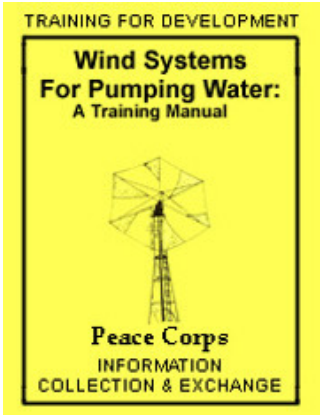
Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



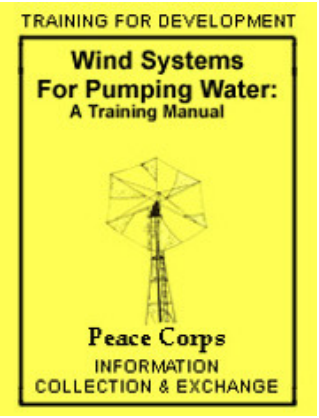
Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

Technical vocabulary

English	Spanish
Ball Bearing	Cojinete a (or de) boles
Bearing	Cojinete
Belt	Correa
Bolt	Perno
Brace and Bit	Berriqui y Barrens
Brake	Freno
Clamp	Tornillo de Banco
Connecting Rod	Biela
Crank	Cigeal
Crankcase	Carter de Cigeal

Crankshaft	Eje de Cigeal
Drill	Taladro
Hose	Manga
Lashing	Trinca(r)
Nut	Tuerca
Pipe	Tubo, Caa
Pump	Bomba
Prime (a Pump)	Cebar
Rod	Vara
Screw	Tornillo
Screwdriver	Destornillador
Shaft	Eje
Valve	Valvula
Washer	Arandela


Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

Report on the wind-powered in-service training

7/26/82 to 8/5/82 - CONACOTO, ECUADOR

PARTICIPANTS

21 Peace Corps Volunteers
Ing. Eernan Alvarez S. Ecuadorian counterpart
Napoleon Cevallos, Peace Corps Ecuador
Willis Eshenbach and Paul Jankura, Trainers

OVERALL OBJECTIVES OF THE TRAINING

To learn how to design and build two types of low cost, dependable mills and pumps.

To learn about working in design groups and construction groups.

To build and test the systems.

To learn about siting of wind powered systems.

To learn about community and large-scale wind systems.

MAJOR COMPONENTS OF THE WORKSHOP

Introduction and objectives - clarifying the objectives of the program, general introduction.

Drawing - to introduce the different types of drawings used to represent designs and hardware and to practice schematic drawing.

History of windmills - done with an eye toward selecting locally useful types of wind systems.

Shop safety and tool care - so that everyone makes it through the workshop with all their fingers and chisels intact.

Joinery and strength of materials - fastening with local fasteners and materials; testing for strength.

Bearings and shafts - how power is transmitted; cranks and wristpins.

Design - how to design, what to consider, the mechanics of the design process.

Designing - designing a windmill, including the driving of the water pump.

Design presentation - presenting the designs, using visual aids, to the rest of the group.

Construction - of the mills and the pumps.

Siting - all of the factors affecting the site of the mill.

Large projects - the community and other factors involved in scaling up the size of the wind system.

Maintenance - the prevention and care of aging in windmills and pumps.

Water and numbers - the tables and calculations needed to size

systems.

Testing - testing the strength and efficiency of the systems that we have built.

Presentation of projects - presentation of the projects, with an explanation of their use, to the rest of the group and anyone else interested.

Field trip- to see a local windmill.

Clean-up and close down - disassembly of the projects, cleanup the site, say goodbye.

RECOMMENDATIONS

The training was well received, and everyone expressed satisfaction with the results. Both the pumps and the mills worked as designed, with efficiencies in the ranges expected.

For model making, we used a combination of 2 Tinkertoy sets with one Erector set. These worked extremely well; people were able to use the models to actually see how the parts of wind pumping

systems work together.

All of the work was done with hand tools and using locally purchased materials and tools. The material for the two mills cost around $40 and $55; the material for the pumps, $18 and $10. These figures include paint and thinner, but do not include tools or labor. The participants and trainers made the following suggestions for possible alterations in the next training.

RESOURCES

Is it possible to buy a small library to be left in the country?

A small, miniature, working model of a windmill would help explain some of the concepts.

A technical appendix to the manual containing the theoretical formulas would be useful.

FURTHER EXPLANATIONS

More relative comparisons of types of mills
Other uses of windmills

Cleanout and capping of wells
Amount of water needed to grow various crops
Applications and system setup

PARTICIPANTS

If participants are Peace Corps Volunteers, they should not be new to the country.

SCHEDULING CHANGES SUGGESTED

More time for basic carpentry skills.

Use basic carpentry skills time to build models of other types of windmills and pumps.

If possible, involve a local craftsman.

Spend more time discussing group dynamics.

Ask a few people each day to stand up in front of the group and give a short talk, in the local language, about some phase of the training.

Don't split the groups up to build windmills and pumps simultaneously - do them consecutively.

Visit a local windmill as early in the training as possible.

