION DES EQUIPEMENTS SOLAIRES

Route de l'observatoire  
Bouzaréah  
Alger  
Algeria

Telephone: 78 42 29  
79 12 08

Telex: 53 198 SEES

Director: Belhamel Maiouf

Contact person: Belhamel M., Director

100 professional staff (5 PhD)

Government funded

Areas of research:

- Photovoltaic solar energy
- Thermal solar energy
- Wind energy
- Geothermal energy
- Biomass

Current projects:

- Photovoltaic solar energy pumping
- Refrigeration
- Solar heating
- Desalination

Commercialized projects:

- Desalination
- Photovoltaic ground lighting
- Heating

Suggested areas of co-operation with other research institutes:

- Refrigeration
- Thermodynamic pumping
- Desalination

ARGENTINA

004. COMISION NACIONAL DE INVESTIGACIONES ESPACIALES (CNIE)  
DEPARTAMENTO DE ENERGIAS NO CONVENCIONALES

Av. Mitre 3100  
1663-San Miguel-Buenos Aires  
Argentina

Telephone: 667-1272/2691/3044    Telex: LANBA AR  
664-1006/1209                            17511

Contact person: Ing. Alfredo Rapallini, Head of Department

12 professional staff

Government funded

Annual budget 1984: US\$ 150,000

Areas of research:

- Solar radiation measurements,  
installation and operation of a solar radiation network  
(50 stations)
- Solar collectors testing and modelling
- Photovoltaic systems

Current projects:

- Installation of a solar radiation network, presently 35 stations  
are in operation
- Photovoltaic systems (two pumping installations, one with 2 kWp  
and one with 4 kWp)

Commercialized projects:

Inflatable plastic air heating collectors for agricultural dryers  
have been developed and the technology transferred to a private  
company which is producing them

Joint research programmes carried out with:

- DFVLA, FRG, on the 2 kWp photovoltaic pumping project
- IILA, Italy, on the 4 kWp project

Suggested areas of co-operation with other research institutes:

In the above-mentioned areas with institutes in developing countries

005. GRUPO DE ENERGIA SOLAR - INSTITUTO DE FISICA ROSARIO  
(CONICET-UNR/GES-IFIR)

Av. Pellegrini 250  
2000 Rosario  
Argentina

Telephon: (041) 63451

Telex: CIROS-AR 41817

Director: Dr. M. Castagnino

Contact person: Dr. R.D. Piacentini, Director, GES-IFIR

11 professional staff (2 PhD)

Government funded

Annual budget 1984: US\$ 15,000

Areas of research:

- Solar drying of agricultural products
- Greenhouses with efficient energy use
- Solar houses and buildings in humid and hot temperate climate
- Energy conservation in buildings

Current projects:

- Underground greenhouses with solar irradiation through lightduct
- Passive solar houses in humid and hot temperate climate
- Incidence of solar radiation in highly glassed buildings

Commercialized projects:

Solar bean with collectors of simple design

Joint research programmes carried out with:

- Laboratorio de Hidraulica, Saneamento e Meio-Ambiente
- Universidade Catolica do Parana, Rua Imaculada Conceicao, 115 - Prado Velho 80000, Curitiba, Brasil

Suggested areas of co-operation with other research institutes:

- Financial support for the exchange programme with Universidade do Parana (Brasil)
- Solar architecture
- Energy conservation

006. INSTITUTO DE INVESTIGACIONES EN ENERGIA NO CONVENCIONAL (INENCO)

Universidad Nacional  
Buenos Aires 177  
4400 Salta  
Argentina

Telephone: 220500-145

Director: Mr. Luis R. Saravia

30 professional staff (7 PhD)

Government funded

Annual budget 1984: US\$ 100,000  
without  
salaries

Areas of research:

- Solar energy (thermal applications: housing, drying, minerals)
- Biomass (alcohol production)
- Geothermy

Current projects:

- Solar houses
- Solar drying of tobacco and red pepper
- Uses of solar ponds in mineral production
- Encymatic conversion of cellulose

Commercialized projects:

- Solar houses
- Drying of red pepper
- Solar production of  $\text{Na}_2\text{SO}_4$

Joint research programmes carried out with:

Several institutes, on national and international level

Suggested areas of co-operation with other research institutes:

As stated under 'Current' and 'Commercialized projects'

BARBADOS

007. CARIBBEAN DEVELOPMENT BANK/TECHNOLOGY AND ENERGY UNIT (CDB/TEU)

P.O. Box 408, Wildey  
St. Michael, Barbados  
West Indies

Telephone: (809) 426-1172      Telex: WB2287      Cable: CARIBANK

Contact person: Jeffrey Dellimore, Manager, Technology and Energy Unit

7 professional staff (1 PhD; 6 in-house consultants)

Funded by CDB and USAID

Annual budget 1984: US\$ 650,000

Areas of research:

- Solar crop drying
- Testing of solar collectors
- Desalination/distillation
- Passive cooling
- Solar radiation measurement
- Water pumping (photovoltaic)
- Photovoltaics
- Wind powered refrigeration
- Wind resource assessments
- Generation of electricity from wind (grid connected)
- Biomass - use of agricultural and industrial wastes
- Charcoal Production/cookstove design and testing
- Biogas
- Mini-hydro
- Energy conservation

Current projects:

- A. More efficient use of oil
  - Hotel energy audits - Grenada
  - Hotel Energy Conservation Manual
  - Energy efficient pilot ceramic tile project
- B. Fuel Substitution
  - Bagasse for electricity generation (with ODA, CIDA AND CSC)
  - TEU passive solar building
  - Non-conventional water heating in tourism sector
  - Solar drying of chilli peppers
  - Testing of solar collectors
  - Wind turbine demonstration - Antigua
  - Integrated energy programme - Orange Hill, St. Vincent
  - Biogas from arrowroot bittie

- Monitoring and evaluation of TEU passive Sola Building
- Biogas at river plantation
- Wind-powered chill room - St. Lucia
- Electric power production from sawmilling wastes
- Grid-connected mini-hydro demonstration - Dominica
- Red Mud Plastic Bag Digester (200m<sup>3</sup>)
- Wind Turbine Project - CDB
- UWI Solar Still Demonstration Project
- Pilot Biodigester at Wallilabou Factory - St. Vincent
- C. Rural development and reducing recruitment of new fossil fuel consumers
  - Banana transportation by aerial cableway
  - Hydropower resources assessment - Dominica
  - Promotion of simple domestic solar dryers
  - Improving charcoal and fuelwood production and utilization
- D. Preparation to meet future needs
  - Peat resource assessment - Belize
  - Wind and solar energy resource assessment
  - Testing and demonstration of photovoltaic solar pumping system
  - Biomass resource assessment
  - Regional renewable energy development station - feasibility study
  - Mineral resource assessment
- E. Employment generation/utilization of indigenous resources
  - Coir fibre pilot plan
  - Chemical lime - Antigua
  - Control of crop damage by monkeys
  - Caribbean Appropriate Technology Centre - feasibility study
  - Banana stem defibering pilot plant
  - Feed and fertilizer from protein wastes
  - Utilization of coconut wood
  - Mechanical harvesting of arrowroot
  - Assessment of arrowroot processing technology

Commercialized projects:

- Solar water heating standards - Barbados
- Drying of chilli peppers - Guyana
- Biodigestion of process wastes at Arrowroot Factory in St. Vincent

Joint research programmes carried out with:

CDB/TEU provides financing and supervises implementation of projects carried out by Institute of Applied Science and Technology, Georgetown, Guyana; Barbados National Standards Institution, St. Michael, Barbados; Caribbean Meteorological Institute, Bridgetown, Barbados; Caribbean Agricultural Research and Development Institute, St. John's, Antigua; Antigua Public Utility Authority, St. John's Antigua; German Appropriate Technology Exchange, Eschborn, FRG; Volunteers in Technical Assistance, Arlington, Va., USA; CARICOM Secretariat, Georgetown, Guyana.

Suggested areas of co-operation with other research institutes:

Sharing of technical information and results of pilot projects in other developing countries, especially small-scale industry, renewable energy and labour-saving devices for small farmers

BRAZIL

008. INSTITUTO DE FISICA - UNIVERSIDADE ESTADUAL DE CAMPINAS,  
GRUPO DE ENERGIA

P.O. Box 6165, UNICAMP  
13.100 Campinas, SP  
Brazil

Telephone: (0162) 39 12 32      Telex: (019) 1150

Director: Prof. M. Zwanziger

Contact person: Prof. I. Chambouleyron, Head, Photovoltaic Programme

5 professional staff (PhD)

Government and private funded      Annual budget 1984: US\$ 100,000

Areas of research:

Photovoltaic cells and materials

Current projects:

- Polycrystalline silicon solar cells
- M-I-S and SIS solar cells
- Amorphous silicon solar cells

Suggested areas of co-operation with other research institutes:

Amorphous silicon solar cells



BURUNDI

009. CENTRE D'ETUDES BURUNDAIS EN ENERGIES ALTERNATIVES - CEBEA

B.P. 255  
Bujumbura  
Burundi

Telephone: 5710

Director: J-P. Trussart, Project Manager  
Contact person: J-P. Trussart

5 professional staff

Government funded  
+ technical assistance  
from Belgium

Annual budget 1984: US\$ 400,000

Areas of research:

- Active heating
- Refrigeration
- Collectors
- Distillation
- Domestic water heating
- Drying
- Photovoltaic conversion
- Solar radiation measurements
- Thermal conversion
- Thermal storage
- Water pumping
- Wind energy
- Gasifiers

Current projects:

As above

Joint research programmes carried out with:

- USAID (dryers and peat)
- European Community (gasifiers, thermal heating)
- University of Burundi
- Federal Republic of Germany (meteorology)
- CEPGL (Zaire - Rwanda - Burundi)
- UNESCO - ANSTI
- various ministries and research institutes in Belgium

010. CENTRE DE RECHERCHE DES UTILISATIONS DES ENERGIES ALTERNATIVES (CRUEA)

B.P. 2700,  
Bujumbura  
Burundi

Telephone: 55 56

Telex: BDI 81

Director: Dr. Joseph Katihabwa

Contact person: Dr. Joseph Katihabwa

6 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 1,500

Areas of research:

- Solar energy in general
- Biomass (biogas, gasification)
- Wind energy
- Hydro-power

Current projects:

- Solar collectors for crop drying and water heating
- Biogas and gasification

Suggested areas of co-operation with other research institutes:

- Solar energy
- Biomass
- Wind power
- Hydro-power

CAMEROON

011. ECOLE NATIONALE SUPERIEURE POLYTECHNIQUE

B.P. 728,  
Yaounde  
Cameroon

Telephone: 23 12 26

Telex: UY 8384

Director: Mr. Henri Botta

Contact person: Mr. Ernest Kaptouom, Head of partment

6 professional staff (2 PhD)

Government and private funded

Annual budget 1984: US\$ 6,250

Areas of research:

- Solar absorption and refrigeration
- Design of a flat air-type collector and application for the drying of agricultural products

Current projects:

- Cold chain, particularly in the area of photovoltaic cold production for the preservation of medicines and perishable foods in rural areas

Commercialized projects:

Drying of agricultural products by means of a solar drier

Joint research programmes carried out with:

French energy research associations:

- Universite Claude Bernard, Lyon
- Fluid Thermodynamics Laboratory of the University of Paris, Sud Orsay
- Energy and Theoretical and Applied Mechanics Laboratory, INPL, Nancy
- GERDAT, Montpellier

Suggested areas of co-operation with other research institutes:

- Cold chains, particularly in the area of photovoltaic cold production for the preservation of medicines or perishable foods in rural areas
- Drying of agricultural products

012. INSTITUTE FOR GEOLOGICAL AND MINING RESEARCH (IRGM),  
ENERGY RESEARCH LABORATORY (LRE)

B.P. 4110  
Yaounde  
Cameroon

Telephone: 23 00 08

Director: Mr. Djallo Soba

Contact person: Mr. Augustin Simo, Chief, LRE

8 professional staff

Government funded

Annual budget 1984: US\$ 50,000

Areas of research:

- Solar Energy Applications
- Biomass
- Wind energy

Current projects:

- Solar radiation measurement
- Wind energy measurement
- Solar electrification of rural welfare centres
- Study of substrates for biogas production
- Woodstove

Suggested areas of co-operation with other research institutes:

- Biomass
- Bioenergy

EGYPT

013. DESERT DEVELOPMENT CENTER, THE AMERICAN UNIVERSITY IN CAIRO

113, Sharia Kasr El Aini  
Cairo  
Egypt

Telephone: 22 969-186

Telex: 92224  
AUCAI UN

Cable: Victorious  
Cairo

Director: Dr. Adli Bishay

Contact person: Dr. Adli Bishay

33 professional staff (15 PhD)

Government and private funded

Annual budget 1984: US\$ 1,500,000

Areas of research:

- Applications of renewable energy for desert development
- Solar thermal and photovoltaic
- Wind/electrical and mechanical
- Biogas
- Hybrid systems

Current projects:

Applications of renewable energy for desert development sponsored by USAID through Egyptian Supreme Council of Universities (Mini & Maxi University Linkages Projects).

Joint research programmes carried out with:

- University of Alexandria, Alexandria, Egypt
- University of Arizona, Tucson, Arizona, USA
- Wye College, London University, England

Suggested areas of co-operation with other research institutes:

Desert Development

ETHIOPIA

014. SCIENCE AND TECHNOLOGY UNIT (SIT/WRD),  
UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA),

P.O. Box 3001  
Addis Ababa  
Ethiopia

Telephone: 44 72 00-215                      Telex: 21029                      Cable: UNECA ET

Director: Prof. A Adedeji, Executive Secretary, UNECA

Contact person: Prof. S. Jugessur, Chief, Science and Technology Unit

2 professional staff

United Nations funded                      Annual budget 1984: US\$ 633,300

Areas of research:

- Solar drying of marine products
- Biogas generation

Current projects:

As above

Joint research programmes carried out with:

African Regional Centre for Technology, B.P. 2435, Dakar, Senegal

Suggested areas of co-operation with other research institutes:

- Solar drying in general
- Biogas generation

FIJI

015. ENERGY STUDIES UNIT (ESU), INSTITUTE FOR NATURAL RESOURCES

University of the South Pacific  
Suva  
Fiji

Telephone: 313900

Telex: FJ2276

Cable: UNIVERSITY  
SUVA

Director: Dr. John Morrison

Contact person: Dr. Bob Lloyd, Project Manager

4 professional staff

Funded by Government and AID

Annual budget 1984: US\$ 50,000

Areas of research:

- Solar radiation measurement
- Photovoltaic conversion
- Solar Refrigeration
- Energy surveys
- Energy audits
- Wind monitoring - small windmill assessment
- Wood stove testing
- Wood gasification

Current projects:

- Solar refrigeration
- Wind monitoring programme (Coom Islands)
- Wood gasification
- Wood stove testing
- Light efficiency testing

Joint research programmes carried out with:

- UN Pacific Energy Programme,  
Private BAG, Suva

Suggested areas of co-operation with other research institutes:

As above

GHANA

016. DEPARTMENT OF MECHANICAL ENGINEERING,  
UNIVERSITY OF SCIENCE AND TECHNOLOGY

Kumasi  
Ghana

Cable: KUMASITECH  
GHANA

Director: Dr. V.K.A. Kpodo, Head of Department

Contact person: Dr. V.K.A. Kpodo

3 professional staff (1 PhD)

Government funded

Annual budget 1984: US\$ 50,000

Areas of research:

Harnessing and applications of solar energy

Current projects:

- Solar cookers
- Solar water heaters
- Solar crop dryers
- Solar distillation
- Evaporative coolers

Joint research programmes carried out with:

GTZ of the Federal Republic of Germany

Suggested areas of co-operation with other research institutes:

- Solar pumps for water supply and  
Irrigation applications



017. DEPARTMENT OF PHYSICS, UNIVERSITY OF GHANA, LEGON

P.O. Box 63  
Legon  
Ghana

Telephone: 75381

Cable: University, Legon

Director: Dr. E.K. Agyei

Contact person: Dr. R.D. Baeta, Senior Lecturer

3 professional staff

Government funded

Annual budget 1984: US\$ 25,000

Areas of research:

- Solar insolation
- Crop drying
- Biomass

Current projects:

Solar insolation studies of the sub-region (collaborative work)

Joint research programmes carried out with:

- Laboratoire sur L'Energie Solaire, Universite du Benin, B.P. 1515, Lome, Togo (Dr. M. Gniniivi)
- E.A.S.T., Universite Nationale du Benin, Cotonou, Republic Populaire du Benin (Dr. T. Bondu-Zin)

Suggested areas of co-operation with other research institutes:

- Crop drying
- Biomass
- Photovoltaics

018. INDUSTRIAL RESEARCH INSTITUTE

P.O. Box M.32  
Accra  
Ghana

Telephone: 75202/77758

Telex: SCIENCES

Director: Ms. A. Amoako-Mensah

Contact person: Dr. M.F. Damphey, Engineering Consultant

30 professional staff (4 PhD)

Government funded

Annual budget 1984: US\$ 905,593.45

Areas of research:

- Solar dryer: for farm produce (cassava, pepper ground nuts etc.)
- Solar cooler: for preserving perishables (meat, fish, vegetables, cold water for rural people etc.)

