2008 International Wind-Diesel Workshop
24. / 25. April 2008
The Hotel Alyeska, Girdwood, Alaska, USA

Wind Energy Development in Harsh Climatic Conditions in Switzerland

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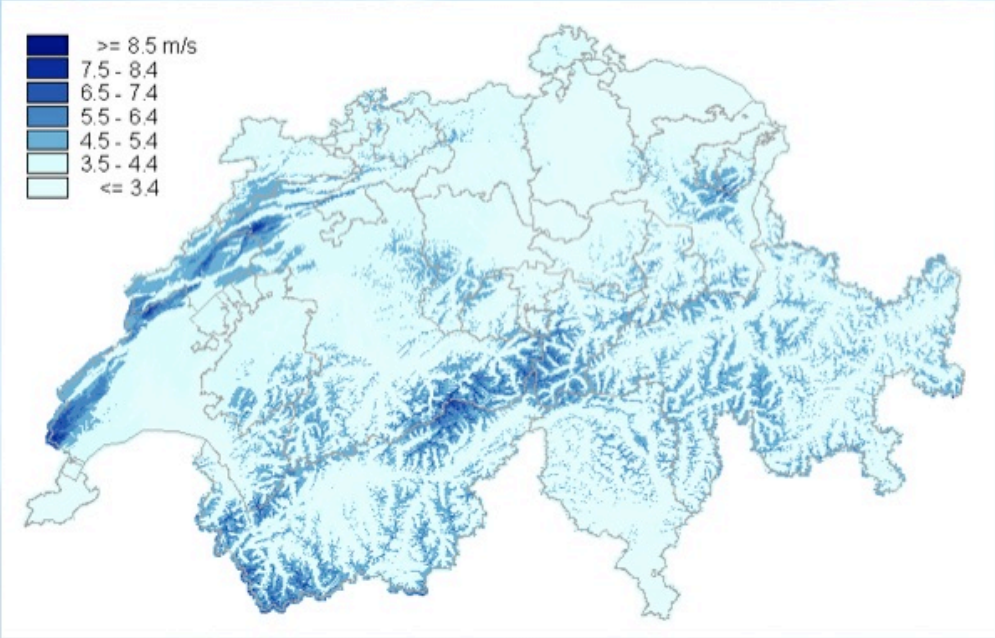
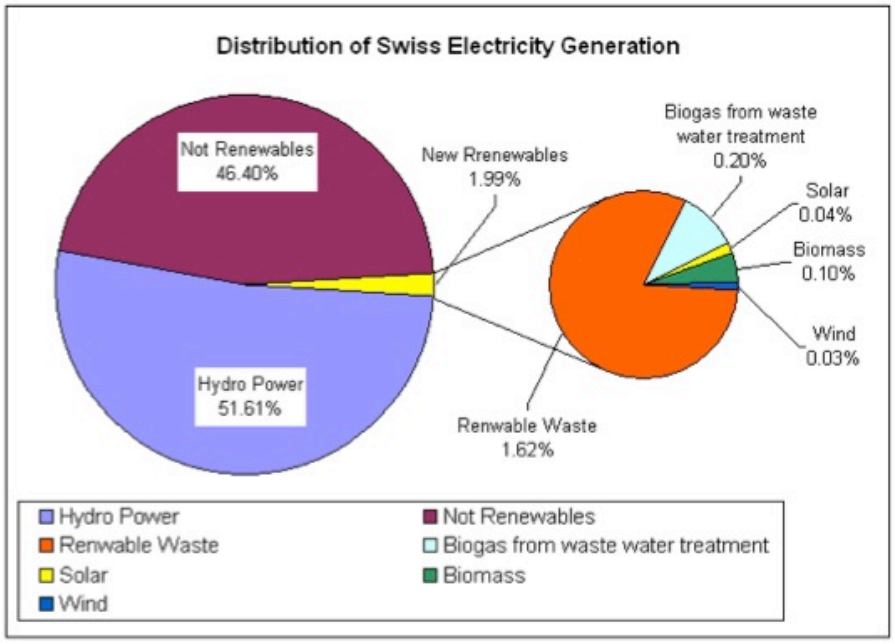
Managing Director Swiss Wind Energy Association "Suisse Eole"