SCHEDULE OF ECUADOR WINDMILL CONSTRUCTION TRAINING

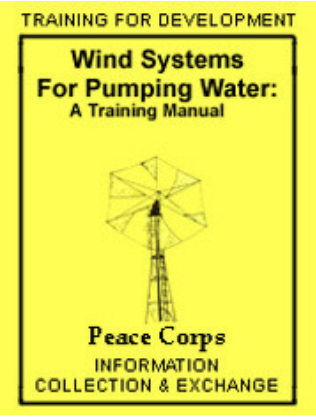
	Monday 7	Tuesday 8	Wednesday 9	Thursday 10	Friday 11
8:00 : 10:00		Shop Safety	Design Consideration	Presentation of Designs	Construction
10:00 : 12:00	Intro. & Objectives	Strength of Materials	Design Time	Same	Construction
2:00 : 4:00	Drawing for Construction	Pumps and Pump Design	Same	Construction	Construction

4:20 : 6:00	History of Windmills	Shafts and Bearings	Same	Construction	Construction

Saturday 31, Construction from 8:00 to 5:00

	Monday 21	Tuesday 22	Wednesday 23	Thursday 24	Friday 25
8:00 : 10:00	Construction	Construction	Construction	Presentation of Mill	Cleanup
10:20 : 12:00	Siting	Construction	Construction	Presentation of Mill	Cleanup
2:00 : 4:00	Construction	Construction	Maintenance	Field Trip	Wrap-up and Evaluation
4:20 : 6:00	Construction	Construction	Erecting the Tower	Assembly of Mill	Inauguration and Closure

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

- **Session 7 Strengths and testing**
- **Session 8 Joinery**
- **Session 9 Pumps and pump design**
- **Session 10 Siting considerations**
- **Session 11 Sizing wind water pumping systems**
- **Session 12 Design considerations for pumps and windmills**
- **Session 13 How to design**
- **Session 14 Presentation of designs**
- **Session 15 Construction of wind measuring poles**
- **Session 16 Exportation for wind sites**
- **Session 17 Tower raising**
- **Session 18 Plumbing the wind system**
- **Session 19 Testing installed wind system**
- **Session 20 Presentation of projects**
- **Session 21 Maintenance - preventive and routine**

Recommendations

THE FOLLOWING "RECOMMENDATIONS" AND "RECOMMENDATIONS AND SUGGESTIONS" WERE TAKEN FROM THE REPORT ON THE WINDMILL CONSTRUCTION IN-SERVICE TRAINING HELD IN ASUNCION, PARAGUAY, FEBRUARY 14, 1983, TO FEBRUARY 25, 1983, BY WILLIS ESCHENBACH.

In generally, this was a very successful and productive training program. There was great interest from the Paraguayans at all levels. The training was shown three times on local television. A local architect came to nearly all of the training sessions, including

the construction sessions, out of his desire to be able to build a windmill on some land that he had in the country. More people were interested in taking the training than we had room for.

In addition, there was excellent support from SENASA, the National Environmental Sanitation Service. SENASA is the technical arm of the Ministro de Salud, The Ministry of Health. SENASA is the Paraguayan agency which is responsible for providing clean water to the isolated villages in the countryside. SENASA gave us the use of their shop in the nearby town of San Lorenzo for the construction phase of the training, and lent us their tools.

UNICEF has given SENASA two well drilling rigs, which SENASA has been using to install wells for small communities. Many of these communities, however, have no electricity; so SENASA has been installing hand pumps in these wells. While this is better than walking, perhaps a few miles, to get water out of a dirty creek, SENASA and the local people are interested in windmills to avoid the work involved.

UNICEF was interested enough in the training to pay 3/4 of the expenses of five of the participants.

The Servicio Forestal, the Forestry Service, is where all of the local trees have been cut down. To further this work, they maintain in partnership with the Peace Corps, nurseries to grow the trees they need. Their interest in windmills comes form the need to water their tress in. the existing nurseries and to expand the areas of the country in which they can install nurseries.

Also, the people of the town where we installed the windmill were a great help. They assisted us in the installation of the windmill, bringing stones and helping lift the tower. They also gave the final dressing to the wind pump for the inauguration, planting sod around the base, hanging flags, and putting potted flowers around the base.

Finally, there was marvelous support from Peace Corps Paraguay. The training was coordinated by Pedro Souza, the Program Manager of the Health Program. He and Joe Kyle, Coordinator for the Health Program, gave freely of their time, energy, and local expertise, especially during the week previous to the training.

SUGGESTIONS AND RECOMMENDATIONS

1. As difficult as it is, considering cultural and political influences,

participating nationals should somehow be screened for their real interest in the technology and its development, and for their work habits. These programs cost time and money, and the interested people should not be hindered or distracted by non-interested, non-active students. Give their places to someone who will benefit.

2. It is important to involve local users of the windpump in the workshop. People from the community were involved, but only in the erecting and' installation of the mill. It would have been better to have at least one person from the community (in addition to their local SENASA agent, who did attend) go to all of the sessions.

3. A process is needed for selecting local people who would benefit from the IST and most of these procedures should be instituted.

