

THE OVERSEAS DEVELOPMENT ADMINISTRATION

TDR PROJECT R6244

**THE STIMULATION OF LOCAL DEVELOPMENT FOR
WINDPUMPS IN ASIA**

FINAL REPORT

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THE STIMULATION OF LOCAL DEVELOPMENT FOR WINDPUMPS IN ASIA
FINAL REPORT
EXECUTIVE SUMMARY

INTRODUCTION

The initial phase of the ODA project to stimulate the development of windpumps in Asia has been highly successful. China, India, the Philippines and Vietnam were selected to participate in the initial phase of the programme. In each country a local association has been formed consisting of manufacturers and distributors of windpumps, government and non-government agencies, rural extension agencies and other relevant bodies. The formation of these networks was accelerated by the country workshops held in the first 10 months of the project. Association activities were further stimulated and assisted by visits from the project consultants and the distribution of supporting literature. Each country has a designated 'liaison' consultant in the project team to encourage trust and a productive dialogue.

The first Asia region workshop was held in November 1996 in India with strong delegations attending from each member country. Interaction between the regional representatives was highly beneficial. Common barriers to windpump development were identified and experience, positive and negative, within each of the countries was widely discussed. Each country presented plans for development of the networks and for future work in their countries. In addition several co-operative actions between member countries were drafted. The papers presented, points raised in discussion sessions and the agreed outputs from the workshop are presented in the proceedings which have been compiled by the consultant team.

The first regional workshop, the national workshops and the discussions throughout the course project have generated greater interest in windpumps and have identified areas of work which could effectively develop the windpump industry in Asia. These further actions have been included in the main body of the report.

SELECTION OF COUNTRIES

The selection of countries in the Asia region was based on a study of the level of windpump activity and project interest in seven Asian countries with previous experience with windpump development. Eight criteria were selected to enable comparisons between the first seven countries. These were given weightings dependant on the level of interest shown in the country and the prospects of success in each of the countries. This ranking system provided a useful basis for discussion amongst the consultant team and based on this analysis four countries were selected to participate in the project, China, south eastern India, the Philippines and Vietnam.

NATIONAL DEVELOPMENTS IN SELECTED COUNTRIES

The progress towards the project goals is summarised in Table 1. All countries have formed a local association comprising of the key players in that country and are still active in expanding their membership base. Each association has run a workshop for the relevant organisations which has led to the development of TORs for each association.

The activities of the networks have been varied; the Chinese have visited the UK (self financed) and are planning to visit Vietnam in 1997, the Indian association has held discussions with the Ministry of Non-conventional Energy Sources and produced a strategy for windpump development which is co-ordinated with the Government 5 year plan, the Philippine association has been active in publicising windpumps to relevant groups in the Philippines notably at the 1996 AGRO-ENVIRIN trade fair, and the Vietnamese have secured Government funding for the further development of their network and have carried out a broad market survey of windpump prospects in Vietnam. Furthermore the Indian association was responsible for hosting the first regional windpump workshop which was attended by representatives of each country association.

The networks were deliberately built up from those active in the windpumping field rather than from above via the responsible Government body. This approach has lent credibility to the associations and in every country Government policy towards windpumping has been augmented after representation from the association. In China windpumps have been newly added to the country wind energy plan. In India Government support has been given to develop financing schemes for windpump developments and some commitment has been given to R&D activities. The Philippine association has managed to revise their Government policy on windpumps, the Non-Conventional Energy Division of the Philippine Ministry of Energy is once again active in the field of windpumps and has part funded training workshops and encouraged the formation of the country association. The Vietnamese association has been officially recognised as part of the Department of Science and Technology and Environment (DOSTE) which has provided funding for a market survey in Vietnam.

Each country has developed plans to promote windpumping within their countries which incorporate issues highlighted in the national and regional workshops. One key point which emerged was the need for adequate Operation and Management support, this has been borne out by the testimony of the manufacturers and users in the Asia network and the project consultants. The recognised importance of this issue and proposed solutions which are present in many of the plans and proposals to emerge from the first phase of the project indicate the partial achievement of one the project goals. The actions emerging from the project are as yet not able to demonstrate an increase in sales of windpumps but the indicators are that this will eventually result from the activities proposed.

DATABASE DEVELOPMENT

A key issue to emerge during the course of the project was the need for appropriate and adequate information to inform and assist the regional networks. A database was developed which included information on windpumps but was significantly extended to take in material related to project management, financing, development issues and manufacturing. This was done in an attempt to address some of the widely recognised barriers to windpump development related to non-technical failures. The database made use of the now widely available technology of CD ROM. Using a standard data management software package, called Dataease, the user is exposed to various levels of enquiry into issues surrounding windpumps. This includes photos, video clips, manufacturers data, technical papers and related literature. Some key publications are included in the database in entirety and others are referred to and can be obtained from the libraries of the project consultants. Arrangements are still to be made for long term support of the database.

CONCLUSIONS & RECOMMENDATIONS

The formation of the networks has been successful in stimulating interest in those countries involved in the project. This increased interest is evident in the raised priority given to windpumps by the relevant government bodies in the member countries and the increased activity in the windpump sector. This activity is not yet measurable in appropriately developed machines nor increased market penetration but rather in the formation of functioning country associations. These associations are formulating windpump development plans which will contribute a larger and more sustainable market for windpumps.

The bottom up method used to identify the key players in the windpump sector and the subsequent development of the country associations is very effective. It is recommended that this approach be used in similar projects aimed at strengthening the capabilities of small industries in developing countries.

This TDR project was designed to carry out Phase 1 of a programme which would need several years and two more phases in order to reach the ultimate aim of successful markets and self-sustaining local associations linked in a regional network. It is recommended that continued support be given to the new associations and that they continue to receive assistance to identify and commit funding sources for the projects which are being developed. It is also recommended that the continued development of the markets be monitored in order to confirm the effectiveness of the project methodology.

Summary	Measurable indicators	CHINA	INDIA	PHILIPPINES	VIETNAM
GOAL	Technology fully adapted to local needs				
	Increasing sales	The manufacturer of the TFS-5 will benefit from proposed projects. New factory proposed.		New manufacturers becoming established.	
	Adequate O&M support available	National and regional discussions have emphasised the importance of O&M	Wide recognition that O&M is of paramount importance.	Wide recognition that O&M is of paramount importance.	Wide recognition that O&M is of paramount importance.
PURPOSE	Country plans available	Windpumps re-introduced into country wind energy plan due to project	Outline plans available, co-ordinated with MNES 5yr plan.	New WEAP programme co-ordinates with plans of DA and DOE.	2 phase plan drafted.
	International network operational	Concept agreed. Four national representatives nominated to prepare for formation of a regional network.			
OUTPUTS	Development plans	National 5 year plan newly includes windpumps. Local Gov. in Changzhou City committed to network.	Improvement of plans of MNES and state nodal agencies	Revision of official Gov. policy on windpumps.	Solarlab (network co-ordinator) directly responsible for increased Gov. interest in wind energy through 5 yr plan.
	Workshops held	National and Asia region workshops held involving all key players.	National and Asia region workshops held involving all key players.	National and Asia region workshops held involving all key players	National and Asia region workshops held involving all key players.
	Publications, active participation and enquiries from Govt. and agencies.	"Wind energy for water pumping in rural areas of China" and supporting documentation, other papers.	Active involvement of GEDA & TEDA.	Technical papers by board. WEAP invited to join REAP (supported by Ministry of Energy) DA has requested two proposals.	Local Gov. reps responsible for renewable energy education, planning, dissemination and installation attended the workshop
	National networks active	Network visit to UK 1996. UK experts invited (Chinese funding) 1997. China/Vietnam exchange visits planned 1997. Network has committed funds for 2nd national workshop.	Hosted the First Asia region windpump workshop. Plans to extend membership nationally.	Attended First Asia workshop in India 1997. Presentation at AGRO-ENVIRON 1996 trade fair. Industry/ Agency liaison.	Attended First Asia windpump workshop in India 1997. SWOT study carried out for Vietnam. \$7000 from DOSTE for project. Outline TORs prepared.
	TORs drafted	Several projects proposed. 40% funding from local funds. TORs to be developed further in Jan 1997.	Windpump network formed. TORs for network defined, initial membership established from key players. Project TORs in development stage.	Wind Energy Association of the Philippines (WEAP) formed. TORs under development.	Network formed, officially "Windpump Project in Asia - Local Committee of Action" recognised as part of the Ministry of Science and Technology (DOSTE). Outline plans prepared
	Publicity	Translations of non-Chinese material and network newsletter planned.	GEDA newsletter, Proceedings from First Asia windpump workshop.	1st newsletter Oct. 1996. General promotion to public and Gov.	

Table 1 Summary of Project Achievements

1. INTRODUCTION

This final report presents the results of a project which has been funded by the UK's Overseas Development Administration (ODA), as part of its Technology Development and Research Programme, project number R6244. The consultancy work has been led by HGa with support from subcontractors Gamos Ltd of Reading UK and Renewable Energy Development of the Netherlands.

It has been a co-operative project which has been successful only because of the involvement of many collaborators in Asian countries. The consultants wish to acknowledge the enthusiasm, practical support and advice which they have received in the countries participating in the project.

The project was designed to apply the results of the latest studies on the development of windpump markets and address in a co-ordinated programme, in participation with the collaborators, the many barriers which are preventing market development. National networks and an international, regional network for local industry were proposed to share information for technical and institutional development of windpump markets. It was also hoped that this regional activity would become a model for other regions and technologies.

The work within this project was conceived as the first phase of a longer term programme to stimulate the markets for windpumps. This report is therefore effectively an interim report on the programme which, provided that it continues, will be expected to further stimulate the development of windpump markets.

2. BACKGROUND

Windpumping is a long-established technology for water supply which has failed to establish itself strongly in many developing country markets despite the existence of small and fragmented markets. Studies by British and Dutch organisations, including the project consultants, identified common barriers to progress and proposed strategies to resolve them. Common problem areas identified were the development and transfer of technology, awareness amongst potential buyers, institutional support, availability of finance, manufacturing development and after-sales service. Technology-led projects set up in the past have often failed. However, potential markets do exist and there is evidence to show that they can be stimulated. The most comprehensive recent work on this subject is contained in the report by the same consultant team to the Dutch Government in 1993 (1).

Water supply to rural areas is one of the keys to development recognised by many government and international agencies and NGOs. Water supply has a critical role in health programmes, self-sufficiency and income generation from crops and animal husbandry. Windpumping is seen to have several advantages for water supply in rural areas of developing countries. It is a technology which can operate with quite modest wind resources and can be easily adapted to suit the local demands. Pumped water can be used for domestic consumption, crop irrigation, animals, fish farming, and salt manufacturing. There are also some markets for drainage pumps. The manufacturing skills and equipment needed are modest and are available in most countries. There is usually no requirement to import manufactured components other than common items such as bearings. A well-designed and maintained windpump can be cost competitive with engine-driven pumps in many circumstances and will be cheaper than a solar pump given an adequate wind resource. The technology can also stimulate technical capability at a village level.

At the “Wind Energy in Rural Areas” workshop held in the Netherlands in 1991 (2), representatives of industrialised and developing countries with windpump experience met and discussed the development of the industries including the concept of an international association to stimulate and channel information. Despite the recommendations of the workshop, the participants failed to persuade any agency to provide funding to set up an international association. This may have been partly due to differing views on the constitution of the proposed association which was seen by some, including HGa, as too “top-down” and academically focused.

