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Evaluation of the 10th international course on the implementation of wind energy

ECN, April 2 – 13, 2001

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Abstract

This report is an evaluation of the "Tenth International Course on the Implementation of Wind Energy" held from 2-13 April 2001 at the Netherlands Energy Research Foundation ECN in Petten, The Netherlands. This course was organised by ECN in cooperation with Arrakis and Buro Netwerk. It was attended by 26 participants from 16 different countries.

Seven participants were financed by their own company or institute. The other participants were sponsored by the following Dutch institutes: The ministry of Foreign Affairs, the electricity companies REMU, Essent, NEG-MICON Holland, ENRON Wind Rotor Production (formerly Aerpac), and other institutes and consultants ECN, Ecofys, GEN B.V. The following foreign institutes also sponsored: CIDA, Canada, NEPO, Thailand.

On behalf of the participants the course management likes to thank these institutes and companies for their generous sponsoring.

Key words

Human Resource Management
Energy Management
Energy Programme
Energy Planning
Electricity Supply
Grid Connection
Implementation of Wind Energy
Manufacturing, Installation and Monitoring
Operating Experiences
Pre-investment Studies
Project Management
Standards and Certificates
Technology Assessment
Training Course
Wind Electric Battery Chargers
Wind Energy
Wind Pumps
Wind farm design
Wind Resources
Capacity building

CONTENTS

1. INTRODUCTION

1.1 General

This report is an evaluation of the tenth "International Course on the Implementation of Wind Energy" held from April 2 - 13, 2001 at the Netherlands Energy Research Foundation ECN in Petten, The Netherlands. This course was organised by ECN Wind Energy in co-operation with Arrakis and Buro Netwerk. It was attended by 26 participants from 16 different countries.
The evaluation of the course is based upon the evaluation forms completed by 26 participants [1] and on a group discussion supervised by L. Bakker of Buro Netwerk. The evaluation report has been made by the organisers of the course, F.J.L. Van Hulle of ECN, J.A. de Jongh and G.C. de Jongh-Versteegh of Arrakis and L. Bakker of Buro Netwerk.

1.2 Background information

More and more countries embrace wind energy as a viable option for the clean production of electricity. The technology has reached maturity and is becoming economically feasible under favourable conditions. The appeal and potential of wind energy has incited many countries to include a wind energy component in their national energy policies.

The basis for the successful implementation of wind energy is an effective infrastructure of skilled, competent human resources. Training of people at all levels is essential in order to become acquainted with the technical and operational issues involved in wind energy implementation. The wealth of experiences gathered in the past is brought together in this course by international experts. Through reflection and a process of trial and error they learned to understand the prerequisites for success. The aim of the present course is to transfer this knowledge to energy experts entering the field of wind energy technology, and provides an invaluable platform for dialogue and open exchange of views and experiences.

1.3 History

Energy policies in many countries have changed after the oil crisis of 1973. The Western governments emphasized the diversification of energy sources, conservation of energy and the use of renewable energy sources. Some countries like The Netherlands, included a wind energy component in their national energy plans. As a result of such programmes, a wealth of experience has been gained which is lacking in many other countries. The need for training on this subject was identified during a market survey in 1991 [2].
The first International Course on the Implementation of Wind Energy was held at ECN in 1992. Suggestions made by the 16 participants of the first course, with a length of three weeks, have been used to optimise and modify the second course [3, 4], which was held in 1993, reduced to two weeks duration and attended by 13 persons. Following courses were attended by 22 people in 1994, 25 (1995), 16 (1996), 20 (1997), 19 (1998), 22 (1999), 18 (2000) and 26 participants this year. Recent requests indicate demand is steadily increasing.

1.4 Survey of opinions of the participants

This evaluation is based on two distinctive measures: The first consisted of an evaluation of the lecturers' presentations and material. To this aim, after each lecture, evaluation forms were filled in by the participants. The second evaluation consisted of an interview with all participants during an evaluation session at the end of the course. At this session a questionnaire was filled out by each participant. A summary of their responses is given below. More details can be found in Appendix 1.

QUESTION:	RESPONSE:	
Value of the programme:	great value	90%
	moderate value	10%
	poor value	-
Quality of the presentations:	excellent	31%
	very good	42%
	good	22%
	moderate	5%
	poor	-
Quality of the technical excursions:	excellent	50%
	very good	38.75%
	good	11.25%
	moderate	-
	poor	-
Organisation of the course:	excellent	65%
	very good	20%
	good	5%
	moderate	-

2. OBJECTIVES

2.1 General

The overall objective of this training course is to help building up a human resource infrastructure for countries that consider, or are already starting with, the implementation of wind energy. Relevant aspects of the implementation process are treated in this course, passing comprehensively through each subsequent phases of the implementation process.
As the knowledge gained by pioneers in wind energy programmes is passed on to the participants, they are enabled to avoid known pitfalls. The small investment in training will result in considerable savings for the new coming country. Moreover, this course brings together international experts and provides an invaluable opportunity for the exchange of views and experiences.

2.2 Target group

The goal of this course is to transfer experience and know-how to decision makers and project managers from government bodies, electricity producers or distributing companies. The course is also useful for industrialists already engaged in implementation projects, scientists, consultants, etc.
The required level of education is BSc (technology or economics). Participants should have a good understanding of written and spoken English.

2.3 Method

The duration of the course is two weeks. The course programme includes seven days of tutorial lessons and exercises, and three days for excursions. The course programme follows the phases which the implementation of wind energy in a region or country will pass through. Especially the subjects: wind resources, planning of wind energy systems, pre-investment studies & financing, technology assessment, production, installation, monitoring & maintenance are highlighted.
Several didactical working methods are applied such as: lectures, audio-visual presentations, discussions, computer model demonstrations and exercises, cases, exercises and excursions.
Teaching modules include exercises to stimulate active class participation, while excursions to wind farms and manufacturers, enhance the effective transfer of knowledge.

2.4 Material

- Course Calendar;
- Course Manual, containing 16 modules;
- Copies of literature available at ECN;
- Manufacturers' information and documentation;
- Background information on financing instruments.

3. DESCRIPTION OF THE COURSE

3.1 General

The course focuses on the implementation of large scale, grid-connected wind energy systems. After a general introduction to the technology and characteristics of the wind resource, the four phases of the implementation process are treated: planning, pre-investment, implementation, operation. Besides lectures, excursions to wind farms and manufacturers of turbines and components are scheduled, as well as a visit to the ECN test facilities and laboratories. Some attention is paid to small scale systems, i.e. wind battery charging. These may be of special interest for developing countries. Finally, participants are invited to present the current status of wind and renewable energy programmes in their countries.

Another way of viewing the course contents is by classifying into three main areas: technology, financing, and planning. Besides, there are the field experiences and some included "miscellaneous" subjects covering an excursion to the ECN photovoltaics installations and biomass installations and laboratories, as well as lectures on specific topics such as on renewable energy during the forum session and on small wind chargers.

3.2 Topics

Forum discussions on Renewable Energy
Mr. H.J.M. Beurskens, head of the Unit Wind Energy, chaired a panel together with representatives from the ECN units working on solar energy and biomass. The panel answered questions raised by the participants on these topics. Participants who wanted to meet specialists to discuss certain topics afterwards, made appointments to meet these specialists later on during the course.

Wind Resources
By: Ir. H. Snel, ECN
The wind conditions at a site determine whether wind energy may be a viable option or not. The main characteristics are average wind speed; frequency distribution; turbulence and (seasonal) variations. This lecture gives an introduction to wind resource assessment, including the evaluation of existing wind data and the set-up of measuring programmes. Methodologies are described to estimate the wind energy potential, and the influence of the local wind regime on the energy production is explained. Finally, state-of-the-art tools such as wind atlases and site evaluation software are treated.

Introduction to Wind Energy Technology
Ir. H.J.M. Beurskens and Ir. H.J.T. Kooijman , ECN
This lecture explains the working principles of grid-connected wind turbines in order to provide a basic technological knowledge necessary to understand the possibilities and limitations of wind as an energy source. Topics dealt with are aerodynamics; mechanical structure; safety & control, and grid connection. The emphasis is on concepts rather than on mathematical physics to address participants who have a non-technical background.

Planning of Wind Energy
Dr. E. van Zuylen, Ecofys
The integration of wind energy in the national energy production involves issues such as the wind energy potential in relation to the national resources and energy demand, structure of the national electricity sector, siting and matching of wind turbines, wind energy production versus demand, penetration level, macro-siting and environmental aspects. The added value of wind energy is discussed: fuel saving, avoided emissions and capacity credit.

Utility Issues of wind power, the Dutch case

Ir. G. Hendriks, GEN

The integration of wind turbines in a national electricity infrastructure involves market aspects as well as legal and economical aspects. The key-role players in the Dutch situation with their policies are treated.

Grid Connection of Wind Energy : Technical Aspects

Ir. J. Knijp, KEMA

Technical aspects of grid-connection concern the interaction between a wind farm and the grid, including methods of operating. Various types of wind turbines have their own characteristics regarding grid-connection and also the grid itself, including the way it is operated, has its own characteristics. The most relevant parameters for assessing the connection of a windfarm of a certain size and typical windturbines to a typical grid are explained.

Design of wind farms & demonstration of WindPro

B. Rajsekhar and Dr. P.J. Eecen, ECN

Aspects of designing wind farms are treated, such as micro-siting, wind farm array options, wake effects, etc. The WINDPRO software package, which is used for micro-siting of wind farms and calculation of wind farm energy output, noise contours, visual impact etc. is demonstrated in a session where participants actually can work with the programme on practical examples.