4. It might be possible to encourage participation by either limiting participation to 10-12 people or by taking on a larger task (building two mills).

5. The largest difficulty with this IST concerned the installation site. The selection of this site involved political considerations, as did selection of the nationals who participated, as well as the colors

each windmill should be painted. For example, two sites in a politically favored area were provided to choose between - neither of these sites were ideal. One of the sites was marginal and the other was poor given the considerations listed in this manual.

Probably what we should have done at that point was to say, "Sorry, neither of these sites will do." Instead, what we said was, "Well, as long as you understand that this is a marginal site and the wind system may not work here, we'll put it in." They said "Yes," they understood, and we went on from there. The situation was complicated by the fact that we told them that it would require a 1-3/4 inch pump to go to the depth of that well (165 feet). They said they had one that they would install, but when push came to shove all they had was a 2-inch pump, too large for that depth.

The outcome was that the mill worked; however, not as well as it should have. It worked and people were happy with it, but it is definitely a marginal installation.

First impressions count for a lot. Introduction of a ''new" technology - even if it is a proven system - can fail if the first steps are weak. In this case the steps have been strong enough, but

marginally so. For success in the future the minimum standards for the site should be:

a. That it provide for a basic need of an interested community.

b. That it be a very good wind site.

c. That the site be easily accessible by people from out of the area - high visibility.

6. Tables in the manual could be arranged in a simpler form.

SCHEDULE OF PARAGUAY WINDMILL CONSTRUCTION TRAINING 2/14/83 - 2/25/83

	Monday 14	Tuesday 15	Wednesday 16	Thursday 17	Friday 18
8:00	Intro. to	Siting considerations	Shop Safety/Strength	Construction	Construction
:	Training	Measuring	of Materials		
:		the Wind			
10:00					
10:20	Introduction	Maintenance	Construction	Construction	Construction

:					
12:00					
2:00	Pumps, Shafts	Water and Numbers	Construction	Construction	Construction
:	& Bearings				
4:00					
4:20	Design	Plans of this	Construction	Construction	Construction
:	Considerations	Windmill			
6:00					

	Monday 21	Tuesday 22	Wednesday 23	Thursday 24	Friday 25
8:00	Field Trip	Construction	Taking the Mill	Assembly of Mill	Off
:	Construction		to the Site		
10:00					
10:20	Construction	Construction	Digging Holes	Assembly of Mill	Off
:			for Tower		
12:00					

2:00 : 4:00	Construction	Construction	Digging Holes	Assembly of Mill	Wrap-up and Evaluation
4:20 : 6:00	Construction	Construction	Erecting the Tower	Assembly of Mill	Inauguration and Closure

Since 1961 when the Peace Corps was created, more than 80,000 U.S. citizens have served as Volunteers in developing countries, living and working among the people of the Third World as colleagues and co-workers. Today 6000 PCVs are involved in programs designed to help strengthen local capacity to address such fundamental concerns as food production, water supply, energy development, nutrition and health education and reforestation.

Peace Corps overseas offices:

BELIZE
P. O. Box 487
Belize City

BENIN
BP 971
Cotonou

BOTSWANA
P. O. Box 93
Gaborone

BURKINA FASO
BP 537 - Samand in Ouagadougou

BURUNDI
c/o American Embassy
Bujumbura

CAMEROON
BP 817
Yaounde

CENTRAL AFRICAN REPUBLIC
BP 1080
Bangui

COSTA RICA
Apartado Postal 1266
San Jose

DOMINICAN REPUBLIC
Apartado Postal 1414
Santo Domingo

EASTERN CARIBBEAN
Including: Antigua, Barbados, Grenada, Montserrat, St. Kitts-Nevis, St. Lucia, St. Vincent, Dominica "Erin Court"
Bishops Court Hill
P. O. Box 696-C
Bridgetown, Barbados

ECUADOR
Casilla 635-A
Quito

FIJI
P. O. BOX 1094
Suva

GABON
BP 2098
Libreville

GAMBIA, The
P. O. Box 582
Banjul

GHANA
P.O. Box 5796
Accra (North)