How to develop the potential markets for windpumps in developing countries was the theme of another international workshop held at Silsoe, UK in July 1994 (3) with sponsorship from the UK (ODA) and Dutch Governments. The results of the studies and the Netherlands workshop mentioned above formed a major input to the discussion. The four major strategic problems were agreed to be the following:

- **The lack of financial resource** is a problem for all renewable energy technologies. In the case of windpumps there is a lack of access to affordable credit for potential purchasers and a lack of working capital for manufacturers to invest in design development, after-sales networks and improved production techniques.

- **Information** on the technology and its applications is hard to find in many countries. There is a poor awareness of the opportunity to use windpumps in government organisations and agencies. Potential users lack information to help them decide on a purchase. The manufacturers have difficulty in obtaining information on design and manufacture.
- **Support to users** is needed to give them the confidence and capability to operate windpumps effectively. In most markets the level of maintenance support is inadequate. In the case of windpumps installed for community use the difficult problem of ensuring long term ownership and commitment by the community has to be resolved.
- **Design and manufacture of windpumps** is the fourth area to be addressed. Manufacturers need assistance to select and/or adapt designs which are best suited to their markets. Many of them also need assistance to raise manufacturing standards, both to reduce costs and to ensure that the potential windpump performance is achieved.

The discussion at Silsoe resulted in the proposal to the ODA's Technology Development and Research programme to develop an international network to provide information and training support for programmes in developing countries, and to encourage the development of those markets through national and regional networks.

3. OBJECTIVES AND METHODOLOGY

3.1 Objectives

This project was designed to identify the barriers discouraging windpump market development in selected countries and then to design appropriate programmes to address them. The project was structured to rely heavily upon interest and effort by the players in each market but to provide them with the encouragement and support which could be brought by external experts.

A key area of support identified at the workshops described above is the provision of information and training. The project was also designed to begin the provision of this support.

The chosen method was to encourage the setting up of local associations on a local, regional or national basis. These would act as a focus for local activity and also as a channel through which the consultants could provide input. It was also anticipated that these networks would become stronger if they could develop international links with other associations.

The project was intended to develop in such a way as to maximise the benefit of contact with existing networks, technical co-operation between developing countries and economic co-operation (TCDC/ECDC activities) and other agencies whilst avoiding competition with other network activities.

This project under TDR funding was conceived as the first phase of a long term programme to build self-sufficient capability. The long term programme structure is as follows.

Phase 1	Form networks and define local programmes	1.5 years
Phase 2	Execute selected projects Continue to build network and regional links	2 to 4 years
Phase 3	Assist to identify follow-up activities Provide support to network until it becomes self-sufficient	2 to 4 years

Overall, the long term output from the project should include examples of how to successfully address particular deficiencies in markets for renewable energy technologies and encourage regional co-operation. The longer term benefits to the host countries would be first to the suppliers of windpumps and their enlarged customer base and ultimately to the health and economy of the rural populations and the global environment.

3.2 Methodology

The formation of a local network within each region or country was chosen as the key element for the following reasons.

- A network was an idea favoured by the developing country representatives at the workshops referred to.
- A network could provide a forum for local manufacturers, suppliers, researchers, NGOs, users etc. to exchange information and also provide a single voice in discussion with national or regional government.
- A network with a central secretariat would provide a focus for the input from the project consultants or other external sources.
- It was essential that the development programme for each market area was fully supported by the local people and jointly developed with them.
- The potential to expand local networks nationally and to link networks within the region.

It was decided to target the establishment of networks in four countries each with different institutional and cultural contexts and also with different levels of development of the windpumping technology. This would provide a robust test of the overall project methodology. Asia was chosen as the region to work in because of the availability of small markets in several countries, the potential for development and existing ODA interests.

Within each country it was decided to make the early approaches direct to manufacturers, researchers and others interested parties. The consultants had already identified many of these persons in previous work. The use of the TDR programme enabled this to be done directly, so avoiding the potential delays and other complications that might arise from working through official inter-government channels. Two other distinct benefits of this approach would be the focus on the manufacturers and industry participation and the avoidance of the problem of lack of awareness of the technology found in some official bodies.

Within the 18 month span of this project it would not be possible to plan and execute major training initiatives but some training was to be imparted through the local workshops and working with the consultants. Also, the information transfer would be limited to *ad hoc* responses to queries and the development of a database of information for the use of the network members.

An international workshop was planned for the last stage of the project in order to encourage regional networking.

The establishment of each country network would rely upon the enthusiasm of a host body to be the secretariat. In order to overcome the administrative difficulties expected funds were set aside to assist the start up expenses of each network in addition to partial funding for the local workshops.

The contacts in each country were developed and followed up by one member of the consultants team with experience in that country in order to foster a trusting relationship.

3.3 Programme of Work

The planned programme for this project is summarised below. In execution the programme was extended by about four months.

Activity No	Activity	Programme (months)
1	Initial enquiries, selection of countries	1 - 2
2	Survey missions to identify participants, assess the current market and prepare for a local workshop	2 - 4
3	An interim report on the situation in each country and co-ordination with parallel projects	5
4	Local workshop to encourage the formation of a new network or association	8 - 9
5	Confirmation of the national agent or secretariat to lead the network and preparation of the operating plans	9 - 12
6	Missions to each country to help prepare Terms of Reference for projects within an overall programme	13 - 14
7	Preparation of the database for use by the network members	12 - 16
8	First Asia region windpump workshop	16
9	Co-operation with other projects and networks as may be possible	5 - 18
10	Project management and final report	1 - 18

4. SELECTION OF COUNTRIES

Seven countries in Asia were initially considered. These were China, India, Pakistan, the Philippines, Sri Lanka, Thailand and Vietnam. In all of these countries there was previous experience of windpumping and it was thought that windpumps were currently manufactured locally. All of the countries had been reported on in the market study of 1993 (1) and many personal contacts were therefore available. Contacts were made with manufacturers and distributors of windpumps, government and non-government agencies, rural extension organisations and other relevant ministries, in order to introduce the idea of the project. From the replies received, an assessment was made of the level of interest shown amongst possible collaborators and the prospects of success in each of the countries. Other indicators that were used to assess the potential of success of the project in the target countries drew upon the available market data and discussions with specialists.

A variety of criteria were used to rank each of the seven countries mentioned above. These are shown in Table 1 and included:

- ODA interest in the country;
- Existence of local manufacturers of windpumps;
- Perceived skill level in the country;
- Government interest in windpumping;
- Market potential for windpumping;
- Local contacts with respect to locating a suitable organisation to host the network secretariat;
- Practicalities of travel within the country and achieving the survey mission objectives,
- Sufficient interested parties in order to create a practical network;
- Positive track record for windpumps within the country.

A scoring mechanism was then used to rank the countries under each of the above categories. The results are shown in Table 1, note that “1” is the best score and “4” is the worst. If the criterion of “Market Potential” is used as an example, it can be seen that China, the Philippines and India (South East region) have very good scores. This is because some windpump manufacturers exist in these regions and given the right support and impetus could make a successful impact on the market place. Thailand, on the other hand, has the lowest score of all the countries, since with the open market in the country, it may prove difficult for a windpump manufacturer to gain a hold in the market place and the overall market scope was thought to be geographically restricted.

All the rows in the table were completed using this type of decision making process. The table was revised by the consultants in light of their experiences in the region and the replies that were received to enquiries in the country prior to final selection.

The ranking system was rather crude and depended rather heavily on personal experiences and opinions where facts were not easily obtainable. Nevertheless, the table provided a basis for discussion and agreement amongst the consultants' team.

The four countries selected for further work in this project were: India (South East), the Philippines, China and Vietnam. It can be seen from the "Totals" row in Table 4.1 that these countries have the lowest scores by a clear margin implying that they would be the most suited to continue onto the next stage of the project.

	CHINA	VIETNAM	THAILAND	PHILIPPINES	INDIA (South East)	PAKISTAN	SRI LANKA
ODA Interest	1	2	4	3	1	2	3
Local Manufacturers of Windpumps	3 (Region Dependent)	3	2	1	1	3	3
Skill Level in Country	1	1	1	2	1	3	3
Government Interest	1	1	3	1	1	2	2
Market Potential	1	2	3	1	1	2	2
Local Contacts	1	1	3	1	1	2	2
Practicalities of Travel & Operation	3	3	1	1	2	3	4
Ability to Network	2	2	4	2	2	4	2
Track Record	2	2	1	1	3	2	3
TOTALS	15	17	22	13	13	23	24

TABLE 4.1 SELECTION OF PARTICIPATING COUNTRIES

5. NATIONAL DEVELOPMENTS IN SELECTED COUNTRIES

5.1 Development in China

5.1.1 State of the Market

China has used wind energy for at least 2000 years. In the Jiangsu Province about 200,000 traditional windmills for pumping water were still operational in 1959. Although most windmills were replaced by electric and diesel systems, a shortage of diesel and electricity has caused an increase in the use of windpumps over the past decade. During that period 150,000 small wind generators have been installed in Inner Mongolia. Currently it is estimated by Shen Dechang (1996) that about 1,600 windpumps are in use, 800 to 1000 of which were developed over the last 15 years.

Relatively reliable data on the wind resource is available from past reports, the country wind map, average windspeed for specific sites, monthly average and maximum gust speed and Weibul distribution are available (1). Wind energy can be used in approximately two thirds of China.

Some new data on water resource was acquired during the project but the detailed number and type of wells, average water levels, level variations and drawdowns, and cost of wells for all China remain unknown. Also in contrast to previous reports groundwater in Inner Mongolia was found to be suitable for drinking water, although salinity remains a problem in some areas.

It has been documented before (1) that "China has a considerable market potential for both deep well and low lift/large volume windpumps. However, apart from opportunities for further market development, there are barriers. These barriers concern the high prices of windpumps and their current shortcomings, i.e. technical, operational, and efficiency. At the same time there is a proper body needed for training and extension. A government system of financial incentives to encourage the use of windpumps is also required."

During the first Chinese workshop a number of barriers and opportunities were identified. As well as endorsing the above, the workshop noted the opportunities in China's favourable climatic conditions for windpumping, the former widespread use of windpumping, a lack of alternative water pumping technologies in many regions, and the long-term commitment by manufacturers, institutes and government. It was agreed that the most important criterion for a windpump is reliability, followed by low cost and high water output.

Three factories currently produce windpumps in China. They are Xinghua Tractor Factory, Shangdu Livestock Machinery Factory, and the Dahua Machinery Factory. The Xinghua Tractor Factory has been developing windpumps over the last 25 years. Although the three factories can annually produce 500 pumps, the actual production is much lower. Both deep well and low lift windpumps have been developed in China. The low lift pumps, amongst them the Xinghua manufactured TFS-5, have been designed with the latest available R&D knowledge. It should be noted that the TFS-5 is based on the experience of the FDG5, FDG6 and FDG7. It should also be noted that there remains some uncertainty regarding the number of the FDG6 machines, popular in Inner

Mongolia, which have been installed. One estimate given was over 1000, while another was as low as 400.

As a result of the project, new information about a locally constructed windpump in Hebei province came to the attention of the wider windpump community for the first time. The development and construction of some 200 windpumps came as a result of one farmer's initiative. The farmer made a hybrid sail cloth piston pump system, which was able to irrigate a smallholding. The initial machine was so successful that a local factory in the city of Changzhou manufactured 200 systems, known as the Hebei-3, for local farmers. The windpump construction has ceased because the priorities of the factory have changed. Of approximately twenty windpumps surveyed, approximately 50% are in operation.

