

WOOT



Year report 2003

Working Group on Development Techniques

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1. Introduction

Welcome to the English version of the WOT year report 2003. This year report is based on the original Dutch version. Several chapters have been left out in the English version, but the activities that have been done in 2003 are still present in this report. The translation has been done by Vico Beerepoot and Ferdinand Kroon.

Many activities have been done at WOT in 2003. The annual T-Week was a success and the course "sustainable energy in developing countries" has been organised for the first time since years. For the first time, a so-called T-Weekend has been organised. The T-Weekend is meant to strengthen the relation with another organisation. In a weekend in September the volunteers from the foundation for Veterinary Medicine in Development Cooperation received a rope pump construction workshop. The success of the T-Weekend has led to plans for a new T-Weekend in 2004.

Other activities were answering questions from developing countries. The advisory service is considered a core activity of the WOT. To assist the advisory service, several new publications have been written and added to the WOT-website. Also, much work has been done to keep the demonstration objects on the WOT-field in shape.

You can read more about the above mentioned activities and much more in this year report, enjoy!

Picture on the cover;

Participants of the T-Week are busy with the construction of a zigzag-solar-collector.

2. Working Group on Development Techniques (WOT)

The WOT is a knowledge centre for small-scale applications of sustainable energy and hand pumps for developing countries. The WOT is a non-profit organisation and is run by volunteers. The WOT is located at the University of Twente in the Netherlands. Therefore, the majority of WOT-members are students. Two professional staff members support the WOT-members.

2.1 Goal

The WOT supports the development of social and economic living conditions in developing countries by means of;

- ◆ Transfer of technical information for sustainable development in the view of appropriate technology.
- ◆ Making people aware of the situation in developing countries, and especially the role that appropriate technology can play in improving these situations.

The WOT focuses on renewable energy sources like waterpower, solar energy and wind energy. In our work we try to involve appropriate technologies. This means we take into account the local circumstances in developing countries. For instance making use of locally available materials, knowledge and skills.

2.2 Activities

2.2.1 Advisory service

A free question and answering service is offered to people or organisations in or on behalf of developing countries. The WOT can answer questions in the areas of small-scale applications of sustainable energy and hand pumps. For example;

- **Wind energy**
 - construction and usage of small wind mills for water pumping
 - construction and usage of small wind mills for electricity generation
- **Solar energy**
 - solar crop dryers
 - solar water heating systems
 - solar cookers
 - solar water distillation/desalination
 - PV-systems for electricity generation
- **Water power**
 - micro hydro power systems
 - water rams for water pumping
- **Hand pumps**
 - rope pumps
 - piston pumps

To be able to give the best possible advise, the WOT tries to tailor the advise to the local conditions. For instance, what are the climatic conditions in the area? What practical skills are present? What materials can be used? What kinds of tools are available?

The WOT is part of the International Network on Technical Information. INTI brings together the combined information resources of development organisations providing an enquiry service. The main objective of the network is to improve the services provided through co-operation and mutual support. INTI is open to all information services focused on development issues.



2.2.2 Technical research

To facilitate the advisory service, the WOT carries out research in the construction and testing of existing systems and/or new systems are developed. WOT-members are actively involved in maintaining existing systems on the WOT-field and the construction of new systems. This practical experience that is gained can be used in the advisory service.

2.2.3 Awareness raising & courses

The WOT tries to make people in the developed world aware of the situation in developing countries, and especially the role that appropriate technology can play in improving these situations. We do this by among other things organising symposia about development related topics and giving tours on the WOT-field to interested people.

On a regular basis, courses are offered by WOT. The annual T-week (Technical week) is a course in basic technical skills for Dutch-speaking development workers. In co-operation with local technical schools the participants are learning things like masonry, wood working, metal working and electrical conduits. The T-Week is a very practical course. Other courses are given on a non-regular basis, and are announced via the WOT-website and other media.

2.3 Facilities

2.3.1 Test and demonstration field

The WOT has a test field where several applications of renewable energy technologies are on display. There are several windmills, hand pumps, solar cookers, solar water heating systems, etc.