Current projects:

Solar dryer: extension service for cocoa beans for the benefit of cocoa farmers (about to start)

Commercialized projects:

Information on solar dryer to women in development is being applied in small-scale cassava flour (Konkonte) factory

Joint research programmes carried out with:

Food Research Institute (CSIR) Ghana

Suggested areas of co-operation with other research institutes:

- Solar electric generators
- Solar cookers

INDIA

019. AGRICULTURAL TOOLS RESEARCH CENTRE (ATRC)

Suruchi Campus  
Post Box 4  
Bardoli 394601  
India

Telephone: 95, 258

Director: Mr. Mohan Parikh

Contact person: Mr. Rahul Parikh, Research Engineer

2 professional staff

Private funded

Annual budget 1984: US\$ 3,000

Areas of research:

- Solar cooker - box type
- Solar still
- Solar dryer
- Biogas manure plants
- Wood burning stoves

Current projects:

- Design of low-cost and reliable fixed dome biogas manure plant
- Design of solar dryer for food drying and cattle meat drying

Commercialized projects:

- Solar cookers - about 1000 marketed
- Solar stills - 5 marketed
- Biogas plants - ATRC design adopted by a few thousand farmers

Suggested areas of co-operation with other research institutes:

- Solar distillation
- Solar drying
- Wood burning stoves

020. APPROPRIATE TECHNOLOGY DEVELOPMENT ASSOCIATION (ATDA)

P.O. Box 311  
Gandhi Bhawan  
Lucknow 226001 (U.P.)  
India

Telephone: 33 506

Cable: APTECH

Director: Mr. M.M. Hoda, Director-cum-Secretary General

Contact person: Mr. M.M. Hoda

28 professional staff

Government and private funded

Annual budget 1984: US\$ 700,000

Areas of research:

- Rural planning
- Agriculture
- Animal husbandry
- Health and Sanitation
- Energy
- Housing and construction
- Cottage and rural industries
- Water supply

Current projects:

- Wool spinning
- Cotton spinning
- Agricultural tools
- Mini cement
- Mini sugar
- Solar cooker
- Water mill
- Dairying
- Hydraulic ram

Commercialized projects:

Mini sugar

Joint research programmes carried out with:

- Bremen Overseas Research and Development Association (BORDA), FRG
- Khadi & Village Industries Commission (KVIC), Bombay, India
- U.P. Gandhi Smarak Nidhi, Lucknow, India
- Intermediate Technology Development Group (ITDG) London, UK
- I.T./I.S, Rugby, UK

021. BHARAT HEAVY ELECTRICALS LIMITED, CONTROL EQUIPMENT DIVISION

P.O. Box 2606  
Mysore Road  
Bangalore - 560 026  
India

Telephone: 60 30 24 Telex: 0845-436 Cable: BHARATELEC

Director: Mr. M.S.S. Murthy, General Manager

Contact person: Mr. E.S. Ramamurthy, Dy. General Manager

30 professional staff (4 PhD)

Government funded

No separate allocation, included in original R+D budget

Areas of research:

- Alternate low cost processing techniques for single crystal solar cells
- Improvements in solar cells for space applications
- Use of polycrystalline silicon in solar cell processing line
- Amorphous silicon technology

Current projects:

- Optimization of AR coating for specific types of texturized surfaces
- Compatibility of polycrystalline silicon wafers with specific processing techniques used in single crystal line
- Screen printed solar cells
- Design and installation of 100 kW photovoltaic power station

Suggested areas of co-operation with other research institutes:

- All areas of solar cell manufacture, both for terrestrial and space applications
- System engineering and evaluation of medium and large sized photovoltaic power stations

022. CENTRAL ARID ZONE RESEARCH INSTITUTE

Jodhpur  
India

Telephone: 23986  
21865

Cable: ARIDZONE

Director: Dr. K.A. Shankarnarayan

Contact person: Dr. Jagdish P. Gupta, Head, Division of Wind Power and  
Solar Energy Utilization and Principal Investigator and  
Co-ordinator (Solar Energy)

7 professional staff (3 PhD)

Government funded

Annual budget 1985: US\$ 1,000,000

Areas of research:

- Solar energy for water heating, cooking, drying, distillation/desalination, process heat for industries, brine evaporation, water pumping, refrigeration, candle making, photovoltaic conversion, hydrogen generation, etc.
- Wind power for water pumping, electric generation
- Biogas for cooking, illumination

Current projects:

- Eco-energy use pattern and energy management
- Solar water heaters
- Solar cookers
- Solar desalination, distillation and electrodialysis
- Solar dryers
- Saline brine evaporation
- Caustic soda regeneration
- Solar thermal storage
- Solar collection from natural surfaces
- Multipurpose solar devices
- Solar cells
- Pulsed concentrated solar radiation for seed growth (Exploratory study)
- Zeolite for refrigeration (Exploratory study)
- Hydrogen energy systems (Exploratory study)
- Wind power for water pumping and battery charging
- Low cost biogas plants

Commercialized projects:

Know-how given to entrepreneurs for commercialization of natural circulation type solar water heaters and solar cookers (oven and box type) and to railways for multisteped basin solar stills.

Joint research programmes carried out with:

The Institute co-ordinates the activities on solar energy at Central Institute of Agricultural Engineering, Bhopal, Central Rice Sukhadia University, Udaipur and Tamil Nadu Agricultural University, Coimbatore under an All India Co-ordinated Research Project for Renewable Energy Sources for Agriculture and Agrobased Industries.

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research' and 'Current projects' and also on wood burning cook stoves.





024. CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (CECRI)

Karaikudi - 623 006  
India

Telephone: 368

Telex: 04 55-285

Director: Dr. K.S. Rajagopalan

Contact person: Mr. S. John, Scientist

4 professional staff

Government funded

Annual budget 1984: US\$ 7,000

Areas of research:

- Solar absorber coatings for flat plate collectors and concentrators
- Solar cooker

Current projects:

High temperature solar absorber coatings for concentrators

Suggested areas of co-operation with other research institutes:

Solar absorber coatings for flatplate collectors and concentrators

025. CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE (CEERI)

SSD Division, CEERI  
Pilani  
Rajasthan - 333 031  
India

Telephone: 192

Cable: ELECTRONIC

Director: Dr. Amarjeet Singh

Contact person: Dr. W.S. Khokle, Deputy Director

8 professional staff (2PhD)

Government funded

Annual budget 1984: US\$ 100,000

Areas of research:

- Photovoltaics
- Development of high efficiency solar cell for panel fabrication using concentrated sunlight

Current projects:

Development of high efficiency silicon and GaAs solar cells

Suggested areas of co-operation with other research institutes:

- Photovoltaics
- Silicon solar cells fabrication for concentrated sunlight (30-50x)

026. CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING

Additional A-Block, GTB Complex  
T.T. Nagar  
Bhopal - 462 003 (M.P.)  
India

Telephone: 63 618, 62 756, 62 598, Telex: 0705- Cable: KRIYANTRA  
75 616, 75 141, 75 088, 273  
74 535

Director: Dr. T.F. Ojha

Contact person: Dr. R.C. Maheshwari, Head, E.M.E. Division

38 professional staff (11 PhD)

Government funded

Annual budget 1984: US\$ 1,000,000

Areas of research:

- Research and development of tools, implements and machinery for agricultural production
- Post harvest technology and sources of energy and power for agriculture and rural sector

Current projects (under the energy research programme):

- Solar cooking
- Solar water heating
- Solar photovoltaic pump
- Crop drying
- Solar irrigation
- Solar refrigeration
- Wind energy
- Biogas

Joint research programmes carried out with:

- International Crop Research Inst. of Semi Arid, Hyderabad, India
- International Rice Research Institute, Philippines
- Regional Network for Agricultural Machinery, c/o UNDP Philippines
- National Institute of Agricultural Engineering, Silsoe, UK

Suggested areas of co-operation with other research institutes:

- Solar greenhouse
- Solar crop drying
- Biomass energy conversion
- Biogas technology
- Wind energy utilization for irrigation

027. CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE (CSMCRI), BHAVNAGAR

Gijubhai Badheka Marg  
Bhavnagar - 364 002  
Gujarat  
India

Telephone: 24496, 23960

Telex: 0162-230

Cable: NAMAK  
BHAVNAGAR

Director: Prof. M.M. Taqui Khan

Contact person: Dr. S.D. Gomkale, Scientist

14 professional staff (5 PhD)

Government (mainly) and  
private funded

Annual budget: US\$ 60,000-80,000

Areas of research:

- Air conditioning and refrigeration
- Collectors
- Desalination/distillation
- Industrial process heat
- Photovoltaic conversion (applications)
- Solar pond
- Solar radiation measurements
- Water pumping
- Wind energy
- Biomass

Current projects:

- Deep solar pond for thermal energy and subsequently power generation
- Solar thermal applications like industrial heat, desalination and cooling
- Solar radiation measurements

Commercialized projects:

Installed demonstration plants for solar water and air heating in three textile mills

Joint research programmes carried out with:

- The Institute worked under UNIDO for setting of solar stills plant in Republic of Somalia (1978-1979);
- The Institute is planning to work with National Aeronautical Laboratory, Bangalore, on solar pond project;
- Work was completed on solar thermal pump in collaboration with Swiss Development Corporation.

Suggested areas of co-operation with other research institutes:

- Desalination
- Solar pond
- Solar cooling

028. CENTRE FOR ENERGY STUDIES, INDIAN INSTITUTE OF TECHNOLOGY, DELHI

Hauz Khas  
New Delhi - 110 016  
India

Telephone: 66 69 79-254  
65 40 54

Cable: TECHNOLOGY DELHI

Director: Prof. N.M. Swani, Director, Indian Institute of Technology

Contact persons: Prof K.L. Chopra, Head, Centre for Energy Studies;  
Prof. S.S. Mathur

27 professional staff

Government and private funded

Areas of research:

- Photovoltaic conversion
- Photovoltaic materials
- Selective coatings
- Low temperature applications of solar energy
- Solar water heating
- Solar drying
- Solar passive heating and cooling
- Solar desalination
- Solar refrigeration
- Greenhouses
- Thermal storage
- Linear solar concentrations
- Concentrators
- Plastic collectors
- Bioenergy
- Energy conservation

Current projects:

- Solar photovoltaics
- Water heating
- Solar drying
- Solar desalination
- Solar cookers
- Solar passive building
- Energy conservation

Joint research programmes carried out with:

- C.N.R.S., France
- International Potato Centre, Peru
- National Industrial Corporation Ltd., New Delhi
- with institutes worldwide, especially in FRG, France and Norway

Suggested areas of co-operation with other research institutes:

In spite of its co-operation programme with developed countries, the Institute is willing to co-operate with developing countries. A United Nations University sponsored programme is already under progress at the CES to train the scientists, technologists and policy makers of various developing countries. Specifically, the Institute would wish to co-operate in:

- Photovoltaic materials
- Selective coatings
- Low temperature applications of solar energy
- Linear solar concentration
- Solar architecture
- Solar refrigeration

029. INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

Powai  
Bombay - 400 076  
India

Telephone: 58 14 21

Director: Prof. A.K. De

Contact person: Prof. S.P. Sukhatme, Deputy Director

10 professional staff

Government and private funded

Areas of research:

- (a) Solar thermal applications
  - Flat-plate collectors
  - Concentrators
  - Thermal power
  - Refrigeration
  - Space cooling
- (b) Biomass gasification and biogas
  - Use as fuels in automotive engines
- (c) Wind energy
  - Development of multiblade wind mill
- (d) Electrochemical cell development

Current projects:

- Solar concentrator development
- Flat-plate collectors using unconventional materials

Commercialized projects:

- Solar refrigeration
- Biomass gasification

Suggested areas of co-operation with other research institutes:

Any of the above-mentioned areas



030. INDIAN INSTITUTE OF TECHNOLOGY (IIT), KHARAGPUR

Kharagpur 2 - 721302  
(W.B.)  
India

Director: Prof. G.S. Sanyal

Contact person: Dr. P. Pramanik, Assistant Professor

425 professional staff (400 PhD)  
(including other sections)

Government funded

Annual budget 1984: US\$ 8,000,000  
(total budget IIT)

Areas of research:

- Solar collector
- Solar photovoltaics
- Solar electrochemical cell
- Development of solar energy materials
- Solar thermovoltaics

Current projects:

- Development of solar cell grade silicon
- Development of solar electrochemical cells

Joint research programmes carried out with:

Indian Association for Cultivation of Science, Calcutta 32

Suggested areas of co-operation with other research institutes:

- Solar furnace
- Solar photovoltaics
- Solar desalination plant

031. INTERDISCIPLINARY RESEARCH GROUP (IDRG)

Vikram Sarabhai Space Centre  
Trivandrum - 695 022  
India

Telephone: 56 38 58

Telex: 0884-201  
-202

Director: Dr. V.R. Gowariker

Contact person: Mr. S.K. Nema, Member, IDRG

6 professional staff (5 PhD)

Government funded

Annual budget 1984: US\$ 50,000

Areas of research:

- Photocatalysis
- Photoelectrochemical solar energy conversion systems
- Synthetic membrane development for solar energy conversion systems

Current projects:

- Photochemical hydrogen generation using perfluoromembrane modified cadmium sulfide semiconductor
- Photochemical diode membrane - synthesis, characterization and evaluation

Suggested areas of co-operation with other research institutes:

Photoelectrochemical and photoassisted water splitting (i.e. hydrogen generation) and systems development thereof

032. JAWAHARLAL NEHRU UNIVERSITY (JNU), UNIVERSITY INSTRUMENTATION CENTRE

Computer Centre Building  
New Delhi - 110067  
India

Telephone: 65 22 82-337(0)  
-299(R)

Cable: USIC/JAYENU

Director: Prof. P.N. Srivastava, Vice Chancellor

Contact person: Dr. G.C. Pandey

Government and private funded

Areas of research:

- (a) Solar energy
  - Solar water desalination/distillation
  - Integrated use of solar appliances
  - socio-economic study
- (b) Energy and environment
  - Application of solar/waste thermal (industrial) energy in water pollution control

Current projects:

- (a) Instrumentation
  - Development of methods for pollution control
  - Photo-acoustic spectroscopy
- (b) Studies on material for metal pollution control in aqueous systems

Commercialized projects:

Absorption of solar radiations by water: work on dyes has already been tested on large solar stills

Joint research programmes carried out with:

Not in the field of solar energy

Suggested areas of co-operation with other research institutes:

- Solar water distillation/desalination
- Studies on photo-electrochemical cells with special reference to their utilization in solar still
- Energy and environment

033. JYOTI LIMITED, ENERGY DIVISION

Tandalja  
Vadodara - 391 410  
India

Telephone: 59 518, 59 618      Telex: 01775-379      Cable: JYOTIPUMPS  
SUN-IN

Contact person: Dr. B.C. Jain, General Manager

30 professional staff (6)

Private funded      Annual budget 1984: US\$ 200,000

Areas of research:

- Solar hot water systems
- Solar hot air systems
- Solar steam generation systems
- Solar desalination systems
- Solar/biomass powered refrigeration systems
- Biomass gasification systems
- Wind electric conversion systems
- Waste heat recovery equipments

Current projects:

- (a) - Solar cabinet dryer
  - Solar wood seasoning kiln
  - Open tank thermosyphon solar systems
  - 100 kW wood gasifier engine system
  - 1 kW wind electric conversion system
- (b) - Solar hot water systems for various applications totalling nearly 10,000m<sup>2</sup> of collector area
  - Solar hot air systems for textile industry and for artificial marble manufacturing company
  - 350W wind electric conversion system for irrigation and village lighting applications
  - Solar powered cold storages of 10 TR and 30 TR capacity
  - Absorption refrigeration system based on waste vapours for chemical industry

Suggested areas of co-operation with other research institutes:

- Industrial hot water/hot air systems
- Biomass gasification systems

034. KAPUR SOLAR FARMS

Bijwasan Najafgarh Road  
P.O. Kapas Hera  
New Delhi - 110037  
India

Telephone: 391 747, 39 19 36

Telex: 2132

Director: Mr. Jagdish Chandra Kapur

Contact person: Mr. Jagdish Chandra Kapur

5 professional staff

Private funded

Annual budget 1984: US\$ 50,000

Areas of research:

Integrated energy systems for the satisfaction of variety of energy needs of rural communities in an optimal manner incorporating solar thermal, photovoltaics, wind, biogas generation, using a variety of animal, plant and human wastes.

Current projects:

- Related experiments using energy drawn from the integrated system for heating, refrigeration, cooking and other applications
- Application of research to three villages now under planning

Joint research programmes carried out with:

M/s. Danfoss India Ltd., New Delhi

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research' and 'Current projects'

035. MECHANICAL AND INDUSTRIAL ENGINEERING DEPARTMENT, UNIVERSITY OF  
ROORKEE (MIED/UOR)

Roorkee - 247667  
India

Director: Dr. D.V. Singh, Professor and Head

Contact persons: Dr. C.P. Gupta, Professor; Dr. Rajendra Prakash,  
Professor

18 professional staff (in thermal sciences group; 12 PhD)

Government funded

Areas of research:

- Solar refrigeration
- Solar distillation
- Solar dryers
- Solar power generation
- Solar assistance in kitchen
- Solar water heating

Current projects:

- Solar refrigeration
- Solar drying
- Solar assistance for kitchen
- Solar water heating
- Solar ponds

Commercialized projects:

- Solar heating of a factory shed
- Solar assistance for kitchens

Suggested areas of co-operation with other research institutes:

Solar engineering in general (all spheres)

036. RESEARCH AND DEVELOPMENT CENTRE, HINDUSTAN BROWN BOVERY LTD.

P.O.Box 284  
Vadodara 390 001  
Gujarat  
India

Telephone: 42 141 (5 lines)      Telex: 212      Cable: HINDBOVERI

Director: Mr. M. Sahadevan

Contact person: Mr. R.S. Soin, Senior Engineer

25 professional staff (25)

Private funded

Annual budget 1984: US\$ 60,000

Areas of research:

- Solar water heating
- Solar air heating
- Solar concentrator
- Two phase transport
- Energy management
- Selective surfaces

Current projects:

- Solar water heater: flow distribution studies and methods of balancing
- Solar air heater: field trials and commercial models
- Solar concentrator
- Selective coating

Commercialized projects:

- Solar water heater and energy management: 250 lpd to 35,000 lpd or more at 60-70 centigrade
- Solar air heater: entering the commercial market

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

037. RESOURCES DEVELOPMENT INSTITUTE (RDI)

1100 Qrs. Area  
Bhopal - 462 016  
India

Telephone: 65361

Cable: RESOURCES DEVELOPMENT  
INSTITUTE

Director: Mr. G.G. Puri, Executive Director

Contact person: Mr. G.G. Puri

7 professional staff

Funded by subscriptions, donations, Annual budget 1984: US\$ 50,000  
consultancy, project funding

Areas of research:

Energy technologies for the poor:

- Solar pumps through stirling engine
- Clay biogas plants
- Cheap solar cookers
- Water heaters
- Aqua Amonia
- Cold storage system
- Indoor solar cookers etc.

