INTERNATIONAL ENERGY AGENCY

Programme of Research and Development
on Wind Energy Conversion Systems
(IEA R&D WECS)

ANNUAL REPORT 1985

A report by the IEA R&D WECS Executive Committee

January 1986

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FOREWORD

This is the eighth Annual Report of the IEA Programme for Research and Development on Wind Energy Conversion Systems (IEA R&D WECS) reviewing the progress during 1985. It is submitted to the IEA in accordance with the recommendations of the IEA Committee on Research and Development. The report is edited by the Secretary of the Executive Committee with contributions from the Operating Agents.

B Maribo Pedersen
Chairman of the
Executive Committee

B Pershagen
Secretary of the
Executive Committee

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EXECUTIVE SUMMARY

The IEA Programme for Research and Development on Wind Energy Conversion Systems (IEA R&D WECS) started in 1977. Thirteen parties from twelve countries (Austria, Canada, Denmark, Germany, Ireland, Japan, the Netherlands, New Zealand, Norway, Sweden, United Kingdom and United States) are participating.

During 1985 Spain and Switzerland have declared their intention of signing the Implementing Agreement. Interest of joining the Programme has been expressed from Belgium and Italy. Observers from these countries as well as from the Commission of European Communities participated as observers in IEA R&D WECS Executive Committee meetings. Formal notice of withdrawal was given from the Canadian and one of the UK Contracting Parties.

The IEA R&D WECS programme comprises nine Tasks, six of which have been completed. Current Tasks include Task VII Study of Offshore Wind Energy Conversion Systems, Task VIII Study of Decentralized Applications for the Use of Wind Energy, and Task IX Intensified Study of Wake Effects behind Single Turbines and in Wind Turbine Parks. All current projects are task-sharing, i.e. the participating parties are committed to in-kind contributions to an agreed programme co-ordinated by an Operating Agent. The Central Electricity Generating Board (UK) is acting as Operating Agent for Task VII and Task IX, and the UK National Engineering Laboratory for Task VIII.

Substantial progress is reported from the ongoing Tasks during 1985. USA entered Task VII taking the lead on structural dynamic studies addressing the problem of analyzing structures excited by random wind and wave loads. National studies of offshore wind power stations were reported from Denmark, Sweden and the United Kingdom. Sweden produced draft design specifications for an offshore WECS prototype.

Task VIII has attracted considerable interest also from countries not yet signatories to the IEA R&D WECS Implementing Agreement. Two meetings were held during the year to discuss in detail the two Subtasks: A. Site Evaluation Techniques for Small Decentralized System and B. Wind Diesel Investigation.

A workplan for Task IX was prepared and agreed to by the Executive Committee. The workplan includes full-scale wake and interaction measurements on single wind turbines and clusters of turbines in Denmark, the Netherlands, Sweden, United Kingdom, and United States, as well as wind tunnel and theoretical studies. The programme will run for five years to be completed in 1989.

In addition to the Tasks, which are governed by Annexes to the Implementing Agreement, the Executive Committee has established a Standing Committee for Recommended Practices for Wind Turbine Testing and Evaluation. The Standing Committee issues and reviews a series of documents prepared by international expert groups. During the year three workshops were held. Decision was taken to publish preliminary reports on Electro-

magnetic Interference and Safety and Reliability. Revised versions of Vol 1 Power Performance and Vol 4 Acoustics are in progress.

During the report period the Executive Committee initiated Joint Actions on Aerodynamical Calculational Methods and Fatigue Characteristics and Load Spectrum Definition. Among the discussed proposals for new co-operative action, a draft Annex was prepared on Systems Interaction, i.e. wind turbine - utility system interaction.

THE IEA R&D WECS PROGRAMME

This report reviews the progress during 1985 of the Programme of Research and Development on Wind Energy Conversion Systems (IEA R&D WECS) initiated in 1977 under the auspices of the International Energy Agency. IEA R&D WECS is one of two IEA projects in wind energy. The companion programme is directed to Co-operation in the Development of Large-Scale Wind Energy Conversion Systems (IEA LS WECS) and is reported separately.