2.3.2 Workshop

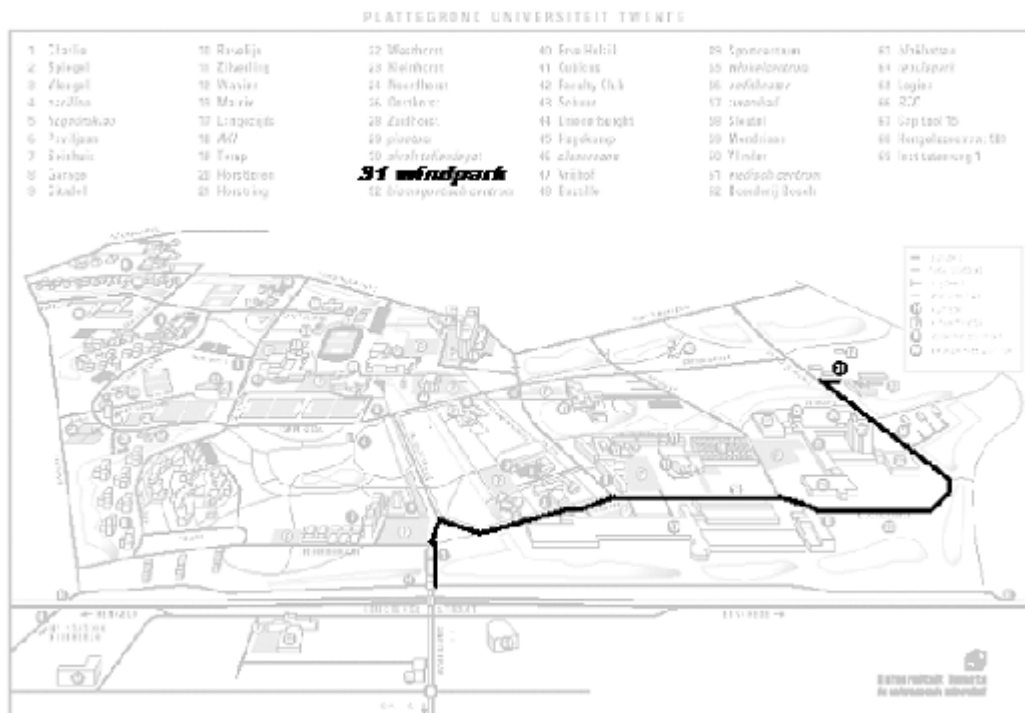
A workshop is present on the WOT-field that is used by WOT-members to conduct practical research and maintain the demonstration objects on the WOT-field.

2.3.3 Office and documentation centre

A small office is present on the WOT-field. Also located in the office is the documentation centre. The documentation centre contains around 2800 books and various magazines. The documentation centre is freely accessible.

2.4 Address

The WOT-field is located on the campus of the University of Twente in Enschede, the Netherlands.



Map of the campus. Location 31 (*Windpark*) is the WOT-field. The route from the main entrance of the campus to the WOT is marked in the map above.

The postal address is:

**Working Group on Development
Techniques (WOT)**
University of Twente
P.O. box 217
7500 AE Enschede
the Netherlands

You can also reach us via:

Tel. 053 – 489 28 45
Fax. 053 – 489 26 71 (att. WOT)
E-mail: wot@tdg.utwente.nl
URL: <http://www.wot.utwente.nl/>

3. Advisory service

3.1 Introduction

The advisory service is one of the main activities of the WOT. The WOT has knowledge about small-scale applications of wind-, water- and solar energy and water pumps. The WOT receives questions from individuals and non-commercial organisations in developing countries about these applications.

In 2003 a new co-ordinator is installed for the advisory group. The co-ordinator has the following tasks:

- Make sure all questions are answered within a reasonable period of time
- Contact the right WOT member(s) which have insight in the question asked, so the best answer will be given.