Although traditional windmills are still used in China, there is a growing need for modern pumps such as the TFS-5, which is a low lift pump used for irrigation and the low head applications, prawn breeding and salt refining. These pumps belong mostly to collective production units who are responsible for the operation and the maintenance of the pumps. Deep well pumps supply drinking water for homes/villages and livestock and are particularly valued in Inner Mongolia. The pumps are again operated collectively and maintained by families. The farmers who used the local Hebei-3 have lobbied the provincial Government to restart production, and increase reliability. These systems are used for micro irrigation.

Both banks and the government provide loans. Further, the State Economic Commission gives subsidies by paying the interest on loans for local windpump applications. There are also subsidies within the framework of a rural energy policy aimed at encouraging the use of windpumps.

There are quite a number of institutions engaged in the design, planning and research of windmills in China. Two of them operate on a national basis, the Chinese Wind Energy Development Centre (CWEDC), which is the co-ordinating body for the development of wind energy in China, and the Chinese Academy of Agricultural Mechanisation Sciences (CAAMS), an institute with 25 years experience in wind energy research. At the start of the project, both of these institutions were limiting their involvement in windpumps due to funding constraints. Windpumps were not on the National Five Year Plan created in 1995, and interest in windpumps at a national level was not very great. This has changed to some extent over the life of the project.

5.1.2 Creation of the Network

Mr Shen Dechang of the Chinese Academy for Agricultural Mechanisation (CAAMs) was nominated as the contact person for China. Mr Shen Dechang was contacted because he is well known internationally in the field of windpumps, he is the main person responsible for CAAMs work on windpumps, and CAAMs is the institution mandated to promote windpumping within China. Its activities include research, development and evaluation. A brochure for the institution is available in project documents. Mr Shen Dechang was well known to the project team, and responded very positively to initial contact from UK. In order to make the project more effective, advantage was taken of Prof. Mao of Tsinghua University who was visiting the project team for other reasons. Prof. Mao is a trusted advisor to the subcontractors Gamos Ltd. and was briefed to discuss with Mr Shen Dechang regarding the formation of the network and the initial workshop.

Mr Shen Dechang arranged the local workshop which was the first step towards formation of the windpump network. The interest in the workshop was so strong that the local government of Changzhou city contributed significantly to the local costs of the workshop.

The workshop was held in Changzhou, Hebei Province, approximately 300 km south of Beijing. There were 29 participants in all, including the principal players in windpump development in China, namely:

- Chinese Academy of Agricultural Mechanisation Sciences,
- Chinese Wind Energy Development Corporation,
- Wind Power Machinery Branch of China Association of Agricultural Machinery Manufacturers,
- Ministry of Machinery Industry,
- New Energy Sources Committee of China Energy research Society,
- Tianjin Well Sinking Co manufacturer,
- Dahua machinery factory manufacturer,
- Yangzhou tractor factory manufacturer.

In addition the local provincial government attended all discussions, having expressed an interest in development of the windpump industry in the province. This included officials from:

- the Mayors office,
- Department of Meteorology,
- Department of Science and Technology,
- local manufacturers.

In addition to papers presented by the consultants, a number of the more senior participants presented papers on current experience with windpumps and the future potential. Many of the experienced participants presented informal speeches about their experience. This semi-formal dialogue is not documented as it was mainly in Chinese with partial translation to English. The workshop included free and open dialogue amongst the participants, and the conclusions reflect this decisive atmosphere.

Site visits were made to two windpumps created by local farmers, approximately 15 windpumps built by the local factory (which has now stopped production) and to two factories that have specifically expressed interest in manufacture of windpumps. In addition, the participants attending from Beijing visited the Tianjin workshop which produces the TFS-5, and a TFS-5 windpump on their way back to the capital. The Mayor of the Province hosted a banquet for the participants.

It was noted by the workshop that there is a considerable commitment to the installation of 1000 MW of wind power capacity (electricity) by the year 2000. However no provision for windpump production is made in the 1995 five year plan presented by the central government. This seems to be a bureaucratic decision which does not take into account the 15 years of recent research into windpumps, and the pre-positioning of three factories tooled for windpump production. A hope was expressed that the interest and co-operation extended through the project would convince the Central Government to put windpumps back on to the 5 year Agenda.

Local needs and barriers to development were discussed in the following terms:

- It was the consensus that there had been sufficient research into novel windpump designs in China. They noted with interest that the conclusions of the recent market studies indicated that this statement above reflected a global situation as well as China.
- The workshop noted that the existing designs still needed some production engineering to increase reliability (to varying degrees depending on the design). Low reliability in a field situation was a barrier to widespread adoption.
- In the past the manufacturers did not pay enough attention to after sales service, with long delays in repairing or replacing broken parts.
- It was not clear how the changing market conditions of China would affect the dissemination of windpumps. Participants suggested that there needed to be several levels of economic impact - from Central Government, Local Government, and financial benefit from the product.
- There is a need for demonstration programmes using **reliable** designs. There are many opportunities for windpumps which have yet to be exploited because of mistakes made in the past.

The participants concluded that a single voice representing and co-ordinating lobbying for windpump activities would be of tremendous value - they therefore **strongly** endorsed the idea of a local network.

The workshop proposed that CAAMS be the co-ordinating institution, a permanent council be formed consisting of representatives from the main windpump institutions, and a general membership of anyone institution or individual interested. The workshop identified three immediate tasks.

- The Network co-ordinator would lobby Central Government to re-establish windpumps on the National Development Plan.
- The permanent council would work with officials of the Changzhou Province to create a proposal for a demonstration programme, to be submitted to Central Government and International donors.
- The local network was very keen to participate in the Asian regional network. They invited the project to hold the regional workshop in China.

Importantly the permanent secretariat for the network. includes all the policy making organisations concerned with windpumps in China. The secretariat and a partial membership list is included in Appendix A.

An interesting response to the project was a mission to the UK undertaken and funded by the local provincial government of Changzhou City. The delegation of seven officials at Vice-Mayor and Vice Director level visited the UK in August 1996. The combined purpose of the visit was to meet the project implementors, to present the draft proposal for the Changzhou demonstration project as discussed at the workshop, to meet IT Power Ltd. and view the innovative windpump funded in part by ODA, and to discuss twinning their

city with one in the UK. A memorandum of understanding was signed between the province officials and IT Power Ltd. regarding the formation of a windpump project (see below).

The one windpump manufacturer not present at the inaugural workshop of the windpump network was Shangdu Livestock machinery Factory, Inner Mongolia whose interests were represented by the Ministry of Machinery Industry. Due to the perceived importance of windpumps in Inner Mongolia it was felt, by both the secretariat and the project consultants, that it was important to ensure active involvement by the factory manager in the network. A visit was made by project consultant P Dunn to Inner Mongolia. Also an independent visit was made by Mr Shen Dechang. The Shangdu Livestock machinery Factory manager subsequently attended the First Asian International Windpump Workshop in India.

5.1.3 Activities and Programmes

The windpump network will continue to lobby central government to make more provision for windpumps in the national plans.

The network is supporting and endorsing a number of project proposals to increase windpumping activity in China. The stated rationale for its activities are that China has invested a considerable sum over the last 15 years in windpump development. It has a number of reliable systems available and in commercial production. However, as China is such a large country, more demonstration projects are required at strategic locations to increase potential demand and supply of windpumps. There is widespread agreement that the key word in any demonstration project must be reliability.

The following draft proposals have been developed by the windpump network in recent months and funding is being actively sought.

- A large scale demonstration of desalination in Hebei province. It is proposed that over 6600 hectares of land that is currently unusable due to the presence of salt will be rehabilitated using the proven windpump system of the TFS-5. The multi-year programme will include setting up a new factory to produce the TFS-5 in Changzhou City.
- A transfer of technology and demonstration programme for small irrigation in Changzhou City. Using the seepage of a large reservoir, the proposed action involves installing 600 windpumps for farmers to use to undertake small scale garden type irrigation. The project also includes transfer of technology from Europe for local manufacture. Note that this project has been specifically discussed with IT Power Ltd (UK) although the network has expressed interest in also transferring the Poldaw Windpump (Neale Consulting Engineers, UK) if the co-funding agency allows.
- Development of a wind rotor, centrifugal pump system. Although the network agreed that there was limited need for more research on windpumps, a noticeable gap in the available technology is a designed, tested, proven, and reliable system including a centrifugal pump. To respond to this need CAAMs has proposed to the central government to develop such a system.

Another idea discussed by the network although not yet developed into a draft proposal is a demonstration of using a deep well system in Inner Mongolia for drip irrigation of grassland.

In the near future:

- The network co-ordinator intends to visit a number of windpump user sites to document their experience. These findings will be circulated among the Chinese network members to encourage a greater understanding of user needs and an emphasis on reliability.
- The secretariat will also arrange for translation of the relevant articles in RERIC Windpump News¹, in order to encourage a greater awareness of global windpump activities.
- In 1997, the network members will meet together again for a workshop to discuss the industry needs and co-operation.
- In Jan 1997, the local Government of Changzhou City has invited two technical experts, Mr Peter Fraenkel and Dr Simon Batchelor to visit China to move the draft proposals forward. International costs will be met by the Chinese. The network secretariat will be involved in endorsing the final proposals.
- In mid 1997, the windpump network has invited representatives of the Vietnam network and will also make a return visit. This was arranged at the international workshop in India. Details of the technical exchange are not known except that all costs are funded locally.
- CAAMs has already submitted to Central Government a proposal for development of a centrifugal pump system, and received a verbal commitment of \$20,000. This will go ahead with or without international co-operation, although as a result of the project, CAAMs would like to partner an international body to co-operate in the development.
- Funding will be sought for the two network endorsed projects, a desalination programme requiring a total of \$5,000,000 investment, and a small scale irrigation programme including technology transfer which requires \$400,000 investment. 40% local funding has been committed.

5.1.4 Indicators of Project Benefits

The Goal (wider objective) indicators for the project were:

- *Technology fully adapted to local needs:* The Terms Of Reference (TOR) for the projects involve transfer of technology from one location in China to another, and transfer of technology (including adaptation) from Europe to China. While the Goal is by no means complete, these TORs are indicative that the project is contributing to the Goal.

¹ Renewable Energy Resources Information Centre (RERIC) News, published by the Asian Institute of Technology, Centre for Library and Information Resources, P.O.Box 4, Klong- luang 12120, Thailand. Windpump section compiled by Jan de Jongh (project consultant) and Remi Rijs.

- *Increasing sales:* The existing manufacturer of the TFS-5 will directly benefit from the proposed projects.
- *Adequate operation and maintenance support available:* An extensive discussion at the workshop emphasised the need for reliability in operation and adequate maintenance and support.

The Immediate Objective indicators were:

- *Country plans available:* China, being a centrally controlled economy, already had national plans for activities in wind energy. These mainly involved large scale electricity production. The project has reintroduced wind pumping to the national agenda, and the network is undertaking ongoing lobbying to keep it in place.
- *Regional network is operational:* The network is expressing itself in an increased co-operation between members. This can be seen in the discussions between CAAMS, the Tianjin Shuangjie Wind Machinery Factory and the Provincial Government of Changzhou City, Hebei province. The network has already planned a second national workshop for 1997 - funded by local contributions.