The general objective of IEA R&D WECS is to undertake collaborative research and development Tasks as defined in Annexes to the Implementing Agreement. To-date nine Tasks have been initiated, six of which have been completed:

Task I Environmental and Meteorological Aspects of Wind Energy Conversion Systems
Operating Agent: National Swedish Board for Energy Source Development
Completed in 1981

Task II Evaluation of Models for Wind Energy Siting
Operating Agent: U.S. Department of Energy
Completed in 1983

Task III Integration of Wind Power into National Electricity Supply Systems
Operating Agent: Kernforschungsanlage Jülich GmbH, Germany
Completed in 1983

Task IV Investigation of Rotor Stressing and Smoothness of Operation of Large-Scale Wind Energy Conversion Systems
Operating Agent: Kernforschungsanlage Jülich GmbH, Germany
Completed in 1980

Task V Study of Wake Effects behind Single Turbines and in Wind Turbine Parks
Operating Agent: Netherlands Energy Research Foundation
Completed in 1984

Task VI Study of Local Wind Flow at Potential WECS Hill Sites
Operating Agent: National Research Council of Canada
Completed in 1985

Task VII Study of Offshore WECS
Operating Agent: Central Electricity Generating Board (U.K.)
To be completed in 1986

Task VIII Study of Decentralized Applications for Use of Wind Energy
Operating Agent: National Engineering Laboratory (U.K.)
To be completed in 1987

Task IX Extended Wake Effect Studies
Operating Agent: Central Electricity Generating Board
To be completed in 1989

There are thirteen Contracting Parties to the Implementing Agreement representing twelve countries. The countrywise participation in current Tasks is shown in Table 1.

In the current Tasks the participants contribute manpower and work usually in their home countries to a joint programme coordinated by the Operating Agent (OA). The total level of effort is typically about 10 manyears per Task.

In addition to the Tasks the Executive Committee has established a Standing Committee for the preparation, publication and review of a series of documents on Recommended Practices for Wind Turbine Testing and Evaluation. In 1985, the

Table 1
Participation in current Tasks

Country	Task VI	VII	VIII	IX
Austria				
Canada	OA			
Denmark	x	x	x	x
Germany	x			
Ireland				
Japan				
The Netherlands		x	x	x
New Zealand	x		x	
Norway				
Sweden		x	x	x
United Kingdom	x	OA	OA	OA
United States		x		x

Executive Committee also initiated Joint Actions on Aerodynamical Calculational Methods and on Fatigue Testing and Load Spectrum Definition.

The progress of the current Tasks, the activities of the Standing Committee, and the Joint Actions are briefly reviewed in the following sections.

TASK VI STUDY OF LOCAL WIND FLOW AT POTENTIAL WECS SITES

The primary objective of this Task, which was technically completed in 1984, was to carry out a major co-operative field experiment to measure in detail the spatial characteristics of mean wind and turbulence over a typical WECS hill site, and to assess the accuracy with which the measured wind flow could be modelled physically (i.e. in wind tunnels) and mathematically.

The participants were Canada, acting as Operating Agent, Denmark, Germany, New Zealand and United Kingdom. Detailed plans were formulated and a site selected in April 1982. Field experiment were carried out in September-October 1982 and September-October 1983 at the Askervein Hill located on the island of South Uist in the Outer Hebrides.

The first field experiment concentrated mainly on mean-flow measurements, while both mean-flow and turbulence results were of major interest in the second main experiment. A total of over 55 towers were deployed on the hill during the experiments ranging in height from 3 to 50 m. In addition, tethered-kite and balloon measurements allowed some profiles to be obtained to as high as 1000-2000 m or more. About 25 scientists and technicians from 6 institutes in 5 countries participated in the experiments.

The wind tunnel simulations were carried out in three laboratories (Atmospheric Environment Service (AES) in Canada, the University of

Canterbury in Christchurch, New Zealand, and the University of Oxford, UK) at three different length scales (1:1200, 1:2500 and 1:800, respectively). In addition to basic testing of each model in its home facility, a model exchange programme is being undertaken in which the smaller models will also be tested in the larger wind tunnels.

Mathematical modelling has been underway for several years at AES on development and improvement of a simple, linearized model of boundary-layer flow over low hills.