GUATEMALA
6a Avenida 1-46
Zona 2
Guatemala

HAITI

c/o American Embassy
Port-au-Prince

HONDURAS
Apartado Postal
C-51
Tegucigalpa

JAMAICA
Musgrove Avenue
Kingston 10

KENYA
P. O. Box 30518
Nairobi

LESOTHO
P. O. Box 554
Maseru

LIBERIA
Box 707

Monrovia

MALAWI
Box 208
Lilongwe

MALI
BP 85
Box 564

MAURITANIA
BP 222
Nouakchott

MICRONESIA
P. O. Box 336
Saipan, Mariana Islands

MOROCCO
1, Zanquat Benzerte
Rabat

NEPAL

P. O. Box 613
Kathmandu

NIGER
BP 10537
Niamey

PAPUA NEW GUINEA
P.O. Box 1790
Boroko
Port Moresby

PARAGUAY
c/o American Embassy
Asuncion

PHILIPPINES
P. O. Box 7013
Manila

RWANDA
c/o American Embassy

Kigali

SENEGAL
BP 254
Dakar

SEYCHELLES
BP 697
Victoria

SIERRA LEONE
Private Mail Bag
Freetown

SOLOMON ISLAND
P. O. Box 547
Honiara

SRI LANKA
50/5 Siripa Road
Colombo 5,
Sri Lanka

SWAZILAND
P. O. Box 362
Mbabane

TANZANIA
Box 9123
Dar es Salaam

THAILAND
42 Soi
Somprasong 2
Petchburi Road
Bangkok 4

TOGO
BP 3194
Lome

TONGA
BP 147
Nuku' Alofa

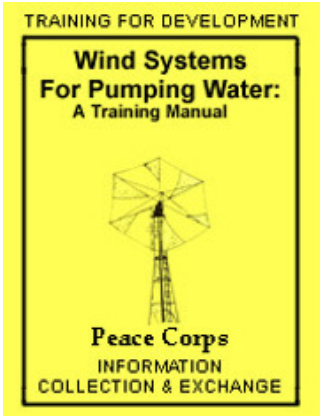
TUNISIA
BP 96
1002 Tunis - Belvedere
Tunis

WESTERN SAMOA
P. O. Box 880
Apia

YEMEN
P. O. Box 1151
Sana'a

ZAIRE
BP 697
Kinshasa

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Manual (Peace Corps, 1984, 93 p.)

- ***(introduction...)***
- **Acknowledgments**
- **Introduction to training**
- **Training guidelines**
- **Objectives for wind system construction training**
- **Session 1 Introduction and objectives**
- **Session 2 History of wind systems**
- **Session 3 Large projects and community analysis**
- **Session 4 Shop safety and tool care**
- **Session 5 Representative drawings for construction**
- **Session 6 Shafts and bearings**
- **Session 7 Strengths and testing**
- **Session 8 Joinery**
- **Session 9 Pumps and pump design**

- **Session 10 Siting considerations**
- **Session 11 Sizing wind water pumping systems**
- **Session 12 Design considerations for pumps and windmills**
- **Session 13 How to design**
- **Session 14 Presentation of designs**
- **Session 15 Construction of wind measuring poles**
- **Session 16 Exportation for wind sites**
- **Session 17 Tower raising**
- **Session 18 Plumbing the wind system**
- **Session 19 Testing installed wind system**
- **Session 20 Presentation of projects**
- **Session 21 Maintenance - preventive and routine**
- **Bibliography**
- **Construction materials list**
- **Tool list for 24 participants**

Training guidelines

Wind Power Suitability

The country or region should have a number of sites with winds over 12 mph [5 meters per second (mps)] for durations of six to eight hours, during that time of the year when water is needed. These sites need to be within 1/8 mile (200 meters) of the location of the waterpump, and they should be located right over the water, if possible.

Participants

A good mix of participants is half to three-quarters nationals, the rest Peace Corps volunteers.

If possible, include several people from the area, where the

windpump will be and from the area where the training will take place if the locations are not the same.

Also, a local worker skilled in building with the chosen materials should be included.

Peace Corps volunteers should have been in the country at least four to six months so that they will be familiar with the local conditions.

All participants should be screened for their genuine interest in the technology and its development and for the effectiveness, style, and quality of their work.

Trainers

This is not a manual which teaches the trainer the theory and practice of windpump construction. It is a training guide for a person who has built and erected windmills and is familiar with the theory involved.

Two trainers are better than one for a host of reasons, the most important of which is that the participants can get better training with more individual attention. Also, different people at times

cannot learn from one teacher, while getting along fine with another and learning a lot.

Scheduling

If necessary, schedule time for teaching basic construction skills. Use time to build small models of projects that will be built later in the training.

At the start or end of every day of construction, schedule some time to discuss how the group is working and how well things are going. Make sure that any differences or difficulties are resolved during this time. Point out how much time remains, if the work is ahead or behind schedule, and who has been doing a great job. Trainees who have experience in theoretical areas, tool use, or material application are of great value and should be invited to share their skills with the others in the group and act as assistant trainers. This time is also used to find out what people don't know and would like to learn. The training can best fill the needs of the participants by taking both types of information into account.

Schedule 15 minutes each day for three different people to come up

in front of the group and talk for about five minutes about some aspect of the training that interests them. This gives everyone the chance to practice their presentation of technical ideas. Trainees should be used as facilitators, observers, and for specific technical training when possible.

Field trips are an important part of the training and should be scheduled as early in the training as circumstances permit.

Make sure the shop or working area is cleaned and swept at the end of the work day, and the tools stowed away and accounted for.

Logistics

Put as little responsibility for the training as possible on the in-country Peace Corps staff.

A pre-training visit by someone who is later going to be involved with the training is advised when possible. During this visit many details can be dealt with that will make the training program more effective.

Selection of the type of wind system to be built is crucial. Make sure

that the particular design selected can be built and repaired at a local level, in terms of materials, tools and skills.

A working model of the wind system to be built is advised. In many places, people are unaccustomed to working from drawings and cannot understand them, but everyone understands a model.