Current projects:

- (a) Research - Technology Transfer-cum-Training Project for rural development
  - Clay solar cookers
  - Clay biogas plant
  - Prefabricated burnt clay cheap houses and fuel efficient wood stove
- (b)
  - Solar pumps through modified stirling engines
  - Indoor solar cookers
  - Clay biogas plant

Commercialized projects:

First field application of research for the benefit of the rural poor just started under the Research Technology Transfer-cum-Training Project



Joint research programmes carried out with:

- National Physical Laboratory, New Delhi
- IIT. Bombay
- CSMCRI Bhavnagar

Suggested areas of co-operation with other research institutes:

- Biogas technology
- Solar technology

038. SOLAR ENERGY GROUP, DEPARTMENT OF MECHANICAL ENGINEERING, PUNJAB  
AGRICULTURAL UNIVERSITY, LUDHIANA

Ludhiana - 141 004  
India

Telephone: 22 960-224/222

Cable: AGRIVERSITI

Director: Prof. Dr. L.S. Cheema, Head, Dept. of Mechanical Engineering

Contact person: Dr. K.D. Mannan. Prof. of Mechanical Engineering

5 professional staff (2 PhD)

Government and private funded

Budget 1983-1984: US\$ 50,000

Areas of research:

- Solar water heaters
- Solar crop drying systems
- Steam generation systems
- Stationary concentrators both of symmetric and assymmetric configurations
- Solar cooking and solar cookers
- Passive environmental control of buildings
- Wind power systems

Current projects:

Three projects concerned with crop drying systems and wind power are currently being investigated:

- Field evaluation of developed solar technologies of solar cooking and water heating
- Natural environmental control of buildings and stationary solar concentrating systems
- Computer modelling of solar thermal systems

Joint research programmes carried out with:

The institute has what came to be known as 'co-ordinated research projects', which are simultaneously being investigated at other centres in the country. These projects are funded by the Indian Council of Agricultural Research.

Suggested areas of co-operation with other research institutes:

- Solar cooking
- Crop drying systems
- Water heating systems
- Passive environmental control of buildings
- Stationary concentrating systems for collecting solar energy up to 150 centigrade

039. THE NATIONAL INDUSTRIAL DEVELOPMENT CORPORATION LIMITED (NIDC)

Chanakya Bhavan  
Africa Avenue  
Chanakya Puri  
New Delhi 110 021  
India

Telephone: 670 153

Telex: 031-2871 Cable: NIDCORPON  
NIDC

Director: Dr. Ram K. Iyengar, Chairman-cum-Managing Director

Contact person: Dr. S.C. Bose, Chief Manager

300 professional staff (2 PhD)

Funded by Government  
and self-generation

Annual budget 1984: US\$ 1,500,000

Areas of research:

- Solar thermal with special reference to hot air systems for industrial and continuous use
- Solar passive and active architecture

Current projects:

- Solar drying establishment for drying agricultural products
- Processing of tea, using predominantly renewable source of energy
- Drying of mill wet bagasse
- Curing of flue cured Virginia tobacco

Suggested areas of co-operation with other research institutes:

As above

040. TATA ENERGY DOCUMENTATION AND INFORMATION CENTRE

TATA Energy Research Institute  
24, Homi Mody Str.  
Bombay 400 023  
India

Telephone: 24 50 70

Director: Mr. N.K. Gopalakrishnan

Contact person: Mr. N.K. Gopalakrishnan

6 professional staff

Private funded

Annual budget 1984: US\$ 20,000

Areas of research:

- Solar energy information
- Indian energy documentation

Current projects:

- Information consolidation and new and renewable sources of energy:  
Cookstoves, biogas technology, windpumps

Joint research programmes carried out with:

UNESCO

Suggested areas of co-operation with other research institutes:

- Information dissemination
- Energy documentation

041. TATA ENERGY RESEARCH INSTITUTE, FIELD UNIT (TERI/FRU)

c/o Sri  
Aurobindo Ashram  
Pondicherry - 605002  
INDIA

Telephone: 3483

Cable: AUROBINDO

Director: Dr. C.L. Gupta

Contact person: Ms. S. Gupta

3 professional staff

Private funded

Annual budget 1984: US\$ 50,000

Areas of research:

- Advanced flat plate collectors using CSD's
- Solar ponds
- PCM storage modules
- Convective drying systems
- Passive heating systems
- Biogas processes
- Biomass productivity
- Energy resources analysis
- Fuelwood cookstoves
- Eco-community

Current projects:

- PCM storage modules
- Biogas process and appliances
- Fuelwood cookstoves
- Integrated rural energy planning

Commercialized projects:

- Solar cookers
- Fuelwood cookstoves
- Integrated biogas plants
- Industrial water heating
- Solar drying systems

Joint research programmes carried out with:

- MCRC, Madras, on integrated rural planning
- Informally with many institutes abroad
- Represented on energy panels of Tamil Nadu and Andhra Pradesh governments and Central Government

Suggested areas of co-operation with other research institutes:

- Co-operation depends on country and institute involved

042. TATA INSTITUTE OF FUNDAMENTAL RESEARCH (TIFR)

Homi Bhabha Road  
Bombay - 400 005  
India

Telephone: 21 91 11

Telex: 011-3009  
TIFR IN

Cable: ZETESIS

Director: Prof. B.V. Sreekantan

Contact person: Prof. G. Swarup, Senior Professor

8 professional staff (in solar energy research; 8 PhD)

Government funded

Annual budget 1984: US\$ 150,000  
(for solar energy research)

Areas of research:

- (a) School of mathematics
  - Algebra
  - Algebraic geometry
  - Algebraic groups
  - Algebraic Topology
  - Combinatorics
  - Differential equation
  - Differential geometry
  - Function theory
  - Functional Analysis
  - Lie groups and Lie algebra
  - Number theory etc.
- (b) School of physics
  - Theoretical physics
  - Astronomy and theoretical astrophysics
  - Cosmic rays
  - Gravitation and high energy physics
  - Nuclear and atomic physics
  - Hydrology
  - Condensed matter and semiconductor
  - Chemical physics
  - Molecular biology
  - Computer science and speech research

Current projects (in solar energy):

- Stretched tape fixed mirror solar concentrator
- Modified photo electrodes
- Biochemical fuel cells
- Amorphous semiconductors

INDONESIA

043. AGENCY FOR ASSESSMENT AND DEVELOPMENT OF TECHNOLOGY (ENERGY DEVELOPMENT AND APPLICATION PROJECT)

Jalan M.H. Thamrin 8  
Jakarta  
Indonesia

Telephone: 3042466

Telex: 44331-ATP-JKT

Director: Dr. L. Panggabean

Contact person: Dr. Abubakar Lubis, Project Leader

21 professional staff

Government funded

Annual budget 1984: US\$ 175,000

Areas of research:

- Solar cell technology
- Photovoltaic power plant
- Solar thermal pump
- Gasification power plant
- Biogas

Current projects:

As above

Commercialized projects:

Wood gasification, under preparation for manufacture

Joint research programmes carried out with:

TUV - Rheinland, Am Grauen Stein - 5000 Koeln 91, FRG

Suggested areas of co-operation with other research institutes:

In the above-mentioned fields and other alternative energy sources



044. LEMBAGA FISIKA NASIONAL (LPN-LIPI) - NATIONAL INSTITUTE FOR PHYSICS

Jl. Cisitu Kompleks LIPI  
Bandung  
Indonesia

Telephone: 022-81052/83050

Director: Mr. Arjuno Brojonegoro

Contact person: Mr. Iman Tarigan, Head of Technology Dev.

8 professional staff (PhD)

Government funded  
research contract

Annual budget 1984: US\$ 600,000

Areas of research:

- Photovoltaic application (water pumping)
- Development of solar cells
- Solar water heater
- Solar crops drying
- Solar irradiation data analysis

Current projects:

As above

Joint research programmes carried out with:

- UN FSSTD (1984-1987; on energy in general, including application of solar photovoltaics for water pumping)

Suggested areas of co-operation with other research institutes:

- Development of solar water heater (materials research, especially coating materials)
- Crop drying
- Solar water pumping (for fresh water and saline or brackish for coastal areas)

IRAN

045. MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF SHIRAZ

Shiraz  
Islamic Republic of Iran

Telephone: 51001-2663

Director: Dr. M.A. Yaghoubi, Chairman

Contact person: Dr. M.A. Yaghoubi

10 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 420,000

Areas of research:

- Simulations
- Solar energy
- Solar distillation
- Wind energy
- Fluid flow
- Aerodynamics
- Combustion

Current projects:

- Modelling in energy consumption
- Passive cooling of buildings in hot areas
- Combustion

Suggested areas of co-operation with other research institutes:

- Joint research in any of the fields listed under 'Areas of research'

046. SOLAR ENERGY CENTER

Engineering School  
Shiraz University  
Shiraz  
Islamic Republic of Iran

Telephone: 51001-2674

Contact person: Dr. M.A. Yaghoubi, Assistant Professor

2 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 10,000

Areas of research:

- Solar desalination
- Solar passive cooling
- Solar radiation measurements
- Wind Energy

Current projects:

- Solar desalination
- Solar radiation in Shiraz

Suggested areas of co-operation with other research institutes:

- Passive cooling
- Solar desalination

IRAQ

047. SOLAR ENERGY RESEARCH CENTRE

Jadiryh  
P.O. Box 13026  
Baghdad  
Iraq

Telex: 2187

Director: Mrs. N.I. Al-Hamdani

Contact person: Mrs. N.I. Al-Hamdani

12 professional staff

Government funded

Areas of research:

- Engineering and industrial application
- Agricultural and biological application
- Photochemical conversion and storage,
- Collectors
- Solar greenhouse

Current projects:

Solar research and development in Iraq (see Sunworld, vol 7, No. 2, 1983, page 51)

Joint research programmes carried out with:

Solar Greenhouses project with Royal Scientific Society in Jordan

Suggested areas of co-operation with other research institutes:

- Photovoltaic water pumping
- Water desalination

IVORY COAST

048. INSTITUT DE RECHERCHE SUR LES ENERGIES NOUVELLES (IREN)

IREN - Universite  
01BPV34, Abidjan  
Ivory Coast

Telephone: (225) 44 08 59  
Ivory Coast

Telex: RECTU-CI  
3469

Director: Mr. Patrice Carrara

20 professional staff (6 PhD)

Government and private funded

Annual budget 1984: US\$ 120,000

Areas of research:

- Solar energy
- Biomass, biotechnology
- Applied nuclear physics (environment, biology, medicine)

Current projects:

Solar energy section

Photovoltaic systems:

- Monitoring, evaluation and optimization of the photovoltaic systems installed in the Ivory Coast;
- Behavioural study of photovoltaic system components under high-humidity tropical climate conditions;
- The interdigitate multi-junction photovoltaic cell;
- Optimized automatic operation of an average size multipurpose photovoltaic system (for rural areas).

Solar cold:

- Solar refrigeration by the solid absorption method;
- Solar climate control of dwelling areas by dehumidification.

Contribution to the energy autonomy of a rural African village:

- The popularization among the public of the rural use of photovoltaic systems and biogas digestors, and the instruction of the public in the operation of these systems through the educational means of a regional secondary school (lycee).

Suggested areas of co-operation with other research institutes:

- Biomass, biotechnology
- Solar energy

JORDAN

049. MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF JORDAN

Amman  
Jordan

Telephone: 84 35 55

Telex: 21629  
UNV.JO

Director: Dr. Munif Hijazi

Contact person: Dr. Mohamed Alsaad, Vice-Dean

3 professional staff (PhD)

University funding

Annual budget 1984: US\$ 6,000

Areas of research:

- Solar water heating
- Flat plate solar collectors
- Wind energy
- Thermal storage
- Solar water desalination

Current projects:

- Long-term performance of solar water heaters
- Generation of electricity from wind energy
- Design and performance of stratified storage tank

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

050. ROYAL SCIENTIFIC SOCIETY (RSS), SOLAR ENERGY RESEARCH CENTER (SERC)

P.O. Box (925 819)  
Amman  
Jordan

Telephone: 84 47 00-9

Telex: 21276

Cable: ERRAMAHA

RAMAH JO

Director: Dr. F. Daghestani

Contact person: Dr. Hani El-Mulki, Director, SERC

13 professional staff (5 PhD)

Private funded  
plus research grant

Annual budget 1984: US\$ 633,396

Areas of research:

- Solar water heater
- Space heating
- Metrological data
- Photovoltaics application and testing
- Wind energy applications

Current projects:

- Solar water heater for large application
- Testing of photovoltaics - panels
- Solar house (space heating)
- Pumping of drinking water using wind mills

Commercialized projects:

Solar water heater

Joint research programmes carried out with:

- Jordan Natural Resource Authority
- Jordan Drinking Water Authority
- German Agency for Technical Cooperation
- Kuwait Institute for Scientific Research

KENYA

051. DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF NAIROBI

P.O. Box 30197  
Nairobi  
Kenya

Telephone: 334244-2383

Cable: Varsity,  
Nairobi

Director: Dr. J.K. Musuva

Contact person: Dr. F.B. Sebbowa, Lecturer

3 professional staff (PhD)

Government funded  
plus equipment donation  
of Commonwealth Science Council

Annual budget 1984: US\$ 14,000

Areas of research:

- Solar energy crop drying systems
- Water and air heating

Current projects:

- Prototype studies on solar crop drying system for the medium scale pyrethrum farmers of Kenya
- Bypass and multipass solar air heaters
- Optimization of the arrangement of flat solar collectors near the equator

Commercialized projects:

Optimization of the arrangement of flat solar collectors near the equator

Joint research programmes carried out with:

Not directly, except via 'The Africa Energy Programme', sponsored by the Commonwealth Science Council (CSC), Marlborough House, London, SW1Y 5HX

Suggested areas of co-operation with other research institutes:

Agricultural crop drying, especially on devices directly applicable to rural farming communities.



052. KENYA INDUSTRIAL RESEARCH AND DEVELOPMENT INSTITUTE

P.O. Box 30650  
Nairobi  
Kenya

Telephone: 557988, 557762

Cable: REDEV,  
Nairobi

Contact person: Mr. Katambo Wakano, Public Relations Officer

Areas of research:

- Photovoltaic solar water pump
- Solar refrigerator

Current projects:

as above

Joint research programmes carried out with:

- Ministry of Water Development, Kenya
- GTZ
- KIRDI
- University of Nairobi

MADAGASCAR

053. DELEGATION UNIVERSITAIRE AUX ENERGIES NOUVELLES (D.U.E.N.)

Universite de Madagascar  
Rectorat  
B.P. 566  
Antananarivo  
Madagascar

Telephone: 24 14-415/566

Director: Prof. Edmond Razafindrakoto, Delegate Co-ordinator

6 professional staff (PhD)

Sources of support include Rectorate of the University of Madagascar and national, foreign and international organizations

Areas of research:

- Solar thermal conversion
- Solar photovoltaic cells, modules and systems
- Biomass
- Wind energy
- Geothermic energy

Current projects:

- Solar radiation measurements
- Solar driers
- Solar water desalination/distillation
- Testing and research on small biogas devices

Commercialized projects:

Solar system drying wood

Joint research programmes carried out with:

- Some laboratories of French universities (Perpignan, Ocean Indien, La Reunion)
- Some agencies of the Ministries for Research, Energy etc.

Suggested areas of co-operation with other research institutes:

Preparations for entering into joint research programmes with some developing countries of the Indian Ocean under way.

MALAWI

054. POLYTECHNIC

7/Bag 303, Polytechnic  
Department of Mechanical Engineering  
Chichiri 3, Blantyre, Malawi

Telephone: 670411

Director: Mr. A. Kambalametore

Contact person: Prof. J. Harris, Head, Mech. Eng.

1 professional staff

Private funded

Annual budget 1985: MK 3,000

Areas of research:

- Solar water heating systems
- Solar air heating

Current projects:

- Low cost solar water heater
- Solar water heating systems
- Solar air heating
- Solar water control valve

Commercialized projects:

- Solar water heating system

Suggested areas of co-operation with other research institutes:

- All areas

055. UNIVERSITY OF MALAWI, THE POLYTECHNIC

B.P. 303, Chichiri  
Blantyre 3  
Malawi

Telephone: 670 411

Telex: 46 13

Director: Mr. A.V. Kambalametore,

Contact person: Dr. G.M. Mhango

10 professional staff

Government funded

Annual budget: As need arises

Areas of research:

- Solar heating
- Solar still
- Crop dryers
- Salt making

Current projects:

As above

Suggested areas of co-operation with other research institutions

Solar crop drying and solar still

MALAYSIA

056. FACULTY OF ENGINEERING, MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF MALAYA

Faculty of Engineering  
University of Malaya  
Kuala Lumpur  
Malaysia

Telephone: 553466-200/204

Telex: UNIMAL  
MA 37453

Cable: UNIVSAL

Directors: Dr. Tengku Mohd. Azzman Shariffadeen, Dean, Faculty of Engineering; Mr. Goh Sing Yau, Head of Department

Contact person: Mr. Ong Kok Seng, Associate Professor

14 professional staff (PhD; Mechanical Engineering Department)

Annual budget 1984: US\$ 100,000

Areas of research:

Solar energy utilization in Malaysia - thermal aspects

Current projects:

- Water and air heating
- Cooling
- Selective surface
- Distillation

Commercialized projects:

Water heating (domestic and swimming pool)

Suggested areas of co-operation with other research institutes:

Solar energy - thermal aspects

057. INSTITUT PENYELIDEKAN & KEMASUAN PERTANIAN MALAYSIA, MALAYSIAN RESEARCH AND DEVELOPMENT INSTITUTE (MARDI)

Petisurat 12301  
Pejabat Pos Besar  
Kuala Lumpur  
Malaysia

Telephone: 35 64 01

Director: Hj. Dr. Mohd. Yusof Hashim, Director General

Contact person: Mr. Mohd. Zainal Ismail, Research Officer

6 professional staff

Government funded

Annual budget 1984: US\$ 40,000

Areas of research:

Testing of solar dryer for drying agricultural crops and food products such as ground-nut, coffee beans, noodles, salted fish, fish crackers etc.

