

BOREAS IV

Hetta, Enontekiö 31.3.-3.4.1998

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The BOREAS IV, an international conference on wind energy utilisation in cold climates, was held end of March 1998 in Hetta, Enontekiö in Northern Finland. BOREAS IV is an important part of the WECO project (**W**ind **E**nergy Production in **C**old Climate) which is partially supported by the European Commission DGXII Non-Nuclear Energy Programme. One of the main objectives of the conference was to transfer and disseminate results and information of the WECO project to industry, operators and authorities, and to establish a forum for information exchange with the surrounding wind energy world in order to improve and focus the work of the project.

SUMMARY

BOREAS IV collected 62 participants from 11 countries. It was interesting to notice, that the number of industrial participants has steadily increased compared to the past conferences (fig. 1). Also the exchange of information with the industry was increased due to the growing number of wind energy plants erected at inland hills and mountainous sites, affected by cold weather and climate, during the last few years. All together 30 papers were presented concerning wind energy assessment, operation and other wind energy applications in cold climate. The closing session with lively discussion gave a good overview about the problems and their solutions. The small exhibition included posters and other presentations from research institutes (2), manufacturers (3) and utilities (1). BOREAS IV was also considered in the Finnish media (newspapers, magazines, radio, TV). The conference was arranged in cooperation of FMI, Enontekiö Commune, Enontekiö Power Company and Kemijoki Oy.

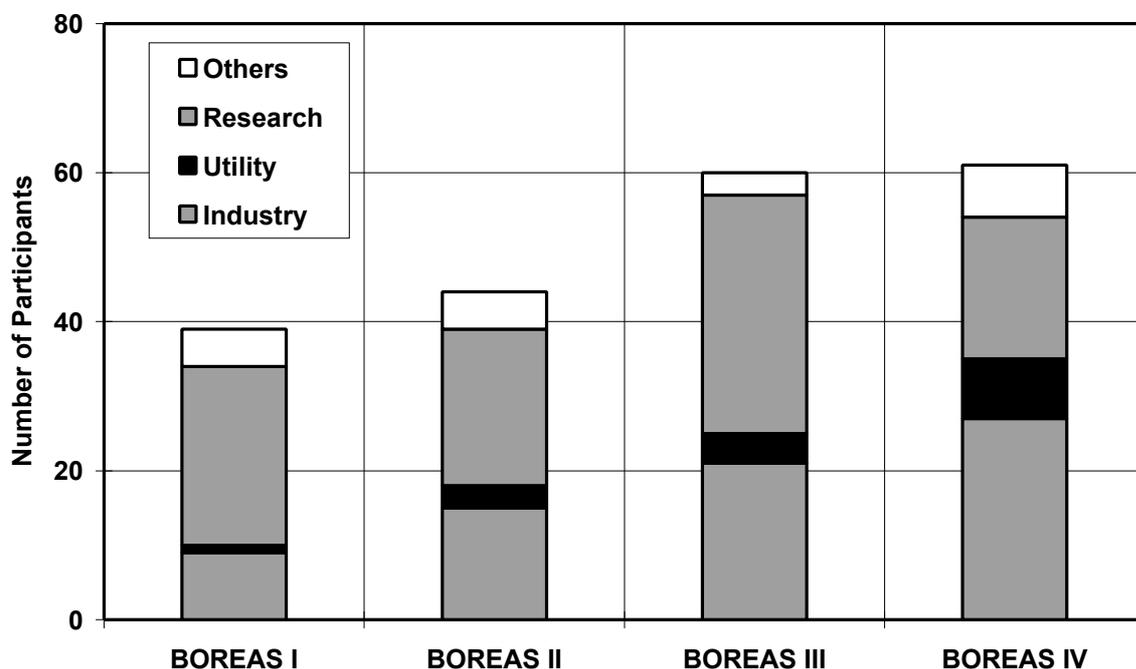


Fig. 1: The share of participants at the BOREAS conferences I-IV.

As the first BOREAS conference at Hetta in 1992 mainly raised questions, this conference also presented many answers to the problems concerning wind energy production and wind measurements under icing conditions and at low temperature.

1. Icing in Europe

The icing map for Europe is calculated from the data of 100 meteorological stations in Europe. The data collecting has been performed in cooperation of the EUMETNET SWS project. The results show, that icing can cause problems in large parts of Europe, from few days icing occasions mainly affecting daily operation and slight loss of power to areas where at least heated anemometers have to be used to avoid significant power losses, up to arctic areas where only the heated blades can guarantee successful power production.