As a general result of the Task an extensive, reliable full-scale data set is available describing mean flow and turbulence structure in atmospheric boundary layer flow over a typical WECS hill site. The data have been used to validate mathematical and wind tunnel models. The models may be applied to candidate sites for screening or ranking purposes.

Mean-flow speed-up ratios of 50 to 60 % were observed in the range of 10-20 m above the hilltop. Maximum speed-up ratios of up to 120 % occur very close (2-3 m) to the surface. A sample result is presented in Figure 1 showing vertical profiles of mean wind speed obtained at the hilltop (HT) and an upwind reference site (RS) well away from the influence of the hill.

A list of relevant publications to date is presented below. The final Task report is nearing completion.

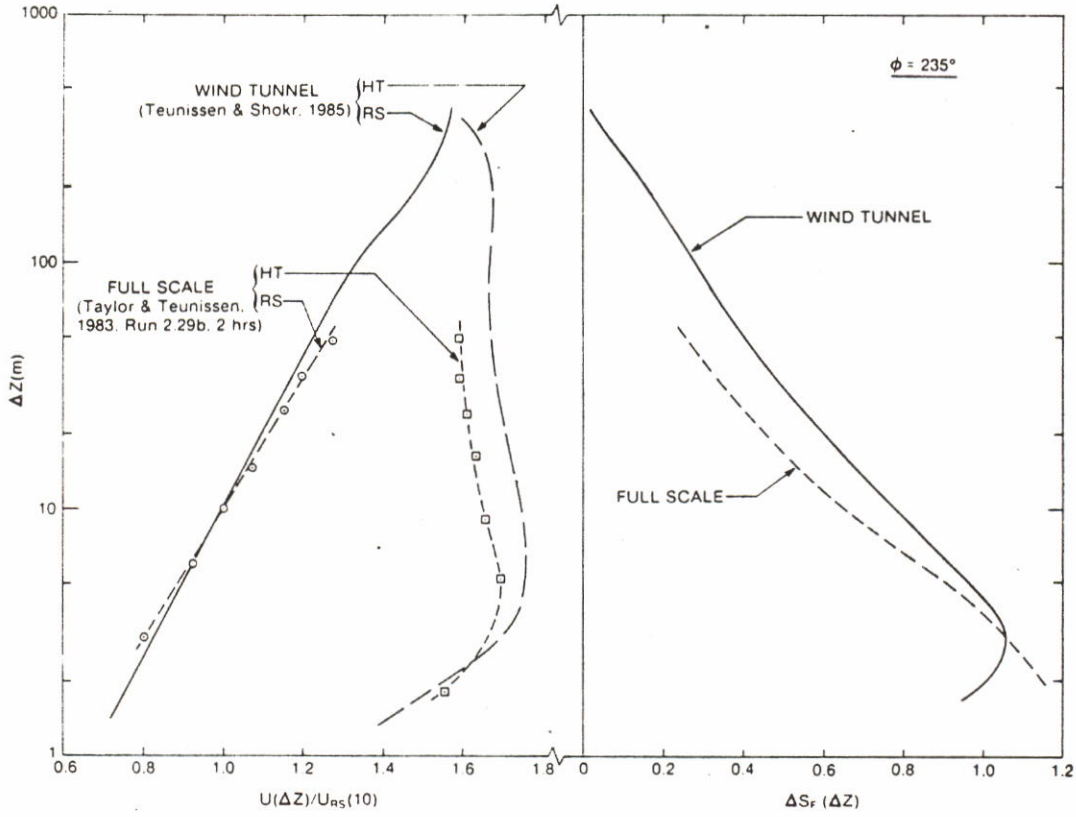

Figure 1 Profiles of mean speed and speed-up ratio in wind tunnel and full-scale at $U=8.3\ ms^{-1}$ and $\emptyset=235^{o}$.
The speed-up ratio is defined as

$$\Delta S_F = \frac{U_{HT}(\Delta z) - U_{RS}(\Delta z)}{U_{RS}(\Delta z)}$$

List of publications

1 Taylor, P.A. and Teunissen, H.W. (1983): Askervein '82: Report on the September/October 1982 Experiment to Study Boundary-Layer Flow over Askervein, South Uist. Report MSRB-83-8, Atmospheric Environment Service, Toronto, November, 1983