Siting

The requirements for the training are a classroom and work area. The work area can be outdoors if rain is not anticipated, otherwise some kind of roof is necessary.

If the wind system is to be installed as part of the training, the installation site and training site should be in close proximity. The minimum standards for selection of the site are that:

- **It provides a felt need of an interested community**
- **It is a very good wind site**
- **The site has adequate wind velocities**
- **It is highly visible and accessible to the people of the area**

Tools

Tools should be of durable quality, but only what is available locally.

Make sure that there are enough tools so the training and construction progress is not held up due to lack of materials and tools. This is also a scheduling issue; plan to split up the construction sessions to minimize demand on tools in short supply.

In general, restrict participants to hand tools unless there is a compelling time factor or what power tools would be normally used.

Maintain high safety standards, enforce them and have necessary first aid supplies in case of emergency.

If a lathe is not available, plan to provide a makeshift one which may be powered by people, animal, or vehicle engine (PTO).

Materials

Buy enough materials for reasonable experimentation (within budget), as well as extra to allow for miscuts and errors.

Timing and Climate

The dry windy season is the best time for doing the training. If there is a wet windy season then it will be less necessary to pump water, and maybe some other pumping system (hydraulic rams, animal power, etc.) should be considered.

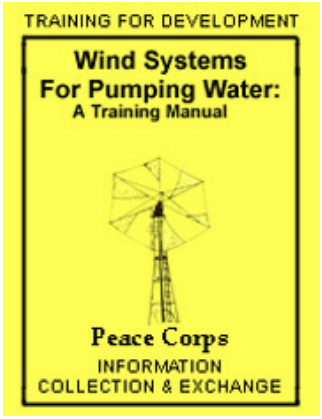
Texts

The general text for the training is "The Homemade Windmills of Nebraska" which shows the many possibilities for homemade windmills. For the pilot training in Ecuador, this was the only text. In Paraguay, the "Construction Manual for a Cretan Windmill'' was used because this was the type of wind system being built. Use text and design materials most appropriate for the type of wind system being built.


Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

(introduction...)



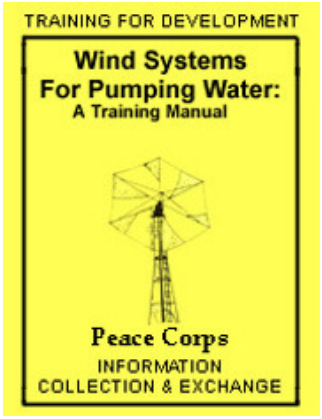
Recommendations

Objectives for wind system construction training

- **To provide trainees during training with all necessary information, skills, materials, tools, and resources to allow them to transfer their knowledge and experience to other communities.**
- **To enjoy the training experience, both in work and play.**
- **To improve the understanding of wind water pumping technology through experimental learning.**
- **To improve personal and group dynamic skills.**
- **To be able to adapt the wind technology they have learned to new situations.**


Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)



- **Session 11 Sizing wind water pumping systems**
- **Session 12 Design considerations for pumps and windmills**
- **Session 13 How to design**
- **Session 14 Presentation of designs**
- **Session 15 Construction of wind measuring poles**
- **Session 16 Exportation for wind sites**
- **Session 17 Tower raising**
- **Session 18 Plumbing the wind system**
- **Session 19 Testing installed wind system**
- **Session 20 Presentation of projects**
- **Session 21 Maintenance - preventive and routine**
- **Bibliography**
- **Construction materials list**
- **Tool list for 24 participants**
- **Technical vocabulary**
- **Report on the wind-powered in-service**

training

Recommendations

Session 1 Introduction and objectives

TOTAL TIME: 2 to 3 Hours

OBJECTIVES To introduce participants to each other and learn something about each participant's background, interests and reason for attending this workshop.

To identify group resources (who knows what, who has done what, what are the skills available within this group and what skills need to be developed).

To clarify and mutually agree upon the objectives of the training program and to reach agreement among participants as to what is necessary to make the training valuable and productive.

MATERIALS: Chalkboard or Flipchart

PROCEDURES:

Step 1: 45 minutes

Begin by going around the room and have each person introduce themselves to the group, giving a short description of their knowledge and experience regarding wind power, their expectations of training and what they hope to get from it. Have participant (volunteer) list comments and expectations on the board as they are mentioned.

Step 2: 30 minutes

After all have spoken, discuss the expectations that have been noted on the board. Come to agreement on which of the expectations are likely to be met, and which are not.

Trainer Note

Use this time to be very explicit about expectations regarding time and its availability, punctuality, the schedule, food, and the other details of the training.

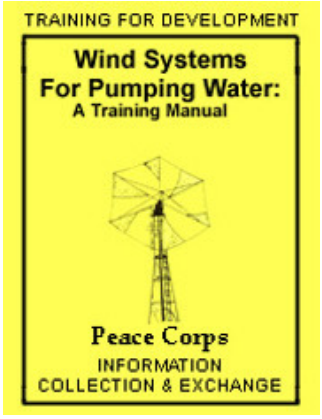
Step 3: 30 minutes

Discuss and agree upon the things that need to be done in order to meet the expectations. These should include attending all of the sessions, being on time, assisting others, etc.