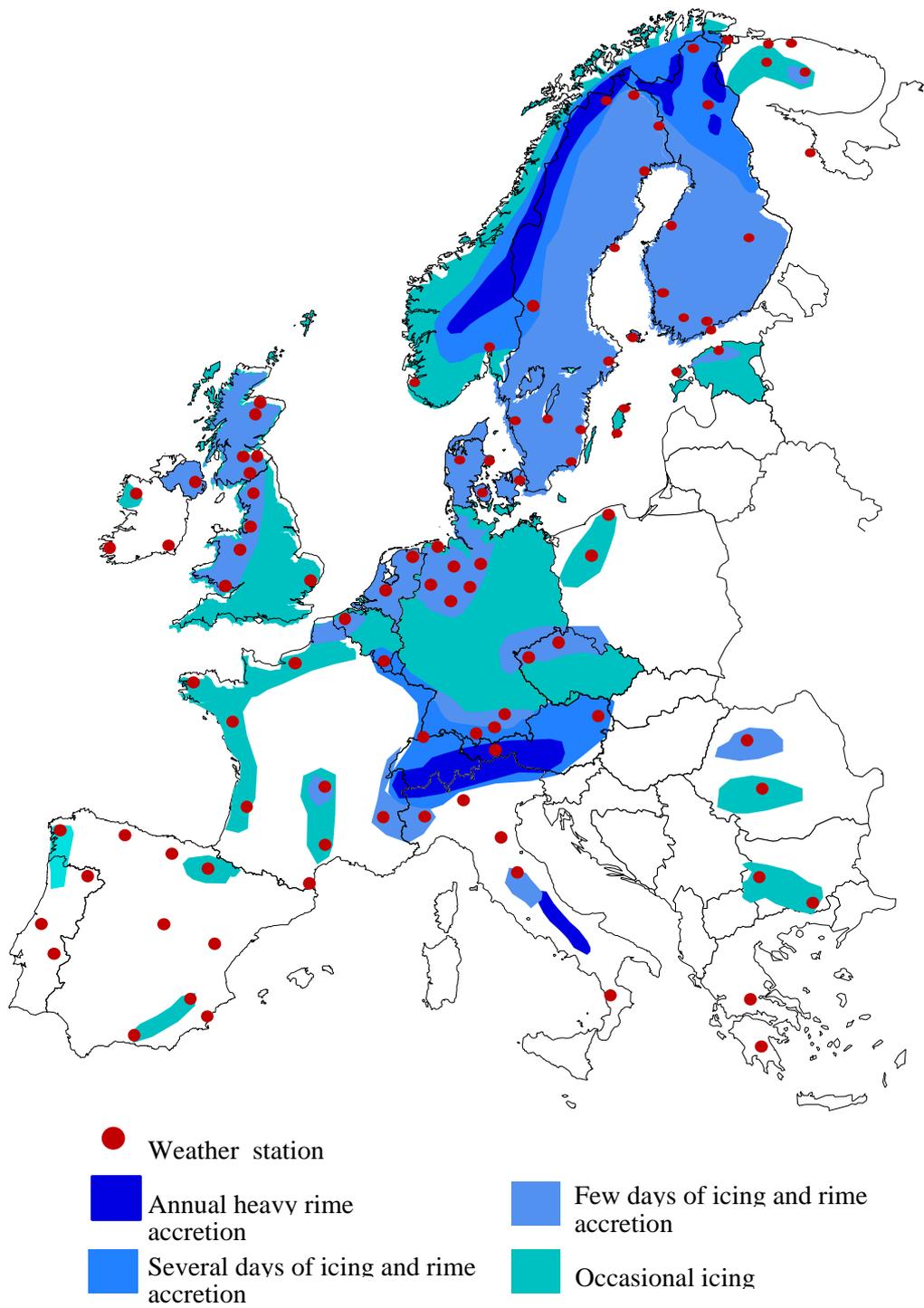


Fig. 2: Icing map over Europe.

The ice map combined with the European Wind Atlas is a proper tool for more precise prediction of annual energy production at cold and ice endangered sites in Europe.

Large temperature differences as well as the combination of low temperatures and high wind speed were identified as targets for further investigation. Also practical recommendations for meteorological services in order to produce more reliable data on icing are needed.

2. Measurements

Reliable wind measurements are essential for the prediction of wind energy potential as well as for the operation of wind turbines. Unheated or non-ice free control anemometers and wind vanes affected by ice may lead to significant loss in annual energy production at sites located in the cold climate, but also at regions like mountains in UK and Apennines in Italy. At present a few ice free anemometers and three component sonic anemometers, but no ice free vanes are available on the markets. However, there is a need to improve the wind gauges for various purposes within the field of wind energy and meteorology.