2 Taylor, P.A. and Lee, R.J. (1984): Simple guidelines for estimating wind speed variations due to small scale topographic features. Climatological Bulletin, 18 (2), 3 (1984)

3 Walmsley, J.L. and Salmon, J.R. (1984). A Boundary-Layer Model for Wind Flow Over Hills: Comparison of Model Results with Askervein 1983 Data. Proc. European Wind Energy Conf., 22-26 Oct., 1984, Hamburg, W.Germany

4 Taylor, P.A. and Teunissen, H.W. (1984): Estimation of Design Wind Speed Variations due to Small-Scale Topographic Features. Proc. 4th Can. Workshop on Wind Engineering, Nov. 19-20, 1984, Toronto, Canada

5 Taylor, P.A., Teunissen, H.W. and Johnson, R. (1985): The Askervein Experiments. Proc. 7th British Wind Energy Assoc. Conf., Oxford, U.K., Mar. 27-19, 1985

6 Teunissen, H.W. and Shokr, M.E. (1985): The Askervein Hill Project: Wind-Tunnel Simulation (Smooth Model) at Length Scale 1:1200. Research Report MSRB-85-1, Atmospheric Environment Service, Toronto, Canada, April, 1985

7 Taylor, P.A., Walmsley, J.L. and Salmon, J.R. (1985): Guidelines and Models for Estimating Wind Speeds at WECS Sites in Complex Terrain. Proc. INTERSOL '85, Montreal, Canada, June, 1985

8 Taylor, P.A. and Teunissen, H.W. (1985): The Askervein Hill Project: Report on the Sept./Oct. 1983 Main Field Expt. Research Report MSRB-84-6, AES, Sept. 1985 (to appear)

9 Teunissen, H.W. and Taylor, P.A. (1985): The Askervein Hill Project: Full-Scale Measurements and Model Comparisons of Wind Flow Over an Isolated Hill. Proc. Fifth U.S. National Conference on Wind Engineering, Lubbock, Texas, Nov. 6-8, 1985

10 Teunissen, H.W. and Shokr, M.E. (1985): Wind-Tunnel/Full-Scale Comparisons of Boundary-Layer Flow Over Askervein Hill, Scotland. Proc. Asia Pacific Symposium on Wind Engineering, Roorkee, India, Dec. 7-8, 1985

TASK VII STUDY OF OFFSHORE WIND ENERGY CONVERSION SYSTEMS

At the fifteenth Executive Committee Meeting, held in Dublin on 1 April 1985, the revised Annex VII was approved to include the changes necessitated by the entry of the US Department of Energy to the Annex, who will be responsible for the additional Subtask E, Structural Dynamics Studies.

A revised programme was agreed at the Annex VII meeting in San Francisco on 22 August 1985. The deadlines for the various task reports are as follows:

Subtasks A and C	March 1986
Subtasks B, D and E	September 1986
Final report	December 1986

Substantial progress is being made towards meeting these deadlines. An outline of the final report is being prepared and it is hoped that this will be circulated for comment before the end of 1985.

UK(CEGB) are preparing an intercomparison of the various national studies which will be made available in due course.

Subtask A: Data Collection and Compilation (Meteorology)

Four major reports from the UK are now available to participants and Sweden has also issued a number of publications. Denmark has also made results available through the Riso National Laboratories. A summary report is being prepared by the UK which will be circulated for comment. This task is, apart from the summary report, substantially complete.

Subtask B: Conceptual Design of an OWECS Power Station

All participants, except the USA, contributed to Subtask B through their respective national studies and reports. Upon availability of the relevant reports a comparative study will be performed in order to assess general economic viability as well as to draw conclusions on characteristics, feasibility and costing of support structures, marine operations and maintenance.

Relevant reports in full are available from Sweden, concerning a concrete and a steel structure, the study from Denmark, on a concrete structure, is now available. The studies from the United Kingdom have been completed: the executive summary was made available in November 1985. The UK studies concentrate on a concrete structure, but include steel options as well. The Netherlands studies on steel structures are being carried out and will be completed in Spring 1986.