Pre-Investment Studies

Ir. D. Kooman, NUON-International

A pre-investment study is carried out in order to decide whether a wind energy project is feasible or not. The study should prove that the planned project is technically and economically viable and bankable. The most relevant aspects are treated, including choice of technology, grid connection, banking schemes, site preparation and environmental issues. A worked-out case is followed by an exercise.

Financing Opportunities

Ir. A. Dankers, ADventures in NRG

After the UNCED conference on global environmental issues (Rio de Janeiro, 1992), the World Bank was one of the first international agencies to present a financing scheme for renewable energy technologies. Other programmes followed such as Finesse and the more recent Joint Implementation initiatives and Clean Development Mechanisms (CDM). The lecturer explains their history and the status of renewable energy sources within global energy policies, and gives an overview of current developments and possible finance schemes.

Implementation Strategies

Ir. E. de Vries, ROTATION

The introduction of wind energy in a country requires support by a national energy policy. A number of legal and economical measures, such as tax incentives, subsidies and a revision of the tariff structure may be conceived for this purpose. This lecture provides an overview of the strategies applied in the United States, Europe (especially Denmark and Germany) and the results thereof on the development of wind energy.

Technology Assessment

Ir. F.J.L. Van Hulle, ECN

This lecture presents the state of the art of current wind turbine designs. Methods are described to classify and evaluate different wind turbine types, including reliability, output, investment and recurrent costs, after sales services etc. Documentation on commercially available wind turbines is handed out.

Project Management , Basics
Ir. J. de Jongh, Arrakis
Basic aspects of project management are dealt with, such as; project-cycle phases, plan of operations, operation, control & monitoring and evaluation.

Project management, Case
Ir. J. de Boer, Essent
The project history of a realised wind farm project, Eemshaven, Delfzijl, is treated by its project manager. The real problems and pitfalls encountered provides valuable lessons for future projects to be managed.

Manufacture, Installation & Monitoring
Ir. D. Knoppers and Ir. F-J Brekelmans, NEG-Micon
During the combined excursion to two leading Dutch companies, the strategies for manufacturing, installation, after sales and maintenance services is discussed, as well as the possible set-up of local production versus import. Relevant aspects of the design and production process are explained, such as: Quality Assurance; ISO-9000 system, human resources, management tasks and employees categories. With respect to wind farm performance are treated: control and monitoring of availability, output and capacity, breakdowns and maintenance efforts. The institutional infrastructure and role of authorities, insurance's, sub-contractors and competitors on the company is treated.

Standards & Certification
Ir. H.B. Hendriks, ECN
The development of international (IEC) and national standards for wind turbines is outlined. The importance of certification and the relevant procedures and criteria, are discussed.

O&M Aspects
Ir. L.W.M.M. Rademakers, ECN
Operation and maintenance is crucial for wind power projects. Although presently O&M costs have been reduced considerably, they recur each year for the total life time of the project. O&M strategies have been developed as well as monitor equipment and methods. The present development of Offshore wind power with its difficult access for maintenance crews will greatly enhance O&M capabilities.

Field Experiences and Monitoring
During the excursion to a large wind farm at the coast of lake Ijselmeer, the experiences encountered during preparation, implementation and operation are presented by a representative of the utility NUON, the owner of the wind farm. Investment aspects are dealt with, as well as actual information on performance, operation and maintenance.

ADDITIONAL LECTURES

Guest lecture: ***European Policies and implementation in the UK***
Mr. N. Goodall, BWEA
History of various implementation policies in Europe in general and for the UK specifically were treated. Recent positive developments in the UK were highlighted.

Small Scale Wind Energy Systems
Ir. J.A. de Jongh, Arrakis
This lecture gives a short introduction to small-scale applications of wind energy for rural areas. Typical aspects for the sustainable introduction of these systems were discussed.

PRACTICAL ACTIVITIES

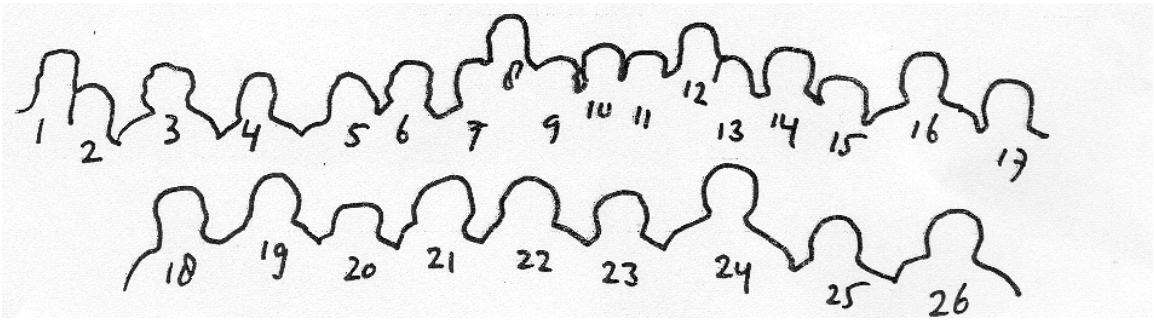
Participants Presentations
The participants prepared and presented a paper on the status of wind energy in their country. The individual viewpoints and experiences were commented and discussed, contributing to mutual exchange of experiences.

Excursion to ECN units: Solar Energy, Wind Energy and Fuels, Conversion and Environment. According to individual interests of the participants, an excursion to several ECN facilities was organised, e.g. wind turbine testing and monitoring facilities, wind turbine design by computer, solar cell testing laboratories and biomass installations.

4. PARTICIPANTS

The following participants attended the 2001 course. The numbers in the sketch below correspond with the photograph and not with the table.

(1) Eddie Lawlor, (2) Agus Nurtjahjomulyo, (3) Jennifer Lugtigheid, (4) Rohan Senerath, (5) Rim Boukhchina, (6) Raul Nino, (7) Edgar Villalobos, (8) Maged Mahmoud Abd El-Rahman, (9) Reginald Kay, (10) Jos Dekker, (11) Agustin Rodriguez Carvajal, (12) Lulamile Xate, (13) M. Kodanda Rama Murthy, (14) Jan de Jongh, (15) Ajay Mehra, (16) Jan Klop, (17) Alvaro Guillen Sanchez, (18) Helmi Nainggolan, (19) Bryan Medwed, (20) S.K.R.K. Ananda, (21) Somchai Stakulcharoen, (22) Ladfali Khouy, (23) Graiwan Krutgul, (24) Kim Doo Hoon, (25) Deepak K. Kharal, (26) D.L. Shrestha. Not on the photo: Gwen van Roekel, Lucia Bakker, Klaas Duijves and Frans Van Hulle.



Name & Institute	Country
1) Mr. M. Kodanda Ram Murthy Non-Conventional Energy Development Corporation (NEDCAP) of Andra Pradesh	India
2)) Mr. Bryan Medwed SolarHead Energy Systems-Kibbutz Samar	Israel
3) Mr. Ajay Mehra/Enercon India Ltd	India
4) Mr. Maged Mahmoud/ NREA (New & Renewable Energy Authority), Cairo	Egypte
5) Mrs. Jennifer Lugtigheid/Suncor Energy Inc., Calgary	Canada
6) Mrs. Gwen van Roekel/ECN International	Netherlands
7) Mrs. Rim Boukhchina/ STEG/DEP (Societe Tunisienne du Gaz et L'Electricite)	Tunesia
8) Mr. Graiwan Krutgul/Department of Energy Development and Promotion, Bangkok	Thailand
9) Mr. Somchai Stakulcharoen/Department of Energy Development and Promotion, Bangkok	Thailand
10) Mr. Kim, Doo Hoon, UNISON Industrial Co, Ltd	Korea
11) Mr. Agustin Rodrigues Carvajal	Costa Rica
12) Mr. Alvaro Guillen Sanchez/ICE	Costa Rica
13) Mr. Edgar Villalobos/ICE	Costa Rica
14) Mr. Helmi Nainggolan/Directorate General of Electricity and Energy Development	Indonesia
15) Mr. Agus Nurtjahjomulyo/LAPAN National Institute of Aeronautics and Space	Indonesia
16) Mr. Eddie Lawlor/Irish Energy Centre, Cork	Ireland
17) Mr. Rohan Senarath/ITDG, Colombo	Sri Lanka
18) Mr. L. Khouy/Centre de Development des Energies Renouvables, Marrakech	Morocco
19) Mr. Lulamile Xate/DARLIPP, Capetown	South-Africa
20) Mr. S. Ananda/ Consultant Engineer	Sri Lanka
21) Mr. Jan Klop/Volker Stevin	Netherlands
22) Mr. Klaas Duijves/ECN	Netherlands
23) Mr. Reginald Kay/Green Cable Power, Vlaardingen	Netherlands
24) Mr. Raul Nino/University of Oldenburg, Germany Post graduate programme in renewable energies Trainee at ECN	Venezuela
25) Mr. Deepak Kharal/Water and Energy Commission Secretariat Kathmandu	Nepal
26) Mr. Dhan Lal Shrestha/Water and Energy Commission Secretariat	Nepal

5. SPONSORSHIP

During the years, the following organisations and companies have financially supported the participation of attendants to the course. The organization would like to thank them for their kind support of this course. Without their help, co-operation and financial donations, this course would not have been possible.