Output indicators were:

- *Development plans available:* The paper "Wind energy for water pumping in rural areas of China" plus supporting documents discusses the networks plans for developing wind powered water pumping in China.
- *Workshops held:* The regional and international workshops involved all the major players in wind powered water pumping.
- *Publications, active participation and inquiries from Govt and Agencies:* The Chinese economy is perhaps unique in the world and normal processes found in the West are not always appropriate. The Government is intimately involved with the network as it must be for the network to function. Encouraging indicators lie in the commitment of local government in Changzhou City to be involved in the network. A number of papers were written during the time of the project both in English and Chinese, and circulated to network members.
- *Network active:* The network is active as discussed above, including plans to meet together again in 1997, mainly funded locally. Other indicators of an active network include the visit by the Changzhou delegation to the UK, and an invitation made by the Changzhou local Government to two UK windpump experts to visit in Jan 1997 and an invitation to Vietnamese windpump network council to visit in 1997, international costs born by China.
- *TORs drafted for individual projects:* Draft proposals have been made for several projects. Approximately 40% of each proposal has been committed as local contribution.
- *Publicity:* translations and a newsletter will be created and distributed as part of the network.

5.2 Development in India

5.2.1 State of the Market

During the "Global Windpump Evaluation Program" (GWEP) (4) in the late 1980s, it was estimated that the potential for windpumps in India is 400,000. While this GWEP figure can be disputed, everyone agrees that the Indian market is certainly of the order of hundreds of thousands.

Until 1984 there were only a few windpumps installed. MNES started supporting windpumps with subsidies in 1984 for the 12PU500, a low-cost model developed at Ghazipur with Dutch assistance. Up to December 1992, more than 3000 windpumps had been installed of which 10% were 1st generation models (those based on traditional designs developed many decades ago) and the remainder were low-cost, 2nd generation models, mainly the 12PU500. In the state of Tamil Nadu around 25% of these windpumps were installed during the period from 1984 to 1990. Roughly 500 windpumps / year were sold in India during the late 1980s.

However, the initial enthusiasm of MNES came to a stop by 1992 when it became clear that the 12PU500 was failing miserably all over the country. In 1993 MNES put the whole program on hold and only 36 windpumps were subsidised during the financial year 1993-94. After a thorough review, MNES decided to proceed cautiously by supporting the 3 metre, geared type, 1st generation copies produced in India by several manufacturers. About 600 of these have been installed so far with an annual average of less than 250 per year during the last 2 years.

Although many organisations have built prototype windpumps and many claim to be manufacturers, the five leading companies are those which have obtained eligibility for MNES purchase subsidies. These companies tend to do little marketing and rely upon referrals from the ministry.

Given the enormous potential for windpumps in India, the market growth has been constrained by four major factors:

- Awareness
- Economics
- Financing
- Quality Assurance.

Several thousand 12PU500s all over India have not been working for many years and this has given a bad name to windpumping in general. This needs to be reversed by raising the awareness of all the involved parties. The 1st generation windpumps being installed for the last 3 to 4 years have been performing somewhat better than the 12PU500s but have still not displayed the reliability for which they are renowned in other parts of the world. Potential customers, government agencies which support windpumps as well as financial institutions (for loans) still need to be convinced that windpumps can provide water reliably.

As a part of the market study in 1992/3 (1) Annualised Life Cycle Costs (ALCC) were calculated for several pumping technologies at sites in India. It was found that with annual average windspeeds of 3ms^{-1} the cost of water from 2nd generation windpumps is less

than that from diesel and PV pump systems. With annual average windspeeds of 4 ms⁻¹ the more expensive 1st generation as well as the 2nd generation windpumps can compete with diesel and PV pumps but only the 2nd generation machines can compete with pumps powered from mains electricity. With free electricity for farmers in several Indian states windpumps stand very little chance against electric pumps.

So far only subsidies have been utilised for financing windpumps. The Indian Renewable Energy Development Agency (IREDA) is the financing arm of MNES and is meant to provide loans for all the renewable technologies. Until now IREDA has not made available any money as loan capital for neither windpump manufacturers nor the users. It has however been financing solar PV pumps with a combination of subsidies and soft loans.

The soft loans for PV pump systems are routed through a Financial Institution (FI) which is in a position to utilise the tax benefits available for renewable technologies, which most users of windpumps are unable to use because they do not pay income tax. The FIs are, on paper, the owners of the windpump and lease it to the user for a period of 10 years after which it is sold to the users for a nominal sum. The FIs are paying 46% of their profits as tax and they would be passing on around 25% of the benefits to the users. With some financial jugglery on soft loans this leasing trick can result in a decrease of 25% in the initial investment.

Secondly, loans at commercial interest rates can be tapped for windpumps to provide, for example, funds to manufacturers for working capital and for expanding capacity.

At present, no system exists for ensuring the quality of windpumps during various stages of manufacture and project implementation. This is one of the main causes for the poor reliability of windpumps.

5.2.2 Creation of the Network

Immediately after India was selected as a participant, Jan de Jongh re-activated his contacts in the country with help from local consultant Mr K Raghavan. The first survey mission was made in October 1995. There was sufficient support for the idea of a network from the government level and declared interest from several manufacturers. Both the Tamil Nadu Energy Development Agency and the Centre for Scientific Research (CSR) at Auroville were willing to assist and host a national workshop. Therefore the workshop was arranged for early December 1995 with one day hosted by Tamil Nadu Energy Development Agency (TEDA) in Madras and a field visit to Auroville the next day.

The workshop was short but successful. 55 participants attended the first day and 24 travelled on the second day for the field visit. The attendees included manufacturers, researchers, central and state government officials and representatives of banking and the press. After some brief presentations on the status of the industry the participants worked out the basic framework of an association and its objectives. It was named the Wind Pumping Network India (WPNI Association). It was agreed that the secretariat would be at CSR, Auroville, led by Mr Tency Baetens and Mr K Raghavan. The institutions represented on the network are listed in Appendix A.

The association would have a remit to become involved with small wind generators as well as windpumping. Membership would be open to all. The scope of its activities were defined to include:

- to strengthen design ability and promote new concepts
- to organise awareness programmes
- to strengthen market research and promotion
- to investigate new channels for funding
- to stimulate manufacturers to provide better support to users
- to help create test facilities
- to improve flows of information.

During the first half of 1996 the consultants maintained close contact with the new association. During this period some organisational and promotional literature for the association was drafted. In June, the next mission was undertaken to assist the development of project proposals. The first part of the mission was taken up with visits to ministries and potential funding agencies in New Delhi to explore funding opportunities. Then in the south of India meetings were held with the network secretariat and others to help define the development programme for the network and draft outlines for new projects.

Development of the network in India was also aided by the First Asia International Windpump Workshop held there in November 1996 which provided direct encouragement and also allowed time for network members and the consultants to develop further the project proposals.

5.2.3 Activities and Programmes

The development plans of the network are now available in outline and are co-ordinated with the proposals of MNES for the next five year plan. The outlines are set out below.

- Human resource development and awareness raising, including the publication of a newsletter by the Gujerat Energy Development Agency (GEDA) with extracts from the RERIC News windpump section
- Training courses on windpump design and manufacture (Asia wide?)
- Workshops on development of implementation schemes
- O&M training for users
- Testing of windpump prototypes at two or three test fields with training facilities (this is in the MNES plan)
- Field research of applications for windpumps
- Development of more attractive finance schemes (MNES is also supporting this area).

The MNES is also planning to support R&D to improve the technology.

5.2.4 Indicators of Project Benefits

It is too early to see any benefit from the operation of the network but the activities around the formation of it, by the consultants and network members, have contributed to stimulation of interest. The meetings and workshops have provided occasions for different players to get together and exchange information. There appears to be a convergence of opinion in India, from the manufacturers and government on the steps needed to develop the industry. Is it worth expanding this in the same format as the Chinese section?

Awareness has improved in some official quarters with a recognition that the technology can be made feasible.

The development of TORs for projects which are co-ordinated and shared by several organisations is indicative of the outputs from the project logical framework being achieved in India.

5.3 Development in the Philippines

5.3.1 State of the Market

The Philippines wind resource is characterised by generally modest wind speeds but frequent occurrences of severe typhoons. The northern region of the islands and parts of Visayas in the central region have potential for wind generation. Rather larger areas have sufficient wind for water pumping, partly because of the extensive coastline. In the windy areas the water depth is usually less than 20 m and often only 4 or 5 m.

Windpumping has been established for many years although market penetration has been very small. The first local manufacturer, Reymill Steel Products, commenced manufacture in the early 1960s. Research and development was then taken up by at least two centres, including the International Rice Research Institute but these programmes did not result in full scale manufacturing. In the 1980s a design was marketed by Condor in Iloilo which went into large scale production for a regional irrigation programme (called Greenwells). However most of these machines and many others have failed under typhoon conditions or because of poor design and manufacture.

There has been renewed interest in the last three or four years partly stimulated by training funded by the Dutch government and the impact of this project. At least four manufacturers are now developing their own designs. The Department of Agriculture has established a project to design and manufacture three types of windpumps for irrigation.

The total number of windpumps installed in the last 30 years is in excess of 600 but it can be assumed that most of these are no longer in use. With the exception of the Greenwells irrigation programme and some prototypes machines the sales have been made on a commercial basis and there has been no direct government support to the industry.

The main existing markets for windpumps are:

- domestic supply for higher income rural families

- poultry and livestock farms
- small scale irrigation such as vegetable gardens
- small industrial supplies, e.g. to concrete block factories and gasoline stations
- municipal water supply.

With improved performance windpump applications could extend these same sectors and become more accepted for irrigation use and in fish ponds and salt pans. The only available market studies are not well-founded but suggest potential markets of many thousands of machines. There are extensive areas of the country which are unlikely to have electricity in the foreseeable future.

The windpump produced by Reymill is a copy of a traditional, heavy, american style machine with a gearbox (1st generation). The other manufacturers are developing second generation windpumps which are lighter and easier to manufacture. The original Condor design had major technical deficiencies but these are being remedied in recent models. Jover is developing two machines based on the CWD 2740 and CWD 2000 models with some technical guidance from the Netherlands. The Jamandre design is a development of the original Condor design and Cadullo is developing a machine on a lightweight guyed tower. These models all need further design and production development but are potentially suitable for the local conditions - if they can be made to resist typhoons.

Condor, Jamandre and Jover are all based around Iloilo and have a business in agricultural machinery as a base. Cadullo was started by a former university lecturer, also in Iloilo. Reymill is based in Central Luzon and also operates as a metal fabrication sub-contractor.

The Non-Conventional Energy Division (NCED) of the Department of Energy has been established for many years to promote renewable energies as part of a broad government policy to this end. Windpumping was classified for some years as fully commercialised and not directly supported. Recently this stance has been revised to become more proactive. The NCED has part-funded training workshops for windpumping with the Dutch Government and encouraged the formation of the Wind Energy Association of the Philippines. The NCED operates an outreach programme through the regional network of Affiliated Non-conventional Energy Centers (ANECs). These are based in universities and provide demonstration, dissemination and support to local industry for renewable technologies. The centre in Iloilo is closely involved in wind energy activities.

The Department of Agriculture and the Department of Science and Technology are also supportive of wind energy. The Provincial Government of Iloilo supported windpumps in the Greenwells Programme.

Until recently contact between departments, industry and others has been limited to project specific activities and there has been no overall programme for development. The manufacturers are small companies which do not have resources for major marketing activities and are short of finance for development. There are two foreign aided schemes of assistance to manufacturers of renewable energy equipment but take up is very low. The major barriers to growth are the development of efficient, robust machines and the improvement of the general perception of the technology.

5.3.2 Creation of the Network

At the start of the project contact was easily established with most of the manufacturers, the NCED and a few other organisations. This process was helped by the existence of the Dutch funded programme of training workshops on windpumping organised by J A De Jongh of RED. Further development was then undertaken through a series of four visits by R J Hacker.

The first visit in November 1995 coincided with a workshop held at the ANEC in Northern Luzon. This provided an ideal opportunity to meet many government and ANEC personnel interested in windpumping. The visit was planned to continue with meetings in Iloilo and the Manila region but two typhoons in one week prevented this. An additional visit in December completed the work.