Step 4: 15 minutes

Discuss the logistics - library use, evaluations, presentations, dividing into work groups, after hours time, meals, breaks, etc.

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

- ***(introduction...)***
- **Acknowledgments**
- **Introduction to training**
- **Training guidelines**
- **Objectives for wind system construction training**

- **poles**
- **Session 16 Exportation for wind sites**
- **Session 17 Tower raising**
- **Session 18 Plumbing the wind system**
- **Session 19 Testing installed wind system**
- **Session 20 Presentation of projects**
- **Session 21 Maintenance - preventive and routine**
- **Bibliography**

- **Construction materials list**
- **Tool list for 24 participants**
- **Technical vocabulary**
- **Report on the wind-powered in-service training**
- **Recommendations**

Session 2 History of wind systems

TOTAL TIME: 1 Hour

OBJECTIVES: To look at and discuss wind systems used throughout history; with an eye toward selecting types and styles which might be useful locally.

MATERIALS: Blackboard or equivalent, 35 MM Slide Projector Screen, or Photographs and Drawings

PROCEDURES:

Step 1: 15 minutes

Discuss the history of the development of wind systems, emphasizing water-pumping applications.

Step 2: 15 minutes

Examine the wind systems pictured in the handouts, noting the different construction methods used.

Step 3: 15 minutes

Discuss the various types of wind systems by categorizing them when possible.

Step 4: 15 minutes

Examine the windmills pictured in the text and discuss the possible uses and ease of construction of the various types.

Trainer Note

Many of the construction styles and other details of methods in this text are very appropriate to low resource areas.

RESOURCES: Text - Homemade Windmills of Nebraska
Copies of Attachment 2-A, 2-B, and 2-C

