Programme Directions for Support in Information Related to New and Renewable Sources of Energy

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March 31, 1985

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Introduction

The terms of reference of this study included the determination and examination of the users and producers of New and Renewable Sources of Energy (NRSE) information related to developing countries; design of methodology to obtain a clearer picture of demand for NRSE information; the application of a referee system and application of questionnaires to elicit demands for NRSE information; the application of the methodology to specific cases; consultation as needed with international organizations; the presentation of formal proposal for a monitoring system of NRSE information; and an assessment of future program direction. 1

The actual workplan modified the terms of reference slightly. The main modification was dropping the questionnaire approach and substituting an approach which included retrospective analysis of user requests to the Renewable Energy Resource Information Centre (RERIC) of the Asian Institute of Technology, Bangkok, Thailand; and retrospective analysis of the Commonwealth Regional Renewable Energy Information Service (CRRERIS). This unforeseen arrangement provides a statistical monitoring capacity for renewable energy requests to the two major developing country oriented NRSE bibliographic data bases. 2

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Needs for NRSE were seen to be large, on the order of $1,000 to $4,000 per year per person. 3-4

Needs for NRSE Information (NRSE/I) are also large, and developing countries have relatively small budgetary allotments for this purpose. The consequences of poor NRSE/I affect national policy, research, industry, and the general community. 5-6

Formulation of programme direction recognizes that energy is not an end in itself, but must be considered in light of specific uses. A series of criteria are to be suggested for an "ideal" NRSE/I program. 7

Approach

Although it is difficult to quantify NRSE/I production several approaches indicate that the bulk of production is in the developed world, 50% in the U.S., and that almost half of the total is in solar energy. As NRSE has only recently been considered a "discipline", much NRSE information, especially information related to chemistry, physics, architecture, and engineering is not specifically classified as NRSE/I, but appears elsewhere. 8-11

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The users and potential users of NRSE/I cover a wide spectrum of public, government, business and community interests.	12-13
The financial and budgetary evidence for NRSE/I R&D activities, where available (for selected Latin American countries) indicate that these activities vary greatly from country to country and that national R&D committments to NRSE vary from about 1 million to about 17 million dollars. It is estimated that few developing countries spend more than $50,000 for NRSE/I activities.	14-15
Limits of end-use knowledge of NRSE/I include needs related to use-frequency, inter- vs. intra-regional variations in needs, and especially, needs for resource evaluation. Although other studies have been conducted, the best active, monitorable single sources of information needs are probably to be found in retrospective searching of internationally available NRSE data bases.	16
The overall approach to demand analysis includes end use analysis, the development of a NRSE/I checklist, the use of referees, analysis of information flow and channel widths, and the application of programme criteria. The uses and limits of end-use analysis and referees are discussed in light of comparable approaches. A checklist for end-user categorization is introduced and briefly discussed, as are the relative disadvantages of questionnaires in the NRSE/I context. By contrast, the tech-	17-26

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nique of analysis of written information requests, retrospective computer data, and analysis of "packets" of information dispatched in response to real (as opposed to questionnaire-indicated) use demand is introduced.

A discussion of information flow, first as presented by the U.S. National Science Foundation, then in terms of results of a "core of used information" from the British Lending Library for Science and Technology, is related to the information flow to an NRSE scientific research unit. The width of the information channels are discussed, and it is concluded that the vast amount of information flow to such a unit is locally generated base data and that outside personal contact, subscriptions and author preprints amount to a small part of the total NRSE/I channel width. 27-42

Criteria for NRSE/I programme direction are developed and discussed with respect to the above and other considerations. It is considered that an NRSE/I activity should: have measurable and attributable research or policy impact; have a clearly delineated interface with general and related scientific information; accord with (real) national priorities, may have potential for cooperative activities; that quality information - as defined - be stressed; that the users be capable of absorbing the information provided, that (for decision makers) there be an 43-49

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effect on the perception of an energy problem; that capacity for self direction be incresed; that an activity may have an effect on long-term policy; involve local design; enhance information flow; and that (with noted exceptions) reliance on extra-national sources be reduced.

Results

The results include discussion of the Information Network on New and Renewable Sources of Energy for Asia and the Pacific (INNERTAP) with respect to end-use, the national focal points, probable use, and the programme criteria. Comparisons are made of individual national presentations and the presentation of the Korean Institute of Energy Research (KIER) is found to fulfill many provisions of the checklist. By way of contrast, the other reports appear to fulfill very few of the checklist items. Application of the criteria to the INNERTAP proposal(s) indicates that, as written, the proposal seems to fulfill few of the criteria of this report. 50-63

Analysis of RERIC and CRRERIS use statistics indicates that there is a strong interest in solar energy; that a great deal of information requested is of a general nature; and that the channel widths are in the order of 100 requests per year. 64-65

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2. That an information needs checklist for NRSE/I requirements similar to that suggested in this report establish standards for knowledge of end-use for NRSE/I projects and be incorporated in the model. 75-82

3. That a machine-readable programme, based on the checklist principles, be acquired.

4. That related retrosearch and other end-use information be similarly stored in a machine readable system in the model.

5. That programme criteria, such as those suggested, be similarly placed in the project model, and that the project be evaluated by these criteria before, during, and after project delivery.

6. That all elements of the project benchmark system be integrated in a master programme with access by the Director, Deputy Director, Associate Director and Project Officers.

7. That appropriate computing facilities be acquired/or adapted.

8. That the model include the capacity to write or aid in writing project completion reports.

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29. The supply of identified documents to target audiences on a regular basis, support to very small decentralized reference centers be considered, that drone systems and other recent technical advances be used in this process. 75-82

30. That all recipients of NRSE/I support receive a set of basic chemistry and physics references.

31. That "channel widths" be a major support consideration.

32. That RERIC statistics be monitored on a regular basis.

33. That CRRERIS statistics be monitored especially with respect to developed/developing country use ratios.

34. That RERIC be used as a standard by wich other systems are judged.

35. That energy audits and assessments be supported only where a clear impact on energy saving is expected.

36. That elements of this study be extended to the Caribbean region.

INTRODUCTION

Terms of Reference

The terms of reference for this study were:

(a) To consult with staff of the Centre, especially the Information Sciences Division, and other organizations to determine and examine the target users and producers of New and Renewable Sources of Energy (NRSE) information related to developing countries. The purpose is to assist the Division in formulating its program of support in energy information;

(b) to devise and elaborate a methodology which can be applied by Division to obtain a clearer picture of demand for NRSE information in the developing countries;

(c) as part of this methodology, to design and produce a questionnaire to elicit regional specific and inter-regional demands for general or project specific NRSE information and to analyze the response to the questionnaire;

(d) in conjunction with Division staff, to identify and select a group of 5 to 10 experts to act as referees in reviewing and advising on the questionnaire. If necessary, you will be required to pay a flat rate fee of up to $100 to each referee out of your research expenses;

(e) to travel, if necessary, to Paris, Vienna, Rome, or elsewhere to consult with UN and other agencies involved in energy information for example, UNESCO, UNIDO or FAO;

(f) to test and modify the methodology by applying it to the Information Network on New and Renewable Energy Technologies for Asia and the Pacific (INNERTAP) recently presented as a project proposal to the Division;

(g) to travel to Bangkok and Manila as necessary to monitor the application of the methodology to the INNERTAP project;

(h) to present a formal proposal for the establishment of a monitoring and reporting system for NRSE information applicable to the INNERTAP project and others which will assist IS management in analyzing changes in information needs; and

(i) to present an assessment of future program direction in NRSE information to the Division Director.

Workplan and Modifications

Under the terms of reference, a trip was made to Thailand and to the Philippines on December 9 - 22, 1984. Visits were made to the Asian Institute of Technology, Bangkok, the Thai National Energy Administration, the Thai Ministry of State for Technology and Energy, and the United Nations Economic and Social Committee for Asia and the Pacific (ESCAP).

This study also included a trip to the Second Annual Regional Steering Committee of INNERTAP held December 17- 20 in Quezon City, Philippines.

It was agreed that it would not be necessary to pay the referees. Further the questionnaire, for theoretical and practical reasons, was dropped and in its place agreements were entered into for retrospective searches of CRRERIS and a detailed examination of all request correspondence from RERIC. In addition an arrangement was made to examine the confidential review of CRRERIS prepared for the Australian Development Assistance Bureau (ADAB). A further arrangement was made to provide all CRRERIS responses to requests and retrospective searches of the RERIC data base.

The referees were then only asked to respond to broad categories of information requirements as the fortuitous agreements with the world's two major NRSE data bases specializing in developing countries made detailed examination of questionnaires obsolete.

Needs for NRSE

Energy has been called the raw material of civilization.* Although uncertanties exist in expert predictions as to exactly when the use of fossil fuels may become uneconomic, no one doubts that at some time this "energy capital" will be expended. Thus the supply and utilization of New and Renewable Sources of Energy (NRSE) are fundamentally related to the shape of civilization to come. The transition to NRSE is complex and difficult. Despite the accelerated search for technological substitutes and conscious "off-oil" policies many countries predict that fossil fuel dependence will actually increase well into the next century.†

Partially in recognition of such a global trend various international bodies have addressed the need for "renewable" energy sources, such as direct solar radiation, winds, tides and biomass energy. "New" energy may also refer to better use and exploration of existing fossil reserves, including tar sands and shale oil. Conservation and energy recyling (energy from wastes) as energy "sources", are often also included in the definition of NRSE.

* By the physicist and science communications writer Sir Arthur Clarke.

† Projections from the Republic of Korea, for example, indicate an increase in the degree of dependency on foreign energy sources (of fossil fuels) from 75% in 1981 to 84% in 1991.

Further a distinction has become necessary between energy sources (such as the sun) and energy carriers or currencies (such as electricity and electrical energy storage) which serve as a means and a mediator for moving and storing energy. A number of bodies including a recent Canadian parliamentary special committee recognized many alternative sources of energy and pointed to hydrogen (H^+) as an ideal energy carrier.

To change from fossil-fuel sources and traditional energy carriers to a system of renewable sources, mediated by a H^+ carrier system, will be one of the larger activities, possibly the largest, ever undertaken in human history. The scale of activity required is unprecedented. Capital costs, estimated at zero population growth are on the order of $1,000 per person to $4,000 per person per year. Indeed it is difficult to believe that even a small fraction of what is needed can be done.

Needs for NRSE Information (NRSE/I)

The amount of information (NRSE/I), in all of its forms, required to make such a vast scheme of technological, and economic change possible is also enormous.

In partial recognition of the needs for NRSE/I various world bodies have specifically referred to NRSE/I needs, notably UNESCO and the World Bank. A UNESCO report stated that studies conducted by UNDP, the World Bank, OECD and commission on International Development Issues (the "Brandt" Commission) indicate that effective information transfer is a key issue in planning, forecasting, economic and technical evaluation and application of NRSE at the industrial and rural levels.

However information transfer is but one dimension of the NRSE/I. Not only is very little information on NRSE currently transferred to developing countries, but very little NRSE/I is collected and processed within developing countries. Indeed, this locally available but "lost" information, primarily on resource availability represents the bulk of useful NRSE/I. Yet, despite proposals to alleviate lack of knowledge of resources and despite the efforts of international organizations in the coordination of meterological data and the availability of satellite data, and hydraulic, solar and wind patterns, resource-knowledge for the purposes of NRSE/I in developing countries can only be considered as primitive.

To some extent the great disparities in NRSE/I - greater by far than differences of monetary wealth between developed and developing countries - are the result of lack of financial support to NRSE/I. For example, information support levels for NRSE/I of about $50,000 per year for Brazil with a relatively high NRSE/I budget must be compared to single area studies providing NRSE/I in developed countries which can easily run - as did tidal power studies in Canada - on the order of $10,000,000.

The consequences of such lack of information, are not simply inefficiencies in NRSE adaptation.

Inadequate information at the national level has led to lopsided national priorites*, to lack of public awareness of conservation, and to policy decisions which are made in the absence of other useful information which might, if available, alter national allocation of reserach funds.

The consequences of poor NRSE/I flow are not restricted to national policy but have effects on the scientific community which strike at the very nature of the scientific creative process. Similarly, lack of NRSE/I affects the industrial process, the academic community devoted to teaching and the community at large.

* Costa Rica spends 97% of its NRSE R&D budget on geothermal energy.

Programme Direction

Programme analysis for NRSE/I information support must first consider that energy is not an end in itself. It must be considered in light of specific uses. With use in mind, a number of "ideal" characteristics of NRSE/I and criteria for programme direction are discussed beginning on page 37. These criteria, developed with end-use in mind and applied to various aspects of NRSE/I flow, produced suggestions for a number of project types, examples of which are given later.

APPROACH

Producers and Users of NRSE

Production of NRSE/I

The production of NRSE/I has been addressed, notably by UNESCO in 1980 and 1982 and by the Review of CRRERIS in 1984. However, it is still very difficult to quantify the amount of information on NRSE produced on a global scale. There are a number of indicators of information production including directories of national government organizations, lists of research centres, periodical lists, lists of trade associations, citations by groups such as the ERG, information centres such as CRERRIS and RERIC, review papers produced by government agencies, and budgetary information. However, use of each of these indicators of NRSE/I information has pitfalls. Directories, such as UNESCO's, can miss major sources of information; the International Periodicals Directory lists certainly less than one-quarter of available NRSE periodicals; organization budgets can be misleading and hence national priorities may not be immediately obvious. Institutional lists may be misleading as information output may vary widely by institutions. Further, gross figures do not indicate - with the possible exception of citations - if the information produced is accessible, important, needed, or useful.

Nonetheless, as a beginning, and to get a general idea of information output the following selected countries are ranked by number of entries in the UNESCO directory: the sum of the total number of national government organizations, research centres, information resources, professional/trade associations, journals, directories and data bases.

The following table lists selected countries by entries in the directory.

Entries in the UNESCO directory by selected country (1982).

TABLE

Countries	Entries
United States	1128
India	143
Canada	114
United Kingdom	95
France	69
Argentina	38
Colombia	37
Philippines	28
Brazil	27
Thailand	22
Egypt	20
Korea	13
Kenya	9
Guinea	6
Trinidad	2

The table is a microcosm of difficulties encountered in gross evaluation and the numbers should be used as a very rough guide only. For example, Canadian budgetary committment is roughly 50 times that of India. Yet there are fewer entries for Canada than India. Also NRSE information activity is implausibly low for Korea - in comparison, say, to Thailand.

Nonetheless the rough proportions hold, with the U.S. producing about 50% of global NRSE/I. The distribution by subject matter of NRSE/I in the United States is given in the following table.

TABLE

U.S. Production of Scientific and Technical Documents on New and Renewable Energy 1974 - 1981*

ENERGY SOURCE	TOTAL†	BOOKS OR CONTRIBUTIONS TO BOOKS	JOURNAL ARTICLES	REPORTS OR CONTRIBUTIONS TO REPORTS	DISSERTATIONS	CONFERENCE PAPERS OR PROCEEDINGS	PATENTS	OTHER
OIL SHALE AND TAR SANDS	6,000	300	1,300	1.600	24	1,100	1,700	3
HYDRO	1,800	200	500	600	17	400	35	8
SOLAR	23,600	1,600	4,000	8,100	100	8,300	1,500	30
BIOMASS	5,600	300	1,700	1,700	63	1,800	49	1
GEOTHER-MAL	8,100	800	1,800	2,900	54	2,400	100	1
OCEAN	1,400	35	200	600	4	600	84	0
WIND	4,200	300	700	1,700	27	1,300	100	4
ALL SOURCES	50,800	3,500	10,300	17,200	300	15,800	1,600	47

* Data adapted from U.S. Dept. of Energy, 1981.

Numbers greater than 100 rounded to nearest 100.

† Numbers won't add due to rounding.

The table shows large information production in solar energy, a pattern which also emerges from consideration of bibliographic information production on a global basis. Although there is much room for interpretation, taken together the two tables indicate that the overwhelming amount of "infrastructure" for NRSE information is in the developed world, and that solar energy appears to account for as much as half NRSE information activity.

It is important in an historical context to understand that the topic of NRSE has, until fairly recently not been a recognized discipline in the scientific community. Thus much NRSE information, especially information on chemical and physical processes, engineering techniques and biochemical, agricultural, and architectural information appears elsewhere. This consideration will be of import in considering (Chapter III) program directions to improve NRSE information flow in developing countries.

Users of NRSE/I

Available Data

The UNESCO report identifies:

Decision/Policy Makers
Researchers
Manufacturers and Suppliers
Educators
(the) General Public

as users of NRSE/I. However, annexes to that report identify other users including:

Engineers
Systems Designers
Builders and Architects
Legislators
Public Interest Groups
Financial Community
The Utility Industry
Insurance Industry
the "Media".

Indeed there are few who are not affected by energy use and to the extent that NRSE is a topic of such use, it seems to be "useful" to a wide spectrum of society.