Discussions with about 20 policy makers and implementors at the workshop and 10 other organisations led to the conclusion that there would be a positive response to the establishment of a network in the Philippines. It was also clear that many would benefit from the supply of information and training, and also that there was a need for a forum for the players in the market and for a more coherent strategy for development.

The NCED was very positive in its support for a local network and agreed to provide assistance to the ANEC at the Central Philippines University to arrange a workshop in Iloilo City.

The workshop was held in February 1996 over two days. It was attended by five representatives of NCED, the Department of Agriculture, Department of Science and Technology, the provincial government, four manufacturers, one renewable energy equipment supplier and university staff. Several key papers were presented including one on the new draft NCED programme in wind energy.

The discussion groups came up with a set of barriers to development in the Philippines and proposed the following corrective actions:

- include windpump technology in financing schemes
- identify potential financing agencies
- conduct more market building activities
- produce brochures and manuals
- strengthen linkages among government agencies
- improve windpump design - typhoon resistant
- train technicians and operators
- establish a wind pump test centre
- establish a windpump network

Key to these actions was the formation of an association to promote windpumping.

It was agreed that a Wind Energy Association of The Philippines (WEAP) should be formed. Initially it would develop in Iloilo but with the eventual aim of covering the whole country. It was also agreed that both small-scale wind generators and wind pumping technologies would be included in the scope. The composition of an interim Board of Directors was agreed, to last until an election could be arranged after registration as a non-profit body with the Securities and Exchange Commission and the adoption of articles of association.

Before the end of the workshop the new board reported back their allocation of responsibilities and also their priority work plan for 1996. The CPU-ANEC accepted the role of secretariat to the association. Refer to Appendix A for more details on this association.

A small sum was made available to the association from project funds to meet initial expenses. The Board met several times through the next few months in order to progress the formalities and start the promotional work.

A final visit by the consultant under this project was made in May 1996. The purpose was to assess progress and help to develop the strategic programme for the association as well as to help draft the terms of reference for new projects. A draft programme prepared by the WEAP Board was reviewed and some amendments discussed.

5.3.3 Activities and Programmes

The new association made a quick start to awareness raising by a presence at a regional exhibition in March 1996. A first edition of a newsletter was published in October and further coverage was gained in the Journal of the Renewable Energy Association of the Philippines (REAP). Technical papers have been presented by Board members at several workshops and conventions.

The registration of the association with the SEC has taken longer than expected.

The proposed programme of development work which was discussed during the last visit of the consultant contained the following key elements.

- A general promotional campaign to create awareness and encourage institutional development
- Establishment of a show site for demonstration installations
- A windpump testing and evaluation centre
- Assessment of potential new markets
- Development of improved windpumps
- A demonstration programme, first for existing designs then a second phase for improved designs
- Support for technology transfer and investment in new designs which have been proven
- Longer term, development of the new applications for improved windpumps.

During the First Asian International Windpump Workshop in November 1996 a modified version of the work programme was presented which reduced some of the inputs to a more manageable level given the resources of WEAP. However, the key elements remained. A proposal to develop the local capability to assess markets was provided by the consultants to NCED at their request. Also, it is possible that the ANEC organisation will develop one or more windpump test centres. These activities will complement the WEAP plan. The Board of WEAP is inexperienced in developing and promoting such projects and would benefit from assistance to identify and apply for funding from foreign agencies.

The NCED has also been providing support to the Renewable Energy Association of the Philippines and encouraging its role as an umbrella organisation for all bodies involved in renewable energy technologies. WEAP has been invited to join. The benefits will include seats on the Board, a more unified voice for all sectors of the renewables industry and the possibility of better access to government funds.

5.3.4 Indicators of Project Benefits

At the start of this project there was a renewed interest in windpumping as a result of the training workshops organised by the Dutch. This project has been able to build on this and accelerate development. The main indicators are:

- the revision of the official policy on windpumping
- communication between government and the industry
- improved information and encouragement to the manufacturers
- general promotion of the technology to government and the public
- the beginnings of a coherent development strategy for the industry
- greater co-operation between the involved government departments.

5.4 Development in Vietnam

5.4.1 State of the Market

Like many countries Vietnam has limited accurate wind data. The country generally has low winds in the region of 2 to 3m/s annual mean. General wind maps are given in other reports (1). Vietnam's long coastline has low mean wind speeds, but strong diurnal effects give rise to strong winds at certain times of the day. This makes wind pumping more than viable.

Much of Vietnam is serviced by shallow wells, less than 10m deep (approx. 3,000,000) 59% of these require repair. A limited quantity of water is available from these wells, and quality is generally poor, not meeting WHO health standards. Since 1982, 82,000 tubewells have been drilled under the UNICEF programme. These have all been fitted with handpumps with between 120 to 300 people per water point. In addition there are 140,000 new tubewells planned for the next five years. Apart from this there is considerable emphasis on rain catchment in most other rural development programmes.

As the project has progressed, new information regarding the history of windpumps in Vietnam has emerged. There are a few traditional wooden windpumps in the South and Coast of Vietnam. These were used for salt pans. The low head allowed the use of a simple paddle pump.

The papers presented by the network members at the First Asia regional workshop on the history of windpumps in Vietnam divide activities into pre 1990 and post 1990. In the late 1970's research began on a multi-blade windpump using the traditional paddle pump to be more durable for salt manufacture, and some multi-blade windpumps were imported from Australia. Estimates for the number of systems produced in Vietnam vary between 300 and 400 of these systems installed. Most network members doubt that any of these systems are still in use, the most optimistic estimate is 50.

Post 1990, The Research Centre for Thermal Equipment and Renewable Energy, Rectere, started manufacture of a wind generator. To date some 700 of these units have been built and installed. Rectere have also built and advertised a number of windpump systems. The systems included multi-blade windpump (copies of the Australian gearbox type) and an innovative vertical axis system with rotodynamic pump for shallow lift. To date six different windpump designs have been created. Given the current popularity of the wind generators and the capacity of the factory, windpumps are not significantly promoted.

It has been documented before (1) that "Vietnam has an emerging free market economy set against a backdrop of socialism and one party state. Its economy is rapidly changing with strong impact coming from a gradual acceptance by and normalisation of relations with the international community. The general rural population is one of the poorest in the world and there is little disposable income. GNP is \$200 per capita. Most rural areas require clean domestic water. Between 1960 and 1980 a drive to create shallow wells led to 3,000,000 new wells. Of these 50% are now in serious disrepair and most give poor quality water. The priority for the government is not increased quantity of water, but increased quality."

“Irrigation in Vietnam is widespread. From less than 3m head, there is a seasonal requirement to pump water. Windpumps are not favoured due to the need for precise and timely application. Salt pans are popular in the South along the coast. Water is pumped by foot using a paddle pump. Some substitution has been possible using purpose built windpumps but windpumping is thought to be expensive.”

The Government has a multi-objective renewable energy programme. However the emphasis by the Government in various other programmes is on biogas and stoves. Wind power ranks fifth after micro hydro and solar.

“Head of Wind Energy Group, Centre for New and Renewable Energy, Institute of Energy, Ministry of Energy proposes the following steps to disseminate windpumps:-

- outline the map for classified dissemination of wind energy utilisation incl. wind data, water data and grid electrification.
- analysis of wind machines to select suitable system with proper design
- analysis to determine the way to supply wind machines and wind equipment's for their application
- pilot project
- dissemination of wind energy utilisation selected in step 1 incl. mass production, organising maintenance and repair, training technicians.” (1).

Since this report it seems that there have been some changes in Ministry responsibilities. The Ministry of Energy is no longer responsible for wind and solar energy. These have been put into the Ministry of Science and Technology. The Institute of Energy quoted above has in fact been made a self standing institute and while it has some connections to the Ministry of Energy, these links are not regarding line management. The Ministry of Energy itself has been placed within the Ministry of Industry, a unification of Ministry of Light Industry, Ministry of Heavy Industry and Ministry of Energy.

The main impact on the market infrastructure is that the Ministry of Science and Technology now has responsibility for Windpumps.

There is a domestic potable water supply market which is very small due to general poverty of rural people. Village supply is more possible as 140,000 tubewells are being drilled by UNICEF. There are demands for water in remote areas of Vietnam and Islands. By far the largest economically viable market is in salt and shrimp production. During the project it became clear that the past failures of windpumps have left an image of windpumps as **unreliable and expensive**.

The windpumps on offer are constructed by government run institutions. These do not have a realistic, market value, cost accounting. Therefore, the cost of the windpumps were not explicit. Estimates varied from \$200 to \$1000 for the same three metre diameter machine.

The HGa report (1) succinctly summed up the scene as “Research has tended to be uncoordinated and individual. Officials readily admit to failure of prototypes. No network for installation and maintenance. No infrastructure for commercialisation.”

One significant change has been that Rectere is more autonomous. In the past it was constrained by centrally controlled decisions as noted in (1). With the liberalisation of the

Vietnam economy, Rectere now has the ability to take managerial decisions without reference to a higher ministry. The beginnings of an infrastructure for commercialisation is now in place.

5.4.2 Creation of the Network

Given the status of the windpump industry in Vietnam, and the difficulty of obtaining accurate information, a collaborator was sought who had a good track record of project implementation and who related well to international projects. This group did not necessarily have to have direct windpump experience.

In Ho Chi Min, the contact point was the Solarlab, Vietnam National Centre for Science and Technology. This centre has been commissioned by the Ministry of Science and Technology to implement demonstration projects for renewable energy, in particular wind and solar. Most of its activities so far have been in solar, and its prestige project is the installation and monitoring of 40 solar panels as a demonstration of electrification for islands off the coast. It has now been commissioned to replicate the project on other islands and is in the process of conducting baseline surveys. The funding sources are the Ministry itself and a number of international donors both Government and NGO. The Solarlab unit is both part of the Ministry and yet autonomous having the authority to make its own decisions. Its principals are Prof. Trinh Quang Dung and Dr Le Hoang To. (NB Solarlab attended the formation of the new Government 5 year plan, and their work on renewable energy had been specifically mentioned in the planning document.)

The Solarlab team had limited technical knowledge of windpumps and is not currently installing any, but had a good grasp of the current activities in Vietnam, and had contacts with all concerned parties.

Prof. Hoang Anh Tuan who is Director of Department of Science, Ministry of Science and Technology, and Vice President of the Committee of Environmental Affairs, in charge of renewable energy for Southern Vietnam. He showed interest in the programme, and offered matching finance for future activities.

Given the revised mandate for the Institute of Energy in Hanoi, and the predominance of demand for windpumps being in the South of Vietnam, the project accepted the advice of the Vietnam co-ordinators to limit the initial activities to South Vietnam only.

The first Vietnamese workshop was held in Ho Chi Min City, hosted by the Ho Chi Min Department of Science, Technology and Environment (DOSTE), arranged by Solarlab. There were 58 participants in all. Given the limited range of windpump activities undertaken in Vietnam the local host decided to include in the workshop a discussion of both wind and solar activities. Accordingly, the principal players in wind and solar development in South Vietnam attended the workshop. In addition, local representatives of the Ministry Science and Technology from most Southern Provinces attended. These representatives have responsibility for installing equipment, educating farmers in renewable energy technology, planning and implementing projects, and technology dissemination. A significant participant was a private supplier of solar panels (Mr Vo Van Binh, Vice Director, Le Minh Trading Company), who has shown interest in supplying and possibly manufacturing windpumps.