Attachment 2-A

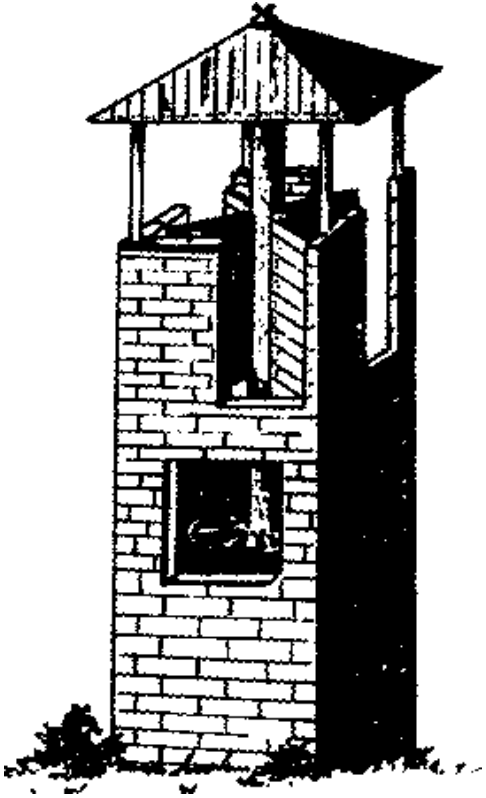


Figure 1: A Horizontal Windmill Mounted in a Tower, c.1495

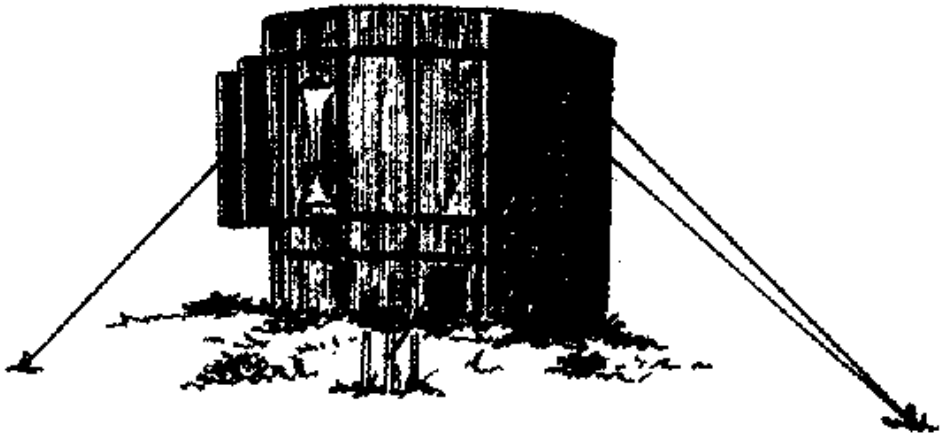


Figure 2: A Horizontal Windmill, c.1718

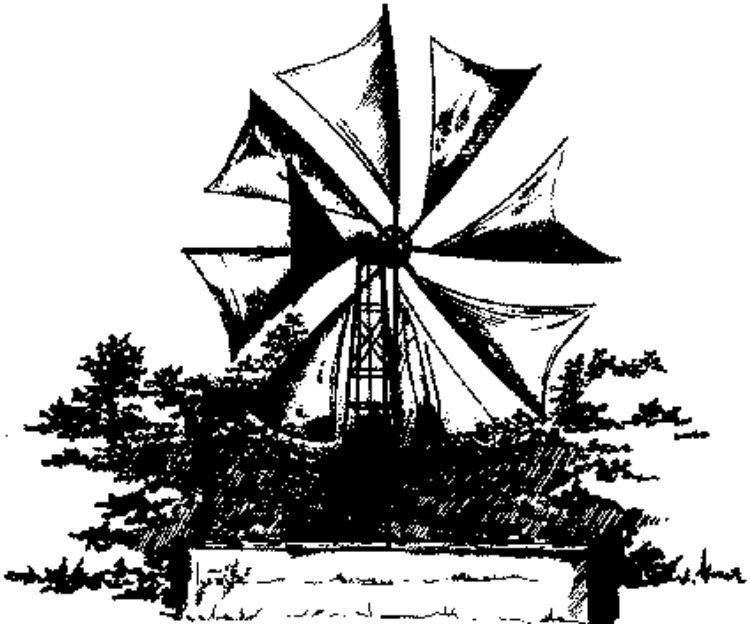


Figure 3: Wind Pumps with "jib" Sails

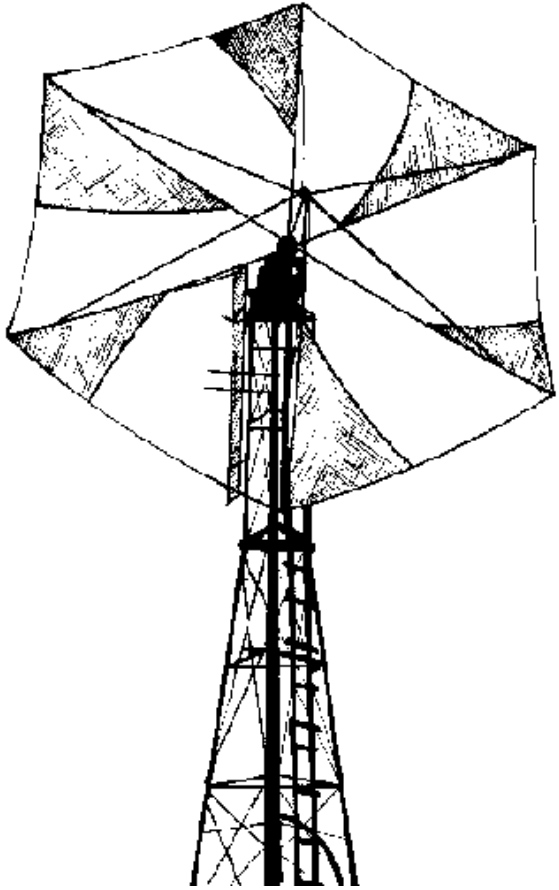


Figure 4: Cretan Sail Wind Water Pump in Operation

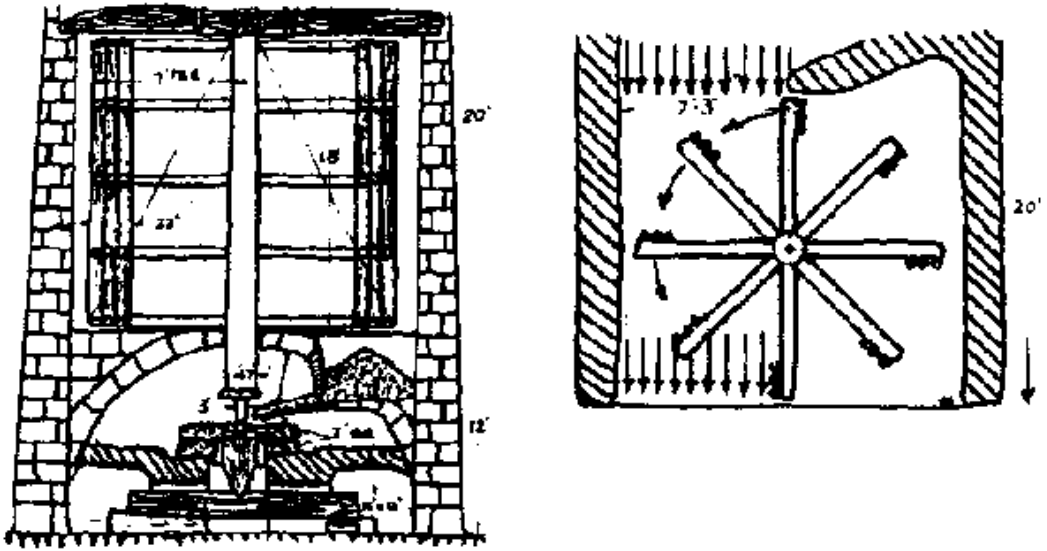
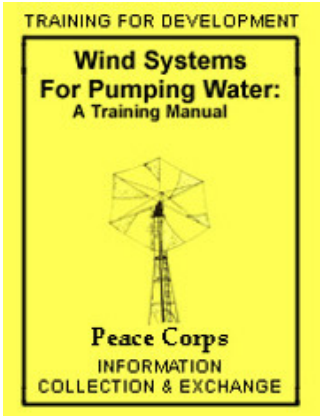


Figure 5: Two Views of a Persian Vertical-Axis Windmill that has Traditionally Been Used to Grind Grain (see grindstones at bottom left)

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Manual (Peace Corps, 1984, 93 p.)