Tables of such use have been prepared, most notably by UNESCO and in a rather well done Annex (V) to its NRSE/I needs study. The study considers the "actions" of "decision/evaluation"; "research"; "manufacture/production"; "training" and "information of the general public".

The information required according to the action to be carried out includes 42 separate topics such as energy models, energy resources of the country, material costs, etc. The various types of NRSE/I, ranging from energy resources of the country to training programmes shows on a small scale the enormous user range (conservation does not seem to be listed). The checklist has its limitations and should be considered as an example only. In addition to this range it is important to note that the topic "energy resources of the country" is the only topic of common interest to all users.

Financial, Budgetary Evidence of NRSE/I Activities

The financial commitment to NRSE R and D in six Latin American countries is shown in the table.

	Argentina	Brazil	Colombia	Costa Rica	Mexico	Uruguay	TOTAL
Financial Resources (US$'000)	3482	17020	1170	11692	9824	1014	44202
Solar (%)	43	6	30	1	71	2	25
Biomass (%)	18	53	51	1	4	24	25
Geothermal (%)	30	-	4	97	23	3	26
Small hydro (%)	9	-	11	-	-	-	3
Wind (%)	3	5	2	-	2	1	2
Low content coal (%)	-	27	-	-	-	-	4
Oil shales (%)	-	7	-	-	-	69	12
Others	7	2	2	1	-	1	3

It may be assumed that NRSE/I is from about 0 to 10% of this expenditure. For example, Argentina lists 21 separate endeavours in the non-conventional energy programme.

Survey of solar energy
Solar architecture
Flat water collectors
Flat air collectors
Solar ponds
Solar concentrating collectors
Development of photovoltaic systems
Water desalination
Survey of wind energy
Development of aerogenerators
Interconnected systems
Biogas
Thermic gasification
Ethanol
Liquid fuels
Autosufficient farms
Power storage
Hydraulics
Coal gasification
Petrol recovery
Synthetic oils

Two of these, wind and solar resource evaluation, have very high information processing demands.

Nonetheless estimates of $50,000 per year for NRSE/I activities for "advanced" developing countries (e.g. Argentina, Brazil, Korea) are certainly top for this activity. It is important to evaluate the IS and indeed IDRC "opportunity impact" in this light.

It is further of import to consider some non-specific demands for "numerical data" processing within this context. With the very high costs for automatic data acquisition (of say meterological station data) the need to make clear well defined "opportunity" choices becomes very obvious.*

* I am indebted to Mr. Ed Brandon of the IS Division for assistance in these calculations.

Limits of end-use knowledge

Knowledge of use and demand patterns is truly limited. Frequency of use is almost never a part of so-called use studies. It is of interest to see that intraregional variations are as large as extra-regional variations. Topics of import to one nation (used oil recovery, hydrogen storage) do not appear as topics of interest either in studies by international bodies or as parts of international data bases. Resource evaluation is virtually nil with specific exceptions.

Studies have been done as to who needs the information. But the best source of who both needs and will use the information, is limited to retrospective searching of internationally available data bases, RERIC and CRRERIS (access to OLADE may of been of help but was beyond the range of this study).

Methods of Demand Analysis

Overall approach

The method for eliciting regional specific and interregional demands for NRSE/I includes the following to be described below:

End use analysis

NRSE/I checklist

Referee system

Information flow analysis

Programme criteria

End-user analysis (EUA)

End-user analysis (EUA) is a classic, traditionally accepted means of improving the effectiveness of information systems. EUA can provide information such as who will use a system, for what purpose, with what frequency and duration and with what preferred mode of delivery. King and Bryant in discussing document transfer systems state that EUA is a valuable tool for providing information about:

a) characteristics of planned systems

b) characteristics of users of an ongoing system

c) potential users

d) characteristics of desired information

e) sources of dissatisfaction with the system

f) needs for user education and system awareness.

EUA is also useful for non-document forms of information transfer and information support to research activities.

King and Bryant list several approaches to EUA, including:

- In-depth interviews
- Group interviews
- Structured interviews
- Questionnaires

They recognized the inevitable bias that can occur during the interview process in EUA. Indeed a certain "channelling" of lines of thought may occur among documentalists in which the means for finding information needs are secondary to the question of what new technologies can be used to supply the documents as fast as possible.

The desire of the recipient of aid to make a request as acceptable as possible plays a role in the thrust to purchase of new technologies.*

While it is not possible to entirely eliminate the unwitting bias of donors which is inherent in the project-granting process, it is especially difficult to eliminate the "second quessing" of acceptable proposals on the part of prospective grant recipients which may make true needs difficult to discern. The referee process is one method of attempting to minimize bias in EUA.

* The American Astrophysical Association experiencing a similar phenomenon has labelled it the "buffalo syndrome"; the paralllel being drawn to a buffalo herd thundering first in one direction and then in another.

Referees

The general function of the referee is to provide continuing guidance for overall direction in NRSE/I needs.

The referees were chosen to represent a wide variety of interests, as far as possible removed from direct grant aid from IDRC. The questions asked referees are open-ended, in an attempt to eliminate bias or (perhaps westernized) "schools of thought". Although some referees know each other professionally "interviews" are conducted separately. To some extent a parallel may be drawn between the referees and the editorial board of a scientific magazine. The referees are:

Dr. Oliver Headley
Senior Lecturer in Chemistry
University of the West Indies
St. Augustine, Trinidad

Dr. Marco Negrete
Insurgentes sur 4411
Mexico, D.F.

Dr. Ramesh Bhatia
Institute of Economic Growth
Delhi, India

Dr. H.D. Panggebean
Director
Energy Conversion and Conversion Technology
Djakarta, Indonesia

Mr. Eric Barney
Instituto de Economia Energetica
Rio Negro, Argentina

Professor Ali Gurses
Chairman, Department of Mechanical Engineering
Dokuz Eylul University
Bornova, Izmir
Turkey

M. Jean Jemeau
Centre de Recherche et d'Application de la
Technologie Appropriée à Milieu Rurale
Port-au-Prince
Haiti

M. Qiu Da Xiong
Institute of Nuclear Technology
Quinghua University
Beijing, Peoples Republic of China

The referees include a wide variety of disciplines including scientists also interested in traditional energy. There is a reasonable spread in geographic distribution, but, importantly, respresentation includes some of the largest generators of NRSE information, Mexico, China, India, and Trinidad. Government, private consultants, and universities are represented.

Comparable Approaches

Several methodologies for determining NRSE/I needs have been elaborated. UNESCO, in 1980, used an expert group approach, involving nearly 40 individual consultants or volunteers who carried out missions in 55 countries and conducted 655 interviews.

The output - a 38 page report with roughly 100 pages of annexes, provides some insight into NRSE/I needs with respect to types of information required by various users. The general thrust of the document is toward an international cooperative NRSE/I system. This thrust subtly affects the approach, and the affected approach produces a document with advantages and disadvantages. The main advantage of the document and the approach taken is a wide-coverge study of NRSE/I needs in 1980. As such, for example the Solar Energy Research Institute (SERI) charts NRSE/I needs by technology (e.g. solar heating), by subject (e.g. systems performance) and by a variety of media for NRSE/I (paper hard copy, microform, graphics, etc.). These results are catalogued in Annex II of the report and from them, for example, we might learn that engineers are interested in:

1. Systems costs
2. Systems performance
3. Climatological data
4. System design

and that (for the case of system costs) technical reports, manuals, handbooks and data compilations, models and algorithms, newsletters, abstract bulletins, microforms, computer models, video tapes, conferences and personal consulting, telephone conversation and personal correspondence are important.

Similarly, sources of production of NRSE/I are discussed in Annex IV: by subject, by country of origin, by language, and, by type of source. For example an analysis of the sources used in preparing reviews of new and renewable energy for rural applications in developing countries shows the following distribution:

Type of source cited	%
Monographs	20
Reports	30
Journals	25
Conference Proceedings	25

The report also contains a useful even brilliant annex (V) on needs and obstacles to information transfer, produced under the Chairmanship of Mme A. David.

One disadvantage of the report, is that it gathers, as annexes, the work of many separate groups. Thus the monographs referred to in the table above, that account for 20% of the total of citations in Annex IV do not even appear as a category in the table of information needs, produced by SERI in Annex II. Nor does the entire journal-reprint system, identified as a separate and major channel of information transfer by the NSF receive much emphasis.*

* This particular bias is not uncommon in discussions of NRSE/I needs. An example of this is in the Review of CRRERIS, which in a Chapter on NRSE/I needs simply fails to mention the ongoing information on measurements of NRSE resources, insolation and base wind and hydraulic data. These forms of information - quite clearly non-bibliographic - have been given priority by several national NRSE programmes. It should be stressed that information cannot simply mean references to experts and document and (unspecified) "numerical data" transfer systems.

Although the categorizations of end users, subject content and medium of information transfer appear to be analysed, little mention, for example, is made of duration or frequency of NRSE/I needs, or what size such a system would have to be to adequately fulfill these needs or the cost to maintain these services.

Yet the main limitation of the report is that it makes no realistic provision to monitor NRSE/I needs. Thus, changes in subject scope - (although recent CRRERIS results indicate the importance of energy conversion systems - accounting for 37% of CRRERIS 1984 use statistics, the hydrogen carrier system that figures prominently in Canadian Government and other discussions of NRSE directions for developed and developing countries does not appear) - and end user needs, which may have taken place recently within the last five years, limit the report's usefulness.

An Assessment Checklist

One technique for elicitation of NRSE/I needs was the production of a checklist assessing the adequacy of knowledge of the transfer process (Annex). This checklist deals with end-user categorization, duration and frequency needs, related users, prime users, subject scope, monitoring capacity, geographical or regional specific needs, delivery style and new information requirements.

Questionnaires

It was initially intended to design and distribute a questionnaire to potential NRSE/I users. This concept had several difficulties. Among the difficulties were those common to all questionnaires, and those specific to questionnaires on NRSE/I. A major problem was foreseen to be that of non-response: those who voluntarily complete a questionnaire frequently have different characteristics than those who do not. King and Bryant, in discussing the use of questionnaires for user surveys indicate that "it is usually necessary to interview a sample of non-respondents to obtain an estimate of non-response bias, an activity which may be so costly as to destroy the cost advantage of using questionnaires rather than interviews".

The application of questionnaires for NRSE/I needs has a further complication deriving from the size of the topic and its rapidly changing nature. An initial checklist of items about which information could be sought ran to over 2,000 items. Clearly several questionnaires would be necessary if this approach were to be continued.

It was further obvious that any end-user questionnaire, unless applied over time in a rigorously uniform fashion would produce only static answers, monitoring changes in opinions/trends would not be possible.

It thus became incresingly apparent that while questionnaires have been used to provide insight on NRSE/I needs, their use as traditionally posed are considered of very limited use is not recommended for the purposes sought in this report.* For this reason, an open-ended questionnaire was distributed to and through the referees, and used in a formal, structural sense during interviews.

The challenge was then to gather EU information on NRSE/I by other techniques.

* King and Bryant stop (just) short of saying they are worthless.

Retrospective and Current Searching

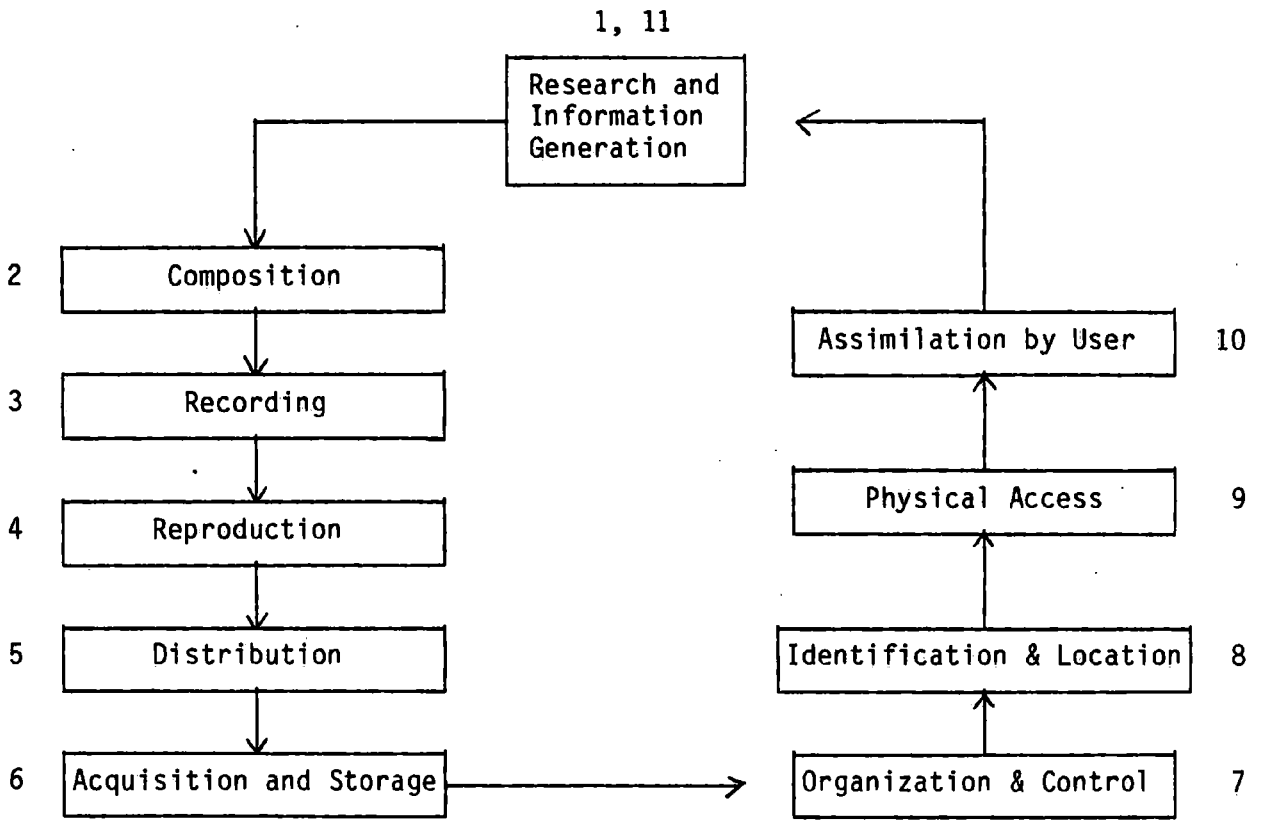
Although not initially envisioned as a part of the report, it has become possible to acquire the latest "on-line" NRSE/I use statistics, accounting for at least 70% of developing country international data base NRSE/I use. The Renewable Energy Resources Information Centre (RERIC) of the Asian Institute of Technology agreed to provide a retrospective analysis of demands including written requests and computer assisted searches. A similar though more limited arrangement was entered into with the Commonwealth Regional Renewable Energy Resource Information Centre (CRRERIS) in Melbourne Australia.

These "on-line" statistics are, with the possible exception of OLADE, the only such statistics that exist for developing country use.

Information Flow

Conclusions from the NSF

The flow of information is a critical component in the analysis of any information system. An example of a simple and very rough analysis of a macro flow, used by the National Science Foundation is given below:



The NSF categorized roles 1 and 2 as that of authors, 2 through 5 as roles of publishers, 5 through 9 as the roles of libraries and information centres, 7 through 9 as the roles of abstracting and indexing services, 8 through 10 as user roles and 1 and 10 as the roles of scientists and engineers.

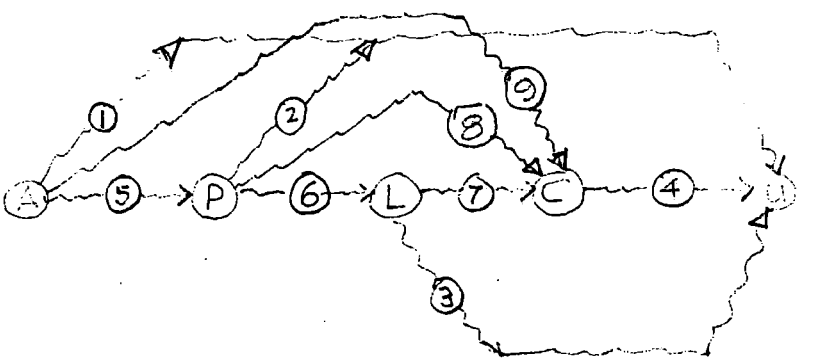
These observations are limited to generation of technical knowledge, and quite clearly deal with information transfer through printed documents.

Apart from any quibble with definitions, several characteristics appear from this simple analysis:

(1) The process is cyclical.

(2) There are many actors in the information transfer process.

To focus on one aspect of information flow the "physical" from an "author" to a "user" one can prepare a more detailed analysis, again that of the NSF. namely a "journal flow" model



A = Author

P = Publisher

L = Library

C = Colleague

U = User

From this it was thus possible to identify "access channels" for this procedure as shown in the table (NSF).