Current projects:

As above

Joint research programmes carried out with:

Joint project with CHOGRM on solar dryers for agricultural crop in preparation

058. STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM)

P.O. Box 35  
Shah Alam  
Selangor  
Malaysia

Telephone: 59 26 01  
59 16 30

Director: Dr. Mohd. Mansor bin Haji Salleh, Director General  
(Controller), SIRIM

Contact person: Dr. Mohd. Mansor bin Haji Salleh; Dr. Chong Chok Ngee,  
Head, Research Unit, SIRIM

170 professional staff (6 PhD)

Mainly Government funded  
plus revenue from services to  
private and government sectors

Annual budget 1984: US\$ 6.6 million

Areas of research:

- Metal industry technology
- Meteorology
- Building materials technology
- Energy technology
- Ceramics technology
- Pollution control technology

Current projects:

- Integrated biogas/solar energy systems (rural applications)
- Biogas from palm oil mill effluent for electricity generation
- Energy assessment and efficiency improvement in power stations
- Biomass energy - briquette fuels, alcohol fermentation, charcoal

Joint research programmes carried out with:

- JILA (Japan)
- Korea Advanced Institute of Science and Technology (KAIST)
- University of Malaya
- Universiti Kebangsaan, Malaysia
- Palm Oil Research Institute of Malaysia

Suggested areas of co-operation with other research institutes:

Joint research programmes in the above fields on a larger scale

059. DEPARTMENT OF PHYSICS, UNIVERSIT' KEBANGSAAN MALAYSIA (UKM)

P.O. 13  
Bangi  
Selangor  
Malaysia

Telephone: 03-350001, ext. 2890 Telex: MA 31496 Cable: UNIKEB

Director: Prof. Dr. Abd Hamid Abd Rahman

Contact persons: Dr. Mohd. Noh Dalimin, Lecturer

10 professional staff (7 PhD)

Government funded

Annual budget 1984: US\$ 100,000

Areas of research:

- Photovoltaics
- Solar drying and thermal system
- Solar refrigeration and cooling
- Solar radiation

Current projects:

- Solar radiation mapping of Peninsula Malaysia
- Solar thermal system
- Solar photovoltaics

Joint research programmes carried out with:

New Energy Development Organisation, Japan

Suggested areas of co-operation with other research institutes:

All areas of energy, especially further co-operation on solar cooling



060. UNIVERSITI SAINS MALAYSIA

Minden  
Pulau Pinang  
West Malaysia  
Malaysia

Telephone: 883822-108

Telex: MA40254

Cable: UNISAINS

Director: The Honourable, Datuk Musa Mohamad

Contact person: Prof. Sharom Ahmat, Deputy Vice-Chancellor (Research and Development)

8 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 140,000

Areas of research:

- Photovoltaic conversion
- Biomass/biogas
- Drying (agricultural produce)
- Desalination

Current projects:

- Evaluation of the potential of biowastes as a potential source of energy
- Investigation of new materials for solar cells
- Water pumping using photovoltaic solar cells
- Solar smoke house
- Production of biogas from agricultural wastes
- Project SOPHOCLE
- Desalination

Joint research programmes carried out with:

- Malaysian Agricultural Development Authority (MADA)
- National Electricity Board of Malaysia
- French Government

MALI

061. LABORATOIRE DE L'ENERGIE SOLAIRE (L.E.SO.)

B.P. 134, Darsalam  
Bamako  
Mali

Telephone: 22 30 41

Telex: Telex  
Public

Director: Mr. Cheickna Traore

Contact person: Mr. Cheickna Traore

27 professional staff

Funded by Government and USAID

Annual budget 1984: US\$ 3,351  
(as provided by  
Government)  
USAID project funding  
from 1978-1985: US\$ 109,800

Areas of research:

- (a) Solar energy:
  - High and low temperature
  - Photocells
- (b) Windenergy
- (c) Biomass

Current projects:

Project on renewable energy sources (involving the study and application of all forms of renewable energy: solar, wind and biomass)

Joint research programmes carried out with:

- Centre de Technologies Adaptee (CTA)
- Ecole Nationale des Ingenieurs (ENI)
- Centre de Recherche Fruitiere (CRF)
- Office Malien du Betail et de la Viande (OMBEVI)
- Ecole Normale Superieure (ENSUP)
- University of Perpignan (France)
- Sheladia Associated Inc. (USA)
- Operation Peche (Fisheries Operation)

MEXICO

062. INSTITUTO DE INGENIERIA, UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM)

Ciudad Universitaria  
Apartado 70-472  
Delegacion Coyoacan  
04510, Mexico, D.F.  
Mexico

Telephone: (905) 548 0735      Telex: 1760155 CICME

Director: Dr. Luis Esteva Maraboto

Contact person: Prof. Luis Palacios-Hammeken, Assistant Director

175 professional staff (24 PhD)

Government funded

Annual budget 1984: US\$ 3,000,000

Areas of research:

- Solar refrigeration
- Experimental solar plant (tracking collectors)
- Automated system for measuring solar irradiation
- Absorber tubes for solar plant

063. INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY/ITESM

Department of Thermal Engineering  
Succursal de Correos J  
Monterrey, N.L.  
Mexico

Telephone: (83) 58 20 00-107      Telex: 0382976 ITESME

Director: Dr. Jose A. Manrique

Contact person: Dr. Jose A. Manrique

3 professional staff (PhD)

Private funded

Annual budget 1984: US\$ 100,000

Areas of research:

- Photothermal water pumping systems
- Space heating and cooling
- Concentrators
- Photovoltaic water pumping systems

Current projects:

As above

Joint research programmes carried out with:

Agence Francaise pour la Maitrise de L'Energie, Paris, France

Suggested areas of co-operation with other research institutes:

As above

MOROCCO

064. ECOLE MOHAMMADIA D'INGENIEURS

B.P. 765  
Rabat Adal  
Morocco

Telephone: 726-47

Telex: 32939 M

Cable: E.M.I.  
Rabat

Director: Prof. A. Alj

Contact person: Prof. A. Mojtabi, Head of Mechanical Department

10 professional staff (5)

Government funded

Annual budget 1984: US\$ 35,000

Areas of research:

- Solar heating and cooling
- Solar distillation
- Wind energy

Current projects:

- Construction of two units of solar distillation
- Study of a refrigeration unit

Joint research programmes carried out with:

- Laboratoire d'Energetique de l'ENSAM, Bordeaux I Talence, France
- I.M.S.T., 13003 Marseille
- Universite Mons, Laboratoire de Thermodynamique

NEPAL

065. BALAJU YANTRA SHALA SANITARY ENGINEERING LIMITED/BYSSEL

P.O. Box 2070, B.I.D., Balaju  
Kathmandu  
Nepal

Telephone: 214835

Cable: BYSSA

Director: Mr. Rajesh Prasad Shriwastab, General Manager

Contact person: Mr. Rajesh Prasad Shriwastab

2 professional staff

Private funded

Annual budget 1984: US\$ 140,000

Areas of research:

- Solar water heaters for urban and rural areas
- Solar space heating
- Solar drying

Current projects:

- Solar space heating - two houses
- Solar dryer for herbs
- Solar dryer for pulps

Joint research programmes carried out with:

Research Centre for Applied Science and Technology, Tribhuvan  
University, Kiritpur, Kathmandu, Nepal

Suggested areas of co-operation with other research institutes:

- Solar water heating
- Solar space heating

NIGERIA

066. DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF LAGOS

Lagos  
Nigeria

Director: Prof. H. Enahoro, Head of Department

Contact person: Prof V.A. Akinsete

5 professional staff (involved in solar energy work)

Government funded

Annual budget 1984: US\$ 20,000

Areas of research:

Low temperature applications for:

- water distillation
- water heating
- crop drying
- cooling
- Development of cheap solarimeters using Si-cell and amp-hour meters

Current projects:

- Design and development of prototype solar water heaters for Nigeria using locally-available materials
- Design and development of charcoal-bed solar stills
- Solar radiation intensities in Nigeria using available meteorological data
- Design and development of a prototype grain dryer for use in Nigeria

Commercialized projects:

Charcoal-bed, roof-type solar still

Suggested areas of co-operation with other research institutes:

Exchange of information and visits

067. NIGERIAN INSTITUTE OF PLANT SCIENCE AND SOLAR ENERGY/TECHNOLOGY

149, Hospital Road  
Aba  
Imo State  
Nigeria

Director: Dr. Ephraim Nkem Okeya

Contact person: Dr. Ephraim Nkem Okeya

4 professional staff

Private funded

Annual budget 1984: US\$ 95,000-150,000

Areas of research:

- Fusion reactor development
- Electro-chemistry
- Electro-analytical chemistry
- Aqua culture/agriculture
- Desalination
- Cooling/drying facilities
- X-ray beams
- Gammaray

Current projects:

- Research contract service
- Community/rural technologies
- Phonons/photons
- Surge performance
- Aqua culture/agro-based parastatals
- Health hazards - solar energy
- Food protein
- Plasmalemma

Suggested areas of co-operation with other research institutes:

- Thermo-therapy (medical) for clinics, hospitals
- Vaccine production - pharmaceuticals
- Aqua culture/agriculture - industries (allied)



068. THERMAL AND PASSIVE ENERGY LABORATORY, UNIVERSITY OF IFE

P.O. Box 1035  
Ile-Ife  
Nigeria

Telephone: IFE 2291

Cable: NGOKA UNIFE NIGERIA

Director: Mr. Nelson I. Ngoka

Contact person: Mr. Nelson I. Ngoka

6 professional staff (2)

Government funded

Annual budget 1984: US\$ 50,000

Areas of research:

- Rural energy systems in Nigeria
- Renewable forms of energy
- Passive solar building technology
- Energy conservation
- Energy policy
- Thermal comfort

Current projects:

- Design of cheap solar water heater for developing countries
- Rural energy systems in southern Nigeria
- Passive solar building design and comfort studies

Commercialized projects:

Energy conservation strategies for industrial sector

Joint research programmes carried out with:

The research unit is in close contact with various research institutions and universities in various parts of the world. There is, however, no joint project at present

Suggested areas of co-operation with other research institutes:

- Energy conservation
- Rural energy systems
- Passive solar building technology

PAKISTAN

069. NATIONAL INSTITUTE OF SILICON TECHNOLOGY

15-B, Street-44, F-8/1  
Islamabad  
Pakistan

Telephone: 851987  
850847

Telex: 5538 NIE PK Cable: SILICONCEN

Director: Dr. Atique Mufti

Contact person: Dr. Atique Mufti

33 professional staff (3 PhD)

Government funded

Annual budget 1985: US\$ 1,000,000

Areas of research:

- Silicon technology
- Photovoltaics
- Research and development starting from quartz to making of solar cells and silicon chips

Current projects:

- As above

Joint research programmes carried out with:

- Arizona University, USA
- University of Miami, USA
- Marmara Research Institute, Turkey
- Some other collaborative projects are being finalized

Suggested areas of co-operation with other research institutes:

Prepared to enter into joint research programmes.

070. PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR)

Solar Energy Division  
P.O.Box 672  
Shahrah-e-Kamal Ataturk  
Karachi-0109  
Pakistan

Chairman: Dr. Naeem Ahmad Khan

Contact person: Dr. Rafiq Ahmad Siddiqi, Principal Scientific Officer,  
PCSIR Laboratories, Shahrah-e-Jalal-ud-Din Roomi,  
Lahore-16

550 professional staff (105 PhD)

Government funded

Annual budget 1985: US\$ 5,000,000

Areas of research:

- Solar water heating
- Solar cooking
- Solar desalination
- Solar architecture
- Solar drying

Current projects:

- Solar heaters
- Solar cookers
- Solar architecture
- Solar drying

Joint research programmes carried out with:

The Division is in close contact with the Clean Energy Institute of University of Miami, USA, and a Clean Energy Institute for Pakistan is on the anvil.

Suggested areas of co-operation with other research institutes:

- Solar architecture
- Rural energy systems
- Passive solar building technology

071. UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR

Directorate of Research  
N.W.F.P. University of Engineering  
and Technology  
P.O.Box 814  
Peshawar  
Pakistan

Telephone: 0521-41562

Director: Mr. Sultan Daood, Head

Contact person: Prof. I.H. Shah, Director

78 professional staff (3PhD)

Government funded

Annual budget 1984: US\$ 2,200,000

Areas of research:

- Solar water heating
- Solar cooker
- Solar desalination

Current projects:

Solar assisted tobacco barn

Joint research programmes carried out with:

- Colorado State University, USA
- Pakistan Council for Scientific and Industrial Research
- Appropriate Technology Development Organization

Suggested areas of co-operation with other research institutes:

- Selective coating
- Solar ponds
- Silicon cell

PAPUA NEW GUINEA

072. DEPARTMENT OF MECHANICAL ENGINEERING, PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

Private Mail Bag  
Lae  
Papua New Guinea

Telephone: 42 4999-2124  
45 7249

Telex: NE42428

Cable: UTECH,  
LAE, PNG

Director: Prof. W.C.K. Wong

Contact person: Mr. S.J. Bialostocki, Associate Professor

16 professional staff (5 Phd)

Government funded

Annual budget 1984: US\$ 100,000

Areas of research:

- Solar and solar assisted drying (air heaters)
- Solar air-conditioning
- Solar radiation monitoring

Current projects:

- Re-installation of solar radiation monitoring system
- Development and testing of air heaters and driers
- Monitoring and modification of solar air-conditioners

Commercialized projects:

- Two on solar assisted driers
- Two on biomass conversion

Suggested areas of co-operation with other research institutes:

- Solar drying
- Biomass utilization

PEOPLE'S REPUBLIC OF CHINA

073. BEIJING SOLAR ENERGY RESEARCH INSTITUTE (BSERI)

Huan Yuan Road  
Beijing  
People's Republic of China

Telephone: 27 75 21

Director: Mr. Gong Bao

Contact person: Mr. Gong Bao

117 professional staff

Government funded

Areas of research:

- Solar
- Biomass

Current projects:

- |                                 |                     |
|---------------------------------|---------------------|
| - Anaerobic                     | - Passive systems   |
| - Biogas digester               | - Photovoltaics     |
| - Cooking                       | - Solar cell design |
| - Building design               | - Solar thermal     |
| - Irrigation                    | - Space heating     |
| - Collectors/concentrators      | - Food drying       |
| - Distributor/collector systems | - Greenhouses       |
| - Manufacturing technology      | - Water heating     |
| - Materials research            |                     |

Commercialized projects:

- Solar cells
- Solar water collectors

Suggested areas of co-operation with other research institutes:

- Solar
- Biomass

074. GENERAL RESEARCH INSTITUTE FOR NON-FERROUS METALS (GRINM)

2 Xin Jie Kou Wai Dajie  
Beijing  
People's Republic of China

Telephone: 66 41 31

Cable: 2589 Beijing

Director: Mr. Wan Qun

Contact persons: Mr. Zhang Chun, Mr. Xiao Dechuan

20 professional staff (1PhD)

Government funded

Annual budget: US\$ 10,000-15,000

Areas of research:

Si solar cells

Current projects:

- Solar cells made of casting Si polycrystal
- a-Si solar cells produced by glow-discharge Method

075. SHANGHAI INSTITUTE OF ENERGY

1960 Long Hua Road  
Shanghai  
People's Republic of China

Director: Mr. Yu Shan-qing

Government funded

Areas of research:

- Basic materials for solar energy applications
- Solar thermal conversion
- Solar photovoltaic conversion

Commercialized projects:

Solar collector (water heater)

Suggested areas of co-operation with other research institutes:

Basic materials for solar energy application



076. SHANGHAI NON-FERROUS METALS RESEARCH INSTITUTE

P.O. Box 8402  
Shanghai  
People's Republic of China

Telephone: 28 51 93, 28 57 39

Director: Mr. Cao Guo-Chen, Vice President, Chief Engineer

Contact persons: Mr. Wang Zhengming, Mr. Shi Shengdee, Engineers

517 professional staff

Government funded

Areas of research:

- Electronic materials
- Semiconductor materials (silicon)
- Solar cells
- Solar grade silicon
- Aluminium alloy solar water heater
- Superconductor materials
- Rare metals
- Non-ferrous metals and alloys

Current projects:

- Casting polycrystalline silicon ingot
- Casting polycrystalline silicon solar cells
- Low-cost solar grade silicon
- Aluminium alloy solar water heater

Suggested areas of co-operation with other research institutes:

- Casting polycrystalline silicon solar cells
- Photovoltaic solar energy conversion
- Water heating

077. SOLAR ENERGY RESEARCH SECTION, SHANGHAI INSTITUTE OF MECHANICAL  
ENGINEERING

516 Jun Gong Road  
Shanghai 200093  
People's Republic of China

Telephone: 43 30 40

Cable: 1191

Director: Prof. Chen Zhihang, President of Institute

Contact person: Prof. Gu Jingxian, Head of Section

25 professional staff (5 PhD)

Government funded

Areas of research:

- Solar power pilot station (thermo generation)
- Collector
- Water and air heating
- Drying
- Energy conservation

Current projects:

- Collector
- Drying
- Energy conservation

Suggested areas of co-operation with other research institutes:

- Solar drying
- Energy conservation

078. ZHEJIANG RESEARCH INSTITUTE FOR BIOGAS AND SOLAR ENERGY (ZIBS)

Hangzhou  
People's Republic of China

Telephone: 43965

Cable: 2889

Director: Mr. Xu Zeng-fu

Contact person: Mr. Xu Zeng-fu

21 professional staff

Government funded

Areas of research:

- Solar passive systems
- Solar energy storage
- Solar collectors
- Solar drying
- Bioconversion
- Biomass applications
- Biomethanation system

Current projects:

- Solar drying of bamboo products
- Solar diluting of sea water

Commercialized projects:

- Solar water heating
- Solar drying

Suggested areas of co-operation with other research institutes:

- Bioconversion and biomass applications
- Solar applications

PHILIPPINES

079. PHILIPPINE NATIONAL OIL COMPANY-ENERGY RESEARCH AND DEVELOPMENT CENTER  
(PNOC-ERDC)

Don Mariano Marcos Avenue Diliman  
Quezon City  
Philippines

Telephone: 97 76 11      Telex: 63667 PNOC PN      Cable: PHILNOCO

Director: Dr. Ibarra E. Cruz, Manager

40 professional staff (3 PhD)

Government and private funded      Annual budget 1983: Phil.Pesos 11,300,000

Areas of research:

- New and renewable sources of energy

Current projects:

- Pilot solar power plant
- ERDC-PAGASA study on the application of windmills (Netherlands Windmill Project)
- Medium-scale wind power systems for rural electricity and fertilizer production
- An assessment of the potential for the utilization of biomass fuels in the Philippines
- Gasification of densified rice hulls
- Direct heat gasifier systems
- Analysis of solar water heating systems

Commercialized projects:

- Solar water heater - hotels and restaurants

Joint research programmes carried out with:

- U.S. Agency for International Development (USAID)
- United Nations Development Programme (UNDP)
- United Nations Educational, Scientific and Cultural Organizations (UNESCO)
- Federal Republic of Germany
- Association for the Growth of Systematized Agricultural Technology (AGSAT)

- INSTO Foundation
- Bureau of Energy Development (BED)
- National Science and Technology Authority (NSTA)
- National Food Authority (NFA)
- National Institute of Biotechnology and Applied Microbiology (BIOTECH)
- Philippine Council for Industrial Energy Research and Development (PCIERD)

080. THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI)

P.O. Box 933, Manila  
Philippines

Telephone: 88 48 69, Telex: (ITT)45365 RICE INST PM  
88 45 14, 673-5003 (RCA)22456 IRI PH Cable: RICEFOUND  
673-5004, 673-5005 (EASTERN) 63786 RICE PN MANILA