3.2 Target group

Our target group consists of organisations and individuals that want to improve the living conditions of people in developing countries. The organisations mainly consist of non-governmental project groups and (educational) institutions. Apart from the questions from our target group, we also receive questions from western organisations and people. These questions have a low priority and will only be answered if questions from the target group have been deal with. The target group is divided in high and normal priority, obviously the high priority questions are answered as fast as possible. In the following table the classification in the 3 groups over one year is given:

Target group, high priority	Target group, normal priority	Non-target
5	118	59

Table 1: Number of questions subdivided in 3 classifications

3.3 Subjects

The received questions are further subdivided in 5 subject groups. These numbers are shown in the table 2. The follow-up questions are questions that we receive as a result of an answer given by the WOT. In most cases this concerns more specific questions about the subject.

Subject:	2003		2002		2001		2000		1999	
	New	Follow-up	New	Follow-up	New	Follow-up	New	Follow-up	New	Follow-up
Wind	18	11	25	8	7	2	3	4	4	0
Solar	11	5	22	4	28	13	11	8	18	1
Water	37	4	24	0	21	6	32	6	19	9
Biomass	1	0	0	0	0	0	0	0	0	0
General	32	4	36	0	14	0	15	6	21	21
Total:	99	24	107	12	70	21	61	24	62	31

Table 2: Subdivision of questions from the target group in 5 subject groups.

The questions about water are sub-divided in waterpower (this includes micro-hydropower and hydraulic rams) and hand pumps. Most questions involve hand pumps and water rams. The questions about solar energy can be subdivided in two categories: thermal and photovoltaic energy. The thermal category includes solar crop dryers, solar water heaters, solar cookers and solar water distillation/ desalination. This year the questions about biomass were classified in a new group (instead of being classified as a general question)

MicroProject 03-045

On the 15th of March, the WOT received a request for advice about PV-panels for electricity generation. The applicant wanted to install air-conditioners in twelve holiday homes of which the electricity should be supplied by PV-panels.

This question was classified as a non-target group question, because it concerned a commercial company.

Even though, an answer was sent. We calculated that the surface of PV-panels required to realise such an energy need is equal to the surface of a football field. The costs were estimated at around 1 million dollar.

This illustrates that PV-panels are more suited for small energy needs and not feasible for large energy needs.

3.4 Means of communication

In table 3 one can see which means are used for contacting the WOT. Most questions are asked by means of Email. As WOT-members are volunteers, applications of advice done in written form are preferred.

Medium / year	2003	2002	2001	2000	1999
Telephone / Visit	8%	11%	9%	22%	14%
Fax	0%	0%	1%	0%	1%
Email	89%	84%	78%	56%	69%
Letter	3%	5%	12%	21%	16%

Table 3: Means of communication by which applications of advice are done.

3.5 Location of origin

In table 4 one can see which part of the world the applications of advice are from. The increased use in e-mail causes a number of questions of which it is unknown from where the question is asked.

Location of origin	2003	2002	2001	2000	1999
Africa	26%	37%	39%	48%	26%
Asia	21%	19%	16%	16%	43%
Latin America & Caribbean	21%	9%	3%	19%	18%
Eastern-Europe	0%	4%	8%	1%	0%
Western-Europe	20%	20%	14%	16%	9%
USA & Canada	1%	3%	2%		3%
Australia & New Zealand	0%	0%	2%	1%	1%
Unknown	10%	8%	16%	0%	0%

Table 4: Geographic subdivision of questions.

3.6 Response time

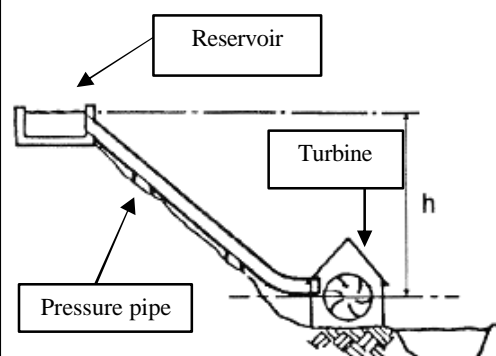
The advisory work at the WOT is done by volunteers. In spite of that, most of the questions are answered within a reasonable time. In table 5 the answering period of the last few years are listed. Questions with a long answering period are stated mostly from the non-target group.