Table

PHYSICAL ACCESS CHANNELS FOR JOURNAL LITERATURE

Path	Participants	Alternative Descriptions
1	Author and User	(a) User obtains reprint from author
		(b) User obtains preprint from author
2	Publisher and User	(a) User subscribes to journal
		(b) User obtains reprint from publisher
3	Library and User	(a) User reads library subscription issue
		(b) User reads library microform edition
4	Colleague and User	(a) User obtains reprint from colleague or office collection
		(b) User obtains preprint from colleague or office collection
		(c) User reads colleague or office subscription issue
5	Author and Publisher	Publisher accepts manuscript for publication
6	Publisher and Library	(a) Library subscribes to journal
		(b) Library purchases microform from publisher
7	Library and Colleague	(a) Colleague obtains library subscription issue
		(b) Colleague obtains library microform edition
8	Publisher and Colleague	(a) Colleague or office subscribes to journal
		(b) Colleague obtains reprint from publisher
9	Author and Colleague	(a) Colleague obtains reprint from author
		(b) Preprint from author

As one part of this expanded analysis it was possible to look more deeply at the "channels", and to categorize them by methods of identification. The identification scheme above is limited to physical entities: means of information flow such as conversation have been excluded. The methods of identification were:

METHODS OF IDENTIFICATION OF JOURNAL LITERATURE (NSF)

1. Discovered while reading own subscription
2. Discovered while reading library subscription
3. Discovered while reading colleague's or office subscription
4. Received preprint from author
5. Obtained preprint from colleague
6. Received reprint from author
7. Received reprint from colleague or co-worker
8. Referred to article by colleague or co-worker
9. Referred to in another article, book or report
10. Found in search of printed indexes
11. Found in output of computerized literature search
12. Found in current awareness or SDI list

It is then possible to ask what method of identification was used for what access channel. One such study produced the following results:

Table

RELATIVE FREQUENCY OF
IDENTIFICATION AND ACCESS CHANNELS

Method of Identification	ACCESS CHANNEL														
	1. User's Own Issue	2. Library Issue	3. Library Microform	4. Colleague/Office Copy	5. Office Microform	6. Publisher Reprint	7. Author Reprint	8. Reprint from Colleague	9. Preprint from Author	10. Preprint from Colleague	11. Colleague's Photocopy	12. No Access	13. Don't Remember	14. Other Sources, as Book	15. Total Percent
1. Discovered reading own copy	15.0		-	-	-	-	0.9	-	-	-	-	-	-	-	16.0
2. Discovered reading library copy	-	6.8		-	-	-	0.7	-	-	-	1.0	-	-	-	8.5
3. Discovered reading colleague's or office copy	-		-	1.0	-	-	-	-	-	-	-	-	-	-	1.0
4. Received preprint from author	0.1		-	-	-	0.1	0.5	-	5.1	0.1	-	-	-	-	5.9
5. Obtained preprint from colleague		0.1	-	0.1	-	-	-	-	0.3	1.0	-	-	-	-	1.6
6. Received reprint from author	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	0.6
7. Received reprint from colleague	-	0.4	-	0.1	-	-	1.2	4.0	-	-	-	-	-	-	5.6
8. Referred by colleague	1.9	7.7	0.4	0.5	-	0.1	2.1	1.2	0.2	0.2	0.7		0.1	-	15.2
9. Referred by other article, book, report	1.2	22.5	1.2	0.8		0.2	1.7	0.4			0.9	1.0	0.4	0.1	30.5
10. Found in search of printed indexes	0.2	8.1	0.5	-	-	0.2	1.3	-	-	-	0.1	-	-	-	10.4
11. Computerized literature search	0.6	0.3	-	-	-	-	-	-	-	-	-	-	-	-	0.9
12. Current awareness or SDI list	-	0.3	-	-	-	-	0.2	-	-	-	-	0.1	0.1	-	0.6
13. Don't remember	0.3	1.3	-	-	-		0.1	-	0.2	-		-	0.6	-	2.5
14. Other or No Response	0.6	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.7
15. Total percent	20.1	47.6	2.0	2.5		0.6	9.3	5.5	5.8	1.3	2.7	1.1	1.1	0.2	100.0

SOURCE: Market Facts, Center for Quantitative Sciences, Author Survey

Key: - = No response received in this category = Less than 0.1 percent of total

It was possible to rank access channels. The following table ranks methods of identification for single access channels. The numbers are not identical to the previous table, due to rounding and the inclusion of numbers which were less than 0.1% in previous totals. However, the following ranking is of interest.

MOST FREQUENTLY EMPLOYED CHANNELS FOR IDENTIFICATION AND ACCESS

RANK	FREQUENCY (%)	IDENTIFICATION	SOURCE OF ACCESS	FORM OF ACCESS	MEAN PATH LENGTH (Years)
1	20.0	Referred to in other article, book or report	Library	Library copy of journal	15.0
2	13.8	Discovered while reading own copy of journal in which article appeared	Publisher	Users's own copy of journal	4.6
3	7.5	Found in a search of printed indexes or catalogs during the course of a literature search	Library	Library copy of journal	16.8
4	7.1	Referred to article by a colleague or co-worker	Library	Library copy of journal	12.6
5	6.2	Discovered while reading library copy	Library	Library copy of journal	12.5
6	4.9	Received a preprint from author	Author	Preprint	4.1
7	4.5	Received reprint from a colleague or co-worker	Colleague	Reprint	8.0
	64.0				

SOURCE: Author Survey, Market Facts, Inc., Center for Quantitative Sciences.

Several general conclusions appear from this data.

(1) That libraries account for the largest amount (40.8%) of physical access.

(2) The second most frequently used channel is that of an individual journal subscription.

(3) The mean path length: the year of the cited article subtracted from the year of the citing article - was calculated for the major identification methods. Not surprisingly access channels involving non-library access had shortest paths.

(4) It becomes obvious, when cost, speed, and use are considered that the fastest, cheapest, and hence perhaps most appropriate physical source of scientific information for low capital outlay is the journal reprint.

To place these information flow results in the context of NRSE/I for developing countries it is necessary to recognize that wide difference in information needs within regions and within countries may make studies such as the author survey invalid by comparison to the more uniform climate of information needs within a developed country. However, to some extent, because of the "hard science" nature of NRSE/I, information flow will parallel that of the NSF study.

A Core of "Used" Information

In this context and with NRSE/I needs in mind it is important to look at the results of Urquart on the use of scientific periodicals. Urquart analyzed

53,000 loan applications at the British lending library for Science and Technology in London, which then had a collection of 9,120 periodicals. The study concluded that more than 50% of the collection was never consulted, 25% was consulted once, 40 journals supplied half of the total demand and 900 were sufficient to meet 4/5 of the requests, these results are plotted in the figure.

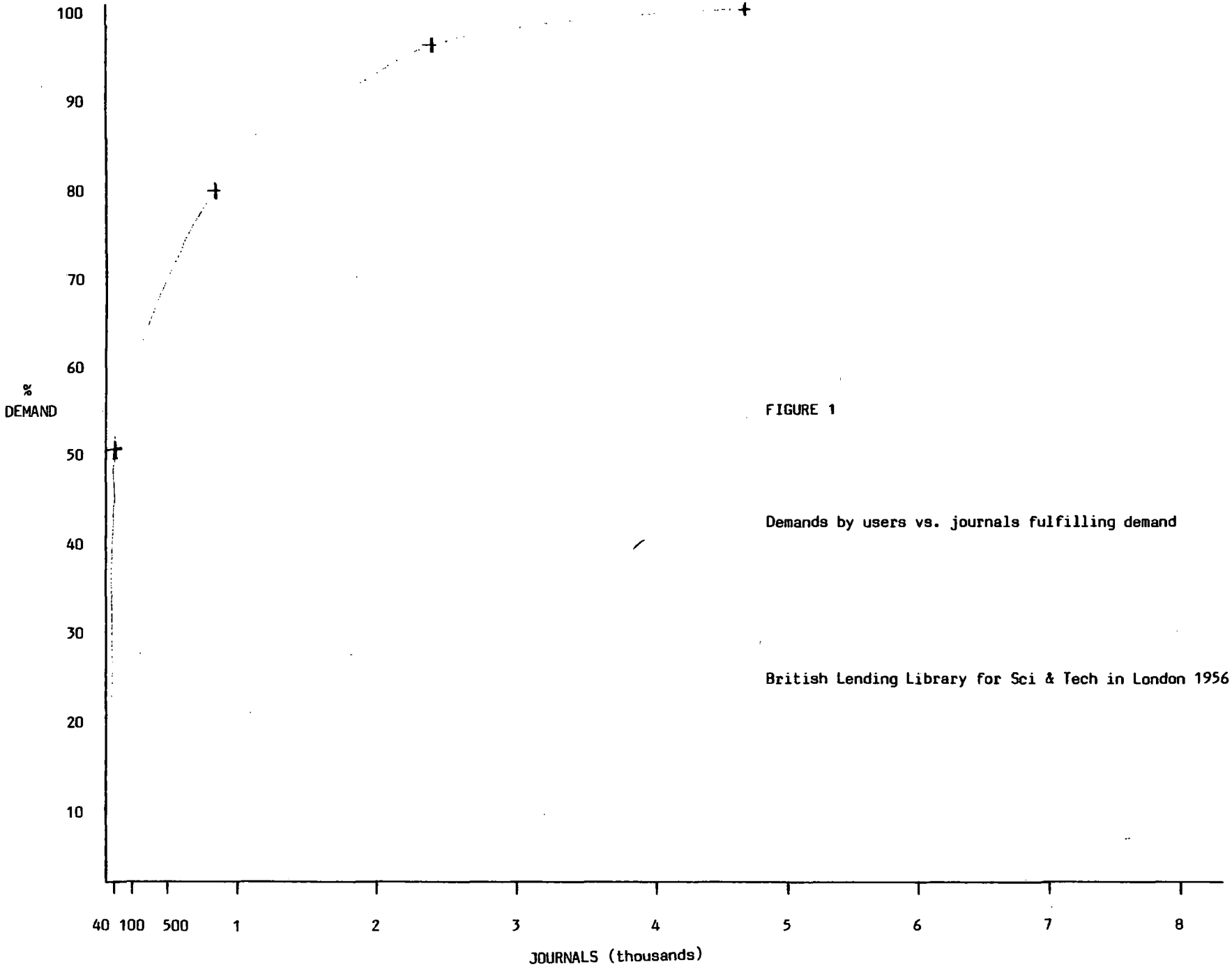


FIGURE 1

Demands by users vs. journals fulfilling demand

British Lending Library for Sci & Tech in London 1956

The clear conclusion of these results as applies to journal-based information is that there exists a small cadre of journals which can fulfill most of the demand for scientific information.

This conclusion has clear implications for NRSE/I support. It suggests that opportunity costs for NRSE/I support are maximized when researchers have physical access to a small core of identified journals. Such a conclusion is in contrast to a support method which allocates resources to provide (generally computerized) access to a wide range of possibly useful documents and provides the capacity to select those which may be useful. By contrast, the Urquart findings indicate that the great bulk of useful documents have already been selected and that researchers know what they want and what they will use. This was the most important result of the referee system.* To some extent this conclusion was counter to the philosophies expressed in many cooperative information system documents and thus requires some discussion.

(a) What about important "fugitive" literature, unpublished reports, monographs and the like?

(b) Is supplying - say 55% - of the literature sufficient, are there not "pearls of wisdom" which escape notice?

* A. David (personal communication) also stressed this point.

(c) Will not "unnecessary" duplication take place?

In answering to these very valid questions it should be noted that a scientific information system such as NRSE/I has certain qualities which make it somewhat different than say social science information systems. There are both practical and philosophical reasons for examining the above questions as they relate to NRSE/I.

From what we can gather, the order of magnitude of NRSE/I documents in a large collection - that of the U.S. Dept. of Energy - was 50,753 in 1981 has doubled every two years since, and is in the order of 200,000 in 1985. With this explosion in the number of NRSE/I documents it is simply difficult to attempt to get even a portion of all "fugitive" literature. Yet some fugitive information is clearly important.

The question of "fugitive" information - the the existance of the miracle that virtually no one knows about - has long been a subject of discussion in scientific information systems. Its possible presence - no one can deny it - leads to a compulsion to cover all the literature for fear that a crucial piece of information may be buried in an obscure report. This compulsion can only be satisfied by sophisticated computerized systems.

The most celebrated case, that of Gregor Mendel and the discovery of the particulate nature of heredity - one of the great landmarks of science - had to wait 35 years before it was rediscoverd. This phenomenon was discussed by Goffman and Warren who point out that the time lag was not because the information was buried, but because "the concept of discrete heredity units could

not be connected with the mid 19th century canonical knowledge of anatomy and physiology". It should also be noted that when the discovery was absorbable that its diffusion - despite the lack of today's rapid and sophisticated information transfer systems, took place within several years.

It is further evident that the example of Mendel is not unique, there have been many discoveries that had to await acceptance by the scientific community. What is of tremendous interest is the speed with which an accepted discovery is sent throughout the scientific community.

In this regard it should be noted that duplication of effort, which has also been used as a point of justification for trying to gather all possible information in a central system, is actually an advantage, indeed a requirement for scientific research, and may be a necessity for NRSE/I research. Further, as pointed out by A. Gagnon, real duplication is unlikely. NRSE applications and capacities vary widely within regions of developing countries, and within microregions of areas within countries. This observation indicates the necessity for general information but says that specific NRSE/I information probably must be generated - at least in part, locally. Such a conclusion is supported by:

(1) evidence from biogas digester applications: in which a number of "schools of thought and application" exist
(2) evidence in discussion with companies involved in NRSE applications

Within the range of opportunities of NRSE/I supply it is important to note that there is growing support for the principle of selectivity in the supply of scientific information.

This is different from an approach in which all information is supplied and some selected. A guiding set of tenets is that the great majority of scientific information will have no further use (a conclusion of the Urquart study) and that truly important information - if hidden - will surface if and when the user community is able to accept it.

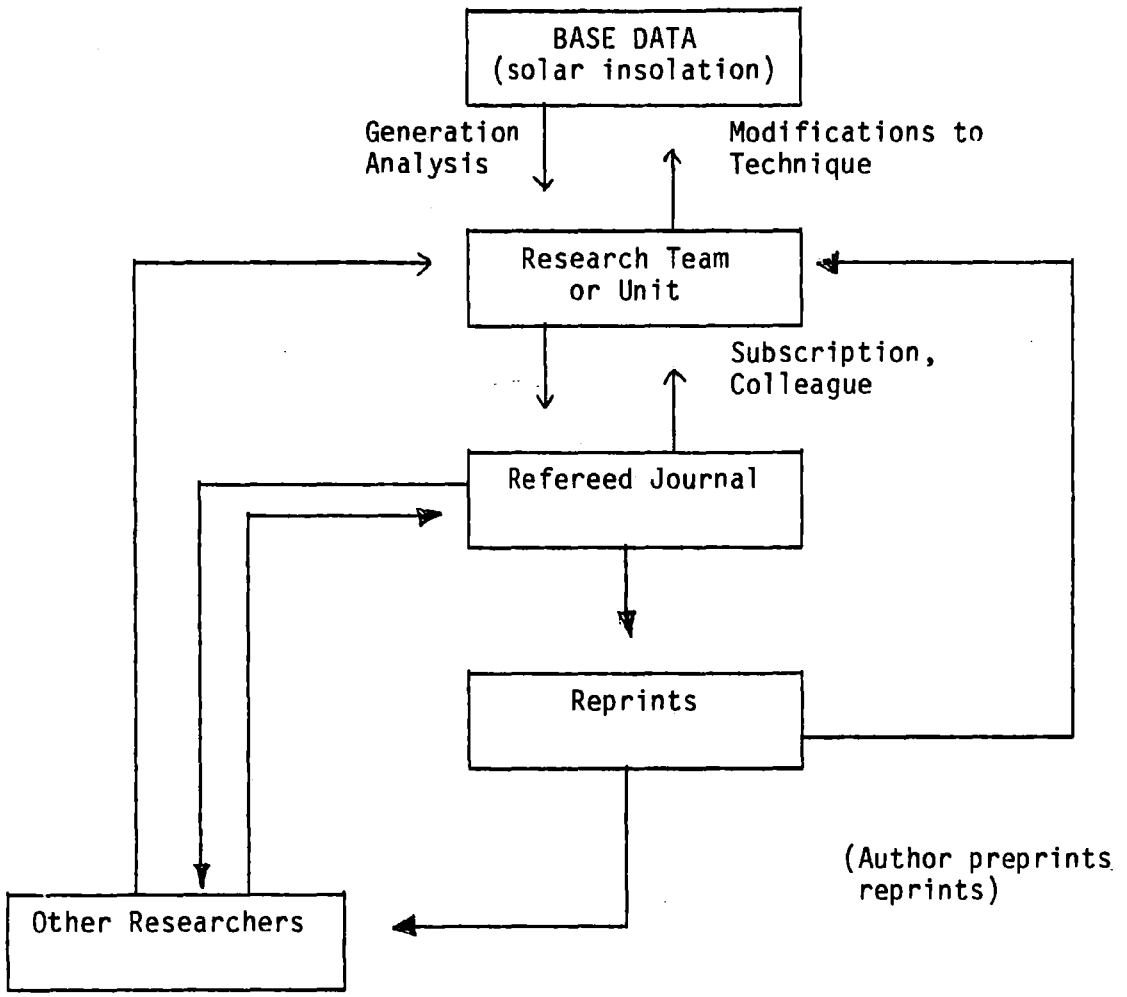
These tenets, while at odds with certain information system approaches, are neither new nor radical. Indeed the entire procedure of refereed scientific journals - the traditional means of communication has, in effect, been based on these principles.