Organisation	**Country**	**Year**									
		92	93	94	95	96	97	98	99	00	01
Ministry of Foreign Affairs	Netherl.	5	7	5	5	5	5	5	5	5	5
Province North Holland	Netherl.						3	1			
IEF	Lybia	6									
Government	Norway	5									
GTZ	Germany		2	1							
Dorgelo Stichting	Netherl.							1	1		
Holec	Netherl.		1								
ECN+University Utrecht	Netherl.		1								
ECN	Netherl.		1		1			2		1	
ECN + Aerpac	Netherl.					1					
Aerpac, Windms+Novem	Netherl.							1			
ECN/Windmaster	Netherl.						1				
NEF	Sudan		1								
Nedwind	Netherl.		1	1	1	1	1	1	1		
PEN	Netherl.			2	1						
REMU	Netherl.			2	2	1	1	1	1	1	1
PNEM+RED	Netherl.			2	2						
PNEM/MEGA	Netherl.					1	1	1	1	1	
ENECO+RED	Netherl.					1					
EZH	Netherl.						1	1			
ABT	Netherl.						1				
Fokker	Netherl.			1							
Framatome	Singapore							1			
ING Bank	Netherl.						1	1			
ING+LMW	Netherl.								1		
LMW	Netherl.							1			
NUON	Netherl.					1				1	
NUON+Aerpac	Netherl.			1			1				
Novem+Lagerwey +LMW	Netherl.								1		
Novem+Lagerwey	Netherl.							1	2	1	
Novem/Aerpac	Netherl.								1		
RES	India			1							
IREDA	India			5	6						
ACE	India				2						
TTG	India				2						
Kanishk	India				1						

Organisation	**Country**	**Year**									
		92	93	94	95	96	97	98	99	00	01
MREL	India					1					
Suzlon	India							1			
MNES	India							1			
WRH	China			1							
LEC	China					1					
ENEL	Italy			1		1					
EUREC	Belgium				1						
NREA	Egypt				1						
DEDP	Thailand					2	2				1
NEPO	Thailand										1
Thyssen	Argentin						1				
Electrabel	Belgium								2		
EDON/ECN	Netherl.								1	1	
Scottish Power	Scotland								1		
Tamil Nadu News Print Papers	India								1		
Asian Windpower	India								1		
TENAGA	Malaysia								2		
Tocardo	Netherl.								1		
CIDA	Canada									2	2
NOVEM/Aerpac/Arrakis/Ecofys	NL/DK									1	
JEPIC	Japan									1	
EDON/ VESTAS DK	NL/DK								1	1	
LM-Glasfiber Holland/NOVEM	DK/NL									1	
NEGMICON/ NOVEM	DK/NL									1	
NEGMICON/ GEN BV	DK/NL										1
ENRONWindRotor Prod.BV/Ecofys/ECN	NL										1
Enercon India	India										1
Wescare	India										1
ECN/ESSENT	NL/NL										2
Irish Energy Center	Ireland										1
Suncor Ltd	Canada										1
Volker Stevin	NL										1
ITDG-Sri-Lanka	Sri Lanka										1
Unison Ltd	S-Korea										1
SolarHead Energy Systems	Israel										1

6. COURSE ORGANISATION

The course has been organized by the Netherlands Energy Research Foundation ECN, ARRAKIS and Buro NetWerk.

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The Netherlands Energy Research Foundation, ECN at Petten is a leading center for energy research in Europe. ECN develops technologies and policies for safe, efficient and environmentally friendly energy supply. The ECN-Unit Wind Energy employs about thirty researchers active in the area of wind technology. Other ECN Units are active in the fields of solar energy, biomass, energy policies, energy conservation and fuel cells.
The ECN mission is formulated as contributing to a clean and reliable energy supply for a viable world.

ARRAKIS, independent company, headed by Mr. Jan de Jongh, has the mission to introduce clean energy technologies and services to fulfill future needs. It focuses on institutional and human resource development and engineering consulting in the field of renewable energies, worldwide. ARRAKIS (formerly RED) initiated this course in 1992,

Bureau NETwerk is an independent company headed by Mrs. Lucia Bakker. She has large experience in the field of communications and logistical support and has co-organized this course since 1996.

7. EVALUATION

7.1 General

The evaluation is based on two different evaluations: The first consisted of evaluation of lecturers presentations and material. To this aim, after each lecture, evaluation forms were handed and filled in by the participants. At the end of the course an evaluation session was conducted by Mrs. L. Bakker. This session was attended by 20 of the 26 participants. To this purpose, evaluation forms were handed out. The results of both evaluations are listed in Appendix 1. During the evaluation session at the end, a group discussion was organised. The presented evaluation is based on the completed evaluation forms and the conclusions drawn from the group discussion.

7.2 Target group

As mentioned before, this course is primarily intended for a target group of decision makers and project managers from government bodies, electricity producers or distributing companies, bank project staff and project developers. However, it may also be of benefit for scientists, industrialists and consultants active in wind energy. Most of the 26 participants of the 2001 course belonged to the specified target group and many are active in wind energy programmes on decision making level. The countries South Korea, Canada, Ireland, South Africa, Venezuela and Israel were represented for the first time.

The presentations held by the participants, the discussions among the group and the often very specific questions, show that the participants were well selected. Since implementation of wind energy is progressing in several countries like India, Sri Lanka, Costa Rica etc., the level of experience among representatives from those countries is also increasing.
No major language problems were encountered.

7.3 Scope, range and level of the programme

7.3.1 General

Individual remarks:

- This entire programme can be continued in the future because this programme is very important for development and implementation of wind energy technology in the world.
- Overall, a great course for me, covered all the topics in overview, which meant that there were no gaps. None of the material was irrelevant, or too difficult to understand, but the pace was not slow either. An excellent course.
- The information of this course could be easily spread if the course could be done in each country around the world, because more people can participate.

The time given for this course is quite short and I suggest that with similar programmes with much technical detail will be more assimilated if it takes more time. More detailed courses will be very useful for us.

7.3.2 Contents

50% of the participants found the intellectual level more than expected and 50% what was expected. The scope and range of the program was found as 10% too much, 70% just right and 20% could be more. 5 participants had a little language problems.

Invidual remarks:

- I would like to have had the participant's presentations up-front in the beginning of the course. These should be directed to be 10 minutes only and include 1) participant's job/

involvement, 2) participant's own current experience with wind energy. This would give a better idea to meet and discuss among us on each other's particular experiences. (This would be just a little more valuable than the "Paper on the wall" introduction).

- It is good if you spend the first two days to build up the basic knowledge on wind energy (i.e. wind necessity, power, PV curve, design, testing etc). Then go for other part such as wind farm designs, financial etc.
- Have an excursion (maybe on the first Saturday to a wind farm cooperative. It is important to understand contracts, loans, etc). It also would help a lot in our countries to have similar mechanisms (more democratic mechanisms) to develop renewable technologies.
- Field trips are very much acceptable. It helps to make confident of participant and application.
- Zoning regulations (restrictions for sites-distance from airports, radar, wildlife areas etc.)
- Lecture should be managed in such a way that it should go step by step, not jumping from one area to another which is not relevant. Seat arrangement in the class should not be like in university class. It should be more seminar type-like rectangular, circular etc. Country presentation was quite boring, in most cases long.
- My personal perspective is that little bit of aerodynamic technology should be included in the course programme.
- What I think the procedure should be:
  Half an hour lecture on each department.
  Then 2 hours visit to each department.
  Half a day to go and to get data on what each participant is interested in.
- We take too much time for the financial.
- The lecturer's presentation structures and content should be clearly defined to prevent overlapping/ repetitions of certain topics. (Some of the lecturers presented the history and definitions of WT). However it was a very good, fruitful and interesting programme.
- Try to reduce overlapping issues during various presentations by in advance limiting the content of each presentation.
- Improvement towards practical application particularly the small scale projects.

7.3.3 Relevance

Hope these programmes can continue again, because these programmes are very important for us, especially for developing countries.

7.3.4 Speakers and material

- Some presenters ran out of time. I think a bit more attention should be paid to make sure that the presenter gets through his material.
- If it is possible to have the lecture in a CD version?
- It is necessary to improve the documentation, in some cases only the film was given to us.
- Use of a wind turbine model during technical presentations.

7.4 Value of the programme

90 % of the respondents believe that the programme has a great value for them; 10 % judges it to have a moderate value. Nobody stated that the value of the programme was poor.
Thank you for an excellent course, beyond my big expectations of ECN.

7.5 Organisation

The response on the evaluation forms for the organisation runs as follows:

excellent	65%
very good	30%
good	5%
moderate	-

poor -

Individual remarks:

- The final night in Enkhuizen was fantastic. This was the first time I felt like a group. I think that may be the reception that was on the Tuesday night should be in the first week to try and stimulate the group experience. This course was really great. I learned more than I expected in two weeks. I would not hesitate to recommend this course to anybody.
- We thank all the persons who have done a great effort in this course.
- Lodging: As the participants have to cook their food in the evening, revision of daily notes had to be postponed. If the food also available during the stay, the participants would have got much opportunity to attend revision during evenings.

I wish to express my deepest appreciation and thanks to all the staff involved in this programme, with special thanks to Mr. Jos Dekker, Mrs. Lucia Bakker and Mr. Jan de Jongh for their dedicated efforts. Hoping that this course will continue for several coming years with success and advancement.

