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- NR8 Wind diesel project in El Cuy Argentine Patagonia.
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- NR9 The research and development of wind turbine generator systems in Japan.
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- A2 This paper has been withdrawn.
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- A12 This paper has been withdrawn.
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- A14 This paper has been withdrawn.
- A15 This paper has been withdrawn.
- A16 This paper has been withdrawn.
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- B10 Calculation of velocity deficits in the wake of a WECS.
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- C2 Additional loads caused by ice on rotor blades during operation.
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- C4 Aerodynamic measurements on a small HAWT rotor in axial and yawed flow.
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- D2 Aerodynamic and aeroelastic analysis of wind turbines.
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- D3 Validation of the aeroelastic simulation program for horizontal axis wind energy converters.
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- D4 Dynamics of a stall regulated horizontal axis wind turbine using a non-linear time domain model.
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- D5 Rotor loading - the influence of dynamics.
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- D6 Effect of coning and tilt angle on HAWT.
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- D7 Investigation of HAWT and VAWT aerodynamics for large WEC design.
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- D8 Fatigue testing of GL-EP in wind turbine rotor blades.
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- D9 Blade and rotor geometry optimization on vertical axis wind turbine.
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- D10 Fatigue loads of water pumping windmills.
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- D11 Frequency responses of upward tilt-controlled wind turbine to wind speed direction changes.
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DESIGN LOADS, STRESSES AND RELIABILITY

- E1 Comparison of standards for wind turbines - overview.
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- E2 This paper has been withdrawn.
- E3 This paper has been withdrawn.
- E4 Development of structural condition monitoring techniques for composite wind turbine blades.
B.R. Clayton, Nottingham University; N. Aftab, L.J. Bond, University College London; A.G. Dutton, A. Irving and N. Lipman, Rutherford Appleton Lab., U.K.
- E5 This paper has been withdrawn.

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- E7 Experimental and design methods of studies of wind turbine aerodynamics.
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- E9 Uncertainties in energy production forecasting.
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- E12 Recommendations for a European wind turbine standard load cases.
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- E14 This paper has been withdrawn.

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- E18 The influence of fatigue design line criteria on the rotor blade design.
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- F2 Experience with utility windfarms in Western Denmark.
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- F3 Main results of the research programme of the Dutch experimental windfarm.
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- F4 Hacia un parque eolico de 50 MW en el sur de España.
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- Part 1. Technical concept analysis.
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Consultants to ECN, The Netherlands.
- Part 2. Manufacturing cost analysis.
R. Harrison, G. Jenkins. A.N. Macrae, Sunderland Polytechnic, U.K.
- Part 3. Site and installation costs. Operation and maintenance costs.
P. Nielsen, DEFU, Denmark.
- Part 4. Energy cost analysis and conclusions.
E. Hau, ISET, Germany.
- F5 This paper has been withdrawn.
- F6 This paper has been withdrawn.
- F7 Monte Ahumada project. (In Spanish. English summary)
T. Bolado, A. Vilas, J.L. Soler, A. Garrido and V. Bencomo, ENDESA, Spain.
- F8 This paper has been withdrawn.
- F9 Yorkshire Water's developments of wind energy generation.
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- G2 The commissioning and early operation of the 1 MW wind turbine at
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- G3 Operation and maintenance experiences and test results from the AWEC-60
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- G7 Operational experience with the Wind Energy Group's MS-2 and MS-3 wind
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- G8 Commissioning and first demonstration activities on the single blade
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- G9 Demonstration of a 1000 kW stall regulated wind turbine for experimental
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- G10 LS1 performance.
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- G11 Operating experience with the Tjaereborg wind turbine, 1989-1990.
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- H4 The development of advanced rotor systems: a survey of the FLEXHAT program including full scale results.
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- H5 A theoretical investigation of the impact of pitch control on the fatigue of wind turbines.
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- H7 Development of composite blades for megawatt size wind turbines.
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- H8 This paper has been withdrawn.
- H9 The operating characteristics of mechanical governor for a variable-speed wind turbine generator.
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O. Skarstein, SEM Saela Ndsvet', Norway and P.D. Lund, NEMO, Finland.
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- J3 Operation experience of wind/diesel system on Dachen Island in P.R.China - EEC and China co-operation project.
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- J4 Computer-aided assessment of maximum wind generation capability of isolated electric power systems.
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- J5 Operational advantages from the use of AC/DC/AC interface for the connection of wind turbines in diesel power systems.
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National Technical University of Athens, Greece.
- J6 Desarrollo y ensayo de un sistema hibrido eolico-diesel.
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J. Pascual Tortella, Gas y Electricidad SA, Spain.
- J7 Optimization technical-economic of the desalination system worked by wind energy.
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- J8 Studies on hybrid generation system of horizontal axis wind turbine and diesel engine.
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- J9 Characteristics of the power output of wind farms and large scale dispersed wind energy systems.
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- J10 Wind energy conversion schemes and electric power supply quality.
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M. Lodge, Resource Ventures Inc., Canada.