It is possible to draw a simplified flow diagram for a very specific form of research. This chart differs from that of the NSF:

(1) The acquisition and handling of data by the research unit is considered part of the information handling process;

(2) a non-document form of information transfer: laboratory data handling and professional contact is included.

Information Flow to a NRSE Research Unit



The example chosen, the generation of base solar data is one which accords with the NRSE/I research priorities of at least 4 developing countries: Argentina, Brazil, Indonesia, and Korea. In this case the "user" is a research unit. If we take the specific example of Korea, the solar insolation data would be provided by automatic data recorders of Korean design. (Eppley-KIER). We can only make guesses about how much useful information might come from the pathway: base data $\longrightarrow$ researcher but it is evident simply from path length times involved that 90% is not unusual. The NSF evaluated the % of use of other channels. Published citations derive about

2.0% from personal contact, 1.2% is from author preprints, and 1.5% is from subscriptions. Clearly once general information has been provided the storage, analysis, and identification of and dialogue with locally generated base data is the vast majority of the NRSE/I activity of the research community.

Criteria

The following criteria were obtained from the referee system or by other techniques and were thought to be important in evaluating NRSE/I project proposals.

1. That an NRSE/I activity have measurable and attributable research or policy impact. This criterion derives from the principle of identifying a targetted user of NRSE/I and continually requesting (not simply whether) in what ways the information has been useful. This first criterion is at the base of any definition of "quality" information and central to the theme of this report. it is related to criterion 5 (quality information). Outside of the system of scientific journals and reprints, few NRSE/I systems yet meet this criterion.

2. That an NRSE/I activity have a clearly delineated interface with general and related scientific information. This may include ongoing consultation in system design direction and changes with scientific personnel (e.g. RERIC). It might also include related access to specialized libraries, and especially for developing countries, access to base references in the fields of physics, chemistry, engineering, and architecture.*

* Lack of such references were a distressing feature of a recent trip to the PNOC Energy Research Development Centre Library.

3. That an activity accord with (real) national priorities. IS is well aware of and uses this criterion. It has special use in NRSE/I as the pronouncements of "off-oil" policies in the 1970's when oil was relatively expensive have given way to massive energy wasteage in the 1980's when prices are relatively lower. Indeed the Thai Ministry of Science and Technology refers specifically to such an attitudinal change and the wasted oil in day-long traffic jams in Bangkok makes one question current real priorities. Priorities in NRSE R&D and its information support may unfortunately be determined by an aid grant (as in the case of Costa Rica which, with eleven million dollars from USAID has 97% of its NRSE research in geothermal energy); or by national economic realities (Brazil's adoption of gasohol in response to low sugar prices). It is for these reasons that information support must be given with true national intent understood.

4. That there be some potential for Cooperative Assistance - either with a Canadian organization or by TC/DC. This is not a criterion, but a characteristic of some programmes. The technical nature of NRSE/I may make this characteristic more desirable than in other types of information programmes, Canadian organizations are extremely well placed to provide and to manage NRSE/I and this capability should be kept in mind. The massive specialized expertise of Hydro Québec International in NRSE and NRSE/I is a resource which should be considered.

5. That the information given be high quality. There are many definitions of information quality. The working definition used here derives from both an examination of principles of physical entropy expressed by Enrico Fermi* in 1936 and the evaluation by King and Bryant in 1971.

   Simply the definition states that information transfer is a process, and that during that process the information donor modifies (or can modify) the process so as to continually reply to demands of the user. The implication is that the donor learns what the user needs before and during the transfer process. Examples are tutoring or expert hands-on advice. In this (limited) definition a large/open or specialized library with minimal indexing facilities and minimal professional contact with borrowers would not be considered to be good source of quality information. This criterion is also related to providing ongoing contact with users, and seeing that information provided is determined by users; a monitoring system is implied.

6. That users involved are capable of absorbing the information provided. This is directly related to EUA. It is also related to studies of Urquart which indiate that well over 50% of information provided in scientific periodical libraries is never consulted.

* Lectures at Columbia University, N.Y.

7. That (for decision-makers) there be an effect on the perception of an energy problem.

NRSE/I information should allow the decision-maker to understand the overall context of directions in NRSE. It is thus important that decision-makers, who may receive highly specialized and technical information, be able to place this information within the overall realm of NRSE as applicable to their country/realm of decision. Thus local energy valances should be constructed and information on technical developments should be in a format to relate to existing local energy balances.

8. That an energy information programme increase capacity for self-direction. This criterion is both very difficult, and very easy to fulfill. Very difficult as with some notable exceptions virtually all NRSE technologies, even "appropriate" ones are unlikely to have been developed within the borders of a developing country and use of these technologies or transfer ot techniques does not imply R&D independence. The Korean representative to INNERTAP stated quite clearly that western technology was what the KIER needed. Analysis of origin of NRSE documentation in CRRERIS shows numbers in the order of one hundred requests from developing countries. This is also true of INNERTAP projections and of RERIC. These numbers may be contrasted to document entry numbers in the hundreds of thousands for work generated in developed countries. However, when one realizes that the acquisition, handling and use of base data is also a legitiamte NRSE/I activity then opportunities for self generated R&D information which will lead to futher such generation are quite large. This criterion has several related criteria, nameley that there be

a reduction of reliance on extra-national sources (see 12), that there is a capacity for generating new information, that there is a capacity for providing an alternative to hi-tech purchases, and that the NRSE/I support may be helpful in producing elements of a national "school of thought".

9. That an activity have an affect on long term policy. This characteristic where measurable - the most important case is the Brazilian decision in the 1930's to convert unsold sugar to alcohol - is related to criterion 8.

10. That the activity involve local design.

This includes, especially, content as well as format.

11. That information flow be enhanced.

Flow and the channels through which flow occurs should be clearly identified it is important to estimate "channel width" or what impact a particular channel might have on flow.

To be effective as a "change-agent", the concept of unproved national self-reliance in NRSE R & D is important.

12. That (except for some bibliographic and other NRSE/I) reliance on extra-national sources be reduced.

Considering four types of NRSE/I activities:

Bibliographic

Audit/Survey

Base Resource

Publication of Research

Two of these types (audit/survey and base resource) are inherently local information. The publication of research results involves international activity; however as infrastructure for this exists in the form of refereed journals, the main bottle-neck is at the local level. Results from this study indicate two broad types of bibliographic NRSE/I: general and site-specific. The latter, in which extra-national sources are important should not be confused with site-specific information, clearly once a basic amount of general information is supplied the bulk of needed NRSE/I, which must be generated locally.

The criteria listed above are summarized below.

I	Measurable and Attributable Results
II	Interface Science/Information
III	National Priorities
IV	(Potential for COOP)
	Canada
	TC/DC
V	Quality of Information: has entropic filters
VI	Institutions (recipient) capable of absorbing info
VII	Effect on perception of energy problem by decision-maker
VIII	Increase of capacity for self-direction
IX	Affect on long term policy
X	Utilizes local design
XI	Enhancement of information flow
XII	Reduce reliance on extra-national sources

RESULTS

The results consist of case studies in which the checklist, criteria and methods of retrospective searching of EUA which have been previously described are applied, as possible, to INNERTAP, CRRERIS, RERIC.

INNERTAP

The "Regional Pilot Project Establishing the Sub-Regional Information Network on New and Renewable Sources of Energy for Asia and the Pacific" (INNERTAP) was proprosed to IDRC on 28 May 1984 by the Philippine National Oil Company (PNOC) Research and Development Center.

The basic objective of the proposal was to "improve energy information flow within, into and out of the Asia and Pacific Region....". This proposal corresponds to the Asian and Pacific component of a world-wide network of institutions sharing NRSE/I as proposed by UNESCO in its Preliminary Study on an International Information System relative to New and Renewable Energy Sources.

This UNESCO-sponsored network has as its goal to start with five countries: China, Indonesia, the Republic of Korea, the Philippines and Thailand. The PNOC proposal notes that "UNESCO expects Nepal and Pakistan to join the network soon". In all 16 countries are envisaged as potential members of a regional information system with its focal point in the Philippines. Among the outputs of the system envisaged are quantity abstracts, selected subject bibliographies, national bibliographies, state-of-the-art review(s), data directories, lists of products and equipment, directory of experts and researchers. IDRC was asked to help with funding of these items as well as funding for translations, computer processing, training, microfiche equipment and photocopying machines.

The total cost of this proposal is CAD $801,156 of which CAD $327,079 is direct assistance from IDRC, CAD $65,373 from the PNOC, CAD $74,384 from the National Focal Points and CAD $334,319 from UNESCO.

This proposal was examined within the terms of reference of this study. As part of such examination, a trip was made to the Philippines to the Second Annual Regional Steering Committee of INNERTAP held 17-20 of December, in Quezon City, Philippines.

End Use

There are several sources of end-use (EU) data by which this project may be analysed:

1. National focal point reports.
2. Comparison with CRRERIS.
3. Comparison with RERIC.

National Focal Point Reports

Among the 5 reports of the national focal points the written report "Final Report On National Information Network Activities/Services in (sic) Republic of Korea (1984) contains information on End Users, subject scope needs, subject scope levels, types of agencies. An active monitoring of information needs seems to have been thought out. Questionnaires on NRSE/I have been collated.

The Korean programme is the only one that recognizes the need for automatic data acquisition of resource (insolation) data, and have invented devices (the Eppley-KIER System) for this purpose. Personal communication with the representative confirmed the very strong position of NRSE/I of the Korean Institute of Energy Resources, as well as realistic understanding of costs involved in numerical data handling.

It is possible then to apply the basic checklist to the "state of knowledge" expressed about NRSE/I needs.

In the case of the Korean report,† this would provide the following:

Checklist	/	%
End User categorization	19/21	90
Duration & frequency needs	3/16	18
Related users	9/11	81
Prime user/end user interface	7/9	77
Subject scope	8/9	100
Monitoring capacity	7/7	100
Geographical effects	5/5	100
Delivery style	2/4	50
New information requirements	3/3	100

In summary:

Knowledge of the user Community	35/41	(85%)
Knowledge of Subject needs and local-regional needs	13/13	(100%)
Knowledge of delivery style, monitoring capacity, frequency, duration	15/30	(50%)

The reports of the other national focal points with the exception of general subject scope information do not mention end-users, but focus on other questions related to NRSE/I, and the creation of networks.

However, the Chinese representative in his verbal presentation mentioned ISTIC use statistics which were highly subject specific.

† The (subjective) estimation of these valves is shown in the appendix.

The representative, Dr. Zhao, stated that ISTIC in 1984 received 83 requests of which 30 were solar energy, 7 geothermal energy, 17 oceanographic energy, 18 biomass energy and 11 wind energy.

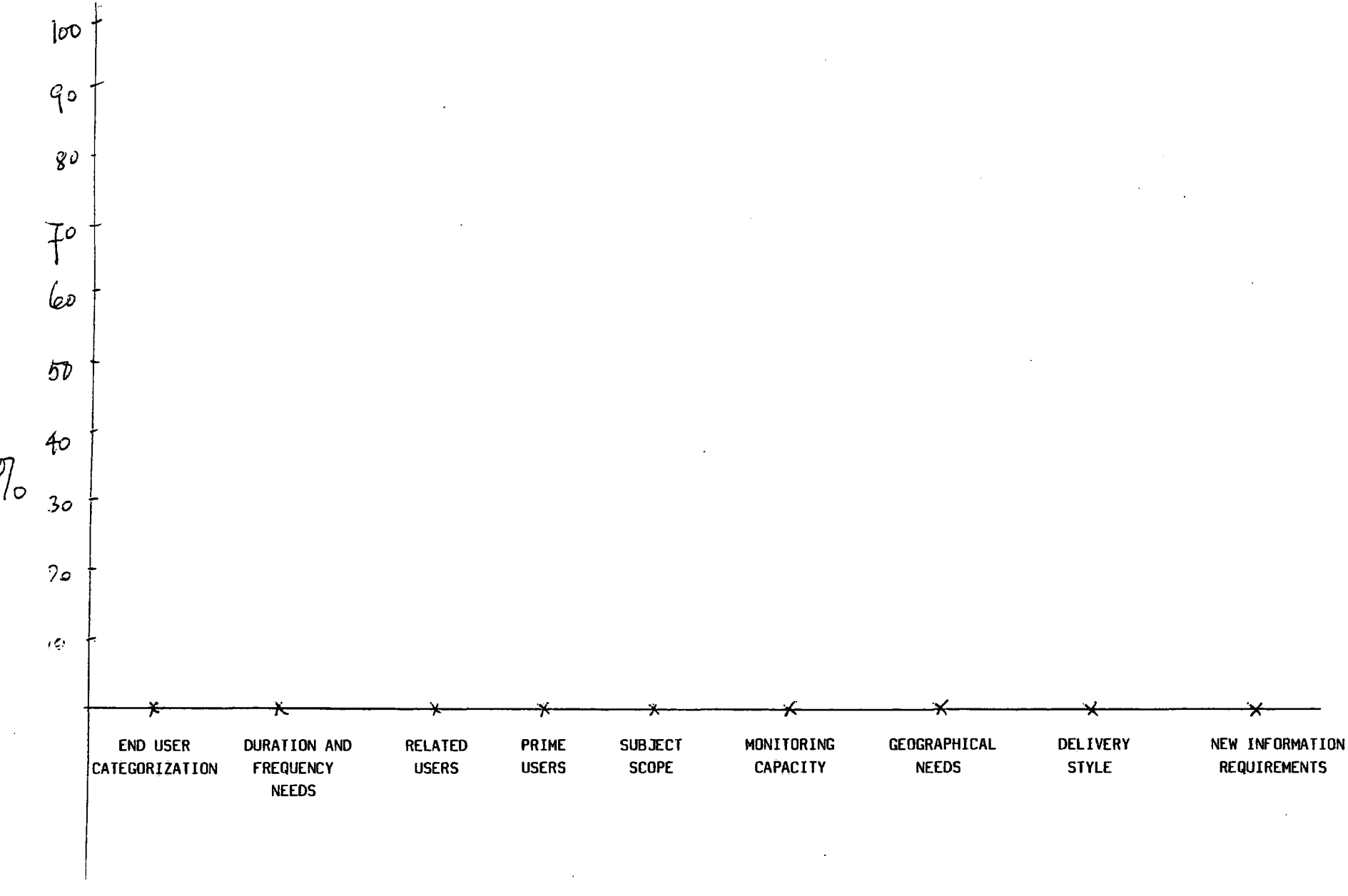
Visitors to ISTIC provided 333 requests as follows:

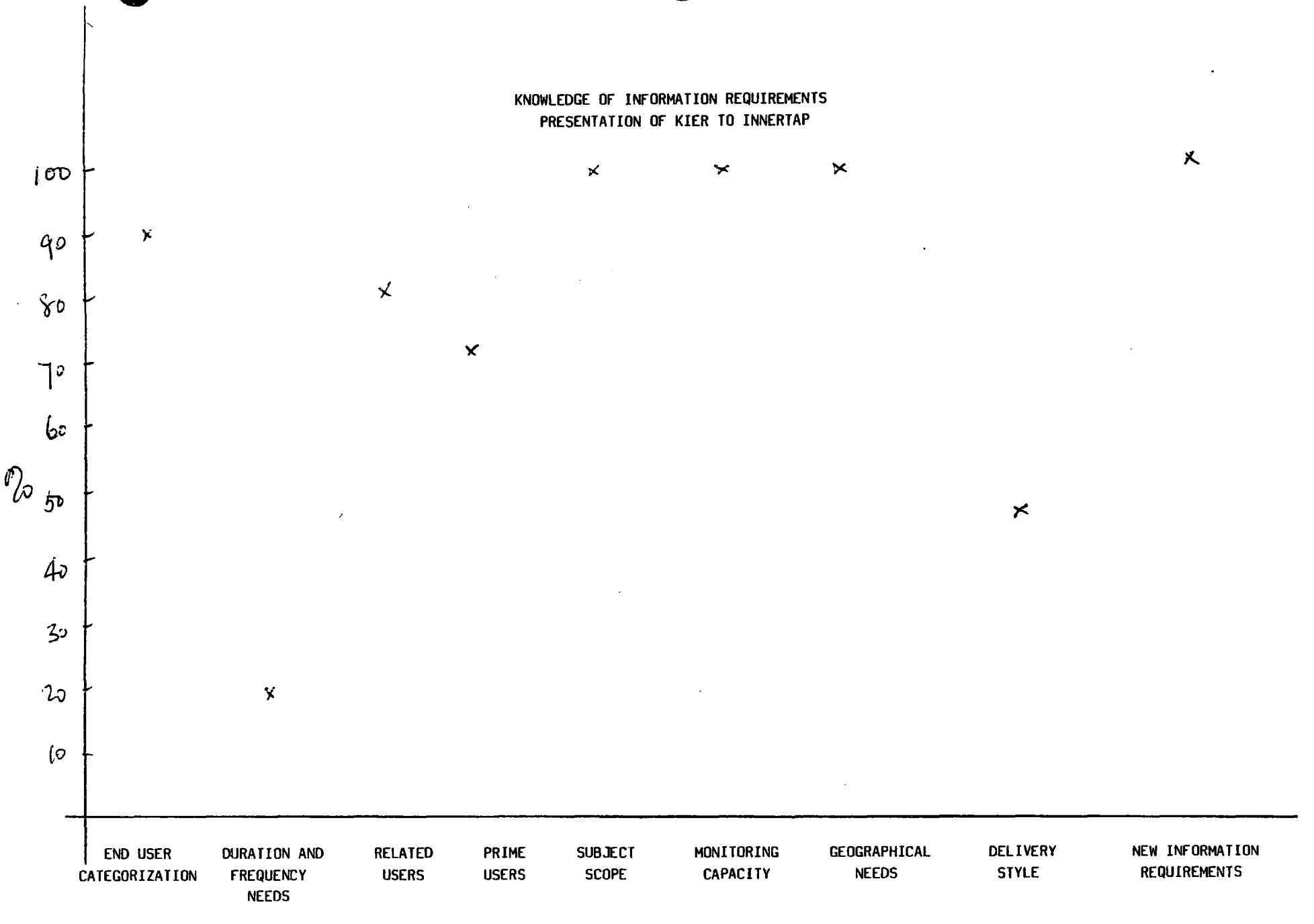
Solar	160
Geothermal	70
Biomass	37
OTEC	70
Wind	49
Other	47

These figures should be taken as a rough guide. By placing the estimated numbers on a three dimensional grid it is possible to map the state of knowledge about NRSE/I needs as expressed at the Steering Committee Meeting by national focal point.

For these purposes it is recognized that the only guide to NRSE/I are the reports, and that more information on NRSE/I needs exists. For example the huge Chinese 3-gorge hydro-electric project for which information, including Canadian Technical information has been sought, is an NRSE/I project which is not within the scope of the INNERTAP proposal.

KNOWLEDGE OF INFORMATION REQUIREMENTS
PRESENTATION OF MOSTE (Thailand) TO INNERTAP




KNOWLEDGE OF INFORMATION REQUIREMENTS
PRESENTATION OF KIER TO INNERTAP
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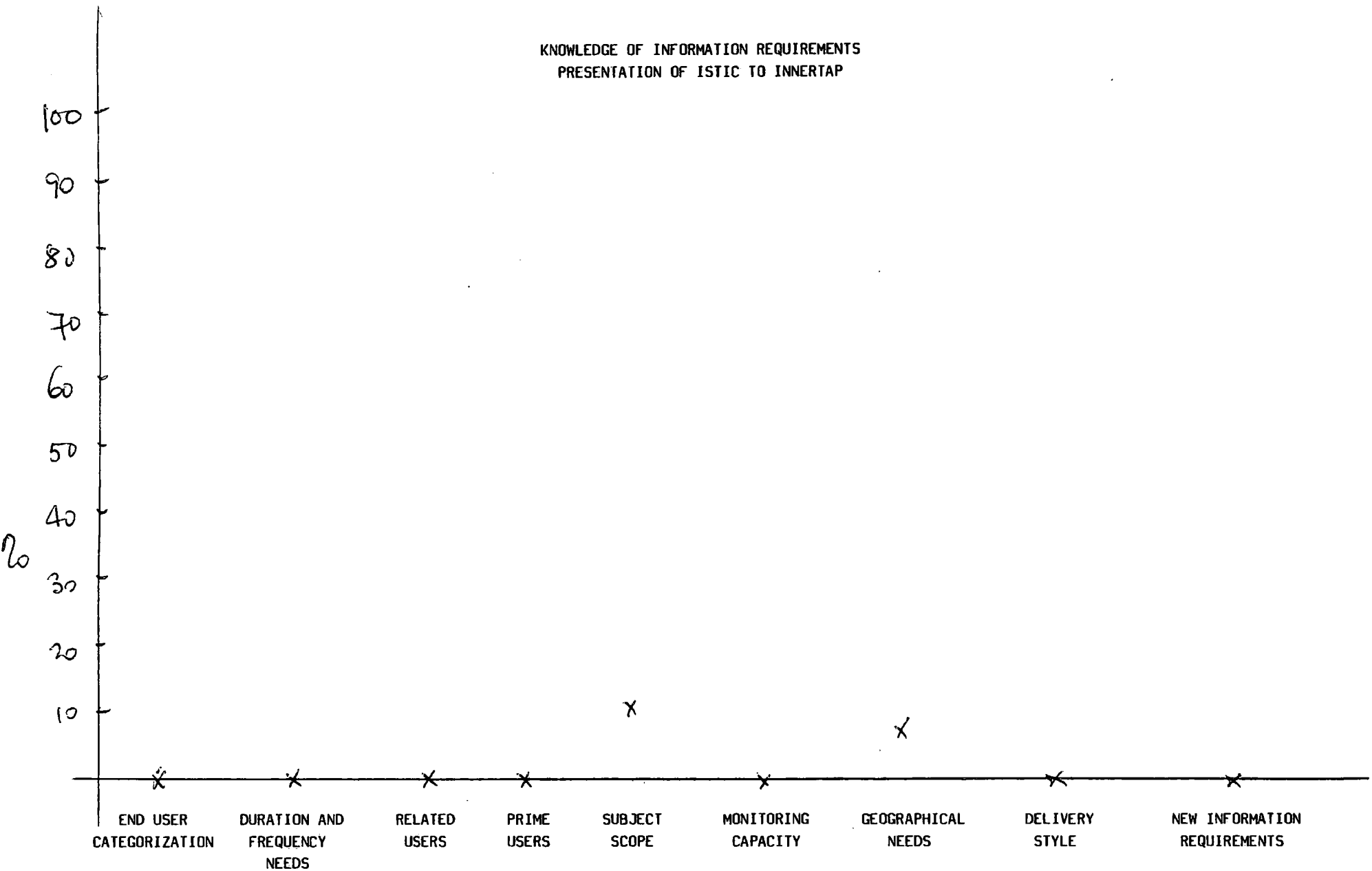
END USER CATEGORIZATION
DURATION AND FREQUENCY NEEDS
RELATED USERS
PRIME USERS
SUBJECT SCOPE
MONITORING CAPACITY
GEOGRAPHICAL NEEDS
DELIVERY STYLE
NEW INFORMATION REQUIREMENTS


KNOWLEDGE OF INFORMATION REQUIREMENTS
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END USER CATEGORIZATION
DURATION AND FREQUENCY NEEDS
RELATED USERS
PRIME USERS
SUBJECT SCOPE
MONITORING CAPACITY
GEOGRAPHICAL NEEDS
DELIVERY STYLE
NEW INFORMATION REQUIREMENTS

Figures showing knowledge of information requirements for selected INNERTAP participants are shown.

The figures show visually the pre-eminence of Korea in overall (stated) knowledge of the EUC. The figure also shows that while both Indonesia and China expressed some knowledge of subject scope that virtually no information on the EUC or on presentation style was evident. The position of the Philippines appears to be intermediate but still quite rudimentary.

Probable Use

The most readily comparable such service is CRRERIS, which in 1984 received 100 requests as follows:

CRRERIS Requests 1984

Subject	
Energy Resources - general	30
Solar energy - general	5
Water energy - general	1
Wind energy - general	2
Fuel energy - general	6
Total general	44
Conversion systems -	
Solar energy	10
Water energy	3
Wind energy	1
Fuel energy	23
	37
Applications	
Solar	14
Water	1
Wind	1
Fuel	3
	19

It is of interest to note that "general" requests form 44% of all requests and possible to plot % general requests by country.

Country	% General Requests	% Conversion System
Australia	31	37
Cook Island	33	33
Fiji	0	100
India	55	33
Kirbati	66	33
Malayna	100	0
N.Z.	66	33
Singapore	0	0
Srilanka	66	33
Tonga	0	100
Western Somoa	25	75

However, if only developing countries are looked at and if general requests and conversion system requests are lumped together then 88% of the requests from developing countries are for either general information or conversion systems. Neither of these topics is peculiar to developing countries, and there are competing sources of information in developed countries. The costs for this NRSE/I is quite low in developing countries.

Taken in concert with site-specific needs expressed by virtually all studies these results seem to indicate that developing countries need (2) types of information.

(1) General information

- which can be obtained from a wide variety of sources.

(2) Site-specific information requiring expert advice.

Checklist - Criteria

It is possible to ask, to what extent does INNERTAP meet the criteria of the checklist:

1. Measurable and attributable research or policy impact.

   It is unlikely that a small data base will have much impact, however, certainly, through retrospective searching, it would be possible to attribute NRSE/I impact.

2. Clearly delineated interface with related scientific information.

   This is a glaring weak point the PNOC reference library is weaker in general scientific references than most, if not all, Canadian high schools. It is not possible to see how effective interface with scientific information could be provided.

3. An activity accord with (real) national priority.

   In the case of the five countries involved this is difficult to assess. Certainly Korea places great value on NRSE/I - although stressing need for information from developed countries. The Thai position is less clear, and the Thai documents show only a beginning stage of NRSE awareness. The Indonesian position is one of knowledge of energy use, but as an oil exporter, it is difficult to know if Indonesia will accord priority to NRSE/I. The Philippines shows clear interest, but long-term national

priorities must await clarification of internal political difficulties. Clearly the Chineese need and want NRSE. But in light of the Canadian-Chinese experience with the 3-gorge project it is my guess that energy storage and distribution are uppermost in the minds of Chinese energy planners.

4. That potential for cooperation exist.

Certainly there would be potential for information exchange. VITA has been mentioned as a formal part of the proposal*.

5. That information be of high quality.

Lack of a feedback procedure makes this unlikely in light of INNERTAP proposals. The exception is the Korean contribution.

6. That users are capable of absorbing the information.

For Korea, yes; China, maybe; Indonesia, if in accord with national priorities, maybe; Philippines, yes; Thailand, no.

This makes one wonder what advantage there is to a regional system when interregional differences may be less than intraregional, or intra country differences.

* Interestingly as U.S. law prohibits AID to assist China, who is a member of INNERTAP, the support would go USAID ⟶ VITA (USA) ⟶ INNERTAP ⟶ (sometimes) China.

7. That, for decision-makers that there be an effect on the perception of the energy problem.

   Virtually no discussion included this.

8. That the activity increase capacity for self-direction.

   Little evidence - apart from lip-service given to "numerical data bases", the content of which is still unknown and which received open derision from one of the delegates - exists for building this capacity.

9. Activity have an affect on long-term policy.

   Possible but unlikely with 495 items.

10. Local (national) design be part of the information project.

    The Philippines seems to have both interest and knowledge and strong participation. Other countries appeared less interested.

11. That information-flow be enhanced.

    Possibly but in the absence of a measuring tool it is impossible to know, what for whom, how, when or where.

12. That reliance on extra-national (in this case extra regional) sources be reduced.

    This proposal and workplan would have the reverse effect.

INNERTAP Summary

Knowledge of end-use, with the exception of Korea and possibly China is well below minimal levels. The Korean report and end-use knowledge is particularly strong in knowledge of who will use what information. It is somewhat weaker on techniques of presentation. There are several alternative sources of INNERTAP information, including commercial data bases. Comparative costs would be of interest. The data base size is very small compared to needs. On the positive side, INNERTAP has provisions for measuring and monitoring effect, potential for cooperative activities, has an active, interested member in the PNOC, might possibly enhance information flow, and has some users currently capable of absorbing its product.

However there is virtually no interface with other scientific information, it is difficult to assess national priorities of INNERTAP members, the information provision does not meet the quality definitions of this report, there is little to aid decision makers in their perception of energy problems, the activity is unlikely to affect research or policy, the activity is unlikely to increase national capacities for self-direction or to reduce reliance on extra-regional sources of NRSE/I.

RERIC

The data from RERIC are shown in the appendix. This data includes a description of retrievals: requests by letter, requests by visitors, retrospective computer analysis, and requests by AIT staff and students where printouts were desired. The requests are broken down by purpose of the request (as opposed to subject) as divided where possible from analysis of written documents, subject, user type (researcher, student, etc.), country, time (by month). These data are presented in a variety of combinations. Retrievals are plotted vs. time and precharts of queried subjects by country, and users by country are indicated. Countries are ranked by subject and user interest. Queries are ranked by purpose, total country requests are tabulated and correlated with subject. A detailed monthly "output" (not computer output but written request output) has been correlated.

This material, the condensed output of one-and-a-half-person months of detailed searching and interpretation represents the most detailed retrieval data from a developing country institution in existance.

While there is a great deal of material to be digested, the following points emerge:

1. The interest in solar energy appears to continue to be strong.
2. A great deal of information requested is of a general nature.
3. The channel width is in the order of magnitude of 100 requests per year.

CRRERIS

Data from CRRERIS are shown in the appendix. This data includes a retrospective search of the CRRERIS data base for 1984. Requests are broken down by country, by subject. The documents sent in response are also recorded. This data has parallels to the data from RERIC in that:

1. There is a strong interest in solar energy.

2. A great deal of the information requested is of a general nature.

3. The channel width is in the order of 100 requests per year.

Project Possibilities

The project possibilities that follow were not designed with the possibility of a worldwide cooperative information system in mind. For this reason they may differ from possibilities presented by UNESCO in 1980.

The project titles should be somewhat self-explanatory. The projects are based on the following types of information flow considerations:

1. Flow of raw data from and to the researcher
2. Flow of external scholarly research to researcher
3. Flow of decision oriented methodology to "planners"
4. Education, Industrial, and Public Information
5. Bibliographic data to all users.

This list is not comprehensive, but to be used as an example. Three project possibilities are examined in somewhat greater detail.

Projects based on the need for resource information, base data, and the ability to handle such.

The parentheses indicate either a reference to the work or where work is in progress.

Resource information handling

1. Automatic data acquisition (Korea)
2. Insolation data (Korea, Argentina, Brazil, Mexico)
3. Biomass study (Sao Paulo)
4. Aeolian map (Argentina National Nonconventional Energy Program)
5. Rural firewood (see Torres, Chile, Mexican, Colombian experience)
   Rural "dendro" energy (forest energy) Satellite Correlation - Africa
6. SHP (especially Africa)
7. Geothermal maps (Costa Rica, Phillipines)
8. Cloud cover (with insolation)
9. Spectral quality
10. Test reference year
11. Biomass inventory
12. Alcohol fuels inventory
13. Hydraulic flow inventory
14. Thermal maps for OTEC
15. Provision of self-generated information assistance (calculators, reference, handbooks, notebooks)
16. Test facilities

Projects based on the principle (from Urquart) that researchers "know" that scholarly information which they need (Core information)

17. Reprint support systems (ICLARM)
18. Acquisition of basic reference works (UNESCO)
19. Support for NRSE and R & D publication results in refereed journals

Projects with decision-makers in mind (Audits and assessments)

20. Energy Surveys, Assessments, Audits (especially à la NSF, UNESCO)
21. Gathering existing energy information from secondary sources (Bernardini)
22. Energy model development

Education, Public Information Projects

23. Conservation outreach
24. Training support for high level abstractors, translators
25. Training of scientists in information techniques (University level using spiral approach with packets)
26. Training of information personnel in basic science needs
27. Training of librarians in sales, marketing techniques (Taiwan)

Bibliographic-type Data

28. Support to RERIC
29. Research in progress
30. Data referral
31. Open-drawer type projects (support to PNOC)
32. Support to Asian National Resource Information Centre

SOLAR INSOLATION DATA

This information on resource evaluation, in layman's terms, how much sunlight falls on a given area, is necessary for any solar energy design and production. In the developing world, the data appears to exist only for the Republic of Korea, Argentina, Brazil (partially) and Mexico (partially). The information has wide ranging potential use for many reasons:

1. National priorities have clearly (with rare exception) focussed on solar energy as the area of major R&D committment. Indeed the new availability of this data coincides in Brazil with a shift from gasohol emphasis.