The Subtask coordinator will, after receipt of the various reports, initiate a comparative study. Early in 1986 an expert meeting will take place in order to plan and organise the comparative study for completion in June 1986.

Subtask C: Development of Design Specification

Sweden has produced a draft specification which was distributed in February 1985 to participants for comment. This Subtask is nearing completion, and there should be no difficulty in making the deadline of March 1986.

Subtask D: Generic Studies

Due to the nature of the subject, little has been done on this task. Participants have been asked to identify the required studies to Denmark and to provide results when available. Completion of the Subtask is completely dependent on these results.

Subtask E: Structural Dynamics Studies

Sandia National Labs have been addressing the problem of analysing structures excited by random wind and wave loads with the goal of performing structural dynamic analysis of wind turbines supported by offshore platforms subjected to ocean environments. The basic tool is a SNL-developed code for horizontal axis wind turbine (HAWT) structural analysis known as HAWTDYN. HAWTDYN is a finite element code which utilizes NASTRAN to analyze a HAWT as a rotating structure (the rotor) attached to a non-rotating structure (the tower) subjected to stochastic winds. HAWTDYN accurately predicts the natural frequencies, teeter response to wind shear, and mean and cyclic flapwise bending moment for the rotor blade of the US MOD 2 HAWT (300 ft. dia., 2.5 MW rated power). Given the wind and wave loading of the elements of the turbine and support structure modes, HAWTDYN can determine the structural time response of the model elements in terms of element displacements, velocities, accelerations, loads and stresses.

As of September, 1985, a code (based upon linear wave theory) to generate random wave velocities and accelerations has been written, and HAWTDYN has been modified as necessary to accept loads resulting from these wave velocities, apply them to a turbine/platform model, and determine the

model response. Tasks to be completed include a linearization of Morison's equation to calculate the structural wave loadings, incorporation of a turbine support structure finite element model into the structural response under various wind and sea conditions. Several points were made at the Annex VII meeting which will require careful study. The placement of offshore platforms will probably be in 10 to 15 meters (33 to 50 feet) of water, so the use of linear wave theory may not be appropriate. This will be reviewed, the limitations in fetch length and wind velocity determined and noted, and the use of shallow water theories investigated. In addition, the use of Morison's equation may not be valid as concrete gravity support structures several meters in diameter may be used. In this case, the structure would be expected to have a significant effect on the wave motion in the vicinity of the structure. The use of diffraction wave theory to determine forces on the structure will be investigated. A list of information needed by the US to complete this Subtask has been assembled and sent to the Annex VII participants. They, in turn, will supply the US with the necessary information so that this Subtask may be completed.

Work Beyond Completion of Task VII

At the Annex VII meeting in San Francisco, it was felt that a continuation of present work in the form of information exchange and an intercomparison of the results of national studies could be fruitful. It was agreed that future work should be discussed at the next meeting.

TASK VIII STUDY OF DECENTRALIZED APPLICATIONS FOR USE OF WIND ENERGY

In the Spring of 1985 there was a change in the Operating Agents for this Task from ERA Technology Ltd to the National Engineering Laboratory - UK

Two meetings have been held since then to discuss in detail each of the two Subtasks in order to set down an agreed work programme. Formal participation agreements have been made on behalf of Denmark, Netherlands, New Zealand and Sweden. However these meetings were also attended by delegates from Canada, Italy, Spain, Switzerland and United Kingdom, who are intending to participate. USA, Japan and Ireland have also expressed interest.

Subtask A: Site evaluation techniques for small decentralised systems

The definition of the content of this Subtask has been the subject of considerable discussion and there still remains several questions relating to the technicalities of the subject, some of which required to be referred back to experts on meteorological matters.

It was agreed however that the ultimate objective should be towards the publication of a recommended practice on site selection. This by the nature of the problem would be aimed at various levels of readership and various levels of complexity and accuracy dependent on wind data available.

A Working Group from UK and NL will draw up a proposal document for circulation and comment by the others by the end of 1985.

Subtask B: Wind diesel investigation

A great deal of discussion has taken place on this topic to reach commonly agreed objectives. Previous meetings in 1984 had proposed a comparison of models for system evaluation, however due to the specific nature of individual models this may be a difficult task and rather than try simply to optimize models an approach to encompass the development of planning, designing and testing guidelines was forwarded. A Working Group coordinated by DK involving UK and NL are drawing up a discussion paper by February 1986 for consideration and comment by the others.