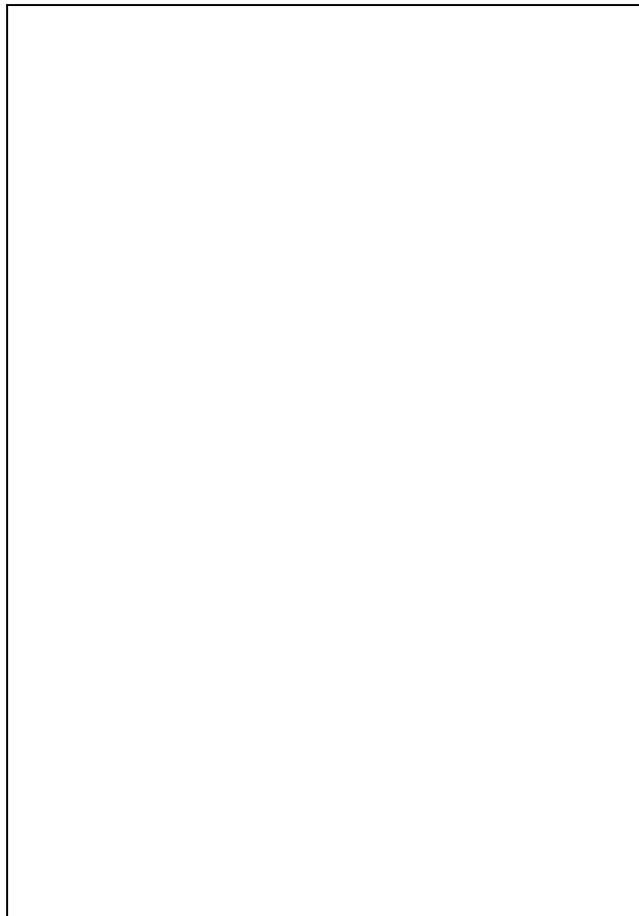
Ice detectors, or other methods to detect ice, are essential for operating the wind turbines under heavy icing (e.g. control of blade heating) and frequent icing conditions (possible ice throw) as well as for meteorological institutes that try to provide icing data. At present the price of ice detectors available is still quite high. Other methods to detect ice have to be investigated.

3. Safety

One of the objectives of the WECO project was to investigate the „ice throw“ - problem and to work out a recommendation and guideline how to guarantee public safety around wind turbines operating at ice endangered sites. The information needed for the development of these guidelines mainly came from two sources: Questionnaires have been sent to wind turbine operators who reported about the frequency of ice throw, the distances fragments have been found and the masses of typical fragments. Based on these more practical experiences and on the basis of wind tunnel investigations also of ice fragment models, simulations and parameter studies have been carried out connected to a risk assessment.

As a result recommendations have been worked out for the planning of wind energy plants at ice endangered sites. As the experience shows - especially in Germany, where more than 50 per cent of the installed power in 1997 was erected at inland sites - icing and in particular ice throw is more and more important and has to be taken into account during the planning of future inland sites. A further experience in discussing with the building authorities is, that if they get information on the basis of the investigations done by independent institutions and if they have simple rules for keeping distances to public roads etc. they mostly collaborate in a positive way.

At the conference a safety distance of 200-250 m for a turbine operated completely unattended in ice endangered areas was discussed.



It was further recommended to organise a work shop for planners and other persons concerned in order to discuss the recommendations worked out by the WECO project participants.

4. Turbine design

At present the estimated losses in power production at relatively heavily or very heavily ice affected sites is estimated to be in the range of 20-50 per cent of the annual wind energy production. There is a need to improve de-icing and anti-icing systems for various parts of the wind turbines to decrease the losses due to low temperature and icing of various parts of the wind turbines and the control systems.

A commercial anti-icing system for blades was presented at the conference.

The industry informed about their experience and modified design which they had collected during the last years concerning the installation of wind turbines in cold climate. The industry also found the markets outside of Europe (China, Canada,..) as very interesting and important for the erection of "cold climate WTs".

5. Markets

During the closing session it was estimated that of the expected growth in the European wind power potential from present 5000 MW to 40 000 MW by year 2010 about 20 per cent of the potential will be related to the items studied within the WECO project and discussed at BOREAS IV. This creates an annual European market (without export) for:

- anti-icing systems	10 MECU/a
- heated anemometers and vanes	10 MECU/a
- ice detectors	1.1 MECU/a.

At present, partly thanks to the WECO project and the earlier EU/Icing project, the European manufacturers are prepared.

The proceedings of the conference will be printed until the end of August 1998. The proceedings are available at:

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