   Solar insolation is mentioned as a national priority by Argentina and Korea and Indonesia. It is consistently referred to by UNESCO in its needs study.

2. Committment to solar energy cannot be adequately translated to energy design and production without insolation data. Thus such information has potential for a measurable policy impact.

3. The interface with other elements of the scientific community - physicists and chemists is quite strong. Such information can be absorbed by and strengthens existing infrastructure.

4. The data design could be designed locally in response to local needs. In Latin America 30% of human and 25% total financial resource NRSE R & D commitment are for solar energy.

5. The technology is well developed.

6. The costs currently involved are low.

7. The project may be self-contained within one area, one country or region.

8. A base data (numerical) handling capability could be begun at an elementary (although meaningful) level and proceed as demands (e.g. for spectral quality) increased.

9. Such a project may be executed with or without TCDC or cooperative or international organization participation.

10. The (locally generated) information is:

    (a) publishable at an international class level

    (b) able to lead to an indigenous "school" of thought.

CONSERVATION OUTREACH

1) The prime advantage of conservation is that results are immediate and measurable.

2) This is an area of policy-impact in which opportunities for credibility-building and change-agent provision are quite solid.

3) In general national priorities involve conservation policy at least formally.

4) Conservation information and its dissemination are areas in which Canadian organizations excell.

5) Conservation information has rapid feedback in terms of expenditure for energy and thus "quality" information is possible.

6) There are numbers of developing country institutions which could use conservation information to their benefit.

7) This type of NRSE/I project should effect the perception of energy problems by decision makers, increase the local control over energy resources, may use local designs, and would certainly improve local self-reliance.

Conservation outreach, as the focus of a conservation information program would involve information specialists in aspects of community and public information, and government and parastatal bodies.

Information support to documentation of changes in consumer habits and information support to public education is an area in which small initial steps might provide large demonstrable continuing impact.

ASSISTANCE IN SCIENTIFIC PUBLISHING (SCHOLARLY) OF EXISTING R & D INFORMATION IN NRSE

Although the general field of scientific publishing in developing countries is the subject of attention by the Communications Division, their interest tends to focus on science writers, editors and publications in developing countries. They have not, to my knowledge, examined the problem of getting NRSE information in the developing world to international journals.

Although research information exists in developing countries (e.g. in NRSE R&D Latin America a total budget of about 150 million $CAN this year) little reaches refereed journals in developed countries. As the refereed scientific journal in developed countries is a main conduit of scientific information and as formal studies (by Eugene Garfield) have shown little contribution by developing countries to these journals, a major bottleneck in acceptance of research done in developing countries is the lack of ability to publish. Such publication of what are now "fugitive" results could greatly enhance north/south scientific information transfer.

Any such results, that is increased publication frequency in major internationally accepted journals - would (especially as citations) be immediately measurable, and progress would be monitorable. The impact on national reputation would be visible, the process once begun would add to local research infrastructure and improve base data handling capability. Here is a clear interface of information science and NRSE/I needs. The major stumbling block is cost of publication.

Costs could range from $500 to $2,000 per publication. Thus $50,000 would have a major impact on north/south NRSE/I patterns. Some of the more important scientific data are: Korea: Insolation data; Costa Rica: geothermal data; Brazil: gasohol and synthetic fuels data; and Argentina: solar programme data.

CONCLUSIONS and RECOMMENDATIONS

The Need for a Choice

The needs for NRSE/I are enormous, and it is difficult to believe that IS, or indeed any organization, can satisfy all of these needs. Therefore, a programme of support must be highly selective in both identification of and assistance to project requests. There are many avenues of programme support for NRSE/I, including resource information handling; research information flow support; method and audit oriented information schemes; industrial, and public information. Thus a choice is implied; a choice which may be aided by considerations of applicable criteria such as those suggested in this study. The criteria are, however, but one tool which the programme planner needs. Both end-use and actual pathways of information must be considered. The checklist is a powerful diagnostic tool. It may be assumed that the more one knows about the information needs of an NRSE/I project, the better will be conformation of expectations of donor and recipient, and possibilities of tracing actual use of the IS and other components of the project. A corollary is that project negotiation and adjustments to ongoing projects can benefit from an agreed reference point.

Project Modelling

The above concept is closely related to the concepts of project modelling. Project modelling is routinely used in industry, especially in scientific and technical projects in which models - sometimes physical scale-models - have been used to save errors in the final product.

Naturally models of NRSE/I projects cannot be physical entitites. However, models with their inherent advantages can be contemplated. It is a conclusion of this report that such a generalized modelling process would be of help in NRSE/I projects. It is a further a conclusion that knowledge of information end-use is the rough equivalent of building a model of a portion of the entire process. If one can model the information needs for end-use in a project, one can model much of the project itself.

This means that any project request, indeed even generalized suggestions about project support, can be virtually immediately subjected to the overall check-list, resulting in a very good model of the information support process - its strengths and limitations.

For example, widespread interest in "numerical data bases" appears in much NRSE/I literature. However, when one talks to those who have closely investigated NRSE/I needs - for example Dr. Park at KIER - the enormous task of numerical data handling and the needs for clearly defined user communities

becomes evident. Certainly any future projected use of a "numerical data" support should be "modelled" on the checklist to identify strengths and weaknesses of knowledge of system use. Such a process will save much time and expense.

Opportunity and Cost

Budgetary evidence indicates that IS is a major actor in global NRSE/I. Thus overall costs per user are of import in a situation where funds are substantial, but nonetheless limited. In this regard, potential for follow-on funding may be of importance in project consideration.

Recommendations

Programme direction should consider as much as possible the entire spectrum of support to NRSE/I, of which bibliographic data is but one facet. The consideration should be based upon a framework of evaluation, which in its most used form would periodically be monitored for new information concerning needs. The following recommendations are based upon the establishment of such a monitoring system. Initially the monitoring system should contain:

a) a checklist

b) criteria for project support

c) end-use analysis results, especially retrospective searches (where available) in depth interviews with NRSE experts

d) channel and channel width data where available

It is thus Recommendation 1 that NRSE/I project requests and NRSE/I projects be subject to a formal monitoring system (called a project benchmark system). Recommendation 2 is that an information needs checklist, similar in design to the checklist presented in this report be used to establish standards for knowledge of end-use for NRSE/I projects. Recommendation 3 is that the checklist, suitably prepared, be placed at the disposal of project officers involved in NRSE/I in machine readable form.

An advantage of this form of storage is instant retrieval, the ability to compare projects, and the ability to examine project knowledge with time. The above recommendation assumes that all related project staff have access to microcomputing, or similar, facilities.

Recommendation 4 is that retrosearch and other end-use information on subject related NRSE/I be similarly stored in a machine readable system. Recommendation 5 is that appropriate criteria, such as those suggested in this report be adopted for NRSE/I be similarly placed in the project model, and the project evaluated by these criteria before, during, and after project delivery.

The generation of the criteria, checklist, and end-use data would be along the lines suggested in this report. A computer programme must then be designed or purchased to integrate the information in machine readable form (probably on a personal computer) at the disposal of every NRSE/I-related project officer and the director and deputy director IS. Recommendation 6 is that such a system be developed and Recommendation 7 is that appropriate computing facilities be adapted/acquired. Recommendation 8 is that the information be used, as is, or

modified, directly in Project Completion Reports. The advantage of a benchmark system is that comparisons are readily made and examined in light of experience.

The above recommendations for a benchmark system can be applied to the following: Recommendation 9 is that in light of needs for solar energy systems and local information on insolation (sunlight) for proper engineering of these systems; and in light of the national priorities accorded to such systems, as well as a number of other criteria which support of such systems would fulfill that handlding of solar insolation data receive support. This is an area in which Canadian expertise is quite strong. Recommendation 10, as discussed under project possibilities is that IS also stress conservation information (especially for the general public). Recommendation 11 is that IS assist the flow of information from the developing country researcher to international journals. In addition to fulfilling many of the criteria this activity would enhance south $\longrightarrow$ north technical contribution communication, which has historically been quite small.

Recommendation 12 is that, apart from insolation data discussed in Recommendation 9, for similar reasons (except for strong universal demand) that support to resource data handling related to NRSE/I as per the 15 other examples in "project possibility" section be given careful attention by project officers. The following projects, to varying degrees, also fulfill the criteria of this report they are: Recommendation 13 automatic resource data acquisition; Recommendation 14 biomass inventory and use study; Recommendation 15 aeolian maps; Recommendation 16 (where lacking) rual firewood surveys; Recommendation 17 geothermal mapping; Recommendation 18 cloud cover measure-

ment; Recommendation 19 spectral quality measurements; Recommendation 20 production of test reference data; Recommendation 21 thermal maps for ocean based NRSE.

The following recommendation are not directly related to resource information. Recommendation 22 is that NRSE researchers be provided as per their expressed needs with reprints of NRSE journal items. Recommendation 23 is that IS support the gathering of information related to NRSE audits from secondary sources (such as census data). This will fill a gap in current (primarily U.S.) energy assessment programmes for developing countries. As will energy model development in rural areas (Recommendation 24). Recommendation 25 is that IS support the training of NRSE scientists in elementary information retrieval techniques. These techniques have often been omitted from a traditional scientific education.

Recommendation 26 is that cooperation be established with Canadian NRSE expertise, and that especially Hydro Québec International be contacted with respect to any NRSE/I projects involving either wind energy or hydroelectricity.

The following data relate to bibliographic data systems:

Recommendation 27 is that where support to bibliographic systems is being considered, that alternatives to computerized systems be considered, among these it is Recommendation 28 that part of the analysis of any bibliogrpahic system include the question: are there a small number of core documents which would supply much of the NRSE/I need?

If a positive answer is found to the above question, it is Recommendation 29 that the first stage of such a project be to supply these documents, outright, on a regular basis, with computerized request systems to be integrated if at all at a later stage.

It would appear from the RERIC and CRRERIS data that up to 80% of all requests can be handled by small decentralized reference centers containing a few basic reference items. This consideration should be discussed and if found valid, incorporated in NRSE/I strategy. A corollary consideration is the provision of "core" journals to identified users, as opposed to support to an information centre which will respond to what appear to be in the majority of cases generally standard, predictable, and routine requests. Recent technical advances, including unmanned drone transmission sites open up possibilities for decentralized systems. This is an area in which Canadian cooperative projects are possible, and recommended.

Recommendation 30 is that all recipients of NRSE/I support receive a set of basic physics and chemistry references. Recommendation 31 is that the total number of projected users of bibliographic data be considered in light of total NRSE/I demand. This is as "channel widths" of less than 1% seem common. The best source of such data is retrosearch of existing data bases, and thus, in keeping with information in this report it is Recommendation 32 that RERIC use statistics be monitored on a regular basis. Recommendation 33 is that CRRERIS use statistics - especially with regard to changes in use ratios between developed and developing countries be monitored annually, as demand by developing countries has decreased in the past 2 years.

Recommendation 34 is that where support to computerized information systems is considered that RERIC, from the point of view of use, cost and integration with existing scientific disciplines, be considered as a benchmark of excellence against which similar NRSE/I systems should be judged. Recommendation 35 is that IS support energy audits and assessments only under conditions where clear impact on energy savings is expected.

Recommendation 36, in accord with discussion during the course of this study is that portions of this activity be extended to the Caribbean region. It is understood that such a mission is planned for April, 1985.

METHODOLOGY FOR NRSE INFORMATION NEEDS

METHODOLOGY FOR NRSE INFORMATION NEEDS

An Assessment Checklist

Design of the checklist requires the identification of elements of concern. While some of these elements will be common to all information systems, other elements can only come from the referee system. Knowledge of these is crucial in the first approximation system construction. Over 40 elements have been identified. Thus, for example, using only seven elements to show how the checklist content is generated:

Elements:

- End-user community
- Prime-user community
- Sectoral content
- Size
- Homogeneity
- Incremental effect of this information
- Duration of need.

These elements are then arranged chequerboard style, for example*:

	End-user	Prime-user	Sectoral Content	Duration	Size	Homogeneity
End-user	X					
Prime-user		X				
Sectoral content			X			
Duration				X		
Size					X	
Homogeneity						X

* X = No? Generated
  Yes = Checklist? Generated

... /4

Each box in the matrix represents a possible question for the checklist. Thus, for the line "End-user", using the elements:

- @ prime user
- @ sectoral content
- @ size
- @ homogeneity
- @ incremental effect

the following questions are generated:

DO WE HAVE:

	HI	LO	NIL
1. Information on end-user community (EUC) with respect to interface with librarians (prime users)			
2. Information on EUC - content needs			
3. Information on EUC - the effect of incremental information on research capacity			
4. Information on EUC - size			
5. Information on EUC - homogeneity (smorgasbord, etc.)			

APPENDIX I

CHECKLIST EXAMPLE DERIVED FROM ELEMENT LIST #1

	HI	LO	NIL
1. Information on end-user (EUC) with respect to size			
2. Information on EUC - homogeneity			
3. Information on EUC - effect of incremental information on research capacity			
4. Information on EUC - comparable or related EUC within area, region, nationally, globally			
5. Information on EUC - effect of delivery style (smorgasbord, etc.)			
6. Information on EUC - effectiveness of information presentation technique (db, dr, etc.)			
7. Information on EUC - what further needs to be known			
8. Information on prime user community (PUC) with respect to size			
9. Information on PUC - homogeneity			
10. Information on PUC - effect on incremental information on ability to disseminate information			
11. Information on PUC - comparable or related PU			
12. Information on other or related users with respect to size			
13. Information on sectoral content with respect to size relative to other information sources			
14. Information on sectoral content with respect to impact of this increment			

	HI	LO	NIL
15. Information on sectoral content with respect to what further needs to be known			
16. Information on frequency & currency needs, seasonal or cyclical use patterns with respect to EUC groups			
17. Information on incremental addition of this information			
18. Information on accessibility by delivery style			
19. Information on technique (eg. db) of information presentation			
20. Information on what further needs to be known			
21. Likely long-term duration of the need for information with respect to groups of EUC			
22. Liekly long-term duration of delivery style			
23. Likely long-term duration - information presentation			
24. Likely long-term duration - is there sufficient information on this			
25. Information on geographic distribution with respect to effectiveness of presentation technique			
26. Information on EUC with respect to interface with prime users			
27. Information EUC - linkages with other users			
28. Information on EUC - sectoral needs by EUC groups			
29. Information on EUC - frequency, currency, use patterns			
30. Information on EUC - likely duration of trend			

	HI	LO	NIL
31. Information on EUC - projected duration of project			
32. Information on EUC - geographical distribution, locally by area, nationally, globally, regionally			
33. Information on prime users with respect to geographical distribution			
34. Information on related users with respect to frequency, currency, and use patterns			
35. Information on related users with respect to geographical distribution			
36. Information on frequency, currency and use patterns with respect to duration of trend			
37. Information on frequency, currency and use patterns with resepct geographical distribution			
38. Information delivery style vs. presentation technique			
	YES	NO	
39. Information derived by questionnaire on EUC			
40. Information derived by questionnaire on PUC			
41. Information derived by questionnaire on related communities			
42. Information derived by questionnaire on sectoral needs			
43. Information derived by questionnaire on frequency/ currency/use patterns			
44. Information derived by questionnaire on trend duration			
45. Information derived by questionnaire on needs by geographical distribution			
46. Information derived by interview on EUC			

	YES	NO	
47. Information derived by interview on PUC			
48. Information by interview on related users			
49. Information by interview on sectoral content, interaction			
50. Information by interview on frequency/currency needs, use patterns			
51. Information by interview on duration of trend			
52. Information by interview on information needs by geographical distribution			
53. Information by seminar or other on EU			
54. Information by seminar or other on PU			
55. Information by seminar or other on related users			
56. Information by seminar or other on sectoral content, needs			
57. Information by seminar or other on frequency/ currency needs, use patterns			
58. Information by seminar or other on duration of trend			
59. Information by seminar of other on geographical distribution of needs			
	HI	LO	NIL
60. Information from pilot project on EUC			
61. Information from pilot project on PUC			
62. Information from pilot project on related users			

	HI	LO	NIL
63. Information from pilot project on sectoral content			
64. Information from pilot project on frequency/ currency of needs, use patterns			
65. Information from pilot project on duration of trends			
66. Information from pilot project on distribution of needs by region, etc.			