Meetings to discuss the working papers and arrive at an agreed programme are scheduled to take place on 28/29 May 1986 at Riso, Denmark with a further meeting in the Autumn.

TASK IX INTENSIFIED STUDY OF WAKE EFFECTS BEHIND SINGLE TURBINES AND IN WIND TURBINE PARKS

A technical meeting was held in London on 7-8 March 1985 when a workplan was prepared. The workplan and corresponding commitments were agreed to at the EC Spring meeting. The workplan includes full-scale measurements in Denmark, the Netherlands, Sweden , United Kingdom, and United States, as well as wind tunnel studies (the Netherlands, UK) and theoretical studies (the Netherlands, Sweden, UK).

Formal notice of participation has not yet been provided by all the participating countries (United Kingdom, Netherlands, Sweden, United States) as minor contractural details are still under discussion. It is hoped that the remaining formal assents will be given shortly. Belgium is considering participation in the Annex.

Denmark

When both Nibe machines are in operation, wake studies will be carried out as part of the general measurement programme. It is possible that measurements from the cluster of five 750 kW machines at Masnedø will also be included in the study.

The Netherlands

The wake of the 25 m, 300 kW rotor at Petten will be measured using four masts. The data will be correlated with measurements of performance on the rotor, with the machine operating in various control modes. Supporting studies using a wind

tunnel model will include measurements of tower and nacelle wakes. Further development of an eddy viscosity wake model is planned, taking measurements at Petten and Nibe into account.

Sweden

Experimental measurements of wake characteristics, made at a number of locations, will be processed and analysed, taking the performance of the rotor into account. A theoretical analysis of the development of the wake close to the rotor will also be made and predictions compared with experimental data.

United Kingdom

Single and interactive wake data are being obtained from the 22 m, 300 kW and the 20 m, 250 kW wind turbines on Orkney spaced 138 m (7 D) apart. Data includes wind measurements at 6 levels on three 30 m masts, machine parameters and blade strains. Analysis procedures developed for the Nibe project will be used to assess the data.

Model studies, supporting the full scale experiments, have been made in the wind tunnel at Loughborough University of Technology using laser Doppler anemometry. Recent studies have concentrated on wake superposition studies and the turbulence properties of wakes. Several 15 cm diameter rotating blade models have been constructed and their wake properties have been investigated. It is now hoped to measure experimentally the effect of wake velocity gradients and turbulence on the mean power and power quality of a second downstream model turbine. A recent theoretical study has

analysed energy losses and turbulence levels in an array of 320 turbines for an offshore study. The overall energy efficiency was higher than expected, reflecting the reduced losses above rated windspeed.

United States

Testing of the three 2.5 MW turbines at Goodnoe Hills resumed in May. Wake interaction tests have been carried out, with the upwind turbine(s) alternately turned on/off to observe wake effects. Recordings have been made on seven 32 m towers and two tall meteorological towers. Data analysis has commenced, including simulations using flow models.

RECOMMENDED PRACTICES FOR WIND TURBINE TESTING AND EVALUATION

The fifth meeting of the Standing Committee held in Copenhagen on 14 June 1985 agreed to publish preliminary reports on Electromagnetic Interference and on Safety and Reliability in the series of documents on Recommended Practices. Revised versions of Vol 1 Power Performance and Vol 4 Acoustics are in progress.

A subcommittee meeting on Fatigue Characteristics was held in Petten on 15-16 April 1985 for evaluation of Vol 3 in the series of documents and discussion of a reference load sequence for fatigue testing of wind turbine blades. The desirability of a cooperative effort for defining a reference load sequence was recognised. The National Aerospace Laboratory (NLR) of the Netherlands will propose a data format and collect data from the participants.

A workshop on Safety and Reliability was held in Copenhagen on 12-13 June 1985. A preliminary review paper concentrating on structural aspects was presented by the Dutch delegate as were papers of national work by participants from Denmark, Germany, Sweden and United Kingdom. Based on the results of the workshop a paper was prepared for the Windpower '85 Conference in San Francisco on 27-30 August, 1985.

