SWEDEN'S BOLD ACTIVITIES IN MEASUREMENTS AND MAPPING OF ICING AND DE-ICING OF WIND TURBINES

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***Abstract**:* In a European perspective, the support for development of wind energy technologies adapted to icing climates has since long been non-existing. To be blamed is a Catch-22-like situation involving a lack of market studies caused by a lack of mapping of icing. The Swedish Energy Agency is currently spending some 30 MEuro during a five-year period on wind farms and the development of wind energy technologies adapted for icing climates. The activities include synoptic icing measurements, mapping of icing, de-icing of wind turbines and the evaluation of performance and loads with respect to icing.

1. INTRODUCTION

The goal of any wind farm owner is to keep the turbines in operation. Iced up wind turbine blades poses a significant challenge to wind turbine manufacturers as well as wind farm developers and owners in certain cold climate regions around the world. The main reasons for the concern are: personal safety, loss of production, increased noise and influence on the expected life of components.

2. RESULTS AND DISCUSSION

Synoptic ice and icing measurements are, mainly thanks to the work carried out in the EU-project COST 727-Atmospheric Icing of Structures, being carried out in a large number of stations across the country. Data from each wind farm site, built or planned, is accompanied by data from a similar installation in a tall mast located between 30 to 50 km away.

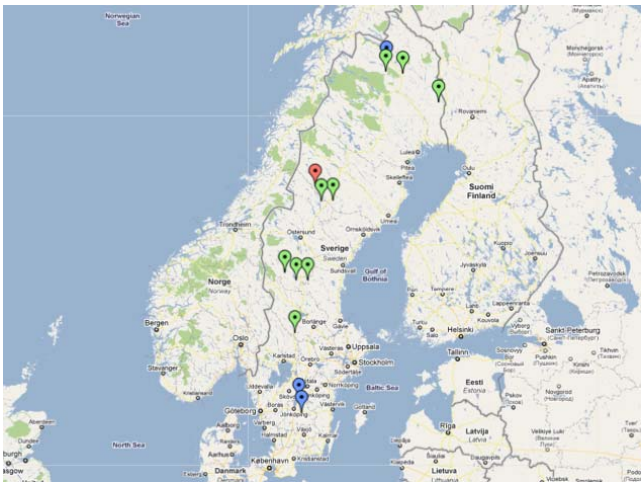

Figure 1: Distribution of ice measurement stations in one of the projects (O2)

At each measurement stations there's a camera installed to enable verification of the icing measurements. These cameras have turned out to be an effective means to support the development of empirical theories for melting and sublimation. Although inherently difficult to calculate, one may also capture brittle ice breaking into pieces at low temperatures.

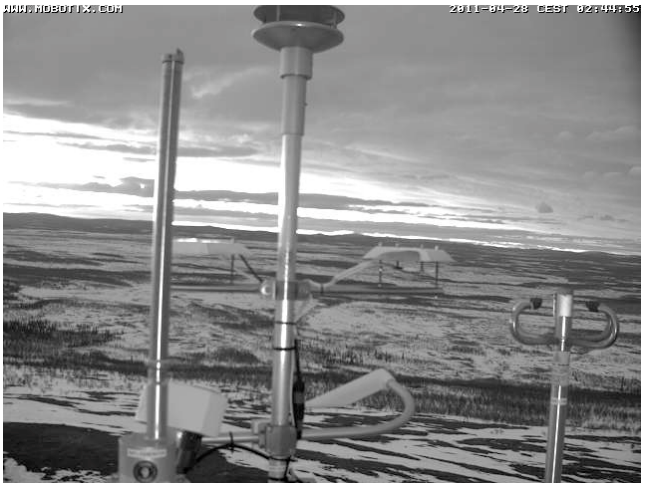

Figure 2: A view of the instruments at the Sjisjka measurement station. This particular mast is 60 m tall.

The ice collected on a wind turbine blade has been photographed as the blade was replaced.

Figure 3: Ice collected on a wind turbine blade.

3. CONCLUSION

Results from the evaluations of modelled and measured icing and power performance show a) icing periods to be captured relatively well in time, b) the magnitude of icing to be difficult to estimate correctly and c) the production losses due to iced up wind turbine blades to be surprisingly large.