	YES	NO
67. Does a monitoring system exist to measure size of end-user community		
68. Does a monitoring system exist to measure size changes of groups within EUC		
69. Does a monitoring system exist to measure effect of information increments		
70. Does a monitoring system exist to measure effects of other sources on EUC		
71. Does a monitoring system exist to measure effectiveness of information presentation		
72. does a monitoring system exist to measure changes in sectoral content needs		
73. Does a monitoring system exist to measure changes in frequency needs		

APPLICATION OF METHODOLOGY TO KIER REPORT

KEIR REPORT

CHECKLIST EXAMPLE DERIVED FROM ELEMENT LIST #1

	HI	LO	NIL
1. Information on end-user (EUC) with respect to size	✓		
2. Information on EUC - homogeneity	✓		
3. Information on EUC - effect of incremental information on research capacity	✓		
4. Information on EUC - comparable or related EUC within area, region, nationally, globally		✓	
5. Information on EUC - effect of delivery style (smorgasbord, etc.)		✓	
6. Information on EUC - effectiveness of information presentation technique (db, dr, etc.)	✓		
7. Information on EUC - what further needs to be known	✓ ↔	✓	
8. Information on prime user community (PUC) with respect to size	✓		
9. Information on PUC - homogeneity	✓		
10. Information on PUC - effect on incremental information on ability to disseminate information	✓		
11. Information on PUC - comparable or related PU	✓ ↔	✓	
12. Information on other or related users with respect to size	✓		
13. Information on sectoral content with respect to size relative to other information sources	✓		
14. Information on sectoral content with respect to impact of this increment		✓	

applicab ?

	HI	LO	NIL	
15. Information on sectoral content with respect to what further needs to be known	✓			
16. Information on frequency & currency needs, seasonal or cyclical use patterns with respect to EUC groups			✓	
17. Information on incremental addition of this information	✓			
18. Information on accessibility by delivery style			✓	
19. Information on technique (eg. db) of information presentation			✓	
20. Information on what further needs to be known	✓			
21. Likely long-term duration of the need for information with respect to groups of EUC		✓		
22. Liekly long-term duration of delivery style		✓		
23. Likely long-term duration - information presentation		✓	✓	need more inform.
24. Likely long-term duration - is there sufficient information on this			✓	
25. Information on geographic distribution with respect to effectiveness of presentation technique		✓		
26. Information on EUC with respect to interface with prime users		✓		
27. Information EUC - linkages with other users	✓			
28. Information on EUC - sectoral needs by EUC groups	✓			
29. Information on EUC - frequency, currency, use patterns	✓			
30. Information on EUC - likely duration of trend	✓			

	HI	LO	NIL
31. Information on EUC - projected duration of project	✓		
32. Information on EUC - geographical distribution, locally by area, nationally, globally, regionally	✓		
33. Information on prime users with respect to geographical distribution	✓		
34. Information on related users with respect to frequency, currency, and use patterns			✓
35. Information on related users with respect to geographical distribution	✓	←	✓ need more inform.
36. Information on frequency, currency and use patterns with respect to duration of trend		✓	
37. Information on frequency, currency and use patterns with resepct geographical distribution			✓
38. Information delivery style vs. presentation technique			
	YES	NO	
39. Information derived by questionnaire on EUC	✓		
40. Information derived by questionnaire on PUC		✓	
41. Information derived by questionnaire on related communities	✓		need more inform.
42. Information derived by questionnaire on sectoral needs	✓		
43. Information derived by questionnaire on frequency/ currency/use patterns		✓	
44. Information derived by questionnaire on trend duration		✓	
45. Information derived by questionnaire on needs by gebgraphical distribution	✓		
46. Information derived by interview on EUC	✓		

	YES	NO	
47. Information derived by interview on PUC	✓		
48. Information by interview on related users	✓		need more inform
49. Information by interview on sectoral content, interaction	✓		
50. Information by interview on frequency/currency needs, use patterns		✓	
51. Information by interview on duration of trend		✓	
52. Information by interview on information needs by geographical distribution	✓	✓	need more inform.
53. Information by seminar or other on EU	✓		
54. Information by seminar or other on PU	✓		
55. Information by seminar or other on related users	✓		applicable?
56. Information by seminar or other on sectoral content, needs	✓		
57. Information by seminar or other on frequency/ currency needs, use patterns		✓	
58. Information by seminar or other on duration of trend		✓	
59. Information by seminar of other on geographical distribution of needs	✓		

	HI	LO	NIL
60. Information from pilot project on EUC	✓		
61. Information from pilot project on PUC	✓		
62. Information from pilot project on related users	✓		

	HI	LO	NIL	
63. Information from pilot project on sectoral content	✓			
64. Information from pilot project on frequency/ currency of needs, use patterns		✓		
65. Information from pilot project on duration of trends		✓		
66. Information from pilot project on distribution of needs by region, etc.	✓			
	YES	NO		
67. Does a monitoring system exist to measure size of end-user community	✓			
68. Does a monitoring system exist to measure size changes of groups within EUC	←	✓		need more inform.
69. Does a monitoring system exist to measure effect of information increments	✓			
70. Does a monitoring system exist to measure effects of other sources on EUC	✓ ←	✓		applicable
71. Does a monitoring system exist to measure effectiveness of information presentation	✓			
72. does a monitoring system exist to measure changes in sectoral content needs	✓			
73. Does a monitoring system exist to measure changes in frequency needs	✓ ← →	✓		need more inform.

END-USE STATISTICS, RERIC

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT	USER	PURPOSE
Argentina	solar refrigeration	researcher	general information
Count:	1	1	
Australia	renewable energy	researcher	general information
Count:	1	1	
Belgium	solar energy	researcher	general information
Count:	1	1	
Canada	solar radiation	researcher	general information
Count:	1	1	
Costa Rica	renewable energy	researcher	general information
Count:	1	1	
Cuba	solar refrigeration	researcher	general information
Count:	1	1	
France	biogas	researcher	general information
Count:	1	1	
Germany, F.R.	biomass fuels	researcher	general information
Count:	1	1	
India	biogas	researcher	research
	biomass energy	student	research
	biomass fuels	student	research
	hydroelectric power	student	research
	solar refrigeration	researcher	general information
		researcher	design
		researcher	general information
	solar water heaters	researcher	design
Count:	6	8	
Indonesia	biomass fuels	student	research
		researcher	general information
	hydroelectric power	student	research
	hydrogen energy	student	research

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT		USER	PURPOSE
	solar energy		researcher	general information
	solar energy storage		student	research
	solar ponds		student	research
	solar stills		student	research
Count:		7	8	
Israel	solar drying		researcher	research
Count:		1	1	
Japan	renewable energy		researcher	general information
Count:		1	1	
Malaysia	solar radiation		researcher	research
Count:		1	1	
Mauritius	solar drying		researcher	general information
Count:		1	1	
New Zealand	solar drying		researcher	general information
Count:		1	1	
Nigeria	solar drying		researcher	general information
Count:		1	1	
Pakistan	solar refrigeration		researcher	design
Count:		1	1	
Seychelles	solar collectors		researcher	general information
	solar heating & cooling		researcher	general information
Count:		2	2	
Sudan	solar energy		researcher	general information
Count:		1	1	
Sweden	renewable energy		researcher	general information
Count:		1	1	

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT	USER	PURPOSE
Thailand	biomass fuels	researcher	research
		student	research
	renewable energy	researcher	general information
		researcher	general information
		researcher	general information
		researcher	general information
		researcher	general information
	solar cookers	researcher	construction
		researcher	construction
	solar drying	researcher	construction
		researcher	general information
		researcher	construction
	solar drying solar cookers	researcher	general information
	solar energy	researcher	general information
		researcher	research
	solar energy storage	student	research
	solar radiation	researcher	general information
	wind energy	researcher	research
Count:	9	18	
Thailand (AIT)	biogas	student	-
		RDC staff	-
	biomass energy	RDC staff	-
		faculty	-
		student	-
		student	-
		student	-
		RDC staff	-
		researcher	-
		student	-
		student	-
		student	-
		student	-
	biomass fuels	RDC staff	-
		RDC staff	-
		student	-
		student	-
		student	-
		student	-
		student	-
		student	-
		student	-
		student	-

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT	USER	PURPOSE
		student	-
		student	-
		faculty	-
		student	-
		student	-
		researcher	-
		RDC staff	-
	energy	student	-
		student	-
		faculty	-
		RDC staff	-
		RDC staff	-
		RDC staff	-
		RDC staff	-
		RDC staff	-
		RDC staff	-
	geothermal energy	RDC staff	-
	geothermal heating	RDC staff	-
	geothermal power plants	RDC staff	-
	hydroelectric power	researcher	-
		researcher	-
		student	-
		RDC staff	-
		faculty	-
		RDC staff	-
		RDC staff	-
	hydrogen energy	student	-
		RDC staff	-
		RDC staff	-
	ocean motion power	RDC staff	-
	ocean thermal power	RDC staff	-
	photovoltaic conversion	RDC staff	-
		RDC staff	-
		RDC staff	-
		faculty	-
	renewable energy	Library staff	-
		RDC staff	-
		faculty	-
		faculty	-
		RDC staff	-
	solar collectors	faculty	-
		student	-
		student	-
	solar cookers	RDC staff	-
	solar drying	student	-
		RDC staff	-
		Library staff	-

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT	USER	PURPOSE
		student	-
		Systems Unit	-
		faculty	-
	solar energy	student	-
		RDC staff	-
		faculty	-
	solar energy storage	RDC staff	-
		RDC staff	-
	solar furnaces	RDC staff	-
	solar heating & cooling	RDC staff	-
		faculty	-
		faculty	-
		Library staff	-
		student	-
		student	-
	solar ponds	RDC staff	-
		researcher	-
		student	-
		student	-
	solar power plants	RDC staff	-
	solar refrigeration	RDC staff	-
		RDC staff	-
		faculty	-
		student	-
	solar stills	RDC staff	-
		Library staff	-
	solar water heaters	RDC staff	-
		faculty	-
	solar water pumps	RDC staff	-
		faculty	-
	solar collectors	RDC staff	-
	water power	RDC staff	-
		RDC staff	-
	windmills	RDC staff	-
		faculty	-
		Systems Unit	-
		RDC staff	-
		Library staff	-
		RDC staff	-
		faculty	-
		Systems Unit	-
		Systems Unit	-
	wind energy	student	-
		researcher	-
		RDC staff	-
		student	-
		RDC staff	-

RETRIEVALS FROM 'RERI' DATABASE - COUNTRY SORTING

COUNTRY	QUERIED SUBJECT	USER	PURPOSE
		Library staff	-
		student	-
		RDC staff	-
	wind turbines	Library staff	-
		RDC staff	-
		student	-
		RDC staff	-
		Library staff	-
		RDC staff	-
Count:	31	126	
Tonga	solar radiation	researcher	general information
Count:	1	1	
U.S.A.	biomass energy	researcher	general information
	biomass fuels	researcher	research
		researcher	general information
		student	research
	ocean thermal power	student	research
	renewable energy	student	research
		student	research
		researcher	research
	solar cookers	researcher	design
	solar drying biogas	researcher	general information
	solar drying energy	researcher	planning
	solar energy	student	research
	solar ponds	student	research
Count:	9	13	
Uruguay	biomass fuels	researcher	general information
		researcher	general information
Count:	1	2	
Count:	83	195	

COUNTRY BREAKDOWN - USER CATEGORY: RESEARCHER

COUNTRY	MONTH	QUERIED SUBJECT	PURPOSE
Argentina	3	solar refrigeration	general information
Count:	1	1	
Australia	2	renewable energy	general information
Count:	1	1	
Belgium	5	solar energy	general information
Count:	1	1	
Canada	4	solar radiation	general information
Count:	1	1	
Costa Rica	2	renewable energy	general information
Count:	1	1	
Cuba	5	solar refrigeration	general information
Count:	1	1	
France	5	biogas	general information
Count:	1	1	
Germany, F.R.	4	biomass fuels	general information
Count:	1	1	
India	1	biogas	research
	2	solar water heaters	design
	3	solar refrigeration	general information
	5	solar refrigeration	general information
	6	solar refrigeration	design
Count:	5	5	
Indonesia	1	solar energy	general information
	2	biomass fuels	general information
Count:	2	2	
Israel	3	solar drying	research
Count:	1	1	

COUNTRY BREAKDOWN - USER CATEGORY: RESEARCHER

COUNTRY	MONTH	QUERIED SUBJECT	PURPOSE
Japan	3	renewable energy	general information
Count:	1	1	
Malaysia	2	solar radiation	research
Count:	1	1	
Mauritius	2	solar drying	general information
Count:	1	1	
New Zealand	6	solar drying	general information
Count:	1	1	
Nigeria	5	solar drying	general information
Count:	1	1	
Pakistan	3	solar refrigeration	design
Count:	1	1	
Seychelles	2	solar collectors	general information
		solar heating & cooling	general information
Count:	1	2	
Sudan	2	solar energy	general information
Count:	1	1	
Sweden	6	renewable energy	general information
Count:	1	1	
Thailand	1	renewable energy	general information
		solar radiation	general information
		solar cookers	construction
		solar cookers	construction
	2	solar energy	research
		wind energy	research
		solar drying	general information
		solar drying solar cookers	general information
	3	renewable energy	general information

COUNTRY BREAKDOWN - USER CATEGORY: RESEARCHER

COUNTRY	MONTH	QUERIED SUBJECT	PURPOSE
	5	solar drying	construction
		renewable energy	general information
		renewable energy	general information
		solar drying	construction
	6	solar energy	general information
		renewable energy	general information
		biomass fuels	research
Count:	5	16	
Thailand (AIT)	1	biomass fuels	-
	2	biomass energy	-
	3	solar ponds	-
	5	hydroelectric power	-
		hydroelectric power	-
	6	wind energy	-
Count:	5	6	
Tonga	5	solar radiation	general information
Count:	1	1	
U.S.A.	2	biomass energy	general information
		biomass fuels	research
		biomass fuels	general information
	3	renewable energy	research
	5	solar cookers	design
	6	solar drying biogas	general information
		solar drying energy	planning
Count:	4	7	
Uruguay	3	biomass fuels	general information
	5	biomass fuels	general information
Count:	2	2	
Count:	42	58	

COUNTRY BREAKDOWN - USER CATEGORY: STUDENT

COUNTRY	MONTH	QUERIED SUBJECT	PURPOSE
India	1	biomass energy	research
		hydroelectric power	research
		biomass fuels	research
Count:	1	3	
Indonesia	1	biomass fuels	research
		solar ponds	research
		solar stills	research
		hydroelectric power	research
		solar energy storage	research
		hydrogen energy	research
Count:	1	6	
Thailand	2	solar energy storage	research
		biomass fuels	research
Count:	1	2	
Thailand (AIT)	1	solar heating & cooling	-
		biomass fuels	-
		solar heating & cooling	-
		biomass fuels	-
		biomass energy	-
		biomass energy	-
		solar collectors	-
		solar collectors	-
		solar ponds	-
		solar ponds	-
		biomass energy	-
		solar refrigeration	-
	2	solar drying	-
		wind energy	-
	3	solar drying	-
		biomass energy	-
		biomass fuels	-
		biomass fuels	-
		biomass fuels	-
		biomass fuels	-
		wind turbines	-
		biomass energy	-
	4	biomass fuels	-
		biomass fuels	-
		biomass fuels	-
		biomass fuels	-
		biomass fuels	-

COUNTRY BREAKDOWN - USER CATEGORY: STUDENT

COUNTRY	MONTH	QUERIED SUBJECT	PURPOSE
		wind energy	-
		hydroelectric power	-
		biomass fuels	-
		biomass energy	-
		biogas	-
		biomass energy	-
	5	solar energy	-
		hydrogen energy	-
		energy	-
		energy	-
		wind energy	-
Count:	5	38	
U.S.A.	2	ocean thermal power	research
		renewable energy	research
		renewable energy	research
	3	biomass fuels	research
		solar energy	research
		solar ponds	research
Count:	2	6	
Count:	10	55	

RETRIEVALS FROM 'RERI' DATABASE - MONTHLY REPORT

MONTH	QUERIED SUBJECT	USER	COUNTRY	PURPOSE
1	biogas	researcher	India	research
	biomass energy	student	India	research
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	biomass fuels	student	India	research
		student	Indonesia	research
		researcher	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	energy	RDC staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	hydroelectric power	student	Indonesia	research
		student	India	research
	hydrogen energy	student	Indonesia	research
		RDC staff	Thailand (AIT)	-
	renewable energy	researcher	Thailand	general information
	solar collectors	student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	solar cookers	researcher	Thailand	construction
		researcher	Thailand	construction
	solar energy	researcher	Indonesia	general information
	solar energy storage	student	Indonesia	research
		RDC staff	Thailand (AIT)	-
	solar heating & cooling	faculty	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	solar ponds	student	Indonesia	research
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	solar radiation	researcher	Thailand	general information
	solar refrigeration	student	Thailand (AIT)	-
	solar stills	student	Indonesia	research
	windmills	RDC staff	Thailand (AIT)	-
		faculty	Thailand (AIT)	-
		Systems Unit	Thailand (AIT)	-
		Systems Unit	Thailand (AIT)	-
	wind energy	RDC staff	Thailand (AIT)	-
	wind turbines	RDC staff	Thailand (AIT)	-
Count:		19	40	
2	biomass energy	researcher	U.S.A.	general information
		researcher	Thailand (AIT)	-
	biomass fuels	researcher	Indonesia	general information
		student	Thailand	research