Director: Mr. M.S. Swaminathan, Director General

Contact persons: Mr. M.S. Swaminathan, Mr. Clarence W. Bockhop, Head,  
Department of Agricultural Engineering

81 professional staff (70 PhD)

Funded by Consultative Group on  
International Agricultural Research

Areas of research:

- Photosynthesis
- Solar drying of grains

Current projects:

Several projects in the field of enhancing the efficiency of  
utilization of solar energy for rice and development of solar grain  
drying technologies

Joint research programmes carried out with:

National research systems in most rice-growing countries

Suggested areas of co-operation with other research institutes:

Development of solar grade silicon from rice hulls

REPUBLIC OF KOREA

081. KOREA INSTITUTE OF ENERGY & RESOURCES (KIER)

P.O. Box 339 Daejeon  
Chungnam  
Korea

Telephone: 822-970

Telex: K45507

Cable: KIEREL

Director: Mr. Keung-Shik Park, President

Contact person: Mr. Paul Chungmoo Auh, Director, Solar R&D Department

30 professional staff (Solar R&D; 4 PhD)

Government funded

Annual budget 1984: US\$ 500,000  
(solar R&D)

Areas of research:

- Passive solar buildings
- Active solar buildings
- Photovoltaics
- Biomass
- Insulation measurements and equipment tests

Current projects:

- Passive building design
- Active DHWS design
- Photovoltaic system design for remote areas
- Methane generator design
- Insolation measurements and collector performance tests

Commercialized projects:

Active solar heating and DHWS

Joint research programmes carried out with:

A.F.M.E. France - solar heating

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

SAUDI ARABIA

082. ENERGY RESOURCES DIVISION, RESEARCH INSTITUTE, UNIVERSITY OF PETROLEUM AND MINERALS

P.O. Box 144,  
Dhahran  
Saudi Arabia

Telephone: 03 860-3554/3555      Telex: 601913      Cable: ALJAMAAH  
UPM RS SJ

Director: Dr. A.E. Dabbagh

Contact person: Dr. Jasem M. Al-Ansari, Manager, Energy Resources  
Division

10 professional staff (5 PhD)

Government and private funded      Annual budget 1984: US\$ 7,000,000 to  
US\$ 8,000,000

Areas of research:

- Develop non-petroleum related energy systems and devices with primary emphasis on the resources and environment of Saudi Arabia
- Application of solar and wind energy resources in the Kingdom and establish an energy input/output data base
- Establish energy conservation measures in residential, industrial and office buildings

Current projects:

- Non-convecting salt gradient solar pond programme
- Climatic chamber tests
- Testing of domestic solar water heater in campus house
- Solar radiation monitoring
- In-house domestic solar water heater
- Solar radiation monitoring

Joint research programmes carried out with:

- Battelle, Columbus, USA
- KISR, Kuwait



SENEGAL

083. ECOLE NATIONALE SUPERIEURE UNIVERSITAIRE DE TECHNOLOGIE (ENSUT)

P.B. 5085  
Dakar Fann  
Senegal

Telephone: 23 00 17

Telex: UY 8384

Director: Mr. Souleymane Seck

Contact person: Mr. Pierre Viaud, Professor

100 professional staff (15 PhD)

Government funded

Annual budget 1984: US\$ 160,000

Areas of research:

- Wind energy
- Solar energy
- Biomass
- Development of natural products,

Current projects:

Research and development projects in the area of biotechnology

Commercialized projects:

Installation in the bush of wind energy units, designed and produced at ENSUT for water-pumping and electrification

Suggested areas of co-operation with other research institutes:

Biomass

084. SOCIÉTÉ INDUSTRIELLE DES APPLICATIONS DE L'ÉNERGIE SOLAIRE (SINAES)

B.P. 1277  
21/A - Zone/B  
Dakar  
Senegal

Telephone: 21 12 08  
21 90 12

Telex: KARELEC  
661 SG

Director: Mr. Mohamed-Ali Toure

Contact person: Mr. Aliou Ba, Chief, Technical Service

24 professional staff (4 PhD)

Government and private funded

Annual budget 1984: US\$ 500,000

Areas of research:

- Water pumping
- Water heating
- Rural solar/wind-power plant
- Biomass

Current projects:

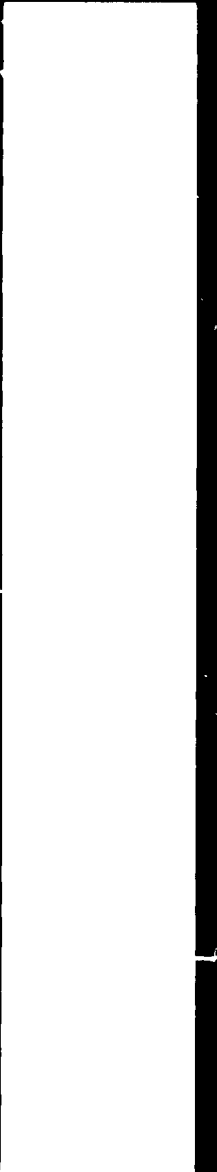
- Domestic water heating
- P.V. solar pumping stations
- Maintenance programme (annual)
- Manufacture of solar water heaters

Joint research programmes carried out with:

- CERER - Dakar, Senegal
- CRES - Bamako, Mali
- ENSUT - Dakar, Senegal
- Total - Paris, France

Suggested areas of co-operation with other research institutes:

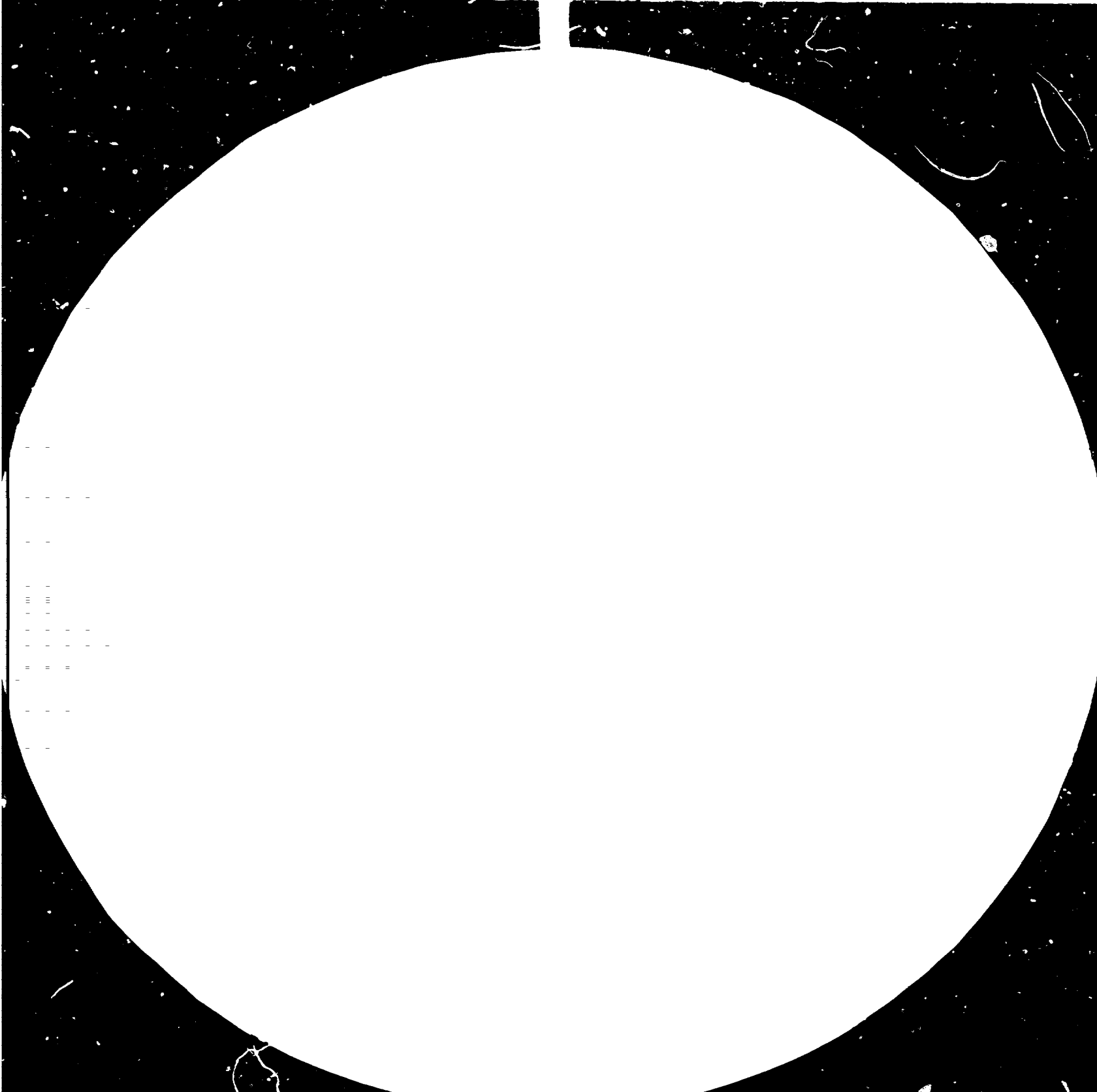
- Engineering
- Windmills
- Rural Electrification
- Biomass
- Water pumping
- Desalination

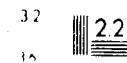
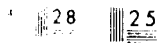


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**MICROCOPY RESOLUTION TEST CHART**

NATIONAL BUREAU OF STANDARDS  
STANDARD REFERENCE MATERIAL 1010A

U.S. GOVERNMENT PRINTING OFFICE: 1963 O 348-890

SEYCHELLES

085. MINISTRY OF NATIONAL DEVELOPMENT, TECHNOLOGY FOR DEVELOPMENT DIVISION

P.O.Box 199  
Victoria  
Seychelles

Telephone: 76631

Director: Dr. Selwyn Gendron

4 professional staff (1 PhD)

Government and funded

Annual budget 1985: US\$ 100,000

Areas of research:

- Biomass gasification
- Biogas production
- Energy policy

Current projects:

- New and renewable energy project
- Energy policy research

Commercialized projects:

- One local assembly of solar water heating system

Joint research programmes carried out with:

- University of Reunion, Reunion, St. Clothilde, P.O.Box 5

SINGAPORE

086. DEPARTMENT OF BUILDING SCIENCE, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus  
Singapore 0511  
Singapore

Telephone: 77 56 666-223

Telex: UNISPO RS Cable: UNIVSPORE  
33943

Director: Prof. Bill B.P. Lim

Contact person: Prof. Bill B.P. Lim

11 professional staff (9 PhD)

Government funded

Annual budget 1984: US\$ 800,000

Areas of research:

- Energy conservation in buildings
- Passive design of buildings
- Passive use of solar energy

Current projects:

- Low-energy housing
- Solar dryer for clothes in high rise buildings
- Efficiency of solar hot-water heating
- Solar radiation measuring
- Computer simulation of energy utilization in buildings

Joint research programmes carried out with:

Development and Building Control Division, Public Works Department, Singapore, on energy conservation building regulations (PWD Ministry of National Development Building, Maxwell Road, Singapore 0106)

Suggested areas of co-operation with other research institutes:

- Computer simulation of energy conservation and passive design
- Solar air conditioning for the hot, humid tropics
- Passive use of solar energy

087. FACULTY OF ENGINEERING, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus  
Singapore 0511  
Singapore

Telephone: 77 56 666

Telex: UNISPO RS Cable: UNIVSPORE  
33943

Director: A/Prof. Aun Neow Poo, Dean, Faculty of Engineering

Contact person: A/Prof. Aun Neow Poo

160 professional staff

Government funded

Annual budget 1984: US\$ 12,000,000

Areas of research:

- Solar cooling
- Photovoltaic applications
- Solar ponds
- Solar heating
- Photovoltaic devices

Current projects:

- Solar air-conditioning
- Photovoltaic water pumping
- Solar ponds
- Simulation of solar collection systems

Joint research programmes carried out with:

GTZ, FRG

Suggested areas of co-operation with other research institutes:

As stated under 'Current projects'



088. PHYSICS DEPARTMENT, NATIONAL UNIVERSITY OF SINGAPORE

Kent Ridge Campus  
Singapore 0511  
Singapore

Telephone: 77 56 666

Telex: NUSBUR  
RS 51112

Director: Prof. Y.K. Lim, Head, Department of Physics

Contact person: Prof. A. Rajaratnam, Professor of Physics

2 professional staff working in this area

Government funded

Annual budget 1984: US\$ 3,000

Areas of research:

- Solar radiation measurements
- Photovoltaic conversion

Current projects:

- Atmospheric water vapour absorption of solar radiation
- Measurements of total, scattered and in three wave band regions
- Building up an amorphous silicon facility

Joint research programmes carried out with:

Space Science Division, Naval Research Laboratory,  
Washington D.C. 20375

Suggested areas of co-operation with other research institutes:

The two above-mentioned related research areas

SRI LANKA

089. CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH

363, Bauddaloka Mawatha  
Colombo 7  
Sri Lanka

Telephone: 93807

Director: Mr. M.S. Wijeratne

Contact person: Dr. S.A. Abeysekera, Head, Pilot Plant and Design Section

20 professional staff

Government funded

Annual budget 1984: US\$ 300,000

Areas of research:

- Solar desalination
- Drying
- Cookers
- Water heaters

Current projects:

- Solar dehydration of fruits and vegetables
- Solar water heating of homes and tourist hotels

Suggested areas of co-operation with other research institutes:

Installation of water heaters on large scale, e.g. for a 200 room hotel

SYRIAN ARAB REPUBLIC

090. GENERAL ORGANIZATION OF ENGINEERING INDUSTRIES

Baramkeh St.  
P.O.Box 3120  
Damaskus  
Syrian Arab Republic

Telephone: 214650

Telex: 411035 SY

Director: Eng. Mandouh Al-Monajed

Contact person: Dr. Mishel Al-Haddad, Supervisor

15 professional staff (1 PhD)

Government funded

Areas of research:

Areas in connection with investment of solar equipment for hot water:

- projection and construction work
- production work
- project studies and supervision

Current projects:

Organization is supplier for solar equipment for heating water for domestic use (houses of workers at Damaskus International Airport)

Joint research programmes carried out with:

- Organization is engaged in joint research programmes with other institutions in the country, such as the General Co. for Studies and Technical Consulting.

Suggested areas of co-operation with other research institutes:

- water heating for domestic and industrial uses
- air conditioning

091. INDUSTRIAL TESTING AND RESEARCH CENTER

S.A.R. Mouada  
EIA P.O.Box 845  
Damaskus  
Syrian Arab Republic

Telephone: 664095  
664083

Cable: INTEST

Director: Eng. Hisham Sharafly

Contact person: Eng. Hisham Sharafly, Director General

135 professional staff (4 PhD)

Government and private funded

Annual budget 1985: US\$ 2,000,000

Areas of research:

- Industrial research
- Petroleum
- Miscellaneous including power and energy

Current projects:

- Research for cement and building material
- Research for petroleum and food industry

Suggested areas of co-operation with other research institutes:

- Same areas as indicated under 'Areas of research'

092. SCIENTIFIC STUDIES AND RESEARCH CENTER (SSRC)

P.O.Box 4470  
Damascus  
Syrian Arab Republic

Telephone: 772603, 772604, Telex: 411374 SY

Director: Dr. A.E. Chahid

Contact person: Dr. A.H. Mansour, Deputy Director General

14 professional staff (3 PhD)

Government funded

Annual budget 1985: US\$ 100,000

Areas of research:

- Photovoltaics
- Thermal conversion of solar energy
- Solar heating and cooling systems
- Solar radiation and meteorological data

Current projects:

- Photovoltaic cell encapsulation
- Photovoltaic panel design, thermally selective absorbing plates
- Solar heating systems

Joint research programmes carried out with:

- Faculty of Electrical and Mechanical Engineering, University of Damascus
- Assad Academy, Aleppo, Syria
- CEN, B.P., Alger - Gare, Algeria

TANZANIA

093. CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY (CAMARTEC)

P.O.Box 764  
Arusha  
Tanzania

Telephone: 3594  
3666

Telex: 42115 CAMART TZ

Director: Edward Ngaiza

Contact person: Frederick Sumaye, Technologist

12 professional staff

Government funded

Annual budget 1985: US\$ 228,500

Areas of research:

- Agricultural mechanization - hand tool, animal drawn implements/equipements
- Rural (appropriate) technologies - biogas, solar energy, devices, water lifting devices, wind energy and energy conservation

Current projects:

- Ox drawn ploughs, planters, cultivators, carts, windpower, sugar cane crusher, coffee pulper, biogas plants (various designs), biogas appliances, solar water heaters, solar crop driers, cookstoves

Commercialized projects:

- Most of Centre's devices are rural (domestic) oriented rather than industrial. Most of the devices under 'Current projects' are applied in fields or homes.

Suggested areas of co-operation with other research institutes:

- Any area mentioned under 'Areas of research'.

094. INSTITUTE OF PRODUCTION INNOVATION (IPI), UNIVERSITY OF DAR ES SALAAM

P.O.Box 35075  
Dar Es Salaam  
Tanzania

Telephone: 49192  
48571

Telex: 41561 UNIVIP TZ

Director: Mr. Klaus-Peter Stoermer

Contact person: Mr. Klaus-Peter Stoermer

10 professional staff

Government funded

Annual budget: TZS 1,000,000  
US\$ 1,000,000

Areas of research:

- Emphasis on energy, agriculture and transport, solar refrigeration
- Ethanol as fuel from agricultural wastes
- Wind energy for water pumping
- pressing of oil-bearing seeds

Current projects:

- Solar adsorption refrigerator (ethanol-charcoal)
- Ethanol production from agricultural wastes
- Water pumping by wind energy

Commercialized projects:

- 80t and 20t mechanical oil press
- Seed decorticator
- Windmill - Savonius rotor type

Joint research programmes carried out with:

- Faculty of Engineering (FoE), Dar Es Salaam
- University of Ottawa, Dep. of Civil Engineering, Faculty of Science and Engineering, Canada

Suggested areas of co-operation with other research institutes:

- Solar energy for refrigeration
- Solar Energy for water pumping

095. TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL (UTAFITI)

Kivukoni Front  
B.P. 43032  
Dar es Salaam  
Tanzania

Telephone: 25 802

Telex: 41177

Cable: UTAFITI

Director: Prof. A.S. Msangi, Director General

Contact person: Prof. A.S. Msangi

13 professional staff (2 PhD)

Government and private funded

Annual budget 1984: US\$ 300,000

Areas of research:

Rural energy

Current projects:

Dodoma Rural Energy Project

Suggested areas of co-operation with other research institutes:

Solar energy utilization in cooking and lighting



096. DEPT. OF AGRICULTURAL ENGINEERING AND LAND PLANNING, UNIVERSITY MOROGORO

University Morogoro  
P.O. Box 300  
Tanzania

Telephone: 2511-357

Telex: 55308  
UNIVMOG

Cable: UNIAGRIC  
MOROGORO

Director: Dr. G.C. Mrema, Senior Lecturer

Contact person: Dr. G.C. Mrema

5 professional staff (1 PhD)

Funded by Government and  
The Commonwealth Science Council

Annual budget 1984: US\$ 300,000

Areas of research:

Solar crop drying

Current projects.