In addition to papers presented by the consultants, a number of the participants presented papers on current experience with windpumps, solar panels and the future potential. A considerable time was spent on the current solar projects. These were said to be for “mental” energy as solar panels were effective for lighting and communication, thus opening opportunities for the rural people to use their minds in the evenings. However, it was thought that wind energy was more suitable for “productive” energy, and there was an expressed need for more wind activities.

In the last few years, Solarlab has been able to install a considerable number of solar panel lighting and communication units throughout the country. Of particular interest has been isolated Islands where grid connection would be cost prohibitive. This action has been taken in co-operation with the NGO Foundation Energies Pour Le Monde.

Rectere, formerly the Ho Chi Min Polytechnic, has set up an autonomous unit which specialises in the production of wind equipment. They produce a small wind generator and a vertical axis windpump for low head applications. High head windpumps can be constructed and tooling is in place but the demand is non existent at the moment.

On the local needs and barriers to development:

- The participants acknowledged the poor history of windpump development in Vietnam. However the presence of these two renewable energy activities in Southern Vietnam is gradually creating a positive framework from which renewables can be promoted.
- It was noted that solar energy was useful in niche applications, such as evening school lighting, but too expensive for use in commercial activities. Mechanical windpumps were seen to have a better long term economic prospects where mechanical work is required.
- The changing economy of Vietnam now provides a new forum for the development of renewable technology.
- The poverty of the rural people was seen as both the main need and constraint to the widespread use of windpumps.
- Renewable energy installations in general have been subsidised by the Government (often with the investment of international organisations). This approach was seen as demonstration of reliable technology to convince farmers of the benefits.
- A principle barrier to development of windpump is the history of **poor reliability**. Inappropriate prototypes have been prematurely installed, and this has resulted in low reliability. There is a need for a reliable windpump.
- It was noted that the wealthier farmers, those involved in shrimp and fish farming, and salt harvesting, need low head high volume windpumps, and would be prepared to invest in a reliable system.
- There is a need for a viable credit system. The Vietnam Agriculture Bank needs lobbying to improve their opinion of renewable technology.

- There is a need for more detailed wind data. Wind is good in the North of the country, solar in the South. The participants proposed that a hybrid system combining wind and solar be developed so that it could be used in any part of the country.

The participants agreed that a network would be useful. Solarlab was elected as the coordinator. A permanent council was formed of Solarlab, Ho Chi Min Polytechnic and the Department of Science, Technology and Environment. Membership would be open to all participants of the workshop and any other individuals or institutions interested.

The workshop participants expressed interest in being involved with a regional network.

5.4.3 Activities and Programmes

Following the formation of the network during the workshop, a number of actions have been undertaken by the network during the lifetime of the project.

- The network has an official name “Windpump Project in Asia - Local Committee of Action” recognised as part of the Ministry of Science and Technology (DOSTE). The committee have created their own letterhead, and they have begun to translate some material for wider distribution. The committee undertook a simple SWOT study for internal use, to identify the strength, weaknesses, opportunities and threats currently facing the network.
- has met a number of times to discuss strategy and action. This is a significant step forward in terms of co-operation within Vietnam. Formerly, Rectere and Solarlab have been reluctant to work together on projects. Solarlab is very good at marketing their achievements; they announce each completed solar panel installation on the general television, write newspaper articles and have good publicity. This has led to a very good image for solar energy within Southern Vietnam. Rectere, are a basic manufacturing institution and do not have the comparable marketing skills. For this reason, the work of Rectere is not widely known, and the value of wind energy is under-rated in Vietnam. By co-operating on the permanent council of the windpump network, Solarlab and Rectere are able to compliment each others skills in the promotion of windpumps.
- Wind data is apparently available through the Can Tho University (network member) and the Ministries of Energy and Meteorology in Hanoi. The network committee will attempt to involve the Hanoi based institutions which are currently not members of the network.
- Through further discussion, a draft action plan was made by the Local Committee of Action of the Windpump Project in Asia. This draft is appended. The plan is in two phases.
 - Phase 1 is achievable within the funding of the current project. Phase 1 involves appropriate data exchange, publicity and propaganda on windpumps, investigation of the wind regime, and identification of sites for Phase 2. The network intends to translate strategic pieces of information into Vietnamese and distribute them throughout the network.

- Phase 2 is a realistic and achievable pilot project of demonstration for windpumps. The project proposal is for 10 windpump systems covering the range of possible applications but with an emphasis on shrimp production. It will include an input of production engineering on the existing Rectere systems from international experts. It was discussed in detail and written up by the committee as a project proposal. The proposal may need some additional information at the front end to justify it to a donor.

DOSTE of HCMC have said that they will provide some local funding for the project. This includes a commitment of at least \$7000 through Rectere.

Planned activities for the immediate future include the following.

- The windpump network will continue to translate and publicise the more successful windpump projects around the world, in order to create a more receptive climate of opinion from Government officials and the public of Vietnam. The permanent council expressed great interest in the database as a source of information.
- It will stimulate dialogue between provincial extension agents for the Department of Science and Technology, to create greater awareness of the potential of renewable energy.
- The proposal for a demonstration project will be discussed with possible funding agencies.

Two members of the permanent council will visit the China Windpump Network in 1997. This exchange will be funded locally. This was arranged at the First Asia Region Windpump Workshop.

5.4.4 Indicators of Project Benefits

The output indicators of the project logical framework have largely been satisfied. Of particular note are the following.

- The Vietnamese economy is still centrally controlled to a large extent. The Government is intimately involved with the network as it must be for the network to function. Encouraging indicators lie in the commitment of local governments in various provinces to be involved in the network.
- Indicators of an active network include meetings by the permanent council, visits to and by provincial field workers, and an invitation made by the network to China to visit in 1997, costs born by Vietnam.
- A draft proposal has been made for a demonstration project. Approximately \$7000 has been committed as local contribution.
- Solarlab, the co-ordinator of the windpump network have directly contributed to the Ministry of Science and Technology's formulation of the national five year plan. While wind energy still has a low profile, there is a significant increase in interest.
- The TOR for the demonstration project involves increasing the reliability of the Rectere manufactured vertical axis system. Rectere has interest to put more effort into

selling windpumps is as a direct result of the project. An extensive discussion at the workshop emphasised the need for reliability in operation and adequate maintenance and support. These are all indicators pointing towards the wider objectives of the project.

6. SUPPORTING ACTIVITIES

6.1 Development of the Database

A database was conceived as a part of the project to:

- support the windpump activities in the four target countries with relevant information
- have a *foundation* for a useful communication of information for global windpump activities

The database should contain relevant information capable of being cross indexed to maximise ease of access.

The most practical database was determined to be in two parts:

- the main data is held on paper in project offices and libraries
- a front end computer database to facilitate selection.

The main data was gathered from existing summaries of windpump literature, project office libraries and public libraries. It was decided to include as many publications on windpumps as identified, with some selection to avoid confusing database users with unnecessary or inaccurate information. The database also includes a number of articles and papers on related subjects such as handpumps, alternative pumps, economic analysis, project implementation, project management and marketing.

The reason for including the non windpump material, was that the report by HGa (1) revealed that the most important of the barriers to market development which may be addressed by the intervention of government, international or foreign aid, or NGOs are usually as follows:

- Finance, credit for purchasers and working capital for manufacturers.
- Information, for manufacturers and implementing agencies.
- Inadequate maintenance infrastructure.
- The use of the wrong type of windpump for the application.
- Low standard of manufacturing.

By offering the windpump network more information on economic analysis, on how other water projects are implemented, on project management, etc., it was hoped that some of these barriers would be addressed.

User selection of the database materials is made through a front end computer programme circulated to project participants. The computer database stores all the titles and abstracts (where available) for the identified resource documents.

An outline of the programme is given below. There were a number of criteria drawn up for the design of the programme. These included:

- The programme should be intuitive making maximum use of on screen buttons to assist users not familiar with computer technology.
- According to recent educational theory, self directed learning is a key to older people assimilating new ideas and concepts. Multimedia programmes presented on computer encourage self directed learning. Accordingly, the computer database should be constructed to encourage exploration of new ideas, rather than giving the most direct route to information on preconceived ideas.
- It should be technically possible to replicate, and easy to install on a new standard computer.

The concept of self directed learning is critical to the layout of the database screens. Whereas if one were attempting to provide easy access to information alone, one might have a single screen with a find button. The user might type in the required key words, such as rotor aerodynamics, and all data on the keywords would be displayed.

However, past investigations have revealed that windpump projects fail, not because of technical considerations but more often because of institutional and market barriers. Many involved in the windpump networks have been working on the technical aspects of windpumps for a considerable number of years. They have pre-conceived ideas of the technical information they require, and in all likelihood would not directly ask for market or socio-economic information. By creating a learning tool as well as a database, it is hoped that network participants will explore the computer environment and “discover” interesting information that they might never have asked for by direct route.

The database was written using Dataease. This has allowed it to be presented in a user friendly, intuitive environment, and to be replicated by CD ROM. However, there is a licence fee for each copy of the proprietary software provided to the user on the disk.

The concept of creating a partly directed learning environment has led to the formation of three levels of screen activity in the database.

Screen level 1 - is the main menu screen. It has a button to take the user to subject areas. The subject areas chosen were those identified by the HGa 1993 report (1). These include:

- Resources
- Technology
- Economics
- Infrastructure
- Suppliers
- Intervention
- Markets.

Also on this introductory screen are buttons to introduce the project consultants and the funding body ODA, to explore generally and to get instructions on the database use.

Screen level 2 - is the subject screen. This posts on the screen the screen title, approximately a 4000 character summary of the main points to remember with the

subject, and a key statement. Also on the screen is a button called Find, which will take the user to the third and final level.

Screen level 3 - is the final level for the database. This presents buttons to search the database using key fields. Key fields for the subject are given and a selection can be made, e.g. for the Resources subject, a key field includes:- Wind, Water or Both. This allows the user to select all the database material labelled with the keyword, "Wind" for instance. The find button is prominent on this page. The screen also contains fields for displaying in full the title and reference for the article or paper found, and its abstract. Browsing through all articles or paper titles found by the keyword choice is possible through Next and Previous buttons.

The instructions include selection of the articles by any word within the title or abstract. The user has to type the word within the display fields of the title or abstract. It is unlikely that a novice to computers would search the database this way, but the facility was made available for those reasonably familiar with computers.

On all levels of screens, there is a button called "Top 5", this leads to a selection of papers pasted in full on the computer front end database. The subject matter of these papers is towards economics and project implementation. Given humanity's general inquisitiveness, it is reasonable to expect the users to push this button and have the papers displayed in full. It is hoped this encourages learning on these critical subjects. Note, the paper is displayed by the database opening the computer's word processor, and putting the document in full in a format that can be displayed, copied and printed.

The database is liberally sprinkled with full colour pictures to make it pleasing to use, and network participants have asked that some video images be added. Since the database is being distributed by CD ROM, which holds 600 Megabytes of information per disc, it is possible to add reasonable quality video clips. Not all user computers will have the capability to display the clips.

The database "front end" was presented to the participants of the international workshop. All of them expressed enthusiasm for the project component. They confirmed that computers were available to read CD ROMs, and had no major criticisms of the presentation. The participants corrected a number of errors regarding addresses of manufacturers in their own country and pledged to send articles written locally to their country but of possible use internationally.

The first release of this database in CD-ROM format will be limited to participating countries and will be provided from within this project. The maintenance of the database and periodic re-issue will require further funding to be identified since it is likely that the demand and affordability in developing countries will permit it to become self-financing.