Switzerland Wind Resources



Electricity Supply in Switzerland

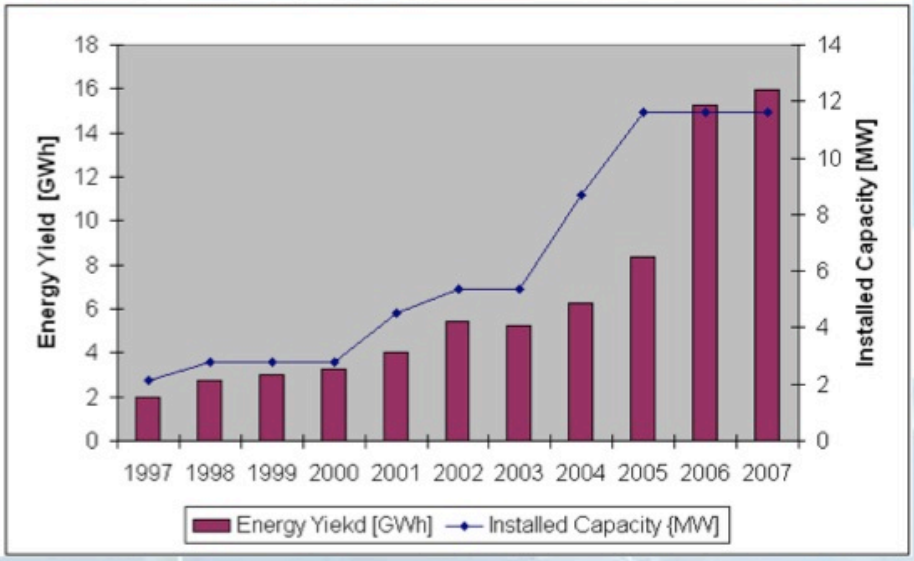


Why Wind Energy in Switzerland?

- Target is sustainable electricity supply
- Big Hydro is developed: new renewables are needed
- Wind Energy is a important mosaic stone to that
- Wind is the cheapest of all new renewables
- People want wind → Green electricity market is growing
- There is a substantial potential in Switzerland: 4‘000 GWh
- Market for Swiss industry, planners and developers

Harsh Conditions?

Installed capacity



- 34 Turbines installed, Peak Power 11.594 MWp, in 2007 (no new turbines)
- 15'946 MWh Energy yield, + 5 %! (Thanks to good winds)

Examples from Switzerland

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7.66 MW Windpark Juvent SA im B
1‘200 m.ü.M

30 kW Anlage auf dem Titlis, 3‘000m.ü.M

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Examples from Switzerland

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900 kW - Anlage im Entlebuch, 1‘000 m.ü.M 600 kW Anlage auf dem Gütsch, 2‘350 m.ü.M