- ***(introduction...)***
- **Acknowledgments**
- **Introduction to training**
- **Training guidelines**
- **Objectives for wind system construction training**
- **Session 1 Introduction and objectives**
- **Session 2 History of wind systems**
- **Session 3 Large projects and community analysis**
- **Session 4 Shop safety and tool care**
- **Session 5 Representative drawings for construction**
- **Session 6 Shafts and bearings**
- **Session 7 Strengths and testing**
- **Session 8 Joinery**
- **Session 9 Pumps and pump design**
- **Session 10 Siting considerations**

- **Session 11 Sizing wind water pumping systems**
- **Session 12 Design considerations for pumps and windmills**
- **Session 13 How to design**
- **Session 14 Presentation of designs**
- **Session 15 Construction of wind measuring poles**
- **Session 16 Exportation for wind sites**
- **Session 17 Tower raising**
- **Session 18 Plumbing the wind system**
- **Session 19 Testing installed wind system**
- **Session 20 Presentation of projects**
- **Session 21 Maintenance - preventive and routine**
- **Bibliography**
- **Construction materials list**
- **Tool list for 24 participants**
- **Technical vocabulary**

- **Report on the wind-powered in-service training**
- **Recommendations**

Session 3 Large projects and community analysis

TOTAL TIME: 1 Hours

OBJECTIVES: To learn some of the factors affecting large projects.

To learn how to analyze a community situation regarding the possibility of a community wind project.

MATERIALS: Blackboard or equivalent

Trainer Note

The difference between the big projects and the small ones is the increase in stress on all the people and systems involved.

PROCEDURES:

Step 1: 30 minutes

Examine and discuss this increase in stress in terms of:

- **The windmill**
- **The pump**
- **The water resources**
- **The material resources**
- **The people involved in building and maintenance**
- **The community**

Step 2: 30 minutes

In terms of the community, discuss some of the important issues:

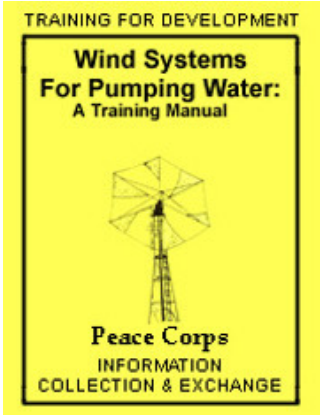
- **Who will pay for the system?**
- **Who will build it?**
- **Who will gain by it?**
- **Who will lose by it?**
- **Who supports it being built?**
- **Who opposes it being built?**
- **Who will maintain it?**
- **Who will pay for the maintenance?**
- **What skills and crafts are available?**

- **What changes might occur in the community (cultural, environmental, health, religious beliefs, agricultural methods, traditional gender roles, economy) if the system is built?**

Trainer Note

No technologies are without their impact on the environment. Discuss difficulties created by windmills in the past.

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



Wind Systems for Pumping Water: A Training Manual (Peace Corps, 1984, 93 p.)

- ***(introduction...)***
- **Acknowledgments**
- **Introduction to training**
- **Training guidelines**
- **Objectives for wind system construction training**

poles

- Session 16 Exportation for wind sites
- Session 17 Tower raising
- Session 18 Plumbing the wind system
- Session 19 Testing installed wind system
- Session 20 Presentation of projects
- Session 21 Maintenance - preventive and routine
- Bibliography

- Construction materials list
- Tool list for 24 participants
- Technical vocabulary
- Report on the wind-powered in-service training
- Recommendations

Session 4 Shop safety and tool care

TOTAL TIME: 2 Hours

OBJECTIVES: To establish and demonstrate tool safety use and maintain practices for the training program.

To identify and establish spotting and other team construction safety practices to be used during training.

MATERIALS: Shop, tools and demonstration materials or projects

PROCEDURES:

Step 1: 15 minutes

This will probably be the participants' first time in the training shop. Draw their attention to the general layout of the shop, location of materials and tools, exits, fire-fighting equipment, etc.

Step 2: 15 minutes

Personal safety is the first and most important topic to discuss. Point out the most common dangers in the shop (fire, tools with cutting edges, heavy things, tripping and falling, and, of course, each other). Stress awareness of the others.

Step 3: 90 minutes

Tool care and maintenance is the second aspect. Go around the shop together and discuss individual tools. Discuss the tools as related groups, mentioning care of sharpening edges, protection from rust, etc. Include any special safety precautions to be taken with that particular tool. Demonstrate proper use of each tool or tool type.

Trainer Note

It may be necessary to expand this session into a detailed basic tool use session, depending on the skill level of the group. In some cases, extra evening sessions may be necessary to insure that all the participants have the necessary basic skills.