7.6 Quality of the presentations

Rated quality of the presentations:

	excellent	**very good**	**good**	**moderate**	**poor**
Wind Resources Ir. H.Snel	10	14	3		
Introduction to wind energy technology Ir. H.Beurskens & Ir. H. Kooijman	4	13	7	2	
Financing Opportunities Ir. A. Dankers	11	7	2	1	
Project Management Ir. J. de Jongh	6	10	9		
Project Management, Case Ir. J. de Boer	20	3	2	1	
Technology Assessment Ir. F. van Hulle	5	13	4		
Design of Wind Farms B. Rajsekhar	13	7	5		
O&M aspects Ir L. Rademakers	4	11	4		
Stand alone Wind Chargers Ir. J.A. de Jongh	1	5	1		
Pre-investment Studies Ir. D. Kooman	12	11	2	1	
Wind Energy Planning Ir. E. van Zuylen	12	10	4	1	
Standards & certificates Ir. H. Hendriks	2	3	14	2	1
Utillity Issues, the Dutch case Ir. G. Hendriks	6	14	5	1	
Implementation Strategies Ir. E. de Vries	2	15	5	3	
Preparing a wind energy development plan for your country; E. de Vries, J. de Jongh, A. van Dijk	1	9	6	2	
Grid connection of Large Wind Turbines/ Ing. J. Knijp	2	3	6	2	

8. CONCLUSIONS AND REMARKS

8.1 Needs

The number of applicants to the course yearly exceeds the available places and possibilities for funding of participants by nearly a factor 3. Together with the reactions and suggestions made by the participants, it can be concluded that the course fulfils a need.

8.2 Target group

The target group identified for this course consists of decision makers of governments, investors, project managers, bank project staff and project developers. Most of the 26 participants of the 2001 course belonged to the specified target group and many are active in wind energy programmes at decision making level. The countries South Korea, Canada, Ireland, South Africa, Venezuela and Israel were represented for the first time.
The participants' presentations gave a good impression of the level and activities of the people. In general, one may conclude that selection has been done carefully and nearly all people were actively working in wind energy. Since implementation of wind energy is progressing in several countries like India, Sri Lanka, Costa Rica etc., the level of experience among representatives from those countries is also increasing. No major language problems were encountered.

The increased entering level of a number of participants also has an influence on their expectations. More than before, they hope to have certain specific questions answered during the course. Many of them are trying to implement wind energy systems in their country and got stuck in some phase of the implementation process, whether it is due to technical, financial, organisational or institutional complications. The course has been adapted, since 2000, to addresses specific questions to a limited extent, by including a tailor made session and by asking participants in advance of the course which specific questions they had. During the course they were directed to specialists which were able to answer their questions. Also, after the course, participants generally know better where to obtain more detailed information.

Many of the potential applicants had good credentials to attend the course. However, it is very difficult to obtain funding even for people engaged in wind energy programmes or projects. Besides the Dutch Government (DGIS- Department of Energy and Ecology), which has substantially supported the course from the beginning, a number of other organisations and companies are found that are willing to contribute. This year again (new) sponsors contributed, but sponsorship remains low.

8.3 Course programme

The increasing variety of needs of the participants makes it difficult to satisfy everybody to the same extent, of which the remarks of the individual participants testify. However, in general, the course was considered well-balanced between the technical and managerial needs of the participants. In general, the scope of the programme was found to be good regarding length, depth and number of topics. The excursions were appreciated as well.
Because of the increasing variety of needs of the participants the course programme has been designed with more flexibility, this year for the second time, which seems to be the right approach.
The development of an outline plan for implementation in their own country, by the participants, which served as an exercise during the course as well as having the plan itself as a result, was in general appreciated and evaluated as an important exercise.

8.4 Location and accommodation

The existing wind energy infrastructure in the Netherlands with experienced wind energy specialists, research institutes, skilled manufacturers, and wind farms located within rather short distances from ECN, justifies that the Netherlands is an excellent location to hold this short course, offering a well balanced programme of good quality.

Although some people expect more luxury, the accommodation in the "recreation-park Carpe Diem" is generally received quite well. For most people it is a new experience that requires some adaptation. After one or two days however, people generally feel very comfortable and more able to create a home than would have been possible in a hotel. Interaction between participants at the bungalow park was limited this year, probably due to the large size of the group.

8.5 Recommendations

It is recommended to continue the course at Petten in the future for the same target group and a similar course programme. The contents should be further fine-tuned and inter-active approach that was introduced should be continued. The increasing demand for specific information should be addressed in the same way as this year with a tailor made session at the end of the course.

It is recommended to set a limit on the number of participants of 24, since a larger group hampers interaction and is too large too give proper individual attention.

Some of the participants do not have a technical background, while others do not have an economical background. It is therefore recommended to develop modules with basic knowledge on these subjects, which should be made accessible to the participants, in advance of the start-date of the course, so that they can already read these modules to be better prepared.

It is recommended to pursue a stronger financial basis to enable updating and improvement of the course, particularly written presentations. One might consider to link up with commercial or non-commercial implementation projects (for example as supported by the Dutch MILIEV, ORET, and Joint Implementation instruments).

9. REFERENCES

[1] Evaluation report of the participants to the 2001 course.

[2] Feasibility study on an international course for the introduction of wind turbines. J.A. de Jongh, RED, 1991.

[3] Course Calendar, International Course on the Implementation of Wind Energy, 2 – 13 April, 2001, ECN-Arrakis

APPENDIX A RESULTS OF THE EVALUATION

Evaluation of the TENTH International Course on the Implementation of Wind Energy, April, 2001. The forms were filled out by 26 or less participants.

General

1. How do you rate the intellectual level of the course?

10 more than expected
10 what was expected
less than expected

2. How do you judge the scope or range of the programme?
2 too much
14 just right
4 could be more

3. Language problems, if any.
10 none
5 not much
5 a little

4. What has been the value of the programme for you personally
18 great value
2 moderate value
0 poor value

5. A relatively new part in the programme were the Forum discussions on April 5th about other renewable energy sources like solar energy and biomass for which you could send in questions earlier. How do you rate this part of the programme.
7 excellent
10 very good
2 good
moderate
1 poor

6 How do you rate the various technical excursions/demonstrations?

6.1. Excursion on April 5th to Wind Farm of Nuon:
12 excellent
7 very good
1 good
0 moderate
0 poor

Any particular comments and suggestions.

- It was great to get inside the large turbine.

- Another, perhaps contrasting wind farm site should be visited.
- If possible, several consultation on wind farm.
- Group should be bigger than 5 people at a time to visit the site. Sometimes I was lost in the group. Small group is better during visiting the site.
- The demonstration contains only the presentation of the project but not the problem or difficulties faced, knowing such thing will be relevant for our experience in future.
- Latest technology of service maintenance was explained.

Lecture at Nuon

3 Excellent
10 Very good
5 good
1 Moderate
0 Poor

6.3. Excursion on April 5th to NEG MICON Holland BV, Rhenen

9 Excellent
8 Very good
3 Good
0 Moderate
0 Poor

Any particular comments and suggestions.

- I had no concept what an assembly facility would look like, so it was great for me.
- If possible, excursion on small WT factory.
- An opportunity to see test procedures would be great.
- Internal construction technology should have been included. During demonstrations we questioned about the Gearbox and the generator, but the demonstration was not in a position to demonstrate or show as an exploded view of a Gearbox or a generator.

5.4. Computer software demonstration at ECN

3 Excellent
6 Very good
6 Good
4 Moderate
0 Poor

Any particular comments and suggestions:

- Break group up into two sessions for more individual attention.
- Have demonstrator go through process first for a preliminary overview.
- Make a clear demonstration. Spend time on it, not 10 minutes. Don't just turn it over to us. We waste most of the time trying to understand the logistics of the programme content and potentially suffered.
- Presentation and practical session was poor. First, a lecture is good before going to practical session.
- This aspect may take more time.
- Utilizing beamer would be of more use.

- Demo CD should be distributed amongst the participants at least with limited access to some of the major parameter determination.
- A little more time would have been useful to demonstrate a couple of contrasting cases, for example, the same turbine in a good location, and a poor location.
- The programme is very important for all of us. A case should be developed in the demo session with all the tools.
- Not more than two people should work on each computer. If possible, each participant should work individually.
- Before we will demonstrate Wind Pro computer, the lecturer should give us the materials, before we do it.
- The time was not more for familiarization with the logic.
- Time is not sufficient. Need a lecture before the exercise. Especially background data should be provided before this. Such as roughness (what it means)

6.5. Excursions to various departments at ECN on April 12th

5 Excellent
11 Very good
4 Good
0 Moderate
0 Poor

Any particular comments and suggestions:
- We can compare the activities in ECN with activities research in our country.
- Still group was big. Not so much chances for introduction with the concerned person. A lecture would be better before going to see the things.
- I had a good opportunity to communicate with biomass department.
- All the gentlemen who represented their department are very very helpful.

6.6 Excursions to ENRON factory on April 12th.

14 Excellent
5 Very good
1 Good
0 Moderate
0 Poor

Any particular comments and suggestions:

- Quite okay. We could ask a lot of things because of smaller group.
- If there is the possibility to get documentation, it will be very good.
- Various aspects of blade manufacture were dealt with in detail.
- Excellent demonstration and now we are fully concerned with the methodology of producing the rotor blades.
- Very kind people.
- Travelling time is somewhat higher.
- I think it is necessary to give to the participants some documentation about the processes in this factory; and general documentation about blades.

7. Did you have sufficient opportunity to communicate with the lecturers?

18 YES
1 NO

Any particular comments and suggestions:
none

8. **Suggestions for changes or adaptations in future, similar programmes**.