Period / year	2003	2002	2001	2000	1999
< 2 weeks	53%	67%	67%	71%	66%
< 1 month	29%	17%	17%	8%	14%
< 2 months	13%	13%	10%	15%	14%
< 3 months	2%	3%	2%	2%	1%
< 4 months	1%	0%	4%	1%	0%
> 4 months	2%	0%	0%	2%	5%
Total	100%	100%	100%	100%	100%

Table 5: answering period of the applications of advice.

MicroProject 03-116

On the 30th of September a question about a micro-hydropower system was received. Someone from Zambia had some questions about the pressure pipe (see figure below)



He asked what diameter of the pressure pipe one should use and which form the inlet and outlet of the pressure pipe is the best.

We formed an answer with help of some books from our own library. The essence of the answer is the diameter of the pressure pipe. The diameter must be small to reduce costs, but on the other hand large to overcome friction losses. The form of inlet and outlet must be as smooth as possible also to overcome friction losses.

Calculations of both energy losses caused by the diameter and the form of the inlet and outlet were included in the answer.

4. Technical research

4.1 Introduction

To facilitate the advisory service, the WOT carries out research in the construction and testing of existing systems and/or new systems are developed. WOT-members are actively involved in maintaining existing systems on the WOT-field and the construction of new systems. This practical experience that is gained can be used in the advisory service.

A workshop is present on the WOT-field that is used by WOT-members to conduct practical research and maintain the demonstration objects on the WOT-field.

4.2 The test and demonstration field

The WOT has a test field where several applications of renewable energy technologies are on display;

Hand pumps

Two piston pumps, one with a metal frame and one with a wooden frame. Several rope pumps are present, constructed during courses. (see next chapter).

Wind pumps

A total of 5 wind pumps are located at the WOT-field.;

- ◆ The Kijito, with an adjacent ferrocement water tank, is a commercially available wind pump.
- ◆ The Oasis is also commercially available.
- ◆ The Vierwiek is a transportable wind pump.
- ◆ The 18PU450 ("Diever")
- ◆ The Kreta, which is made from wood and has sails as blades.

A new tail for the Kreta wind pump has been constructed in 2003, and will be placed in 2004.

Electricity generating wind mills

Next to the Virya, an electricity generating windmill designed by Adriaan Kragten, three additional windmills have been installed on behalf of the windmill construction contest. (see section 4.4).

Hydraulic ram pumps

A commercially available hydraulic ram, the Billabong, is installed on the WOT-field. Also, several Breurrams can be demonstrated. The Breurram is designed by WOT-member Gert Breur.

Solar water heaters

The kitchen water is heated by the so-called Deuss system. This system has three collectors and a storage tank. The solar shower has 6m² collector surface and is used to heat the water for the showers that are mainly used during the T-Week (see chapter 6). Both solar water heaters have been renovated in 2003.

PV-panels

The electricity for the lighting in the solar shower is supplied by two PV-panels.

Solar cookers

The WOT has a wide variety of solar cookers, two parabolic cookers, several cookboxes and a number of cookits.

Solar dryer

A solar dryer is on display that is capable of drying herbs or other small agricultural products.

Portable demonstration objects

For the purpose of demonstrations outside of the WOT-field, there are several portable demonstration objects. Among other things there are a mini-solar water heater, a Breurram and a demonstration piston pump.

4.3 Research

4.3.1 Vrij Kruiende Touwpomp Molen (VKTPM)

This research project has not progressed very much this year due to foreign internships of several of the executive WOT-members. The project is aimed at designing and constructing a windmill that pumps water using the rope pump. Similar wind pumps exist in Central and South America, but these are dependent on the direction of the wind. The windmill that is designed in this project can aim at the wind from any direction.

4.3.2 Injection-moulding machine

The injection-moulding machine is capable of producing small plastic products from (waste) plastic. The current design creates pistons for the ropepump. Construction drawings have been made this year. These drawings are checked by a local technical school, after which a construction manual will be published.

4.3.3 Biogas plant

Inspired by a WOT-member that was doing an internship at the Biomass Technology Group, attempts have been made to construct a small-scale biogas plant. A plastic barrel has been used as digester, which needs to be filled with water and cow dung.