Solar crop drier for pyrethrum flowers, fish and tobacco for  
use in rural areas

Joint research programmes carried out with:

- Department of Agricultural Engineering, Nairobi University, Kenya
- Department of Agricultural Engineering, Makerere University,  
Uganda

Suggested areas of co-operation with other research institutes:

- Solar crop drying for rural applications
- Photovoltaics
- Solar pumps

THAILAND

097. ASIAN INSTITUTE OF TECHNOLOGY (AIT)

G.P.O. Box 2754  
Bangkok  
Thailand

Telephone: 51 68 321-22  
52 39 300-13, 52 38 891-93

Telex: 84276TH

Cable: AIT-  
BANGKOK

Director: Prof. A.M. North, President, AIT

Contact person: Prof. G.Y. Saunier, Chairman, Energy Technology Div.

Government and private funded      Annual budget 1984: US\$ 900,000

Areas of research:

- Solar heating, drying and radiation
- Solar air conditioning and refrigeration
- Testing of solar thermal collectors performance
- Generation of electricity with photovoltaic systems
- Solar pond

Current projects:

- Development of a dynamic testing method to determine solar thermal collector performance
- Village size thermal solar refrigerator
- Field trials on solar photovoltaic refrigerator
- Solar water heating test systems of Royal Orchid Hotel (consultancy project)
- Development of multifuel intermittent ice making machine appropriate for remote rural areas
- Development of a multi-biomass fuel pump for rural area

Commercialized projects:

- 800m<sup>2</sup> of solar heater on Royal Orchid Hotel
- Saunier Dynamic Testing Method and Bench (one in National Thai Energy Authorities, one in University of Lyon and CETIAT (France))

Joint research programmes carried out with:

- CRA, Gembloux University (M.J. Cane)
- TNO, Netherlands

Suggested areas of co-operation with other research institutes:

- Testing of solar thermal collectors performance
- Solar pond

098. DEPARTMENT OF SCIENCE SERVICE, PHYSICS AND ENGINEERING DIVISION

Rama 6 Road  
Bangkok 10400  
Thailand

Telephone: 281-5830

Director: Dr. Chalio Surasiti

Contact person: Mr. Pipat Panpaprai, Director Physics and Engineering  
Division

75 professional staff (1 PhD)

Government funded

Annual budget 1984: US\$ 300,000

Areas of research:

Solar energy for drying and water distillation

Current projects:

Use of solar energy for water distillation

Commercialized projects:

160 units of roof type solar still

Suggested areas of co-operation with other research institutes:

Solar still

099. ELECTRICITY GENERATING AUTHORITY OF THAILAND (EGAT)

Nonthaburi 11000  
Thailand

Telephone: (02) 42 48 043      Telex: TH 82711      Cable: EGAT  
NONTHABURI

Director: Mr. Kasama Chatikavaniij, General Manager

Contact person: Mr. Chaya Jivacate, Chief, Special Energy Division

46 professional staff (1 PhD)

Government and private funded      Budget 1980-1984: US\$ 2,500,000

Areas of research:

- Alternative energy
- Technology for electricity generation

Current projects:

Research, development, demonstration test and evaluation on solar  
Electricity (Photovoltaics and Thermodynamics)

Commercialized projects:

Wind Electricity (horizontal and vertical axis)

Joint research programmes carried out with:

- Chulalongkorn University
- King Mongkut's Institute of Technology, Thonburi Campus
- King Mongkut's Institute of Technology, North Bangkok Campus
- Prince of Songkhla University

100. ENERGY INDUSTRY DEVELOPMENT OFFICE

Office of Permanent Secretary  
Ministry of Industry  
Rama 6 Road  
Bangkok 10400  
Thailand

Telephone: 282 3835

Director: Mr. Ta-noo Vicharangsarn, Chief

Contact person: Mr. Ta-noo Vicharangsarn

4 professional staff

Government funded

Annual budget 1984: US\$ 100,000

Areas of research:

- Applications of photovoltaics in remote areas
- Applications of renewable energies (biomass, solar) in rural development activities

Current projects:

- Remote areas photovoltaics
- Ethanol as motor fuel

Commercialized projects:

Ethanol as motor fuel (as a blend with gasoline)

Suggested areas of co-operation with other research institutes:

- Ethanol as motor fuel
- Remote areas applications of photovoltaics

101. ENGINEERING INSTITUTE OF RESEARCH AND DEVELOPMENT (EIRD), SOLAR ENERGY RESEARCH GROUP

Faculty of Engineering  
Chulalongkorn University  
Bangkok 10500  
Thailand

Telephone: 2525001-192

Director: Dr. Somsak Panyakeow

Contact person: Mr. Ekachai Leecarasme, Secretary

6 professional staff (4 PhD)

Government funded

Annual budget 1984: US\$ 10,000 - 20,000

Areas of research:

- Solar thermal power plant
- Solar drying
- Solar refrigerator
- Solar distillation
- Selective surface

Current projects:

Solar drying

Commercialized projects:

Solar collector for hot water supply

Joint research programmes carried out with:

- National Energy Administration (NEA)
- Electricity Generation Authority of Thailand (EGAT)

102. KING MONGKUT'S INSTITUTE OF TECHNOLOGY (KMUTT)

Thonburi Campus  
Rasburana  
Bangkok 10140  
Thailand

Telephone: 46 25 719

Director: Dr. Fiboci Hungspreug, Vice-Rector

Contact person: Dr. Prida Wibulswas, Professor, Energy Technology Prog.

200 professional staff (30 PhD)

Government and private funded

Annual budget 1984: US\$ 3,500,000

Areas of research:

- Solar process heat (drying, distillation, flat plate and concentrating collectors, thermal power generation, thermal storage, refrigeration and air conditioning, radiation measurements and assessment, selective surfaces, solar simulator)
- Photovoltaic systems
- Bioenergy conversion (biogas, thermochemical conversion, bioproductivity)
- Wind technology (wind energy assessment, water pumping, electric power generation)

Current projects:

About 40 projects in above-mentioned areas

Commercialized projects:

- Flat plate collectors
- Natural convection type dryers

Suggested areas of co-operation with other research institutes:

The areas identified above

103. NATIONAL ENERGY ADMINISTRATION

Kasatsuk Bridge  
Bangkok 10500  
Thailand

Telephone: 2224102-10

Telex: 20524

Cable: NATPOWER

NAPOWER TH

Director: Mr. Prapath Premmani, Secretary General

Contact person: Mr. Prapath Premmani

3 professional staff (1 PhD)

Funded by Government  
and USAID

Government contribution (per year): US\$ 528,600  
USAID (over 5 years): US\$ 5,000,000

Areas of research:

- Solar collector testing
- Solar pumping system
- Solar dryer
- Solar distillation
- Solar data analysis
- Feasibility study of solar hot water system application for industries, hospital and commercial service building

Current projects:

- Demonstration projects on solar photovoltaic pumping system for village irrigation and water supply
- Demonstration projects on solar hot water heating system for industrial application

Joint research programmes carried out with:

- Faculty of Engineering, Chulalongkorn University, Thailand
- Faculty of Engineering, King Mongkut's Institute of Technology, Thailand
- Meteorological Department, Thailand

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'



104. PHYSICS DEPARTMENT, SOLAR ENERGY GROUP, PRINCE OF SONGKLA UNIVERSITY

P.O. Box 3, Kohong  
Haad Yai  
Thailand

Telephone: 24 48 77-267

Telex: 62168 PSU HI TH

Director: Dr. C. Silawatshananai, Assistant Professor

Contact person: Dr. C. Silawatshananai

1 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 10,000

Areas of research:

- Utilization of small solar furnace
- Development of solar energy material by means of plasma sputtering

Current projects:

As above

Commercialized projects:

Solar drying of rubber sheet

Suggested areas of co-operation with other research institutes:

As stated under 'Areas of research'

105. SEMICONDUCTOR DEVICE RESEARCH LABORATORY

Faculty of Engineering  
Chulalongkorn University  
Bangkok 10500  
Thailand

Telephone: 2525001-187

Director: Dr. Somsak Panyakeow

6 professional staff (4 PhD)

Government funded

Annual budget: US\$ 30,000 - 40,000  
1984

Areas of research:

- Photovoltaic cells
- Photovoltaic system and application

Current projects:

- Single crystalline silicon solar cells
- Polycrystalline silicon solar cells
- Photovoltaic system design and applications

Joint research programmes carried out with:

- National Energy Administration (NEA)
- Electricity Generation Authority of Thailand (EGAT)
- Military Research and Development Center
- Tokyo Institute of Technology

106. THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

196 Phahonyothin Road  
Bang Khen  
Bangkok 10900  
Thailand

Telephone: 57 91 121-30

Telex: TISTR BANGKOK

Director: Dr. Smith Kampempool

Contact person: Ms. Nara Pitakarnnop, Director, Energy Research Div.

304 professional staff (15)

Government and private funded  
with contributions of international  
agencies

Annual budget 1984: US\$ 4,300,000

Areas of research:

- Renewable energy
- Industry
- Agriculture
- Building
- Environment

Current projects (in energy sector):

- Production of fuel alcohol from cassava
- Pyrolysis of rice husk
- Industrial implementation of a photovoltaic project (under negotiation)

Commercialized projects:

- Feasibility study on production of rice husk briquets
- Production of biogas from waste water

Joint research programmes carried out with:

- Japan Association of Industrial Fermentation (JAIF)
- National Energy Administration (NEA)
- International Development Research Centre (IDRC)

TRINIDAD AND TOBAGO

107. THE UNIVERSITY OF THE WEST INDIES (U.W.I.), SOLAR ENERGY PROJECT

Department of Chemistry  
University of the West Indies  
St. Augustine  
Trinidad and Tobago

Telephone: Direct Line: 662-4524  
P.B.X. 66 31364, 31374

Cable: STOMATA

Contact person: Dr. Oliver Headley, Senior Lecturer, Dept. of Chemistry  
4 professional staff (PhD)

Funded by U.W.I., E.D.F., OAS                      Annual budget 1984: US\$ 10,000

Areas of research:

- Solar crop drying
- Solar distillation for distilled water
- Solar collectors for alcohol fuel production

Current projects:

- Solar stills for schools (appr. 20 in Trinidad and Tobago and appr. 50 in Jamaica)
- Solar driers for rural farmers (Barbados 20 m<sup>2</sup> drier, Grenada 8m<sup>2</sup> drier, Guyana one 20 m<sup>2</sup> and a few 2.5 m<sup>2</sup> driers, Dominica 2m<sup>2</sup> driers)

Joint research programmes carried out with:

- University of McGill, Brace Research Institute, Canada
- Caribbean Agricultural Research and Development Institute (CARDI)
- Brace Research Institute, McDonald College,  
Ste Anne de Bellevue, Quebec H9X 1C0, Canada
- Grenada Agro Industrial Laboratory, Belmont, St. Georges, Grenada

TURKEY

108. KOC HOLDING S.A. - RESEARCH AND DEVELOPMENT CENTER

Sutluce Karaagac Cad 2/4  
Halicioglu  
Istanbul  
Turkey

Telephone: 150 0890, 150 1427    Telex: 24101 arcktr  
150 1427, 150 0891

Director: Mr. Jean Nahum

Contact person: Mr. Jan Klod Holat, Project Co-ordinator, Dept. Manager

24 professional staff  
(5 in Energy Department)

Private funded

Annual budget 1984: US\$ 600,000  
(For energy projects US\$ 100,000)

Areas of research (Only in Energy Department concerning solar energy):

- Feasibility studies for photovoltaic manufacturing plant
- Development of three flat plate solar collectors
- Technical and economic feasibility studies for wind generators

Current projects:

As above

Joint research programmes carried out with:

116 industrial and/or commercial companies belonging to the KOC Holding Group

UGANDA

109. MAKERERE UNIVERSITY

P.O. Box 7062  
Kampala  
Uganda

Telephone: 42471

Director: Prof. J.O. Ilukor, Head, Department of Physics

Contact person: Prof. J.O. Ilukor

14 professional staff (7 PhD)

Government funded                      Annual budget 1984: US\$ 70,000 - 100,000

Areas of research:

- Solar heating and cooling
- Solar crop drying
- Biogas and improved charcoal stoves

Current projects:

- Refrigeration
- Parabolic concentrators
- Biogas appliances

Commercialized projects:

Biogas and charcoal stoves

Joint research programmes carried out with:

Through Commonwealth Science Council (London) with: Kenya, Tanzania, Zambia, Malawi, Zimbabwe, Mauritius, Seychelles, Cyprus etc.

VENFUZUELA

110. UNIVERSIDAD SIMON BOLIVAR, NUCLEO UNIVERSITARIO DEL LITORAL

Ap. Postal 314, La Guaira 1160-A  
Departamento Vargas  
Venezuela

Telephone: (031) 71111 to 115 Telex: 21910 USB-NUL

Director: Dr. Carlos Pittaluga Zerpa

Contact person: Dr. Eric R. Mayer, Solar Energy Research Co-ordinator

7 professional staff (1 PhD)

Government and contract funded          Annual budget 1984: US\$ 25,000

Areas of research:

- Solar active and passive cooling
- Energy conservation
- Bioclimatic constructions
- Integrated energy systems
- Industrial process heat

Current projects:

- Development of a simplified model for comfort assessment in constructions
- Passive cooling, simulation and optimization of an industrial
- Process heat plant based on the maximization of the exergetical gain

Commercialized projects:

Use of solar cells to provide energy to service modules in a remote village of the Amazonas Territory

Joint research programmes carried out with:

- Dr. E. Hernandez - Faculty of Architecture - UNAM Mexico
- Dr. J. Vigneron - Department for Environment, Paris VII, France

Suggested areas of co-operation with other research institutes:

- Passive cooling
- Simulation of thermal processes
- Energy conservation

YUGOSLAVIA

111. INSTITUT "RUDJER BOSKOVIC" (IRB), MATERIALS RESEARCH AND ELECTRONICS DEPARTMENT

Bijenicka 54  
41001 Zagreb  
SR Croatia  
Yugoslavia

Telephone: (041) 435-111

Telex: 21383

Cable: INSTRUBO

yu irb zg

Directors: Dr. S. Kveder, Director General, Dr. B. Etlinger, Director,  
Materials Research and Electronics Department (MRE)

Contact person: Dr. Natko Urli, Scientific Adviser

54 professional staff (17 PhD)

Funded by Government (70%)  
and Industry (30%)

Annual budget 1984: US\$ 500,000

Areas of research:

- Solid state physics and chemistry
- Interaction of plasma with surfaces
- Electronics
- Solar energy
- Nuclear energy

Current projects:

- Ion implantation in semiconductors
- Electron beam annealing
- Thin film solar cells
- Solid-state electrolytes and batteries

Commercialized projects:

- Tables of solar irradiation on inclined surfaces in Yugoslavia
- Solar collectors and solar water heating systems
- Gas-sensor (explosive and poison gases) systems



Joint research programmes carried out with:

The institute co-ordinates solar energy research programme in Croatia and co-operates with eight institutions in the country located in Zagreb, Split and Rijeka

Suggested areas of co-operation with other research institutes:

Photovoltaic solar cells

ZAMBIA

112. PHYSICS DEPARTMENT, THE UNIVERSITY OF ZAMBIA

P.O. Box 32379  
Lusaka  
Zambia

Telephone: 213221-277  
213681-277

Telex: UNZALU  
ZA 44370

Cable: UNZA  
LUSAKA

Director: Professor A.F. Fort, Head of Department

Contact person: Dr. P.K. Jain, Lecturer

18 professional staff (PhD)

Government funded

Annual budget 1984: US\$ 500,000

Areas of research:

- Solid state physics - magnetism
- Nuclear physics - low energy
- Solar energy

Current projects:

- Magnetic separation of cobalt
- Study of solar radiation in Zambia

Suggested areas of co-operation with other research institutes:

- Magnetism
- Solar energy

ZIMBABWE

113. CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF ZIMBABWE

P.O.Box MP 167  
Mount Pleasant  
Harare  
Zimbabwe

Telephone: 303211

Telex: 4-152 ZW

Head of Dept.: Prof. W.R. Mackechme

Contact person: Eng. J.C. Johnston, Senior Lecturer

10 professional staff (2 PhD)

Government funded

Areas of research:

Occasional research projects are done by students at present, but it is hoped to increase the scope of the work in the future.

Current projects:

- Improvement of an already built solar oven
- Production of further "Clear Day Radiation" data - a follow-up of M. Phil thesis by J.C. Johnston
- Specification for meteorology data bank for solar energy research

Suggested areas of co-operation with other research institutes:

Data bank, crop drying and water heating are the principal practical considerations at present.