- Zoning regulations (restrictions for sites-distance from airports, radar, wildlife areas etc.)
- This entire programme can be continued in the future because this programme is very important for development and implementation of wind energy technology in the world.
- Lecture should be managed in such a way that it should go step by step, not jumping from one area to another which is not relevant. Seat arrangement in the class should not be like in university class. It should be more seminar type-like rectangular, circular etc. Country presentation was quite boring, in most cases long.
- The time given for this course is quite short and I suggest that with similar programmes with much technical detail will be more assimilated if it takes more time. More detailed courses will be very useful for us.
- My personal perspective is that little bit of aerodynamic technology should be included in the course programme.
- Some presentators ran out of time (due to delays as caused by point 7 above). I think a bit more attention should be paid to make sure that the presentator gets through his material.
- If it is possible to have the lecture in a CD version?
- Hope these programmes can continue again, because these programmes are very important for us, especially for developing countries.
- What I think the procedure should be:
- Half an hour lecture on each department.
- Then 2 hours visit to each department.
- Half a day to go and to get data on what each participant is interested in.
- It is necessary to improve the documentation, in some cases only the film was given to us.
- We take too much time for the financial.
- The lecturer's presentation structures and content should be clearly defined to prevent overlapping/ repetitions of certain topics. (Some of the lecturers presented the history and definitions of WT). However it was a very good, fruitful and interesting programme.
- Use of a wind turbine model during technical presentations.
- Try to reduce overlapping issues during various presentations by in advance limiting the content of each presentation.
- Improvement towards practical application particularly the small scale projects, as most

9. How did you get information about this course

7.4. direct mail (the course leaflet)
4 former participant
2 Indirect information. How?
1 advertisement.in Wind Power Monthly
1 Internet site ECN
2 Other Internet sources
1 notice in Renewable Energy World

B. ORGANIZATION AND SOCIAL PART OF THE PROGRAMME

1. The organisation of the course has been:
13 Excellent
4 Very good
1 Good
0 Moderate
0 Poor

2. The social programme and excursion on sunday was:

12 Excellent
4 Very good
1 Good
0 Moderate
0 Poor

3. The lodgings (accommodation) provided was:

7 Excellent
9 Very good
2 Good
0 Moderate
0 Poor

4. The food at the ECN restaurant was:

8 Excellent
3 Very good
4 Good
2 Moderate

5. Space for further comments:

- The final night in Enkhuizen was fantastic. This was the first time I felt like a group. I think that may be the reception that was on the Tuesday night should be in the first week to try and stimulate the group experience. This course was really great. I learned more than I expected in two weeks. I would not hesitate to recommend this course to anybody.
- Thank you for an excellent course, beyond my big expectations of ECN.
- We thank all the persons who have done a great effort in this course.
- Lodging: As the participants have to cook their food in the evening, revision of daily notes had to be postponed. If the food also available during the stay, the participants would have got much opportunity to attend revision during evenings.
- Have an excursion (maybe on the first Saturday to a wind farm cooperative. It is important to understand contracts, loans, etc). It also would help a lot in our countries to have similar mechanisms (more democratic mechanisms) to develop renewable technologies.
- Overall, a great course for me, covered all the topics in overview, which meant that there were no gaps. None of the material was irrelevant, or too difficult to understand, but the pace was not slow either. An excellent course.
- It is good if you spend the first two days to build up the basic knowledge on wind energy (i.e. wind necessity, power, PV curve, design, testing etc).
- Then go for other part such as wind farm designs, financial etc.
- Field trips are very much acceptable. It helps to make confident of participant and application.
- I wish to express my deepest appreciation and thanks to all the staff involved in this programme, with special thanks to Mr. Jos Dekker, Mrs. Lucia Bakker and Mr. Jan de Jongh for their dedicated efforts. Hoping that this course will continue for several coming years with success and advancement.
- The information of this course could be easily spread if the course could be done in each country around the world, because more people can participate.
- I would like to have had the participant's presentations up-front in the beginning of the course. These should be directed to be 10 minutes only and include 1% participant's job/ involvement, 2% participant's own current experience with wind energy. This would give a

better idea to meet and discuss among us on each other's particular experiences. (This would be just a little more valuable than the "Paper on the wall" introduction).

6. How do you rate the relevance (importance) of the subjects treated for your personal function (job)?

	Highly relevant	**relevant**	**neutral**	**Not so relevant**	**Not relevant**
Wind Resources Ir. H.Snel	19	6	1	1	
Introduction to wind energy technology Ir. H.Beurskens & Ir. H. Kooijman	15	9	1	1	
Financing Opportunities Ir. A. Dankers	8	10	3		
Project Management Ir. J. de Jongh	11	11	3		
Project Management, Case Ir. J. de Boer	17	6	2	1	
Technology Assessment Ir. F. van Hulle	14	7	1		
Design of Wind Farms B. Rajsekhar	16	8	1		
O&M aspects Ir L. Rademakers	9	9	1		
Stand alone Wind Chargers Ir. J.A. de Jongh	4	3			
Pre-investment Studies Ir. D. Kooman	16	8	1	1	
Wind Energy Planning Ir. E. van Zuylen	15	11	1		
Standards & certificates Ir. H. Hendriks	3	10	7	1	
Utillity Issues, the Dutch case Ir. G. Hendriks	16	8		2	
Implementation Strategies Ir. E. de Vries	8	10	7		
Preparing a wind energy development plan for your country; E. de Vries, J. de Jongh, A. van Dijk	5	11	2	1	
Grid connection of Large Wind Turbines/ Ing. J. Knijp	11	1	1		

Quality of the programme

1 How do you rate the quality of the presentations?

	excellent	very good	good	moderate	poor
Wind Resources Ir. H.Snel	10	14	3		
Introduction to wind energy technology Ir. H.Beurskens & Ir. H. Kooijman	4	13	7	2	
Financing Opportunities Ir. A. Dankers	11	7	2	1	
Project Management Ir. J. de Jongh	6	10	9		
Project Management, Case Ir. J. de Boer	20	3	2	1	
Technology Assessment Ir. F. van Hulle	5	13	4		
Design of Wind Farms B. Rajsekhar	13	7	5		
O&M aspects Ir L. Rademakers	4	11	4		
Stand alone Wind Chargers Ir. J.A. de Jongh	1	5	1		
Pre-investment Studies Ir. D. Kooman	12	11	2	1	
Wind Energy Planning Ir. E. van Zuylen	12	10	4	1	
Standards & certificates Ir. H. Hendriks	2	3	14	2	1
Utillity Issues, the Dutch case Ir. G. Hendriks	6	14	5	1	
Implementation Strategies Ir. E. de Vries	2	15	5	3	
Preparing a wind energy development plan for your country; E. de Vries, J. de Jongh, A. van Dijk	1	9	6	2	
Grid connection of Large Wind Turbines/ Ing. J. Knijp	2	3	6	2	

2 How do you rate the documentation (texts, brochures, copies of sheets, etc.) of the topics?

	excellent	very good	good	moderate	poor
Wind Resources Ir. H.Snel	7	13	7		
Introduction to wind energy technology Ir. H.Beurskens & Ir. H. Kooijman	4	12	7	3	
Financing Opportunities Ir. A. Dankers	8	8	4	1	

Project Management Ir. J. de Jongh	6	8	6	4	
Project Management, Case Ir. J. de Boer	8	8	9		1
Technology Assessment Ir. F. van Hulle	3	8	4	2	
Design of Wind Farms B. Rajsekhar	6	9	8	1	
O&M aspects Ir L. Rademakers	2	9	8		
Stand alone Wind Chargers Ir. J.A. de Jongh		5	2		
Pre-investment Studies Ir. D. Kooman	10	8	6	2	
Wind Energy Planning Ir. E. van Zuylen	5	12	8	1	
Standards & certificates Ir. H. Hendriks	1	3	15	2	
Utillity Issues, the Dutch case Ir. G. Hendriks	6	13	3		
Implementation Strategies Ir. E. de Vries	1	9	10	3	
Preparing a wind energy development plan for your country; E. de Vries, J. de Jongh, A. van Dijk	n.a.				
Grid connection of Large Wind Turbines/ Ing. J. Knijp	2	3	8		

APPENDIX B REPORTS OF PARTICIPANTS SPONSORED BY THE DUTCH MINISTRY OF FOREIGN AFFAIRS (DGIS)

Introduction

The present document contains the summaries compiled by the participants of the Tenth International Course on the Implementation of Wind Energy who received funding from the Dutch Ministry of Foreign Affairs (DGIS). The course took place from April 2 till April 13, 2001 at the ECN Energy Research Foundation, Petten, The Netherlands.

Report of Mr. Lulamile L. Xate**,** Darlipp, South Africa

1 INTRODUCTION

During April of 2001 from the 2-13 I took part in the annual ECN wind implementation course. My full attendance fees were sponsored and paid for by the DGIS including travelling costs.
My company is presently involved in the development of pilot wind farm in my country. As private individuals we started working in 1996. The progress we have made up to now has been slow due to a number of barriers prevalent in South Africa. However during June 2000 the Minister of Minerals and Energy declared our project to be a "National Wind Demonstration Project" in recognition of its importance in the future development of energy development in South Africa in particular wind energy.

Wind energy is novelty in South Africa and as such the industry does not exist. This means that also the required skill and expertise to implement wind projects is not available. It therefore became important and necessary that I attend the course because I am one of the key players in our company DARLIPP.and in the whole development of the renewable movement in my country as a member of South African Wind Energy Association (SAWEA)

Tell that you have participated to this training course at ECN at Petten from 2 – 13 April 2001 That DGIS have funded your participation etc.
Tell a little bit why it is important to participate in this course.