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- K2 Wind power park. Measurements on wind and power conditions in the cluster and voltage quality on the connected grid.
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- K3 Modelling of wind power in the Finnish power supply system.
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- K4 Wind and load forecasting for integration of wind power into a meso-scale electrical grid.
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- K5 The first off-shore wind farm in the Danish wind power programme.
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- K6 Implementation of off-shore wind power plant.
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- K8 A mechanical hybrid wind/diesel system based on MEL's 'Windmel' wind turbine.
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- K9 Wind integration into a diesel power grid of a Greek island.
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- K10 Anholt 55 kW wind turbine. Operation strategy, experience and results.
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- K11 Development of a novel small windpump for ultra-reliable low-cost water supply.
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- K16 Dachen Islands wind/diesel facilities.
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- K17 Wind and solar energy supply for a sewage plant - the Fehmarn project.
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- K18 This paper has been withdrawn.
- K19 Wind energy penetration in a local energy system operated on biogas: an EC demonstration project in Chania. D. Papastefanakis, Hellenic Agency for Local Development and Local Government S.A.; L.A. Pyrgiotis, National Technical Univ. of Athens; M. Kavroulakis, Municipal Enterprise of Water and Sanitation of Chania, Greece.
- K20 Storing wind energy.
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- L2 The Group ENDESA wind energy plan.
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- L3 Wind energy research activities of the Dutch Electricity Generating Board.
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- L4 Latest results of the international discussion on the social costs of energy - how does wind compare today?
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- L5 The siting problem: wind power as a social dilemma.
M. Wolsink, University of Amsterdam, The Netherlands.
- L6 A multifaceted study: environmental issues impacting on wind energy developments.
P. Bosley, Towson State University and K. Bosley, Wind Energy Cons., U.S.A.
- L7 The contribution of the social sciences to wind power research - environmental ideology and public perception.
H. Martin Edge, Robert Gordon's Institute of Technology, U.K.
- L8 Design recommendations for large WECS.
F.J. Füllings, INTRON, The Netherlands.
- L9 Low frequency sound from wind turbine arrays.
W.E. Holley and B.F. Bell, U.S. Windpower Inc., U.S.A.
- L10 Avoided fuel, capacity and emission costs by wind energy in the Netherlands.
A.J.M. van Wijk and W.C. Turkenburg, University of Utrecht, The Netherlands.
- L11 This paper has been withdrawn.
- L12 Possibilities and restrictions of wind energy use in Central Europe.
M. Kaltschmitt, Universität Stuttgart, Germany.
- L13 This paper has been withdrawn.
- L14 Simulation of a wind/diesel autonomous energy system for long term studies.
J. Kabouris, G.C. Contaxis, National Technical University of Athens, Greece.
- L15 Investigation of the feasibility of joint production of decentralised wind energy systems for the People's Republic of China.
P. Johansen, COWiconsult; P. Lundsager, Risø National Laboratory, Denmark; J.P. Johnson, GOPA-Consultants, F.R. Germany.