4.4 Windmill construction contest

Mecal is an engineering company that among other things performs calculations on large wind turbines. Several former WOT-members are employed by Mecal. A contest was held, which was aimed to design and construct an electricity generating windmill for a maximum of 500 Euro. Two teams from Mecal and one team of WOT-members participated. The contest will be finished in 2004.



Participants in the construction contest are making some modifications to their blades.

5. Promotion & awareness raising

Promotion & awareness raising activities are aimed at making people aware of the situation in developing countries and especially the role that small-scale sustainable energy and hand pumps can play in improving this situation. Through promotional activities, we also try to reach more potential beneficiaries who can benefit from our advisory service.

Symposium "Business in development"

For the third year in a row, in co-operation with Monsoon a symposium was organised during the International Week. The International Week consists of several activities, and is organised by PITS. WOT and Monsoon are also part of PITS. "Business in development" was the title of the symposium that was given in English this year. Three speakers talked about the role of companies in development co-operation from a different angle. Wim Hardeman has set up a technical training school in Cameroon. Students do not only learn practical skills, but are also taught how to set up and run a small business. Rob Schuurman has retired from the army but still plays an advisory role in civil military co-operation. He discussed the role of civil military co-operation in rebuilding a country after a war or during a peace-keeping mission. The military takes part in the reconstruction of the infrastructure, but also creates a secure environment for companies to develop. Finally, Kevin Offel from the large multinational company General Electric (GE) elaborated on what a company like GE can do in areas where the company is active. A report of the symposium was written (in English).

Website and documents

The WOT maintains an informative website that makes information available to a wide public. Via the website, people can find answers to their questions. If a question is too specific, people can make use of the advisory service. Upcoming events are also announced on the website.

Several new documents have been added to the WOT-website this year; the report of the symposium in English, parts of the reader of the course "sustainable energy in developing countries" in Dutch, a document about the Virya, and a document about the Breurram in both English and Dutch. The document about the Breurram was written on the basis of questions and answers from the advisory service. The document about the Virya is a technical document about the electricity generating windmill on the WOT field.

Tours

The WOT maintains a demonstration field where different applications of small-scale sustainable energy and hand pumps are on display. Tours around the field are regularly given to a variety of people. Larger groups in this year were amongst others a group of master students from MAKS (Management of Agro-ecological Knowledge and Social Change) of the University of Wageningen, and a group of participants of the course "Energy Management and Cleaner Production in Small and Medium Scale Industries", offered by the TDG.

Information stands

If the people can't get to the WOT field for a tour, the WOT will get to the people. The WOT is present at various events with an information stand. Several demonstration objects can be displayed, for instance a solar cooker, Breurram, or portable ropepump. Since a few years the WOT is present at the Full Colour Festival in Emmen. This free festival attracts thousands of people. In our information stand, visitors can enjoy a fried egg from the solar cooker or can gaze at the wonder of the hydraulic ram pump. Other recurring events where we are present are during the introduction periods of the University of Twente (UT) and the Saxion Hogeschool Enschede.

Publicity

On a regular basis different media pay attention to WOT and/or our activities. Several journalists and a film crew were present at the T-Week. Also, the windmill construction contest that started this year attracted journalists. Several articles about the WOT have appeared in some regional newspapers.

Newsletter

A newsletter is distributed to donors and related organisations a few times each year. The newsletter informs about events that are organised by WOT and discusses some of the questions and answers from the advisory service.

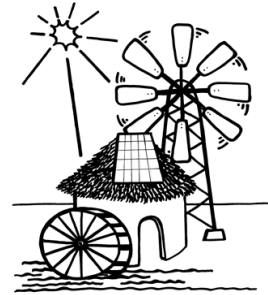
Other activities

WOT facilitated a research project about the Breurram that has been performed by a group of 6 students from the "Technische Hogeschool Eindhoven".

6. Courses

Course "Sustainable energy in developing countries"

A course was offered in the spring of 2003; "sustainable energy in developing countries". The course was organised in co-operation with Monsoon. The course was aimed at giving the participants an insight in the possibilities and potential of sustainable energy applications in developing countries. Important issues like suitable site conditions, cost and maintenance were discussed by 4 lecturers. In 4 evenings 4 topics were dealt with; hydropower, wind energy, energy from biomass and solar energy. Each lecture concluded with a small practical problem that had to be solved by the participants. The course concluded with a tour around the WOT-field. An expert on biomass was present to explain the two in biomass gasifiers that are present on the WOT-field in detail.