2 INFORMATION OF THE ORGANISATION

My company DARLIPP (Darling Independent Power Producer) is a small pioneering company of private individual focusing on developing commercial wind farming in South Africa. I am one of the two executive directors of the company with many and diverse responsibilities. Because of the stage of the development of wind energy in my country we have to work at deferent levels and try to address many direct and indirect problems. So apart from leading and managing the company both at providing the strategic input and direction and day to day tasks I am also involved in efforts of trying create a favourable and positive environment for the wind energy in South Africa. This means lobbying and influencing a whole range of decision-makers including government ministers, members of parliament, government officials and other key players in the energy sector.

3 NATIONAL WIND ENERGY PLAN

In South Africa today there are many activities around wind energy and broad renewable energy that are taking place. This most important are the following:

1) NATIONAL RENEWABLE ENERGY STRATEGY PLAN: The department of minerals and energy and its ministry and all other stakeholders are involved in a process of developing a national strategy and framework for the development of renewable energies. This is based on the existing White Paper on Energy that provides for the development of renewables.
2) PLANNING AND IMPLEMENTATION DARLIPP PROJECT: As indicated above our project is a National Wind Demonstration Project. Currently both the DME, DARLIPP, are involved in this project. International support for the project up to now has also been received from a number of organisations including:
3) ESKOM the state power monopoly has announced plans to develop an 8-10 MW test and demonstration farm in the next eighteen months.
4) The Central Energy Fund (CEF) another state owned monopoly that is responsible for acquisition of fuel energy for the government has been given a mandate by the minister of Minerals and Energy to get involved in funding and development of renewable energies. Two months ago the new CEO of CEF

indicated in an interview that CEF will create a division dedicated to renewable energies in line with their new mandate.

There are a number of other behind the scenes efforts that are taking place on a many fronts. The process is slow and complex. It needs a lot of time, effort and commitments. The future of wind energy is great in South Africa.
Indicate which National programme is in operation, or is planned with regard to wind energy for electricity generation.
These programmes may vary from wind measuring to real implementation. Mention targets set, number of MW to be installed by the year

4 PARTICIPANTS PERSONAL ROLE IN THIS PROGRAMME

As indicated above I am essentially involved directly and indirectly in many roles in the above programme.

4.1 As a director of DARLIPP
4.2 As an active member of SAWEA
4.3 Based on the above I participate in all the consultative processes that take place in shaping the future of wind energy in South Africa.
4.4 As lobbist in government and other circles.
4.5 Developing a unified renewable energies umbrella body.

At this point in time South Africa needs generalists who will fight for the wind energy development.

5 CONCLUSIONS AND GENERAL REMARKS

Within the next two years South Africa will be having its first wind farm generating power. Within the next three years we will have legislation and number of regulations and targets for the renewable energies.

Both from the political and economic point of view wind energy carries huge benefits for South Africa and its people. Of utmost importance now is for countries like Holland and institutions like ECN to assist people in South Africa to acquire skills and expertise in all relevant areas. Secondly resources to carry out some of the tasks above are also needed . Again the institutions of Holland should consider supporting these efforts with needed resources. Finally joint ventures with the South African companies should be encouraged at all levels.

The tasks above are many and complex and costly thus effective planning and strategies are needed to ensure success. We are always willing and ready to cooperate to share ideas and initiate projects.

It has been a very useful and enriching course and I gained a lot of knowledge that will help us in South Africa.

Report of Mr. Maged K. Mahmoud**, N**ew & Renewable Energy Authority, Egypt

1. INTRODUCTION

With the support of the Netherlands Ministry of Foreign Affairs, I got the opportunity to participate in the 10th international training course on the implementation of Wind Energy 2001. The training course was held at The Netherlands Energy Research Foundation (ECN) in the period April 2-13, 2001 and was organized jointly by ECN, ARRAKIS and BUREAU NETwerk.

As wind energy is my career, currently I am one of wind energy department staff in New and Renewable Energy Authority (NREA), Egypt. This training course was quite fruitful in providing me with precious knowledge covering a wide spectrum of activities in the depth of the state-of-the-art of the wind energy projects. During the course I become more acquainted with many issues of vital importance to my scope of work including wind resource assessment, planning, pre-investment preparations and wind project development. In addition, invaluable experiences were shared during this course concerning project management and implementation strategies as well as operation and maintenance of existing wind farms.

2. INFORMATION ABOUT THE EGYPTIAN NEW & RENEWABLE AUTHORITY

As a result of the growing interest in renewable energy in Egypt, the New & Renewable Energy Authority (NREA) was established in 1986 to provide the institutional framework for the renewable energy strategy implementation, and to act as a focal point for expanding efforts to develop and introduce renewable energy technologies to Egypt on a commercial Scale. Besides, NREA is also entrusted to coordinate efforts with national, regional and international entities for:

- Renewable energy resource assessment.
- Development and introduction of new technologies.
- Pilot and field testing projects and evaluation.
- Market and economic evaluation studies.
- Technical and environmental feasibility studies.
- Support the formulation of energy labeling program.
- Support of technology transfer and local manufacturing of renewable energy equipment.
- Training of engineers, technicians and users.
- Offering information services as well as developing and implementing information dissemination and public awareness programs.

One of NREA's remarkable achievements is the establishment of the Egyptian Renewable energy development organization (EREDO), as a specialized center which integrates a set of advanced laboratories for testing and certification of renewable energy components and systems. EREDO includes indoor and outdoor laboratories for; solar thermal low and high temperatures, photovoltaic, wind, biomass and energy conservation, as well as resource assessment and environmental measurement facilities.

3. NATIONAL WIND ENERGY PLAN

Securing energy resources on continuos bases is considered of vital importance to Egypt to accomplish sustained national development plans. Egypt's primary energy requirements have significantly increased during the last few years with a rate of increase reaching 6%. In view of Egypt limited proven oil reserves, the government has realized since the early 1980s that conventional energy sources will fall short of satisfying the growing energy needs, thus

requiring other energy resources for establishing an optimum energy mix along with implementing energy conservation measures.

Accordingly, the ministry of electricity and energy had formulated its national strategy in the field of new & renewable sources of energy as an integral part of its global energy strategy. The strategy targets to supply 3% of the countries total primary energy requirement from new and renewable sources of energy (wind, solar and biomass) by the year 2010, and to support the achievement of the a/m strategy the New and Renewable energy authority was established in 1986.

Wind resource assessment

Wind energy utilization was promoted to occupy the top priorities of NREA as it seems the most legible renewable energy source to rely on. Wind energy in Egypt is not a subject of prediction and speculation, it is based on a precise scientific analysis and evaluation of 45 synoptic measuring station that was erected all over Egypt and proved the availability of abundant wind energy of theoretical potential of about 20,000 MW at the western coast of the Suez Gulf. Moreover, about 80,000 MW at south-west of Egypt at East Owienat in addition to northern coast and south Sinai are estimated.

Wind energy program

Encourage by the huge wind potential available in Egypt (average annual wind speed reaches 10 m/s on Gulf of Suez), Egypt has already crossed the phase of limited scale demonstration and field testing projects to the intensive implementation of grid connected large wind farm with local manufacture of some main components (e.g. Blades, Tubular & lattice Towers and other mechanical and electrical parts).

The wind Energy program is to construct 600 MW wind farm in successive stages each stage is about 60 MW capacity. NREA planned that 300 MW shall be jointly financed through the state budget and donor countries, while the private sector (local and foreign investors) are encouraged to finance the other 300 MW under the formula of BOOT or BOO systems.

The first experimental commercial wind farm at Hurghada

The first experimental commercial wind farm consisting of 38 wind turbines with a total installation capacity of 5 MW including different designs and different sizes is running successfully at Hurghada on the Red Sea coast.

Commercial projects at Zafarana

Feasibility studies proved the economical feasibility and technical viability of establishment large-scale grid connected wind farms at the Gulf of Suez, whether to be owned by the Government or private sector. An area of 80 km^2 was dedicated for NREA by a presidential decree for these projects along the Suez Gulf as an institutional support and governmental commitment to the wind energy program. Also a 220/22 kV substation at Zafarana is already established together with 220 kV transmission line for connection of the wind farms to the nearest substation in the national grid.

The first stage of the governmental wind farm projects was inaugurated in March 2001 with a total installation capacity of about 63 MW. This stage comprises two individual projects; the first is 33 MW in cooperation with the Danish Government represented by DANIDA as the 1st

phase of 60 MW wind farm. The contract for the 2nd phase of this 60 MW is expected to be signed this year. The second project is the establishment of about 85 MW wind farm in Cooperation with the German Government represented by KfW. The project is implemented on three phases, the 1st which was inaugurated in March 2001 is 33 MW. The tender document for the 2nd phase (of about 20-25 MW) will be issued this year, while the German side has agreed in principle to finance the 3rd phase.

Currently several wind farms are under negotiation at Zafarana on the Gulf of Suez such as 120 MW wind farm in cooperation with the Japanese government, the 60 MW wind farm in cooperation with the Spanich government and the 60 MW wind farm in cooperation with the Canadian government

Private sector projects

Concerning private sector projects, based on the cabinet ministers' decision, the Egyptian ministry of Electricity and Energy is currently preparing the Request for Proposals (RFP documents) to be issued internationally this year for a 300 MW wind farm in Equal segments to be connected to the national grid and selling the electricity the Egyptian Electricity Holding Company (EEHC) according to a special power purchase agreement (PPA).

Wind Energy projects for generating electricity are expected to continue either in the form of governmental or private sector projects to achieve the long term objective for the installed capacities to reach 1800 MW by the year 2017 located in both the Red Sea Coast and East Owienat.