RETRIEVALS FROM 'RERI' DATABASE - MONTHLY REPORT

MONTH	QUERIED SUBJECT	USER	COUNTRY	PURPOSE
		researcher	U.S.A.	research
		researcher	U.S.A.	general information
		faculty	Thailand (AIT)	-
	energy	RDC staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	hydroelectric power	RDC staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
		faculty	Thailand (AIT)	-
	ocean thermal power	student	U.S.A.	research
	photovoltaic conversion	faculty	Thailand (AIT)	-
	renewable energy	student	U.S.A.	research
		student	U.S.A.	research
		researcher	Costa Rica	general information
		researcher	Australia	general information
		faculty	Thailand (AIT)	-
		faculty	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	solar collectors	faculty	Thailand (AIT)	-
		researcher	Seychelles	general information
	solar drying	student	Thailand (AIT)	-
		researcher	Thailand	general information
		faculty	Thailand (AIT)	-
		Library staff	Thailand (AIT)	-
		Systems Unit	Thailand (AIT)	-
		researcher	Mauritius	general information
	solar drying ; solar cookers	researcher	Thailand	general information
	solar energy	researcher	Sudan	general information
		researcher	Thailand	research
		faculty	Thailand (AIT)	-
	solar energy storage	student	Thailand	research
	solar heating & cooling	faculty	Thailand (AIT)	-
		Library staff	Thailand (AIT)	-
		researcher	Seychelles	general information
	solar radiation	researcher	Malaysia	research
	solar refrigeration	faculty	Thailand (AIT)	-
	solar stills	Library staff	Thailand (AIT)	-
	solar water heaters	faculty	Thailand (AIT)	-
		researcher	India	design
	solar water pumps	faculty	Thailand (AIT)	-
	windmills	Library staff	Thailand (AIT)	-
	wind energy	researcher	Thailand	research
		Library staff	Thailand (AIT)	-
		student	Thailand (AIT)	-
	wind turbines	Library staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-

RETRIEVALS FROM 'RERI' DATABASE - MONTHLY REPORT

MONTH	QUERIED SUBJECT	USER	COUNTRY	PURPOSE
Count:		21	50	
3	biogas	RDC staff	Thailand (AIT)	-
	biomass energy	student	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
		student	Thailand (AIT)	-
	biomass fuels	student	U.S.A.	research
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		researcher	Uruguay	general information
	hydroelectric power	RDC staff	Thailand (AIT)	-
	photovoltaic conversion	RDC staff	Thailand (AIT)	-
	renewable energy	researcher	U.S.A.	research
		researcher	Thailand	general information
		researcher	Japan	general information
	solar drying	student	Thailand (AIT)	-
		researcher	Israel	research
	solar energy	student	U.S.A.	research
	solar ponds	student	U.S.A.	research
		researcher	Thailand (AIT)	-
	solar refrigeration	researcher	Argentina	general information
		researcher	India	general information
		researcher	Pakistan	design
	water power	RDC staff	Thailand (AIT)	-
	windmills	Systems Unit	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	wind energy	RDC staff	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	wind turbines	Library staff	Thailand (AIT)	-
		student	Thailand (AIT)	-
Count:		14	30	
4	biogas	student	Thailand (AIT)	-
	biomass energy	student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	biomass fuels	student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
		researcher	Germany, F.R.	general information
	energy	RDC staff	Thailand (AIT)	-

RETRIEVALS FROM 'RERI' DATABASE - MONTHLY REPORT

MONTH	QUERIED SUBJECT	USER	COUNTRY	PURPOSE
	geothermal energy	RDC staff	Thailand (AIT)	-
	geothermal heating	RDC staff	Thailand (AIT)	-
	geothermal power plants	RDC staff	Thailand (AIT)	-
	hydroelectric power	student	Thailand (AIT)	-
	hydrogen energy	RDC staff	Thailand (AIT)	-
	ocean motion power	RDC staff	Thailand (AIT)	-
	ocean thermal power	RDC staff	Thailand (AIT)	-
	photovoltaic conversion	RDC staff	Thailand (AIT)	-
	renewable energy	RDC staff	Thailand (AIT)	-
	solar cookers	RDC staff	Thailand (AIT)	-
	solar drying	RDC staff	Thailand (AIT)	-
	solar energy	RDC staff	Thailand (AIT)	-
	solar energy storage	RDC staff	Thailand (AIT)	-
	solar furnaces	RDC staff	Thailand (AIT)	-
	solar heating & cooling	RDC staff	Thailand (AIT)	-
	solar ponds	RDC staff	Thailand (AIT)	-
	solar power plants	RDC staff	Thailand (AIT)	-
	solar radiation	researcher	Canada	general information
	solar refrigeration	RDC staff	Thailand (AIT)	-
	solar stills	RDC staff	Thailand (AIT)	-
	solar water heaters	RDC staff	Thailand (AIT)	-
	solar water pumps	RDC staff	Thailand (AIT)	-
	solar collectors	RDC staff	Thailand (AIT)	-
	wind energy	student	Thailand (AIT)	-
	wind turbines	RDC staff	Thailand (AIT)	-
Count:		29	36	
5	biogas	researcher	France	general information
	biomass energy	faculty	Thailand (AIT)	-
	biomass fuels	RDC staff	Thailand (AIT)	-
		researcher	Uruguay	general information
	energy	faculty	Thailand (AIT)	-
		student	Thailand (AIT)	-
		student	Thailand (AIT)	-
	hydroelectric power	researcher	Thailand (AIT)	-
		researcher	Thailand (AIT)	-
	hydrogen energy	student	Thailand (AIT)	-
	photovoltaic conversion	RDC staff	Thailand (AIT)	-
	renewable energy	researcher	Thailand	general information
		researcher	Thailand	general information
	solar cookers	researcher	U.S.A.	design
	solar drying	researcher	Thailand	construction
		researcher	Thailand	construction
		researcher	Nigeria	general information
	solar energy	student	Thailand (AIT)	-
		researcher	Belgium	general information

RETRIEVALS FROM 'RERI' DATABASE - MONTHLY REPORT

MONTH	QUERIED SUBJECT	USER	COUNTRY	PURPOSE
	solar radiation	researcher	Tonga	general information
	solar refrigeration	RDC staff	Thailand (AIT)	-
		researcher	Cuba	general information
		researcher	India	general information
	wind energy	student	Thailand (AIT)	-
Count:	14	24		
6	biomass energy	RDC staff	Thailand (AIT)	-
	biomass fuels	researcher	Thailand	research
		RDC staff	Thailand (AIT)	-
	renewable energy	researcher	Thailand	general information
		researcher	Sweden	general information
		Library staff	Thailand (AIT)	-
	solar drying	researcher	New Zealand	general information
	solar drying biogas	researcher	U.S.A.	general information
	solar drying energy	researcher	U.S.A.	planning
	solar energy	researcher	Thailand	general information
	solar refrigeration	researcher	India	design
	water power	RDC staff	Thailand (AIT)	-
	windmills	faculty	Thailand (AIT)	-
		RDC staff	Thailand (AIT)	-
	wind energy	researcher	Thailand (AIT)	-
Count:	11	15		
Count:	108	195		

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT	PURPOSE	USER	COUNTRY
biogas	-	RDC staff	Thailand (AIT)
		student	Thailand (AIT)
	general information	researcher	France
		researcher	U.S.A.
	research	researcher	India
Count:	3	5	
biomass energy	-	RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
		RDC staff	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		researcher	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
	general information	researcher	U.S.A.
	research	student	India
Count:	3	13	
biomass fuels	-	RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		faculty	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		researcher	Thailand (AIT)
		RDC staff	Thailand (AIT)
	general information	researcher	U.S.A.
		researcher	Indonesia
		researcher	Uruguay
		researcher	Uruguay
		researcher	Germany, F.R.
	research	researcher	Thailand

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT	PURPOSE	USER	COUNTRY
		student	Thailand
		researcher	U.S.A.
		student	U.S.A.
		student	India
		student	Indonesia
Count:	3	28	
energy	-	student	Thailand (AIT)
		student	Thailand (AIT)
		faculty	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
	planning	researcher	U.S.A.
Count:	2	10	
geothermal energy	-	RDC staff	Thailand (AIT)
Count:	1	1	
geothermal heating	-	RDC staff	Thailand (AIT)
Count:	1	1	
geothermal power plants	-	RDC staff	Thailand (AIT)
Count:	1	1	
hydroelectric power	-	researcher	Thailand (AIT)
		researcher	Thailand (AIT)
		RDC staff	Thailand (AIT)
		student	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
	research	student	Indonesia
		student	India
Count:	2	9	

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT	PURPOSE	USER	COUNTRY
hydrogen energy	-	student	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
	research	student	Indonesia
Count:	2	4	
ocean motion power	-	RDC staff	Thailand (AIT)
Count:	1	1	
ocean thermal power	-	RDC staff	Thailand (AIT)
	research	student	U.S.A.
Count:	2	2	
photovoltaic conversion	-	RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
Count:	1	4	
renewable energy	-	Library staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
		faculty	Thailand (AIT)
		RDC staff	Thailand (AIT)
	general information	researcher	Thailand
		researcher	Thailand
		researcher	Thailand
		researcher	Sweden
		researcher	Australia
		researcher	Thailand
		researcher	Japan
		researcher	Costa Rica
		researcher	Thailand
	research	student	U.S.A.
		student	U.S.A.
		researcher	U.S.A.
Count:	3	17	
solar collectors	-	faculty	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
	general information	researcher	Seychelles
Count:	2	4	

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT	PURPOSE	USER	COUNTRY
solar cookers	-	RDC staff	Thailand (AIT)
	construction	researcher	Thailand
		researcher	Thailand
	design	researcher	U.S.A.
	general information	researcher	Thailand
Count:	4	5	
solar drying	-	student	Thailand (AIT)
		RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
		Library staff	Thailand (AIT)
		student	Thailand (AIT)
		Systems Unit	Thailand (AIT)
	construction	researcher	Thailand
		researcher	Thailand
	general information	researcher	New Zealand
		researcher	U.S.A.
		researcher	Thailand
		researcher	Nigeria
		researcher	Mauritius
		researcher	Thailand
	planning	researcher	U.S.A.
	research	researcher	Israel
Count:	5	16	
solar energy	-	RDC staff	Thailand (AIT)
		student	Thailand (AIT)
		faculty	Thailand (AIT)
	general information	researcher	Thailand
		researcher	Sudan
		researcher	Indonesia
		researcher	Belgium
	research	student	U.S.A.
		researcher	Thailand
Count:	3	9	
solar energy storage	-	RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
	research	student	Thailand
		student	Indonesia
Count:	2	4	

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT	PURPOSE	USER	COUNTRY
solar furnaces	-	RDC staff	Thailand (AIT)
Count:	1	1	
solar heating & cooling	-	RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
		Library staff	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
		faculty	Thailand (AIT)
	general information	researcher	Seychelles
Count:	2	7	
solar ponds	-	RDC staff	Thailand (AIT)
		researcher	Thailand (AIT)
		student	Thailand (AIT)
		student	Thailand (AIT)
	research	student	U.S.A.
		student	Indonesia
Count:	2	6	
solar power plants	-	RDC staff	Thailand (AIT)
Count:	1	1	
solar radiation	general information	researcher	Thailand
		researcher	Canada
		researcher	Tonga
	research	researcher	Malaysia
Count:	2	4	
solar refrigeration	-	RDC staff	Thailand (AIT)
		RDC staff	Thailand (AIT)
		faculty	Thailand (AIT)
		student	Thailand (AIT)
	design	researcher	India
		researcher	Pakistan
	general information	researcher	Cuba
		researcher	India
		researcher	Argentina
		researcher	India
Count:	3	10	

RETRIEVALS FROM 'RERI' DATABASE - SUBJECT SORTING

QUERIED SUBJECT		PURPOSE	USER	COUNTRY
			Library staff	Thailand (AIT)
			RDC staff	Thailand (AIT)
		research	researcher	Thailand
	Count:	2	9	
wind turbines		-	Library staff	Thailand (AIT)
			RDC staff	Thailand (AIT)
			RDC staff	Thailand (AIT)
			student	Thailand (AIT)
			Library staff	Thailand (AIT)
			RDC staff	Thailand (AIT)
	Count:	1	6	
	Count:	63	198	

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RETRIEVALS FROM 'RERI' DATABASE - PURPOSE SORTING

PURPOSE	QUERIED SUBJECT	USER	COUNTRY
construction	solar cookers	researcher	Thailand
		researcher	Thailand
	solar drying	researcher	Thailand
		researcher	Thailand
Count:	2	4	
design	solar cookers	researcher	U.S.A.
	solar refrigeration	researcher	India
		researcher	Pakistan
	solar water heaters	researcher	India
Count:	3	4	
general information	biogas	researcher	France
	biomass energy	researcher	U.S.A.
	biomass fuels	researcher	U.S.A.
		researcher	Indonesia
		researcher	Uruguay
		researcher	Germany, F.R.
		researcher	Uruguay
	renewable energy	researcher	Thailand
		researcher	Japan
		researcher	Thailand
		researcher	Thailand
		researcher	Thailand
		researcher	Sweden
		researcher	Costa Rica
		researcher	Australia
		researcher	Thailand
	solar collectors	researcher	Seychelles
	solar drying	researcher	New Zealand
		researcher	Thailand
		researcher	Nigeria
		researcher	Mauritius
	solar drying biogas	researcher	U.S.A.
	solar drying solar cookers	researcher	Thailand
	solar energy	researcher	Thailand
		researcher	Indonesia
		researcher	Sudan
		researcher	Belgium
	solar heating & cooling	researcher	Seychelles
	solar radiation	researcher	Thailand
		researcher	Tonga
		researcher	Canada
	solar refrigeration	researcher	India
		researcher	Argentina

RETRIEVALS FROM 'RERI' DATABASE - PURPOSE SORTING

PURPOSE	QUERIED SUBJECT	USER	COUNTRY
		researcher	India
		researcher	Cuba
Count:	12	35	
planning	solar drying energy	researcher	U.S.A.
Count:	1	1	
research	biogas	researcher	India
	biomass energy	student	India
	biomass fuels	researcher	Thailand
		student	Thailand
		researcher	U.S.A.
		student	U.S.A.
		student	Indonesia
		student	India
	hydroelectric power	student	Indonesia
		student	India
	hydrogen energy	student	Indonesia
	ocean thermal power	student	U.S.A.
	renewable energy	student	U.S.A.
		student	U.S.A.
		researcher	U.S.A.
	solar drying	researcher	Israel
	solar energy	researcher	Thailand
		student	U.S.A.
	solar energy storage	student	Thailand
		student	Indonesia
	solar ponds	student	U.S.A.
		student	Indonesia
	solar radiation	researcher	Malaysia
	solar stills	student	Indonesia
	wind energy	researcher	Thailand
Count:	14	25	
Count:	32	69	

END-USE STATISTICS, CRRERIS

CRRERIS REQUEST STATISTICS 07-FEB-85

Summary of documents sent(All requests)

Summary of above
+ subject of document

Total number sent : 633
Total number of fiche sent : 443
Total number of photocopies sent : 190

subjects sent

Energy Resources - General	80
Solar Energy - General	11
Solar Energy - Resource estimation	4
Solar Energy - Applications	153
Solar Energy - Conversion Systems	104
Solar Energy - Environmental aspects	6
Water Energy - General	3
Water Energy - Conversion Systems	11
Wind Energy - General	3
Wind Energy - Resource estimation	3
Wind Energy - Applications	4
Wind Energy - Conversion Systems	6
Geothermal Energy - Resource estimation	1
Fuel Energy - General	37
Fuel Energy - Resource estimation	26
Fuel Energy - Applications	91
Fuel Energy - Conversion Systems	84
Fuel Energy - Environmental aspects	6

CRRERIS REQUEST STATISTICS 07-FEB-85

Summary of All requests (Summary of previous table)

	Requests	Circular letters	Replies	Documents
Energy Resources - General	30	0	0	254
Solar Energy - General	5	0	0	14
Solar Energy - Applications	14	0	0	103
Solar Energy - Conversion Systems	10	0	0	75
Water Energy - General	1	0	0	2
Water Energy - Applications	1	0	0	5
Water Energy - Conversion Systems	3	0	0	5
Wind Energy - General	2	0	0	5
Wind Energy - Applications	1	0	0	1
Wind Energy - Conversion Systems	1	0	0	2
Fuel Energy - General	6	0	0	2
Fuel Energy - Applications	3	0	0	21
Fuel Energy - Conversion Systems	23	1	2	143

PERSONS CONTACTED

ANNEX I: Persons Contacted

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GENERAL BIBLIOGRAPHY

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