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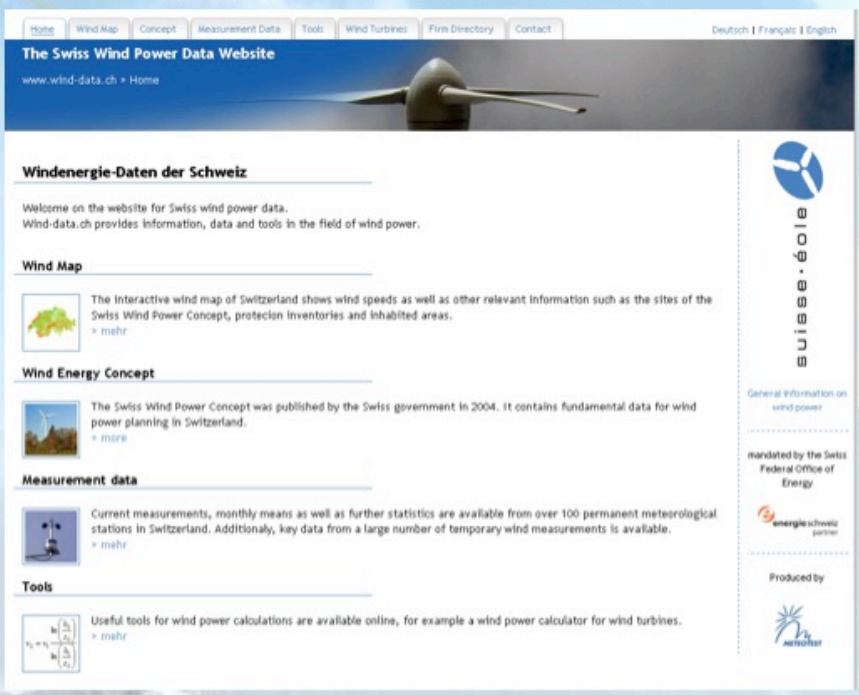
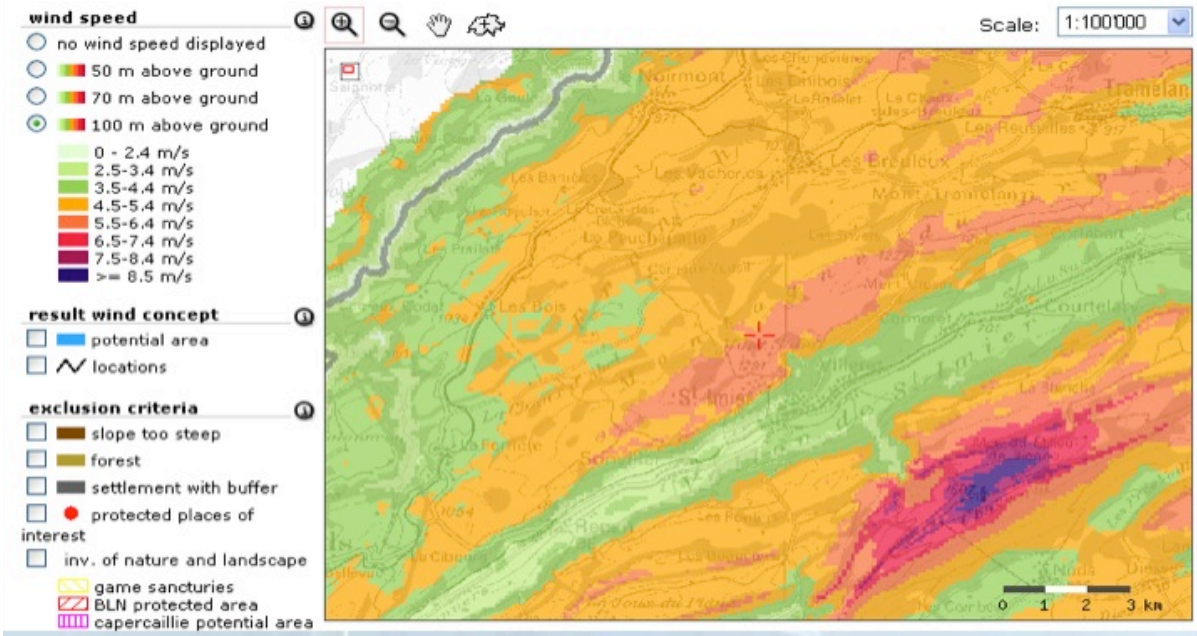
Development for incentive programs: Wind Energy Research 2008 -2011

- Increase the availability and energy yield at extreme sites (cold climate, high turbulence intensity and difficult access).
- Development of wind turbine components for the application of this technology under specific Swiss conditions by Swiss industry
- Increase the value of wind energy (fore- and now-casting, regulating energy etc.)
- Increase the acceptance of wind energy („Social Acceptance“)