4 PARTICIPANTS PERSONAL ROLE

As one of NREA's wind department engineering staff, I participate in the main activities of the projects implemented to achieve the strategy. I participated in the preparation of projects proposals and projects preliminary works in addition to tender document preparation as well as evaluation of tenders for the projects: a) the Egyptian/ Danish 60MW wind farm and b) the Egyptian/German 85 MW wind farm. I am also involved in the preparatory works and negotiations for three future projects with Spain, Japan and Canada. Besides, I participate in several studies covering many issues in the field of wind energy development such as Market barriers analysis, Private sector BOOT projects development, Integration of wind Energy with the National Grid, Wind systems for remote and rural areas…etc. Also, I participate in organizing and lecturing in training courses for engineers, technicians and new comers in the renewable energy field.

5 CONCLUSIONS AND GENERAL REMARKS

Through the lectures, presentations, discussions and technical excursions I have the feeling that I become more integrated with the wind technology society. A thorough understanding and a solid knowledge about the most important technical and economical issues that to a far extent can guarantee the successful implementation of wind energy projects have been gained, especially for large scale, grid connected wind farms. The course helped me in improving my professional skills, which will enable me to carry out more effectively and enhance the quality of work performed in the future.

Although the training course period was relatively short, the course was very efficiently organized; topics, lecturers and practical excursion sites were well selected. I 'd like to thank Mr. Jan de Jongh, Dr. Jos Dekker and Mrs. Lucia Bakker for their dedicated and intensive efforts in arranging the training course. I'd like also to express my deepest appreciation to the

Netherlands Ministry of Foreign Affairs and The Netherlands Energy Research Foundation (ECN) for giving me the precious opportunity to attend this excellent course.

Report of Mr. Helmi Priko Nainggolan, Directorate General Electricity and Energy Utilization, Ministry of Energy and Mineral Resources, Indonesia

1 INTRODUCTION

I have participated to this training course at ECN at Petten from 2 – 13 April 2001 That DGIS have funded my participation. I would like to thanks to DGIS that supporting me sothat I have followed this course until finished. And also I would like to thanks to Mrs. Lucia Bakker (Secretary course wind energy) who helped me before going to Netherlands until I arrive and I don't forget to say thanks to Mr. J. de Jongh (Course Director) who accompany us until we finished this course and also Mr. F. Van Hulle (Project Management) who help us especially for the success in this course.

We think that training in wind energy which held by ECN is very important for us, especially for the developing countries like Indonesia. It is necessary to get the knowledgment about technology of wind energy. Especially if we have a plan to make regulation, policies and development regarding with energy utilization. As I know that the technology of wind energy is very useful to be developed. Wind energy are the one of the renewable energy development that environmentally friendly energy supply.

I hope, the Netherlands government can increase cooperate with Indonesia government relate to transfer technology, designing, financing etc.

2. INFORMATION OF THE ORGANISATION

Directorate General of Electricity and Energi Utilization consist of 4 Directorate and 1 Secretariat directorate general:

- Directorate New and Renewable Energy and Energy conservation
- Directorate Technic of Electricity
- Directorate Electricity programme plan
- Directorate Business Supervisory of the electricity
- Secretariat Directorate General.

Directorate General Electricity and Energy Utilization have tasks to make national policies and regulation regarding to electricity and energy utilization.

In Directorate Energy Utilization have activities in several field i.e.: to develop New and Renewable Energy, rural electrification, energy conservation, energy data processing, Energy program. All activities are aimed to sustainable development. To achieve these objectives, Directorate New and Renewable and Energy conservation have National Energy Policies relate to strategic environment, limitation of energy resources and to implement these activities, the government make policies i.e.: Diversification (optimal Energy Mix), Intensification, Conservation (up streams and down stream), Energy Pricing, and environment

Indonesia have annual wind speed is around 3-6 m/sec and wind energy conversion system (WECS) have been installed. Total capacity are 0.5 M Watt. Capacity of wind energy in Indonesia is still low sothat it is necessary to extend wind energy development.

3. NATIONAL WIND ENERGY PLAN

The vision of Indonesia Government is Renewable Energy (RE) develop in small and large to support the national economic development and community welfare, and will be a substitute of energy fossil to support the sustainable energy supply.

Regarding with that vision, the government have the plan to reach the objectives.

a. Short Term:

The development of RE is mainly aimed at securing the basic energy need of society that has not been reached by commercial energy.

b. Long Term:
The development of RE is directed toward having a significant role of national energy supply mix for sustainable energy development.

Wind

- **Objective**

The electricity supply for small scale with the installed capacity 10 kW per unit to rural area and remote area with semi-centralization system.

- To household: 20 W – 100 W per household
- Water pumping for several consumption
- Refrigerator

The middle scale utilization (25 kW-50 kW per unit) with hybrid system: Wind-Solar, or Wind-Diesel to:

- Household electricity and public to 450 W per household.
- Water pumping and irigation
- Potential site: Selayar, Nusa Tenggara Barat (NTB), Nusa Tenggara Timur (NTT).

Pilot project development with large scale (100 kW or 300 kW per unit) with the interconnection system at one site in NTT.

- Objective with short term

Small scale utilization and middle scale to household and public.

- Objective with long term

* Large scale utilization with interconnection system in NTT.
* The availibility of commercial product in wind energy system conversion for several capacity in Indonesia.

- Strategy

- Development strategy
  Technology development as wind electricity supply to priority for wind energy conversion system with simple model, easy to be installed, operated and maintained, and can produce large electricity in area which have annual average wind speed from 3 m/s – 6 m/s. The component, material and equipment are provided in Indonesia market in order to develop local production
- Utilization strategy
  Wind energy conversion system (WECS) according to available potential in site based on wind speed class or available power, i.e.: small scale, middle and large.
  - Middle scale
    Electricity supply with hybrid system wind-solar or wind-diesel
  - Large scale
    Electric supply with interconnection system to local grid.

- Long Term until 2020
  - Dissiminate wind energy utilization which supported by availability for WECS production and private participants and industry.
  - Provide commercial product in WECS which several capacity in Indonesia

4 PARTICIPANTS PERSONAL ROLE IN THIS PROGRAMME

I have been working in New Energy Utilization Division as Head of New Energy Guidance Section. To increase New and Renewable Energy Utilization, we carry out promoting, guidance, training, exhibition, implementation and development. In order to Technology of New and Renewable Energy is known by people, we making socialization to rural area. Beside that in the implementation, we have strategy that have been discussed by stakesholders. These strategies are master plan of New and Renewable Energy (NRE) and Strategic Plan of NRE. To make realization these strategies, we will be doing:

- Develop policies

- Increasing R & D and Demonstration Project
- Develop Financing Scheme
- Increasing the role of Private Sector.
- Information Dissemination
- Market Penetration

5 CONCLUSIONS AND GENERAL REMARKS

- Indonesia government realize that energy fossil consumption will cause the increasing green house gas emission and energy fossil supply is limited reserve sothat Indonesia can not depend to fossil energy for the long time which isn't environment friendly. In the future RE can substitute energy fossil.
- Indonesia has large potential for RE especially for Wind Energy Utilization because Indonesia has thousand islands.
- Increase wind energy development, Indonesia government should cooperate to the other country (multylateral, bilateral, International Organizations) which have experienced, high technology, financing etc.
- For all support, nice cooperation so that I can participate in this course. Particularly I would like to thanks to DGIS who has funded me and also to ECN and the committee.

Report of Mr. Agus Nurtjahjomulyo, National Institute of Aeronautics and Space (Lapan), Indonesia

1. INTRODUCTION

I would like to thank you for the Ministry of Foreign Affairs, Directorate Environment and Development for the sponsorshipment; and Mr. Ir. Beurskens, Unit Manager ECN for the supporting; therefore, I can participate on the International Course of Wind Energy in Netherlands at ECN – Petten from 2 – 13 April 2001. I would like to thank also for Mr. Ir. F. Van Hulle, Project Manager Training; Mr. Jan de Jongh, head of Arrakis; and Mrs. Lucia Bakker, head of Bureau NetWerk that have successful performed this course.

The International Course of Wind Energy is a good course and very important for development and implementation of wind energy technology in the world. In this course we can learn about the basic of wind energy technology, wind energy system, planning of wind energy, technology assessment, project management, investment studies, financing, manufacture & installation , etc. The lecturer of course from the international expert that have experience in the field. The participant of course from several country, therefore, we can be change experience and know the development wind energy technology in each country. Beside that the course also performs excursion to the private company, manufacture of WECS component, wind farm installation, etc, therefore, we can see directly the implementation of wind energy technology.

2. INFORMATION OF THE ORGANISATION

National Institute of Aeronautics and Space (LAPAN) is an institute of government under the Ministry of Research and Technology. The Main program of LAPAN is constitute the research, development and utilization of aerospace. Wind energy technology is one of the aerospace technology spin-off that has also developed as an applied technology directly related to public use. Base on the new organization of LAPAN, valid in 2001, program and activities R & D of wind energy technology are now in the Energy Conversion Division .

The Energy Conversion Division has three main program to development of wind energy technology. These program are follows :

- Monitoring and collecting wind data

  The purpose of this program is to identification of potential location, selection of suitable capacity of wind turbine , and analyze the wind resources.

- R & D the Component of wind turbine

  The purpose of this program is to design and manufacture of several component of wind turbine with use local material, selection of component that suitable with location.

- Utilization and Dissemination of Wind Energy Technology

  The purpose this program is to introduce the wind energy technology on the society, local government, privates etc.

3. NATIONAL WIND ENERGY PLAN

LAPAN have performed the measuring of wind data in several locations potential and prospective in Indonesia. The result of this measurements show that the most of location in Indonesia have annual average wind speed range of 3 – 5 m/s at 10 m of height. Several location have annual average wind speed range of 6 – 8 m/s. Therefore development and utilization of wind energy technology concentrate on small scale of wind turbine (100 W – 10 kW).