For this course, an extensive reader was compiled. This reader gives an overview of potential and possibilities of sustainable energy in developing countries. Parts of the reader are available on the WOT-website. The reader can also be ordered. Both the course and the reader are in the Dutch language.

T-Week

The T-Week is a technical week for development workers, which is given in Dutch once a year. This year 22 people participated in this one-week course. In the day-program basic skills in masonry, electrical conduits, water conduits, vehicle mechanics, woodworking and metalworking are taught by professional teachers from local technical schools.



In the evening program, the participants enjoyed interesting lectures from Bart Deuss about solar water heaters and from Henk Holtslag about low-cost water technologies. The other evenings were used to exchange experiences. Every year the participants camp at the WOT-field. The final Saturday of the T-Week takes place on the WOT-field. A well is drilled and a rope pump is constructed on top of it. Also, a solar collector is constructed.



The participants of the T-Week pose at their newly constructed well, rope pump and solar collector.

7. External contacts

For various reasons the WOT maintains contacts with other organisations. The advisory service can make use of knowledge from other organisations that is not present at WOT or vice versa. Awareness raising activities can also be organised in co-operation with other organisations.

International Network on Technical Information

The International Network on Technical Information (INTI) links over 10 European organisations which are providing technical information mainly in the fields of agriculture and nutrition, energy, water and sanitation, building, textiles and training. The WOT is also part of INTI. Basically, the purpose of INTI is



- To **improve the exchange of information** in the field of technical enquiries and to increase knowledge and skills,
- To save resources by the **exchange of materials**,
- To link **development work**,
- To increase the impact of the **question and answer services**.

The annual INTI-meeting was hosted by DIO in Utrecht, the Netherlands. To reach a broader public, the INTI-website has a new URL: www.inti-online.org

Foundation for Veterinary Medicine in Development Cooperation

Foundation for Veterinary Medicine in Development Cooperation (DIO) offers a free question and answer service for developing countries in the field of veterinary medicine. Volunteers are mainly students from the faculty of veterinary medicine of the University of Utrecht, the Netherlands. DIO is also part of the INTI network. In September the WOT offered a 2-day course in the construction of a ropelump to the volunteers of DIO.

TaT

A group of WOT-members has visited TaT (*Transferzentrum für angepasste Technologien GmbH*) in Rheine, Germany. TaT is also part of the INTI-network.

“vereniging de Civiël Ingenieur”

“*Vereniging de Civiël Ingenieur*” was founded in 2001 with the goal of offering free advice to developing countries in the field of civil engineering like bridges, irrigation systems and housing. Advice requests are exchanged several times a year.

TDG

The Technology and Development Group (TDG) is a chair at the University of Twente. The TDG offers courses in the field of development co-operation. The symposium “Business in Development” was organised in co-operation with Monsoon, which is the study association of the TDG. The course Sustainable Energy in Developing Countries was also organised in co-operation with Monsoon. On a regular basis, students from the TDG are given a tour around the WOT-field.

PITS

The *Platform Internationalisering Twentse Studenten* (PITS) is an umbrella organisation for the internationally oriented student organisations at the University of Twente. Developments in the area of internationalisation within the University are discussed, and activities are organised. The symposium “Business in Development” was organised as part of the International Week.

Foundation BACIBO

The co-operation between WOT and BACIBO dates long back. BACIBO aims at solar water heaters with the so-called zigzag-collectors. Bart Deuss from BACIBO lectures during the annual T-Week and the construction manual for the zigzag-collectors are used in the WOT advisory service.

Other contacts

The windmill construction contest, as described in chapter 4, has been organised in co-operation with engineering company Mecal. Also, contacts have been made with General Electric Wind Energy in among other things an excursion to their windmill blade factory in Almelo. Of course, the WOT has contact with many more organisations, many advisory request are received from an organisation.