JOINT ACTION ON AERODYNAMICAL CALCULATIONAL METHODS

At an expert meeting in October 1984 in Copenhagen three major areas of research were identified:

- Aerofoil characteristics appropriate for wind turbine blades
- Unsteady aerodynamics
- Development of aerofoil sections for specific wind turbine applications, e.g. stall regulations

To exchange information and co-ordinate planned research the Executive Committee agreed to establish a Joint Action on Aerodynamical Calculational Methods at the Spring meeting 1985. Some exchange of information took place during the year. A first meeting will be arranged in early 1986.

JOINT ACTION ON FATIGUE TESTING

The Executive Committee agreed at the Fall meeting 1985 to set up a Joint Action on Fatigue Testing in order to co-ordinate research. A primary task will be to define a reference load spectrum. An expert meeting was held in Stuttgart/Schnittlingen on 28-29 November.

PROPOSALS FOR NEW CO-OPERATIVE ACTION

The following proposals for new cooperative action were discussed by the Executive Committee:

- Extension of Annex VI
- Systems Interaction
- OPTIWA Phase III
- Environmental Aspects

Annex VI could logically be extended to cover wind flow over irregular terrain to improve and/or validate models for WECS siting in the wake of flow obstacles. Further discussion of the proposal was deferred to the EC Spring meeting 1986.

The US Contracting Party prepared a draft Annex on Systems Interactions, i.e. wind turbine - utility system interaction. The interactions fall into two categories:

(1) microimpacts of individual wind turbines or at small penetration in local networks

(2) macroeffects on the electric system at large penetration

A workshop to discuss the proposal was held in Honolulu on 21 August 1985, attended by experts from Denmark, Germany and USA. Enough interest was expressed to warrant further efforts of organizing a task-sharing programme.

OPTIWA is a German project for the optimization of WECS by development of reliable predictive methods and validation of the methods in a versatile test wind turbine. Phase 1 of the project was subject to IEA cooperation in Annex IV. Phase 2 was a purely German undertaking completed in 1985. In

the Spring meeting of the Executive Committee phase 3 was offered open for participation of the IEA R&D WECS Contracting Parties. However, the EC concluded that the prospects were small for a new Annex at the present.

Environmental Aspects will be subject to a workshop in the UK in the Spring of 1986 in order to identify research issues for a possible cooperative effort.

ACTIVITIES OF THE EXECUTIVE COMMITTEE

The 15th Executive Committee meeting was held on 1 April 1985 at the Kinsealy Research Centre, Dublin, Ireland. The 16th meeting took place in San Francisco, California, on 23 August 1985 in connection with the Windpower '85 Conference.

At the 16th meeting Mr D Ancona (USA) and Dr R H Taylor (UK) were elected Chairman and Vice-Chairman for 1986. Some changes of members and alternate members were announced. A revised list is attached.

In response to interest shown in the activities of the Executive Committee, representatives of the Commission of European Communities (CEC), Italy and Switzerland were invited as observers to the 15th meeting, and of Belgium, CEC, Italy, Spain and Switzerland to the 16th meeting. Representatives of the CEC and Switzerland attended the 15th meeting, and of Belgium, Italy and Switzerland the 16th meeting. Official information was received indicating the Spanish intention of entering the IEA R&D WECS Agreement and of participating in Annex VIII.

During the year the National Research Council of Canada gave formal notice of withdrawal as a Contracting Party to the Agreement, effective 31 March 1986. Similarly, ERA Technology Ltd gave notice of withdrawal as a UK Contracting Party, effective 11 June 1986. Thereafter the Central Electricity Generating Board will become the sole UK Contracting Party to the Agreement.

At the request of the Royal Ministry of Petroleum and Energy of Norway and by unanimous agreement of the Executive Committee, the Institute of Energy Technology was replaced by the Directorate of Energy as the Norwegian Contracting Party to the IEA R&D WECS Agreement.

The status of current Tasks and other joint activities were reviewed at the Executive Committee meetings and the appropriate decisions taken. Proposals for new cooperative actions were discussed. The draft Annex IX as amended was approved at the 15th meeting, and the revised Annex VIII at the 16th meeting.

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