6.2 International Workshop

The First Asian Region Windpump Workshop was designed as the final event of the project for the participating countries. The objectives of the workshop were for participants:

- to share experiences
- to learn about other designs and practices

- to generate ideas for windpump development
- to define the needs for future projects in windpumping
- to form contacts and work together.

After discussion with each of the participating countries it was decided to hold the event in India. The CSR at Auroville, Tamil Nadu offered to host the workshop. CSR operates as the secretariat for the Windpump Network of India and has associated R&D and manufacturing for windpumps. CSR also has expertise in organising workshops. The practical arrangements for the workshop were very effective, despite unusually wet weather, and it passed off very smoothly.

Four participants from each country were invited from each country with all expenses paid. Several other Indian delegates also joined in. The national associations were requested to nominate the participants, with a strong preference for a predominance of manufacturers. 25 country delegates attended, plus four of the consultants' team.

The workshop was held from Monday 25 November to Friday 29 November 1996. Participants assembled on the Monday and the workshop was officially opened on Tuesday morning. The schedule for the first day included presentations on the market status in each of the four countries. Visits to windpump installations and the local windpump fabricator were also included early in the programme. This schedule helped to encourage free interchanges between the participants.

The main content of the second day was an exercise to identify common barriers to development followed discussion in working groups and presentations on three general themes which had been identified in the exercise. These were:

- Technical, manufacturing and sales
- Markets, users and awareness
- Policy and integration.

This day also included a presentation by the consultants on proposals for an information database.

On the final working day each country gave a presentation on the current development plans for windpumping. There was then a presentation by the consultants on ideas for international projects and how to approach international agencies for funding. This was followed by general discussion on international projects, co-operation and exchanges between the networks.

The final sessions wrapped up the proceedings by establishing the general or majority views of all on a wide range of issues ranging from the technical features of certain windpump designs to the need for more international co-operation. Then the follow up actions and recommendations of the workshop were agreed.

The general recommendations for further action were:

- to develop a plan for the creation of a regional network

- to develop the joint activities discussed previously, particularly the proposals for joint training and a newsletter
- to plan another meeting in about 12 months time
- to seek further support for the new national associations from aid agencies in order to consolidate their promising beginnings.
- to continue the development of the windpumping information database and its distribution.

One participant from each country was nominated to work in a group to develop plans for the formation of an international network at a future workshop. Several participants made arrangements to stay in contact and perhaps work together in the future. It was agreed that the workshop had been very productive.

The proceedings of this workshop have been compiled and given limited circulation to the participants, some other members of each national association, and other workers in this field who have expressed an interest.

6.3 Co-operation with Other Programmes

At the time of writing the proposal co-operation was envisaged with a proposed Dutch funded programme with the Gujerat Energy Development Agency in India to undertake a similar market development exercise. In the event, this programme did not proceed and India was included in this project.

It was also known that the Economic and Social Commission for Asia and Pacific (ESCAP) had started a wind energy network in Asia some ten years ago but very little had happened, probably due to lack of funds. Contact was made with the secretariat in China and the responsible officer of ESCAP in Bangkok. The situation of the network was confirmed in that there have been some meetings and reports but only one actual project has been identified. This was to place a Chinese low head windpump in Sri Lanka. The project manager for this project visited the ESCAP project officer in May 1996 and an informal agreement was reached to swap information on progress. An offer was made by ESCAP to help identify potential donor countries for projects coming out of the local associations in Asia.

Throughout the project the consultants have emphasised the intent to co-operate with and complement any existing activities. This approach has led to a widened range of contacts in the host countries. Members of the new associations have been encouraged to seek out and try to co-operate with other agencies and companies. This approach has also enabled some of the consultants' activities to be carried out more cost-effectively or produce extra benefit because some of the missions to countries have had a dual purpose. One example is that the Dutch are funding a series of training workshops in the Philippines which are organised by HGa's sub-contractor RED of the Netherlands. One of these was used to promote this project to potential collaborators whilst the project manager was able to assist the training. Some visits to the Philippines have been used to develop both projects. Similarly some visits to other countries have produced dual benefits.

There has also been some preliminary contact with international agencies as part of the work to identify potential funding sources for future projects in the four countries.

6.4 Project Management

Although managed by HGa the project success is also due to the strong commitment of the sub-contractors. A feature of the plan was to use as the lead contact for each country one individual with relevant experience who would become the friendly face of the consultants' team. This also led to the selection of a team with wide experience which could be fully consulted on major decisions. The team selected at the proposal stage was two HGa staff and two from Gamos Ltd. Shortly after the start of the project Ms Donna Munro started a period of maternity leave and short time working which made travel impossible. HGa were fortunate in being able to engage as another sub-contractor Jan de Jongh of RED in the Netherlands who had worked before with both Gamos and HGa.

After selection of the countries the team members were allocated to each:

China and Vietnam	Dr Simon Batchelor with Prof. Peter Dunn assisting
India	Mr Jan de Jongh
Philippines	Mr Rod Hacker.

Junior personnel in HGa and Gamos provided technical support.

The overall timescale of 18 months duration was deliberately extended in order to allow time for the activities in the host countries to be developed. The idea behind this was that, if the project was to succeed, the new network organisations would have to start taking the lead in the activities. Therefore the consultants should allow time for this and not drive the programme forward too quickly.

In fact the programme has gradually slipped by about four months in total. However, the completion date is still well within the same financial year and so there will be no financial problems arising from this.

The activities identified in the work programme have all been completed and largely as intended. As noted above there have been enforced changes in the proposals for co-operative activity and there were also some changes in the way the missions were carried out to meet particular needs or opportunities in each country.

Three interim reports on progress have been produced:

- a progress report on the recommended countries in June 1995
- a progress report at the annual reporting point of ODA in October 1995
- an interim report scheduled for the end of stage 1 in March 1996.

The proceedings of the Asia Region Windpump Workshop have also been made available.

The final cost of the project will be within the budget allocated. There have been some savings on travel costs and materials by the consultants but the number of person days allocated to the work was slightly exceeded. The costs allowed for the travel and accommodation of participants at the international workshop was under-estimated but the extra has been accommodated within the total budget because of the savings elsewhere.

An unusual feature of this project has been the discretionary funding which was allocated to help the establishment of the new networks and the continuation of their operations for twelve months after the end of the project. This was intended to be available with flexibility to overcome whatever practical problems might prevent operation of the network or its secretariat. This fund has proved necessary for the quick start up of the networks and their effective operation.

A summary of the project expenditure is given in Appendix D.

7. CONCLUSIONS

7.1 On The Methodology

The project proposal contained a logical framework which is reproduced in Appendix E. The measurable indicators against activities and outputs have all been verified although in some countries the documentation is not as complete as might have been hoped for. This project is only phase 1 of a longer programme and therefore it is too early to verify the achievement of the overall goal. The regional network identified as a purpose in the proposal is not yet in place but the prospects look promising.

A second general indicator of the success of the methodology in this case is the completion of all the sequential development activities defined in the programme.

The programme was designed to a fairly rigid framework but was expected to be applied in four countries with their own distinctive culture and institutional framework as well as varying levels of development of windpumping and industry generally. Therefore it was anticipated that sensitivity to local circumstances would be important. In practice the consultants' team were flexible in their approach to developing the activities in each country. For example, it became clear from early contact with the Chinese that the existing relationships between players in the sector were strong. On the advice of respected Chinese academic the consultant waited for an invitation from China to assist at a workshop rather than going there to ask if one could be set up. The end result was still a commitment to formalise a network and co-operate with other country networks.

The ability to avoid government to government relations (because the work was under the TDR programme) and go direct to the manufacturers and others involved added to the flexibility afforded the consultants and permitted faster progress by immediate contact with the important players in the business. However, this also accentuated the need for the consultants' team to establish personal credibility with the organisations they visited. It was important that the team members were senior personnel, known in the renewable energy community, who understood the difficulties faced by the manufacturers. There was initial caution and even suspicion from some manufacturers visited but these barriers were soon overcome and the team established good personal relationships.

The ability to be able to provide the new associations with small sums to help them get established and then operate through their first 18 months was found to be very valuable. The associations have used the funds for office expenses, secretarial support, communications, local travel, newsletters and publicity. The start up funding undoubtedly helped persuade the key organisations to accept the role of secretariat in each country. The funding to continue activities through 1997, when the project will have already come to an end but further consultancy support is likely to be undecided, is expected to prove essential to ensure that the momentum of the new associations is continued. At a total cost of £3,500 per country this is a relatively small investment in the programme.

The contributions to the national workshops were underestimated and had to be increased before the workshop could be confirmed in three of the countries. In fact the ODA funding met the lion's share of the costs. This was compensated for by reducing the money actually paid for the secretariat. One view expressed was that the original

contribution to the workshop was so small that it might be considered an insult. These budgets should be re-assessed if the exercise is repeated.

The methodology of the project was devised to deliver benefits to the players in each market and the results are recorded in the next section. The methodology has proved to be successful here.

In summary, the indications so far are that the methodology devised for this project has proved to be successful. There have been minor adjustments made to the plans as the work has progressed but the objectives have been achieved. The longer term success will have to be measured at some future time when the effective operation of the networks and the achievement of the market development goals may become evident.

The further application of this methodology could be considered in situations where there is a need for a variety of activities to stimulate a market and also where the players would benefit from greater cohesion to pursue common aims. It would certainly appear to be suitable for other renewable technologies and perhaps for other developmental plans requiring local manufacture. The diversity of the four countries where it has been tested suggests that it could be applicable in other regions of the world.

7.2 Impact of the Project

It is too early to identify the full impact of the project in each of the participating countries but the early indications are positive. The following experiences can be cited.

- the revision of the official policy on windpumping in the Philippines and encouragement elsewhere, notably the re-introduction of windpumps to the Chinese 5 year plan
- communication between government and the industry has been improved
- improved information and encouragement to the manufacturers has happened through widening their range of contacts and exposure to advice from the consultant
- general promotion of the technology to government via direct contact and to the public through the media coverage of events
- the beginnings of a coherent development strategy for the industry as shown in the programmes being drafted by the associations
- greater co-operation between the involved government departments.

Of course, some of these things may have happened anyway, but the project has accelerated events and raised the levels of awareness and commitment. The developments in prospect are much closer to achieving the “critical mass” which may be needed to really accelerate market development.

7.3 Potential Projects and Programmes

The market situations found in each country are much as was expected but the information has been updated and detailed. Generally, the models used to describe the barriers to development (e.g. see Section 2) have been proved true. There is a need to address a range of problems in each country. No single company or agency can cover the range alone. Co-ordinated programmes, or at least projects which are developed in cognisance of other plans, are the way forward on the basis that a critical level of effort can be brought to bear in each market and so accelerate the rate of progress.

The new associations have started to prepare outline programmes and are generally co-operating with government programmes or other planned activities to ensure that the necessary activities are covered. It is not realistic to attempt to address all problems at once and the programmes are being focused on the priority needs with each association, member or group of members taking on those activities with which they feel comfortable.

Some opportunities for co-operation between the countries were identified at the international workshop and these are expected to be followed up.

Many of the proposed projects will depend on support from national governments and the promoters will have to be prepared to make their case for funding. The assistance of some government officers in the associations will be of benefit here. Other projects will need assistance from international aid agencies or other foreign aid. The consultants' team will continue to assist the promotion of these projects where wanted. It should be made clear here that this effort is not dependent upon the consultants being involved in the proposed projects since it is their role to stimulate new projects.

Recommendations for support to particular activities are given below. In these conclusions it is sufficient to summarise the main proposals which are being brought forward.