114. INSTITUTE OF AGRICULTURAL ENGINEERING

P.O. Box BW 330, Borrowdalle  
Harare  
Zimbabwe

Telephone: 88 27 22, 88 31 19

Cable: IAE

Director: Mr. John Spear

Contact person: Mr. B. Byabura-Kirya, Research Engineer

10 professional staff

Government funded

Areas of research:

- (a) Solar crop drying
- (b) Solar water pumping
  - Thermodynamic pumps
  - Photovoltaics
- (c) Wind energy for water pumping

Current projects:

- Solar steam pump (Vanek)
- Testing of photovoltaic pumps for deep borehole pumping

Commercialized projects:

Solar crop drying using roof collectors

Suggested areas of co-operation with other research institutes:

Solar water pumps (thermodynamic pumps)

115. ZIMBABWE UNIVERSITY TECHNOLOGY FORUM (UTF)

Dept. of Land Management  
University of Zimbabwe  
Box MP-167, Mt. Pleasant  
Harare  
Zimbabwe

Telephone: 303211-412

Telex: 4152 UNIVZ ZW

Director: Chairman, Dept, of Land Management

Contact person: Mr. W.J. Ascough, Senior Lecturer, Agric. Engineering

1 professional staff

Private funded

Annual budget 1984: US\$ 1,000

Areas of research:

- Technology transfer to low-income rural communities
- Low-cost solar energy applications for rural development, e.g. crop drying, cooking, water heating and biomass use

Current projects:

- Application of solar energy to a low-income isolated community in north-east Zimbabwe
- Introduction of solar energy into new secondary school science curriculum

Joint research programmes carried out with:

General solar energy promotion talks, lectures and information to schools, service organizations and co-operation with Solar Energy Society of Zimbabwe

Suggested areas of co-operation with other research institutes:

The limited resources of the institute and national needs dictate focusing on promotion and education more than research

ALPHABETICAL INDEX OF INSTITUTIONS

AGENCY FOR ASSESSMENT AND DEVELOPMENT OF TECHNOLOGY (ENERGY DEVELOPMENT AND APPLICATION PROJECT), Indonesia	043
AGRICULTURAL TOOLS RESEARCH CENTRE (ATRC), India	019
APPROPRIATE TECHNOLOGY DEVELOPMENT ASSOCIATION (ATDA), India	020
ASIAN INSTITUTE OF TECHNOLOGY (AIT), Thailand	097
BALAJU YANTRA SHALA SANITARY ENGINEERING LIMITED/BYSSEL, Nepal	065
BEIJING SOLAR ENERGY RESEARCH INSTITUTE (BSERI), China	073
BHARAT HEAVY ELECTRICALS LIMITED, CONTROL EQUIPMENT DIVISION, India	021
CARIBBEAN DEVELOPMENT BANK/TECHNOLOGY AND ENERGY UNIT (CDB/TEU), West Indies	007
CENTRAL ARID ZONE RESEARCH INSTITUTE, India	022
CENTRAL BUILDING RESEARCH INSTITUTE (CBRI), India	023
CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (CECRI), India	024
CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE (CEERI), India	025
CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING, India	026
CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE (CSMCRI), BHAVNAGAR, India	027
CENTRE DE DEVELOPPEMENT DES MATERIAUX - LABORATOIRE DES MATERIAUX SOLAIRES, Algeria	001
CENTRE DE RECHERCHE DES UTILISATIONS DES ENERGIES ALTERNATIVES (CRUEA), Burundi	010
CENTRE D'ETUDES BURUNDAIS EN ENERGIES ALTERNATIVES - CEBEA, Burundi	009
CENTRE FOR AGRICULTURAL MECHANIZATION AND RURAL TECHNOLOGY (CAMARTEC), Tanzania	093
CENTRE FOR ENERGY STUDIES, INDIAN INSTITUTE OF TECHNOLOGY, DELHI, India	028
CEYLON INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Sri Lanka	089
CIVIL ENGINEERING DEPARTMENT, UNIVERSITY OF ZIMBABWE, Zimbabwe	113
COMISION NACIONAL DE INVESTIGACIONES ESPACIALES (CNIE), DEPARTAMENTO DE ENERGIAS NO CONVENCIONALES, Argentina	004
DELEGATION UNIVERSITAIRE AUX ENERGIES NOUVELLES (D.U.E.N.), Madagascar	053
DEPARTMENT OF BUILDING SCIENCE, NATIONAL UNIVERSITY OF SINGAPORE, Singapore	086
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF SCIENCE AND TECHNOLOGY, Ghana	016
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF LAGOS, Nigeria	066
DEPARTMENT OF MECHANICAL ENGINEERING, UNIVERSITY OF NAIROBI, Kenya	051
DEPARTMENT OF MECHANICAL ENGINEERING, PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY, Papua New Guinea	072
DEPARTMENT OF PHYSICS, UNIVERSITI KEBANGSAAN MALAYSIA (UKM), Malaysia	059
DEPARTMENT OF PHYSICS, UNIVERSITY OF GHANA, LEGON, Ghana	017
DEPARTMENT OF SCIENCE SERVICE, PHYSICS AND ENGINEERING DIVISION, Thailand	098
DEPT. OF AGRICULTURAL ENGINEERING AND LAND PLANNING, UNIVERSITY MOROCORO, Tanzania	096

DESERT DEVELOPMENT CENTER, THE AMERICAN UNIVERSITY IN CAIRO, Egypt	013
ECOLE MOHAMMADIA D'INGENIEURS, Morocco	064
ECOLE NATIONALE SUPERIEURE POLYTECHNIQUE, Cameroon	011
ECOLE NATIONALE SUPERIEURE UNIVERSITAIRE DE TECHNOLOGIE (ENSUT), Senegal	083
ELECTRICITY GENERATING AUTHORITY OF THAILAND (EGAT), Thailand	099
ENERGY CONVERSION DEVELOPMENT CENTER (C.D.C.E.), Algeria	002
ENERGY INDUSTRY DEVELOPMENT OFFICE, Thailand	100
ENERGY RESOURCES DIVISION, RESEARCH INSTITUTE, UNIVERSITY OF PETROLEUM AND MINERALS, Saudi Arabia	082
ENERGY STUDIES UNIT (ESU), INSTITUTE FOR NATURAL RESOURCES, Fiji	015
ENGINEERING INSTITUTE OF RESEARCH AND DEVELOPMENT (EIRD), SOLAR ENERGY RESEARCH GROUP, Thailand	101
FACULTY OF ENGINEERING, MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF MALAYA, Malaysia	056
FACULTY OF ENGINEERING, NATIONAL UNIVERSITY OF SINGAPORE, Singapore	087
GENERAL ORGANIZATION OF ENGINEERING INDUSTRIES, Syria	090
GENERAL RESEARCH INSTITUTE FOR NON-FERROUS METALS (GRINM), China	074
GRUPO DE ENERGIA SOLAR - INSTITUTO DE FISICA ROSARIO (CONICET-UNR/GES-IFIR), Argentina	005
INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY, India	029
INDIAN INSTITUTE OF TECHNOLOGY (IIT), KHARAGPUR, India	030
INDUSTRIAL RESEARCH INSTITUTE, Ghana	018
INDUSTRIAL TESTING AND RESEARCH CENTER, Syria	091
INSTITUT DE RECHERCHE SUR LES ENERGIES NOUVELLES (IREN), Ivory Coast	048
INSTITUT PENYELIDEKAN & KEMASJUAN PERTANIAN MALAYSIA, MALAYSIAN RESEARCH AND DEVELOPMENT INSTITUTE (MARDI), Malaysia	057
INSTITUT "RUDJER BOSKOVIC" (IRB), MATERIALS RESEARCH AND ELECTRONICS DEPARTMENT, Yugoslavia	111
INSTITUTE FOR GEOLOGICAL AND MINING RESEARCH (IRGM), ENERGY RESEARCH LABORATORY (LRE), Cameroon	012
INSTITUTE OF AGRICULTURAL ENGINEERING, Zimbabwe	114
INSTITUTE OF PRODUCTION INNOVATION (IPI), UNIVERSITY OF DAR ES SALAM, Tanzania	094
INSTITUTO DE FISICA - UNIVERSIDADE ESTADUAL DE CAMPINAS, GROUPO DE ENERGIA, Brazil	008
INSTITUTO DE INGENIERIA, UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO (UNAM), Mexico	062
INSTITUTO DE INVESTIGACIONES EN ENERGIA NO CONVENCIONAL (INENCO), Argentina	006
INSTITUTO TECNOLOGICO Y DE ESTUDIOS SUPERIORES DE MONTERREY/ITESM, Mexico	063
INTERDISCIPLINARY RESEARCH GROUP (IDRG), India	031
JAWAHARLAL NEHRU UNIVERSITY (JNU), UNIVERSITY INSTRUMENTATION CENTRE, India	032
JYOTI LIMITED, ENERGY DIVISION, India	033
KAPUR SOLAR FARMS, India	034
KENYA INDUSTRIAL RESEARCH AND DEVELOPMENT INSTITUTE, Kenya	052
KING MONGKUT'S INSTITUTE OF TECHNOLOGY (KMUTT), Thailand	102
KOC HOLDING S.A. - RESEARCH AND DEVELOPMENT CENTER, Turkey	108
KOREA INSTITUTE OF ENERGY & RESOURCES (KIER), Republic of Korea	081
LABORATOIRE DE L'ENERGIE SOLAIRE (L.E.S.O.), Mali	061

LEMBAGA FISIKA NASIONAL (LPN-LIPI) - NATIONAL INSTITUTE FOR PHYSICS, Indonesia	044
MAKERERE UNIVERSITY, Uganda	109
MECHANICAL AND INDUSTRIAL ENGINEERING DEPARTMENT, UNIVERSITY OF ROORKEE (MIED/UOR), India	035
MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF JORDAN, Jordan	049
MECHANICAL ENGINEERING DEPARTMENT, UNIVERSITY OF SHIRAZ, Iran	045
MINISTRY OF NATIONAL DEVELOPMENT, TECHNOLOGY FOR DEVELOPMENT DIVISION, Seychelles	085
NATIONAL ENERGY ADMINISTRATION, Thailand	103
NATIONAL INSTITUTE OF SILICON TECHNOLOGY, Pakistan	069
NIGERIAN INSTITUTE OF PLANT SCIENCE AND SOLAR ENERGY/TECHNOLOGY, Nigeria	067
PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR), Pakistan	070
PHILIPPINE NATIONAL OIL COMPANY - ENERGY RESEARCH AND DEVELOPMENT CENTER (PNOC-ERDC), Philippines	079
PHYSICS DEPARTMENT, NATIONAL UNIVERSITY OF SINGAPORE, Singapore	088
PHYSICS DEPARTMENT, SOLAR ENERGY GROUP, PRINCE OF SONGKLA UNIVERSITY, Thailand	104
PHYSICS DEPARTMENT, THE UNIVERSITY OF ZAMBIA, Zambia	112
POLYTECHNIC, Malawi	054
RESEARCH AND DEVELOPMENT CENTRE, HINDUSTAN BROWN BOVERY LTD., India	036
RESOURCES DEVELOPMENT INSTITUTE (RDI), India	037
ROYAL SCIENTIFIC SOCIETY (RSS), SOLAR ENERGY RESEARCH CENTER (SERC), Jordan	050
SCIENCE AND TECHNOLOGY UNIT (SIT/WRD), UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA), Ethiopia	014
SCIENTIFIC STUDIES AND RESEARCH CENTER (SSRC), Syria	092
SEMICONDUCTOR DEVICE RESEARCH LABORATORY, Thailand	105
SHANGHAI INSTITUTE OF ENERGY, China	075
SHANGHAI NON-FERROUS METALS RESEARCH INSTITUTE, China	076
SOCIETE INDUSTRIELLE DES APPLICATIONS DE L'ENERGIE SOLAIRE (SINAES), Senegal	084
SOLAR ENERGY CENTER, Iran	046
SOLAR ENERGY GROUP, DEPARTMENT OF MECHANICAL ENGINEERING, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, India	038
SOLAR ENERGY RESEARCH CENTRE, Iraq	047
SOLAR ENERGY RESEARCH SECTION, SHANGHAI INSTITUTE OF MECHANICAL ENGINEERING, China	077
STATION D'EXPERIMENTATION DES EQUIPEMENTS SOLAIRES, Algeria	003
STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM), Malaysia	058
TANZANIA NATIONAL SCIENTIFIC RESEARCH COUNCIL (UTAFITI), Tanzania	095
TATA ENERGY DOCUMENTATION AND INFORMATION CENTRE, India	040
TATA ENERGY RESEARCH INSTITUTE, FIELD UNIT (TERI/FRU), India	041
TATA INSTITUTE OF FUNDAMENTAL RESEARCH (TIFR), India	042
THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH, Thailand	106
THE INTERNATIONAL RICE RESEARCH INSTITUTE (IRRI), Philippines	080
THE NATIONAL INDUSTRIAL DEVELOPMENT CORPORATION LIMITED (NIDC), India	039
THE UNIVERSITY OF THE WEST INDIES (U.W.I.), SOLAR ENERGY PROJECT, Trinidad and Tobago	107

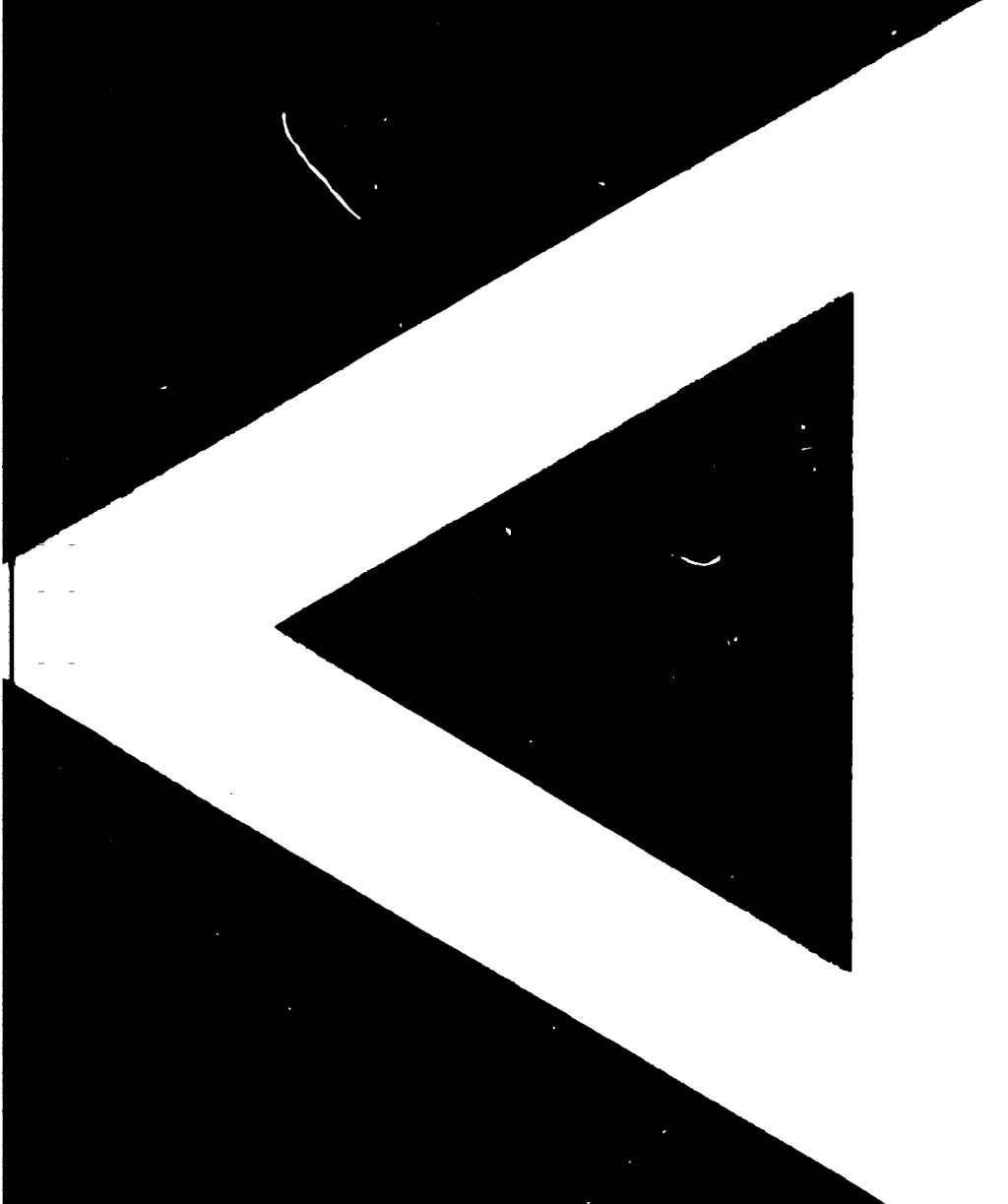


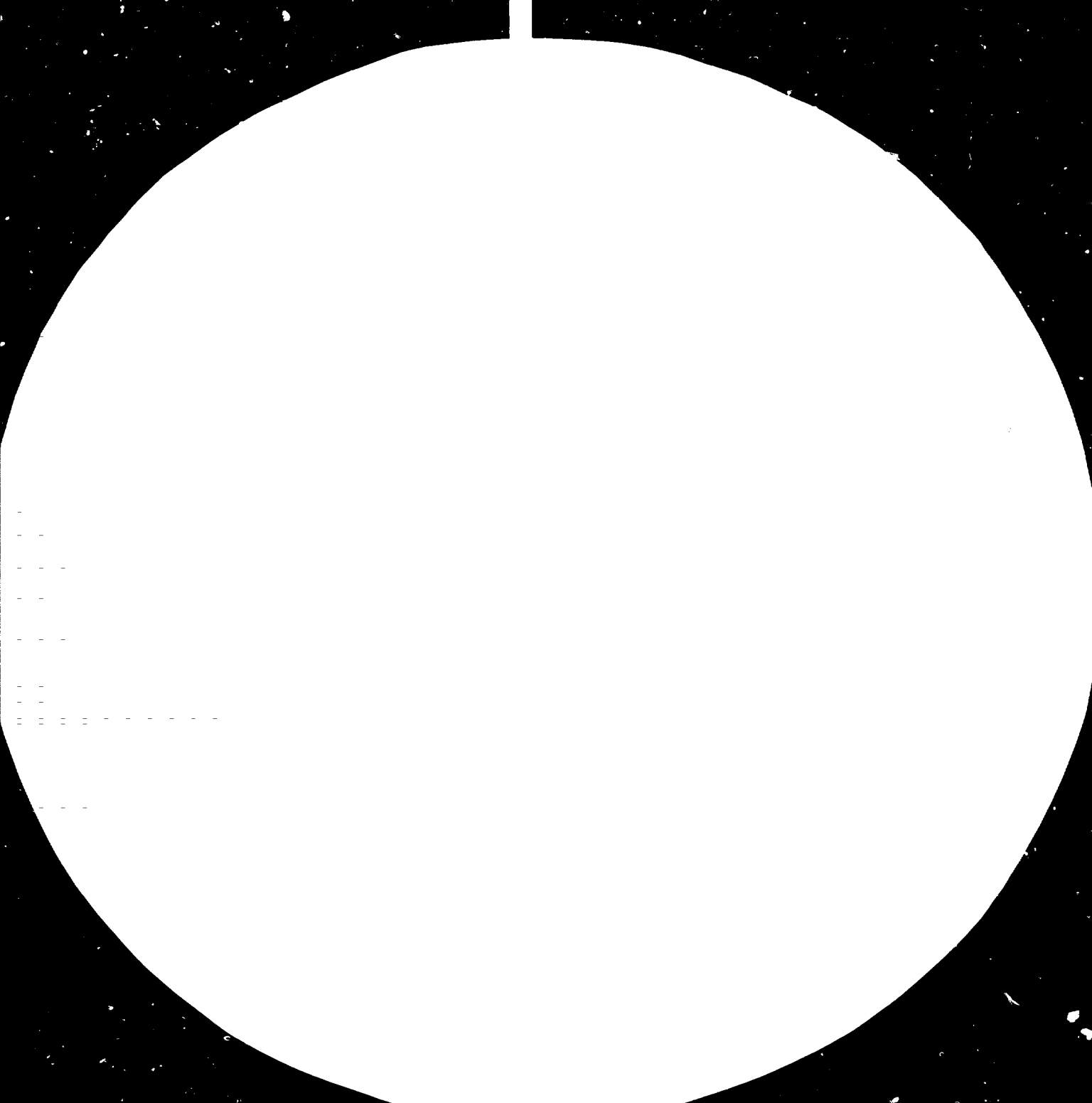
THERMAL AND PASSIVE ENERGY LABORATORY, UNIVERSITY OF IFE, Nigeria	068
UNIVERSIDAD SIMON BOLIVAR, NUCLEO UNIVERSITARIO DEL LITORAL, Venezuela	110
UNIVERSITI SAINS MALAYSIA, Malaysia	060
UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR, Pakistan	071
UNIVERSITY OF MALAWI, THE POLYTECHNIC, Malawi	055
ZHEJIANG RESEARCH INSTITUTE FOR BIOGAS AND SOLAR ENERGY (ZIBS), China	078
ZIMBABWE UNIVERSITY TECHNOLOGY FORUM (UTF), Zimbabwe	115