Development and utilization of wind energy technology for medium scale (> 10 kW – 100 kW) and large scale (> 100 kW) is one of planning on the future.

The national planning for development and implementation of wind energy on 2000 – 2005 are as follows :

- Continuous of wind measuring at several potential locations in Indonesia
- Making the regional wind map with use the wind map program
- R & D of component prototype of wind turbine for small and medium scale
- Design and manufacture several component of wind turbine with use local material
- Development of project and pilot projects in several location, cooperate with local government, national and international institution
- Cooperate with local industry to manufacture several component of wind turbine

The long term prospect for development and implementation of wind energy technology for electrification in Indonesia is possible, because the conventional energy resources such as oil, coal, natural gas, etc is limited.

4 PARTICIPANTS PERSONAL ROLE IN THIS PROGRAMME

I have been working in LAPAN, especially in the Conversion Energy Division, since 1990 until now. My job is coordinator program monitoring and collecting data. The activities on this program are installation of wind measurement equipment in several locations in Indonesia, processing and analyzing of wind data, and making of regional wind mapping.

5 CONCLUSIONS AND GENERAL REMARKS

- I hope this course can be continued on the future and the substance of course can be applied in our country
- The most matter of course for large wind turbine, little bit small scale wind turbine technology is learned. For the country that have average wind speed is small, development of wind energy technology small scale is very important.
- Supporting and cooperate with institutions which perform development of wind energy technology is very important.

Report of Mr. S.K.R.K. ANANDA, Consultant Engineer, Sri Lanka

1 INTRODUCTION

First of all I would like to offer my grate pleasure to the Netherlands Ministry of Foreign Affairs who gave me this grate opportunity to participate in the 10th international training course on the implementation of Wind Energy 2001. The training course was held at The Netherlands Energy Research Foundation (ECN) in the period April 2-13, 2001. It was organized jointly by ECN, ARRAKIS and BUREAU NETwerk.

I am a mechanical engineer by profession. Now I am working as a freelance consultant for renewable energy. I had some experience on small-scale wind water pumping and electricity generation. But this course made me the path to work in large-scale wind power applications. It is very much useful for me as well as for my country.

Sri Lanka has a long history of small-scale wind applications especially on water pumping (details included in country presentation). In 1978, The Water Resources Board (WRB) started a wind energy program, with assistance from the Consultancy Services Wind Energy Developing Countries (CWD) in Netherlands, to develop and commercialize wind pumps suitable for lift irrigation purposes under Sri Lanka conditions. But large-scale electricity generation from wind is just started.

This training course was very useful in providing me with wide knowledge covering the various topics. During the course I could through on wind resource assessment, planning, pre-investment preparations and wind project development. It was very important to share the invaluable experiences of the experienced project developers during this course concerning project management and implementation strategies as well as operation and maintenance of existing wind farms.

2. INFORMATION OF THE ORGANISATION

Currently I work on part-time basis carrying out activities on renewable energy for several projects. At the same time I am reading for my Masters Degree in Energy Technology at the University of Moratuwa. I have already completed the 1st year (PG Diploma) and the special study topic is " Wind Energy Development in Sri Lanka". My research study is in the field of small wind machines and the topic is "Study on passive control systems used in small scale wind machines; Application to 5kW wind machine".

I am conducting awareness creation programmes on renewable energy for rural communities as a part of the Energy Services Delivery (ESD) Project of the World Bank. (Up to now 42 programmes were conducted.) ESD project is a credit line from the World Bank to the Government of Sri Lanka that supports the use of renewable energy based power systems. (E.g. 3MW pilot wind power project in Sri Lanka comes under this) I do this work for the Sri Lanka Business Development Centre, which is carrying out marketing work for the ESD project. This has being an on going activity since 1998.

3. NATIONAL WIND ENERGY PLAN

Sri Lanka's primary energy requirements have significantly increased during the last few years with a rate of increase reaching almost 10%. Total maximum generating capacity is nearly 1700MW. Peak demand of the country is around 1550MW. 76% of the generation is from hydropower. Rest is from thermal power plants. Most of the large hydropower potentials have already been taped now. A 300MW coal power plant was proposed to built in future. But it is postponing due to the public obligations. Still wind energy contribution to the national grid is negligible.

The situation, however, changed in Sri Lanka in early nineties amidst world-wide concerns about the adverse impact of conventional energy systems on the global climate. For the first

time, the national power utility – Ceylon Electricity Board (CEB) started preparing the ground for a plan to support long-term wind energy development for large-scale electricity generation. As the first step in this direction, CEB embarked on a 3 MW pilot wind power plant in Hambantota with a view to study the implications of integrating wind power into the national power system. Under the Energy Services Delivery (ESD) project, the World Bank has provided 50% of the total cost as loan and Global Environmental Facility (GEF) has provided 17% of the cost as a grant. All the local expenditure was borne by the CEB. The project was commissioned in February 1999.
Currently CEB is purchasing electricity from privet sector people. There are some privet sector investors running their own diesel generators or mini hydro power plant to feed electricity to the main grid. How ever CEB is giving more priority for renewable energy developers.

Wind resource assessment
The history of wind energy measuring goes up to 1911. At the earlier stage it was targeted for mainly agricultural purposes. Wind data is available from 3m up to 50m for a long period. Under the UNIDO project, wind data measuring is going on in several places of the country up to the height of 50m. This was started in 1998. The ultimate target of this project is to develop a wind map for the country.

The pilot wind farm at Hambantota

The first experimental commercial wind farm consisting of 5 wind turbines (each 600kW) with a total installation capacity of 3 MW is running successfully at Hambantota in the Southern coast area.

Project Specifications

Total capacity	3MW
Unit Size	600kW
No of units	5
Site Area	17 ha

Turbine data

Tower height	46 m
Tower type	Steel
Rotor Diameter	43 m
Rotor Speed	18/27 rpm
No of blades	3
Blade Material	glassfiber
Rated wind speed	15 m/s
Control type	Computer
Manufacture	NEG Micon

General Data

Rating	150/600 kW
Type 3 phase Asynchronous	4/6 poles
Speed (rpm)	1000/1500
Nominal Voltage	690 V
Nominal frequency	50 Hz
Operation	Grid connected
Expected Annual Energy (kWh)	4.5 million

Now the second phase of the project in planning stage. Now privet sector investors also show their interest to install wind projects in the country. They are now negotiating with the CEB to put up wind farms in Sri Lanka.

4 PARTICIPANTS PERSONAL ROLE

As a freelance consultant and a student of Master of Engineering energy technology, I can give my inputs to the ongoing activities of the wind measuring and wind farm design for the country. I can participate in the preparation of projects proposals and projects preliminary works as well as evaluation of tenders for the projects. I can involve for the policy influencing activities for wind energy through my university activities as well as awareness creation programmes of ESD (World Bank) project. Also, I participate in organizing and lecturing in training courses for undergraduate of the university as well as engineers, technicians and new comers in the renewable energy field.

In addition, promotion of small wind energy systems for water pumping and battery charging is also one of my main dream. (Because 43% of the total households are still not access to the main grid. Lot of fuel driven engines are been using for water pumping which can be easily replace from a wind water pumping unit.) I work for that also.

5 CONCLUSIONS AND GENERAL REMARKS

In general, this wind energy implementation course is much useful for the future of the wind energy in the world. It was very well organized. By following the lectures, presentations, discussions and technical excursions I have the feeling that I become more knowledgeable person on wind energy. I feel that this course open my mind and the eyes to see the world through wind energy. With a thorough understanding and a good knowledge about the most important technical and economical issues that to a far extent can guarantee the successful implementation of wind energy projects have been gained. This course especially help for large scale, grid connected wind farms.

In addition, This course helped me to improve my professional skills, which will very much useful for me as well as for my country to carryon quality works.

The training course period was relatively short. But the course was very well organized through a busy schedule. Lecturers, topics and practical excursion sites were well matched with the course content.

I would like to take this grate opportunity to thank all the ladies, gentlemen and the organizations involved to make this training programme so successful. Especially I must thank Mr. Jan de Jongh, Dr. Jos Dekker and Mrs. Lucia Bakker for their dedicated and intensive efforts in arranging the training course. I'd like also to express my deepest appreciation to the Netherlands Ministry of Foreign Affairs who gave me this fellow ship to follow this training course. I must thank for The Netherlands Energy Research Foundation (ECN) (including all the department represents who provided more detail on other energy areas also) who is the main body of this training course. I pleasure to express my thanks for the project developers (such as NEG Micon, Nuon) who showed the practical applications of the wind.

Finally I would like to thank all my colleagues (I learn a lot from you, related to the subject as well as other lot of other unquantified things) who came from different countries and associate as a family members.

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Principal(s)	-
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Abstract
This report is an evaluation of the "Tenth International Course on the Implementation of Wind Energy" held from 2-13 April 2001 at the Netherlands Energy Research Foundation ECN in Petten, The Netherlands. This course was organised by ECN in cooperation with Arrakis/RED and Buro Netwerk. It was attended by 26 participants from 16 different countries.

Key words Human Resource Management, Energy Management, Energy Programme, Electricity Supply, Implementation of Wind Energy, Manufacturing, Installation and Monitoring, Operating Experiences, Practical Work, Pre-investment Studies, Project Management, Standards and Certificates, Technology Assessment, Training Course, Wind Electric Battery Chargers, Wind Energy, Wind Farm design, Capacity building

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