International co-operation

- All countries are involved in setting up a regional network
- Exchanges of missions China/Vietnam
- Technical exchanges India/Philippines

Information, promotion and awareness

- Workshop on developing implementation schemes, India
- Dialogue with extension agents, China
- Newsletters, exhibitions, fora in Philippines
- Translation of material into local language, China, Vietnam

User needs

- Visits to users by windpump specialists, China
- Identification of sites for windpumping, Vietnam
- Assessment of new markets, Philippines

Finance

- Development of better finance schemes, India

Training

- Courses on windpump design and manufacture, India, multi-national
- O&M skills for users, India

Demonstration

- Projects on desalination and small irrigation, China
- Ten units in Vietnam
- Show site for demonstrations in Philippines

Technology transfer and development

- Import of designs for small scale irrigation, China
- Support to manufacturers to improve designs, Philippines
- Development of windpump with centrifugal pump, China
- Test fields, India, Philippines
- Evaluation of wind resource, Vietnam
- Production engineering of better windpumps, Vietnam
- Windpump development and manufacturing improvements, Philippines

8. RECOMMENDATIONS

8.1 For Further Development of Windpumping in Asia

The new local associations have started off with a great deal of enthusiasm. It is essential that some support is forthcoming from the international aid community in order to maintain the initiative. The programmes and projects generated contain many ideas which can be worked up into sound and worthwhile projects.

Recommendation 1 - Support and encouragement to the new associations should be continued until they are firmly established.

Bi-lateral and multi-lateral interests have been identified which are causing the associations to consider collaborative actions. There is potential for cost effective co-operative projects. A regional network would support and develop these activities.

Recommendation 2 - Support the proposals which are being developed for a regional network, specifically support the proposed next international workshop.

Some of the projects which are being proposed are likely to take a considerable time in the process of obtaining commitment of funds, due to their size, the procedural process, or the need to identify a potential donor. The transition period could be covered by smaller scale activities, using more accessible funds, which will maintain the momentum of the programmes.

Recommendation 3 - Consider funding small-scale activities in the immediate future in pursuit of Recommendation 1. Examples are:

- a) Continue funding to secretariats for overhead costs, say 2 years more, four countries in 1998 & 1999.
- b) Technology transfer, assist licensing of proven new designs of UK origin or other foreign origin into Asian countries.
- c) Assist in India, China and Philippines to expand coverage from regional to national.
- d) Support entry of new Asian countries into the regional network and establishment of their local network.
- e) Training for manufacturers and agencies, e.g. staff exchanges and specialist courses in-country or overseas, and the possible Asian course on windpump design and manufacture.
- f) Continue development and dissemination of the database for windpumping.
- g) Other small projects that may be generated in the country programmes.

8.2 For Similar Programmes

The indications so far are that the adopted methodology is working well. The continued development of the programmes in the four countries should be kept under review over the next few years in order to evaluate the longer term success and learn from the experiences.

Recommendation 4 - A mission in late 1997 or early 1998 should review progress of local networks and results of TDR Project.

Recommendation 5 - For any similar programme in windpumping or other renewable energy technology consider this methodology.

The methodology appears now to be satisfactory enough for it to be used in any extension of the proposed Asian network to include new countries or to starting a new network in another region.

Recommendation 6 - Allow flexibility and supporting funds to ease the establishment of new/expanded networks.

The flexibility given the activities allowed the consultants to adapt the project in the different countries. The modest funding available to set up and operate the local associations proved invaluable to help overcome practical problems and accelerate progress.

REFERENCES

- 1 Windpumps in Developing Countries: A View of the Markets, study by HGa for DGIS, Ministry of Foreign Affairs, Government of the Netherlands, 1993.
- 2 Wind Energy for Rural Areas, Proceedings of an international workshop at Bergen, the Netherlands, 10 to 14 October 1991, Sponsored by DGIS and organised by Netherlands Energy Research Foundation (ECN) and Eindhoven University of Technology.
- 3 Prospects for International Collaboration on Windpumps, Proceedings of an international workshop at Silsoe, UK on 11 July 1994, Sponsored by ODA and DGIS, organised by IT Power.
- 4 Global Windpump Evaluation Programme, a series of country studies and overall summaries, by CWD and Haskoning of the Netherlands for the World Bank and UNDP, 1987.

APPENDIX A.

DETAILS OF NATIONAL ASSOCIATIONS

This appendix contains extracts from communications with the country associations. These give the available details of the membership of the associations and the secretariat in each country.

INDIA

CHINA

PHILIPPINES

VIETNAM

Network Committee:

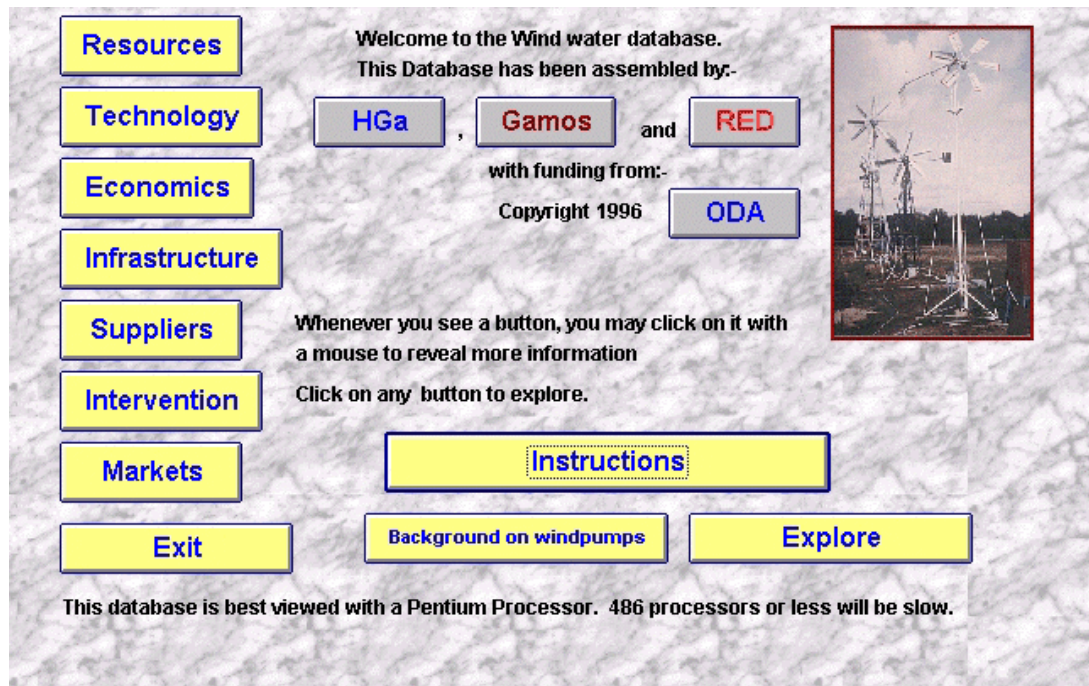
Mr Dung	Director	Solarlab
Mrs To	Director	Solarlab
Mrs Luong	Director	Rectere
Prof. H A Tuan	Director	DOSTE HCMC

A full list of the committee affiliations and membership is currently being prepared in Vietnam.

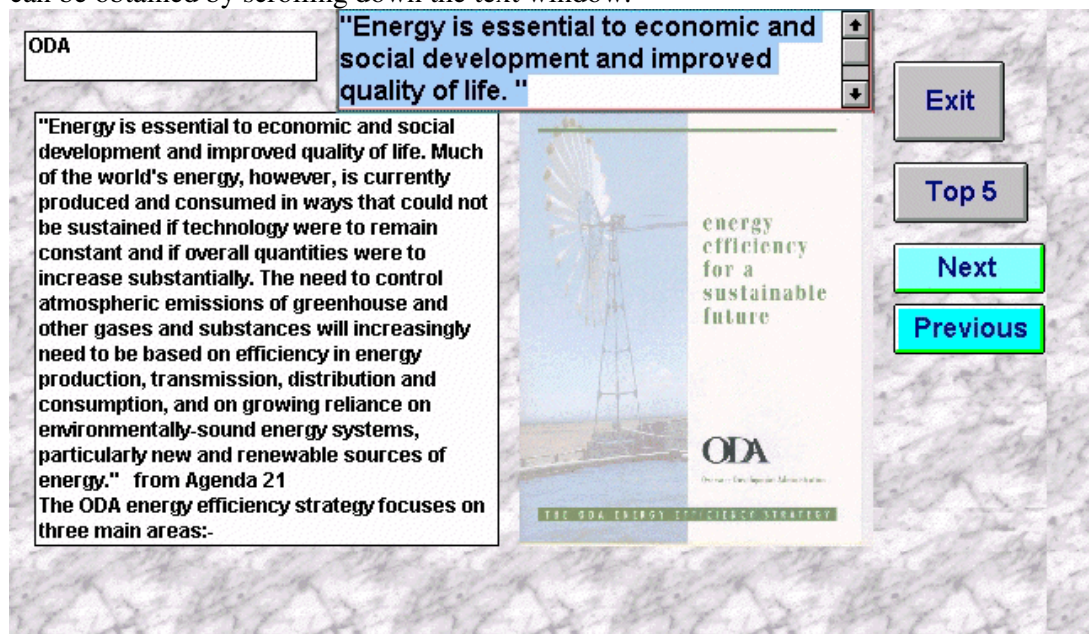
APPENDIX B.

SAMPLES OF DATABASE

The first window provides information on the ODA and the project consultants and the options for searching the database.



The ODA page provides a summary of the ODA's policy on energy, further information can be obtained by scrolling down the text window.



Searches can be made of the literature database and abstracts are available for most listed publications. Pictures and video clips are widely used throughout.

C/B comparisons

Remember: Press Find first, then make your selection/choices then use Next and Previous to browse

Next

Previous


This field gives you the reference title

Find Chilcott R.E. 1984 "Wind Powered Water Pumping." Lincoln College, University of Agriculture, Canterbury, New Zealand.

This field gives you a summary of the publication. Scroll by clicking on it, and down arrow

Exit

In order to provide guidelines for the installation and operation of low-speed wind-powered water-lifting devices, a non-dimensional performance prediction method is developed and presented in closed form. The method takes account of the characteristics of typical positive-displacement pumps, windmill rotors and wind regimes. The approach leads to the conclusion that, where conditions permit, the type of




Manufacturers information is also presented.

Wind Power Machinery Branch of China Association of Agriculture Machinery manufacturers, No 26, South Yuetan Street, Beijing, China, Fax 8513472

Next

Previous



Exit

Use Next and Previous to browse

FS-8	
Rotor diameter	8m
Number of Blades	12
Rated Windspeed	8m/s
Water Lifting height	3m
Lifting capacity	150t/h
Cutin windspeed	2.5m/s
Working windspeed	2-40m/s

Find

APPENDIX C.

SUMMARY OF PROJECT COSTS

The line item summary of the project budget and estimated final out-turn is provided here to support the comments in the report on the expenditure of the TDR funds and to demonstrate the level of resource which has been applied to this project, for guidance of possible future work.

ITEM	BUDGET £	ESTIMATED EXPENDITURE £
Labour costs (approx. 14 person months)	111,094	112,723
International travel and subsistence	27,590	21,666
Travel in UK	635	125
Reports, materials, communications	8,120	2,822
Support to networks:		
a) contribution to national workshops	2,000	3,868
b) first Asia regional workshop	10,500	11,920
c) start up facilities	6,500	5,162
d) operating expenses for first 18 months	9,000	6,897
TOTAL (excl. VAT)	<u>175,439</u>	<u>165,183</u>

APPENDIX D.

LOGICAL FRAMEWORK

Reproduced from the project proposal.