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I N F O R M A T I O N S H E E T

1. Name of Institute / Acronym:		
2. Address in full:		
3. Telephone:	Telex:	Cable:
4. Name of director/head of institute:	Contact person: Name: Position:	
5. Number of professional staff: (Number of PhD):		
6. Approximate annual budget (in US\$):	Source of funding: Government Private	
7. Areas of research:		
8. Current projects:  Research projects already applied in industry (indicate No. and type):		
9. Is your institute engaged in joint research programmes with other institutions, either in your country or abroad? If so, please give names and addresses of these institutions.		
10. If not, would your institute be prepared to enter into joint research programmes with institutions in other developing countries: In which particular area would you wish to co-operate:		







45

50

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DIRECTORY OF SOLAR RESEARCH INSTITUTES  
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Addendum 1986

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245

C O N T E N T S

<u>Country</u>	<u>Name of Institute</u>	<u>Page</u>
ANGOLA	Instituto de Energia Renovaveis	1
BRAZIL	Centro de Tecnologia-CPGEM	2
EGYPT	Khalifa for Engineering, Consultation and Computers Application	3
MEXICO	Department de Energia, CINVESTAV-IPN	4
NEPAL	Research Centre for Science and Technology (RECAST)	5
NIGERIA	Semiconductor Laboratory, University of Ife	6
PAKISTAN	N.W.F.P. University of Engineering and Technology	7
PERU	Institute of Industrial Technological Research and of Technological Research and Technical Standards	8
SRI LANKA	Arthur C. Clarke Centre for Modern Technologies	9
SUDAN	National Energy Administration (NEA) Energy Research Council	10 11
TOGO, Republic of	Solar Energy Laboratory	12
TURKEY	FIRAT University	13
VENEZUELA	Universidad Nacional Experimental	14

SUBJECT INDEX

<u>Area of research</u>	<u>Institutes</u>
Collectors (flat plate and concentrating)	128
Desalination/distillation	116, 120, 122, 129
Drying (crop, fish, timber etc)	116, 117, 120, 122, 123, 127
Industrial process heat	124
Photovoltaic conversion	116, 123
Selective surfaces	128
Solar cooker	120, 122, 126, 127
Solar cooling and refrigeration	117, 125
Solar materials	119, 121
Solar pond	117, 127
Solar radiation measurement	116, 117, 127, 129
Solar thermal applications	119
Solar water heating	122, 123, 127
Storage (thermal and photochemical)	119
Solar data handling	128
 <u>Related areas</u>	
Biomass/biogas	116, 123, 127
Wind energy	116, 123, 126, 127
mini-, small-hydro	116, 123, 126
Energy conservation	118, 125
Energy planning	125
Computer modelling and simulation of energy systems	118



ANGOLA

116. INSTITUTO DE ENERGIA RENOVÁVEIS, MINISTÉRIO DA ENERGIA E PETRÓLEOS

Rua Rainha Ginga  
Luanda  
R.P. Angola

Telephone: 70730/70751/70752      Telex:      Cable:

Director: Mr. Felix Mathias Neto

Contact person: Mr. Felix M. Neto, Head of Institute

9 professional staff (5 PhD)  
Government funded

Annual budget 1986: US\$ 300,000

Areas of research:

- Photovoltaic solar energy
- Low temperature applications of solar energy
- Wind energy
- Biomass
- Ethanol-sugar cane
- Small hydroelectric power plants
- Solar radiation measurement

Current projects:

- Photovoltaic conversion
- Solar drying
- Solar water heating
- Solar desalination
- Water pumping (photovoltaic)
- Biomass gasification and biogas

Commercialized projects:

- Solar collector
- Solar drying

Joint research programmes carried out with:

- Universidade Agostinho Neto, R.P. Angola
- A.F.M.E. - Agence Francaise Pour La Maitrise de l'Energie
- I.P.T. Instituto de Pesquisa Tecnológicas do Sao Paulo

Suggested areas of co-operation with other research institutes:

BRAZIL

117. CENTRO DE TECNOLOGIA - CPGEM (Postgraduate course in Mechanical Engineering)

Universidade Federal de Paraiba  
58059 Joao Pessoa Pb.  
Brazil

Telephone: (083) 224 7200/2186 Telex:(083)2187 Cable:

Director: Prof. Jader Nunes de Oliveira (Centre)  
Prof. Severino R. De Araújo (CPGEM):

Contact person: Pío Caetano Lobo, Professor

4 professional staff (in solar energy) (PhD)

Government funded Annual budget 1986: US\$ 30,000

Areas of research:

- Solar refrigeration and natural cooling
- Solar ponds and collectors
- Solar radiation instruments and measurement
- Solar drying

Current projects:

- Solar and natural cooling
- Solar ponds
- Silica gel/water system adsorption/desorption characteristics
- Electrical equivalence phranometer
- Design procedures for drying of agricultural produce

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- 
- 
- 
- 

Suggested areas of co-operation with other research institutes:

- Solar ponds
- Design and performance prediction of dryers
- Solar refrigeration and air conditioning

EGYPT

118. KHALIFA FOR ENGINEERING, CONSULTATION AND COMPUTERS APPLICATION

King Faisal City  
King Faisal Road, Buildg. 7, Apt.2, 3rd floor  
Giza  
Egypt

Telephone:

Telex:

Cable:

Head of Institute: Dr. Adel M.A. Khalifa

Contact person: Dr. Mohsen Eniat, Technical Director

10 professional staff (3 Ph.D.)

Privately funded

Annual budget 1986: US\$ 50,000

Areas of research:

- Solar energy in general
- Energy conversation
- Computer modelling and simulation of energy systems

Current projects:

- Solar drive-in cafeteria in Cairo
- A portable Shesh Kababer driven by solar heat

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- Under negotiation with Cairo University, Faculty of Engineering:
- A heat pipe solar water heater for Egypt

Suggested areas of co-operation with other research institutes:

- Solar energy applications
- Energy conservation

MEXICO

119. DEPARTMENT DE ENERGIA, CINVESTAV-IPN-MERIDA

Km.6 Ant. Carr. Progreso  
A.P. 73 Cordemex.  
Merida, Yuc. 97310  
Mexico

Telephone: (99) 26-03-99  
(99) 26-02-43

Telex: 0753654 CIEMME

Cable:

Director: Dr. Alonso Fernández G.

Contact person: Dr. Roberto Uribe, Chairman of Energy

11 professional staff (6 Ph.D.)

Government funded

Annual budget 1986: US\$180,000

Areas of research:

- Uses of solar thermal energy
- Silicon, solar grade
- Photochemical storage
- Hydrogen and thermal storage

Current projects:

- Solar distillation; solar heating in fish-hatching;
- Thermochemical and catalytic processes applied to solar energy storage; H<sub>2</sub> systems pX-Si production by electrolysis and by direct reduction; silanes production; a-Si:H production and characterization;
- photoactivated electron transfer in organized media

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- Universidad Autonoma Metropolitana-Iztapalapa, Avs. Michoacán y Purísima Col. Vicentina, C.P. 09340, Mexico City, Mexico

Suggested areas of co-operation with other research institutes:

- Photochemistry in organized media
- Solar energy storage - hydrogen systems
- Synthesis and characterization of semiconductors

NEPAL

120. RESEARCH CENTRE FOR APPLIED SCIENCE AND TECHNOLOGY (RECAST)

Kirtipur Multiple Campus,  
Kirtipur  
Kathmandu  
Nepal

Telephone: 2-14303

Telex:

Cable: RECAST

Director: Dr. K.L. Shrestha, Executive Director

Contact person: V.M. Shrestha

4 professional staff

Government funded

Annual budget 1986: US\$ 2,000

Areas of research:

- Solar cooker, drier and distillation

Current projects:

- Solar cooker

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- There has been collaboration with
- GTZ, Federal Republic of Germany and JOCV, Japan

Suggested areas of co-operation with other research institutes:

- Solar cooker; solar crop drying; timber drying;
- Passive heating/cooling
- Selective coating

**NIGERIA**

**121. SEMICONDUCTOR LABORATORY, UNIVERSITY OF IFE**

Department of Electronic and Electrical Engineering  
University of Ife  
Ile-Ife  
Nigeria

Telephone: Ife 2291

Telex:

Cable: IFEVARSITY  
IFE

Director: Prof. V.A. Williams

Contact person: Dr. Titilayo A. Kuku

6 professional staff (4 Ph.D.)

Government funded

Annual budget 1986: US\$ 40,000

Areas of research:

- Silicon-based integrated devices
- Production of silicon from local quartz deposits
- PV: development of tertiary materials like  $\text{Cu}_2\text{SnS}_3$  and  $\text{Cu}_2\text{O}$
- Material study for solar spectral selectivity ( $\text{Cu}_2\text{O}-\text{Al}_2\text{O}_3$ ,  $\text{In}_2\text{O}_3:\text{Sn}$ ,  $\text{SnO}_2:\text{Sb}$ )
- Silicides--formation and surface characterization

Current projects:

- As above

Commercialized projects:

- Negotiating for industrial testing of some of our devices

Joint research programmes carried out with:

- Material Science Laboratory, Imperial College of Science and Technology, London

Suggested areas of co-operation with other research institutes:

- Material study for solar energy conversion
- Development of silicon-based integrated devices

PAKISTAN

122. N.W.F.P. UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR

Department of Mechanical Engineering  
P.O.Box 814  
Peshawar  
Pakistan

Telephone:

Telex:

Cable:

Director: Dr. Jamal Khan

Contact person: Prof. I.H. Shah

83 professional staff (3 Ph.D.)

Government funded

Annual budget 1986: US\$ 1.6 million

Areas of research:

- Solar water heating
- Solar cooker
- Solar desalination
- Solar grain dryer

Current projects:

- Solar assisted tobacco barn

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- Colorado State University, USA
- Pakistan Council for Scientific and Industrial Research
- Appropriate Technology Development Organization

Suggested areas of co-operation with other research institutes:

- Selective coating
- Solar ponds
- Silicon cell

PERU

123. INSTITUTE OF INDUSTRIAL TECHNOLOGICAL RESEARCH AND OF TECHNICAL STANDARDS (ITINTEC)

Av. Guardia Civil 400 Esq. Av. Canadá  
San Borja  
Lima 41  
Peru

Telephone: 711617 - 719058      Telex: ITINTEC      Cable:  
20496 PE

Director: Eng. Jorge Succar

Contact person: Eng. Benjamin Jarufe, Sub-General Director of Technology

7 professional staff (engineers) in Energy Division

Government funded      Annual budget 1986: US\$ 4 million  
(2% net income of industrial enterprises)

Areas of research:

- Direct use of solar energy: conversion to thermal energy at low temperature (heating and drying);
- Direct conversion to electric energy: pv cells
- Indirect use of solar energy: wind energy: water pump and electricity generation; Bioconversion energy: biogas,
- gasification of wood;
- Micro hydroelectric power plants

Current projects:

- Industrial solar drying, ind. solar systems for water heating;
- Electric energy from windmills; gasification of wood;
- Biogas production from organic wastes

Commercialized projects:

- One solar system for water heating in the textile industry
- Technology transfer to two factories: solar water heaters;
- wind mills for water pumps; solar driers

Joint research programmes carried out with:

- Universidad Nacional Ingeniería, Apart. 1301, Lima, Peru
- COFIDE, Camino Real 390, Lima 27, Peru
- CENERGIA, Av. Las Artes s/n, Lima 41, Peru
- PETROPERU, Av. Paseo de la República 3361, Lima 27, Peru
- Universidad Nacional de Piura, Piura, Peru

Suggested areas of co-operation with other research institutes:

- To receive: bioconversion energy and pv cells;
- To provide: solar heating and drying, water pumping w. windmills



SRI LANKA

124. ARTHUR C. CLARKE CENTRE FOR MODERN TECHNOLOGIES

Katubedda  
Moratuwa  
Sri Lanka

Telephone: 546546, 507461,  
507462

Telex:

Cable:

Director: Prof. Cyril Ponnampereuma

Contact person: Dr. W.T. Weerakoon, Deputy Director

12 professional staff

Government and privately funded

Annual budget 1986: US\$ 48,000

Areas of research:

- Solar energy application in industry and communication

Current projects:

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- 
- 

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- The above programme will be carried out in collaboration with Industrial Organizations Centre, Electricity Board and
- Telecommunication Dept. as well as the two technical universities
- in Sri Lanka

Suggested areas of co-operation with other research institutes:

- 
- 
-

SUDAN

125. NATIONAL ENERGY ADMINISTRATION (NEA)

P.O.Box 2649  
Khartoum  
Sudan

Telephone: 73315

Telex: 215

Cable: TAGA

Director: Dr. Abdel Rahman Shulli

Contact person: NEA Library

100 professional staff (2Ph.D. plus 4 Ph.D.cand.)

Government funded  
USAID, AFME

Annual budget 1986:US\$ 750,000 - 1  
million

Areas of research:

- Energy planning
- Energy resources
- Conservation
- Renewable energies

Current projects:

- Energy balance for Sudan
- Hot water collection for small scale industries
- Solar fridge for medicine storage in rural area

Commercialized projects:

- Biomass (5)
- Energy conservation (2)
- Planning management (1)

Joint research programmes carried out with:

- Energy Development International (E/DI/USAID)
- French Agency for Energy (AFME)
- German Agency for Energy (GTZ)

Suggested areas of co-operation with other research institutes:

- Economic costs of new technologies
- Dissemination of information on and commercialization of solar energy
- Energy management and planning

SUDAN

126. Energy Research Council

P.O.Box 4032  
Khartoum  
Sudan

Telephone: 70701

Telex: 24113  
SREP

Cable: BUHUTH

Director: Dr. El Tayeb Idris Eisa

Contact person: Dr. Ahmed Hassan Hood, Researcher

7 professional staff

Government funded

Annual budget 1986: US\$ 100,000

Areas of research:

- Solar energy
- Biomass energy
- Wind and mini-hydro

Current projects:

- Diverse

Commercialized projects:

- Cooking stoves
- Wind mills

Joint research programmes carried out with:

- G.I.T. USA
- University of Khartoum, Sudan
- Delft University, Netherlands

Suggested areas of co-operation with other research institutes:

- Biomass
- Solar
- Wind, mini-hydro

TOGO, Rep. of

127. SOLAR ENERGY LABORATORY

University of Benin  
B.P.1515  
Lomé  
Rep. of Togo

Telephone: 21-50-95

Telex:5258 UNIVER-BENIN

Director: Messan Gnininvi

Contact person: Messan Gnininvi, Head of Institute

15 professional staff (2 Ph.D.)

Privately funded

Annual budget 1986: US\$ 25,000

Areas of research:

- Solar radiation measurements
- Domestic water heating,
- Cooking stoves
- Solar drying, refrigeration
- Solar pond
- Biomass; wind energy

Current projects:

- Initial operation of salt gradient solar pond
- Solar radiation measurements
- Drying crops and other agricultural products
- Flat plate collectors for domestic water heating
- Testing and research on cooking stoves

Commercialized projects:

- Domestic solar water heater

Joint research programmes carried out with:

- Togo-Benin-Ghana: West African solar radiation measurements
- Ghana: University of Ghana, Legon
- Benin: East National University of Benin

Suggested areas of co-operation with other research institutes:

- Wind energy
- Stoves
- Drying agricultural products

TURKEY

128. FIRAT UNIVERSITY

Elazig  
Turkey

Telephone: 11904

Telex:

Cables

Director: Prof. Dr. Seref Kunc (Chemistry Dept.)  
Dr. Asaf Varol (Mechan. Education Dept.)

Contact person: Prof. Dr. Seref Kunc, Head, Chem. Dept.

5 professional staff (5 Ph.D.)

Government funded

Annual budget 1986: US\$ 5,000

Areas of research:

- Flat plate collectors
- Concentrating collectors
- Selective surfaces
- Solar data handling

Current projects:

- Flat plate collectors
- Concentrating collectors

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- None

Suggested areas of co-operation with other research institutes:

- Concentrating collectors
- Selective surface

VENEZUELA

129. UNIVERSIDAD NACIONAL EXPERIMENTAL "FRANCISCO DE MIRANDA" (U.N.E.F.M.)

Departamento de Fisica y Matematica, Antiguo Seminario  
Calle Zamora  
Coro, Estado Falcon  
Venezuela

Telephone: (068) 78.072                      Telex:                      Cable:  
(068) 51.75.85

Director: Dr. Hernandez Prado, Abraham, Rector

Contact person: Williams J. Garcia O., Head of Lab. Non-conventional  
1 professional staff

University funded                                      Annual budget 1986: US\$ 3,000

Areas of research:

- Desalination
- Distillation
- Solar radiation measurements

Current projects:

- Desalination: studies on efficiency of desalin. plant
- Radiation: study of solar radiation in Coro, Edo. Falcón

Commercialized projects:

- 
- 
- 

Joint research programmes carried out with:

- 
- 
- 

Suggested areas of co-operation with other research institutes:

- Desalination
- Solar radiation