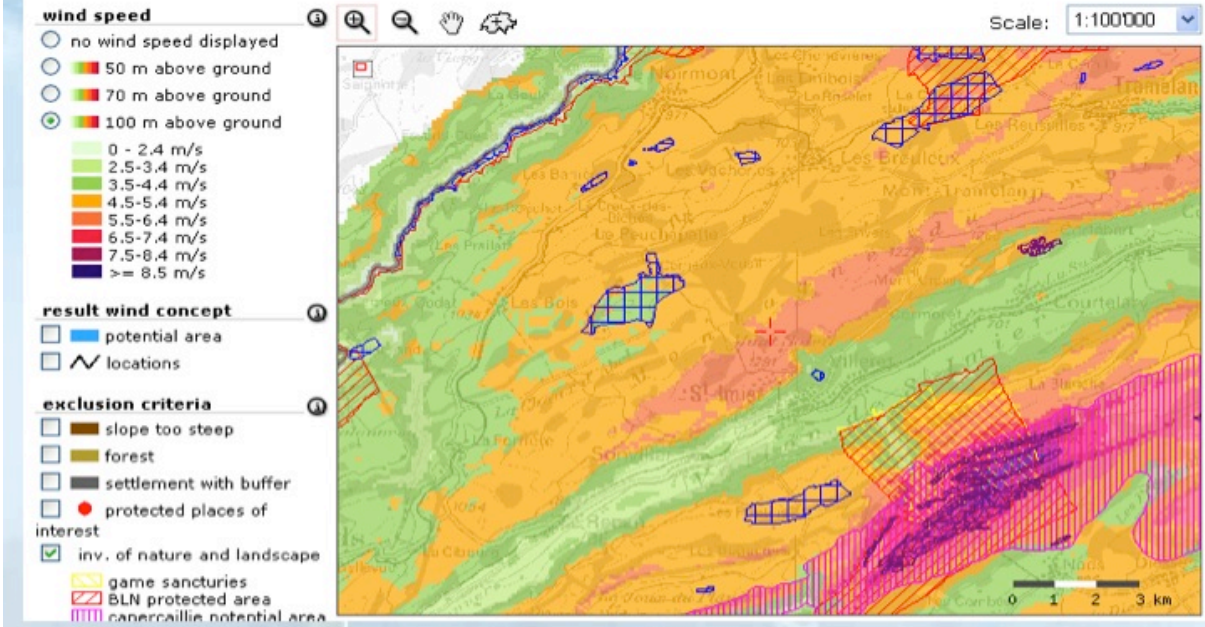
Wind Power Data Website



Wind Power Map of Switzerland



Wind Power Map of Switzerland



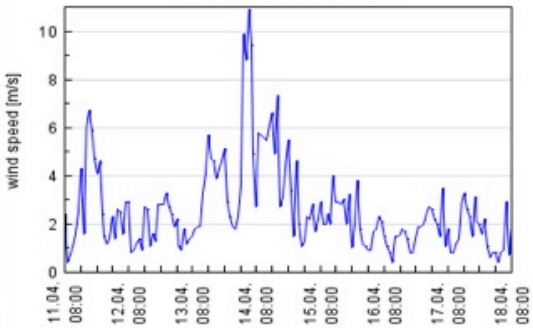
Measurement Stations Switzerland

Click on a site to get more information on the measurement station.

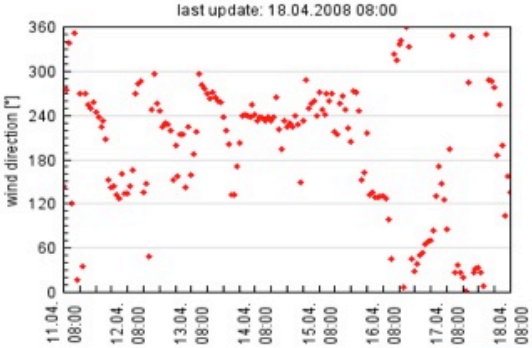
Hourly Wind Speeds
Station: Plaffeien

WMO Number	66'280
Station type	SwissMetNet
Coordinates	586'850 / 177'400
Altitude	1'042 m
Measurement height	10 m

Wind Speed Plaffeien
last update: 18.04.2008 08:00

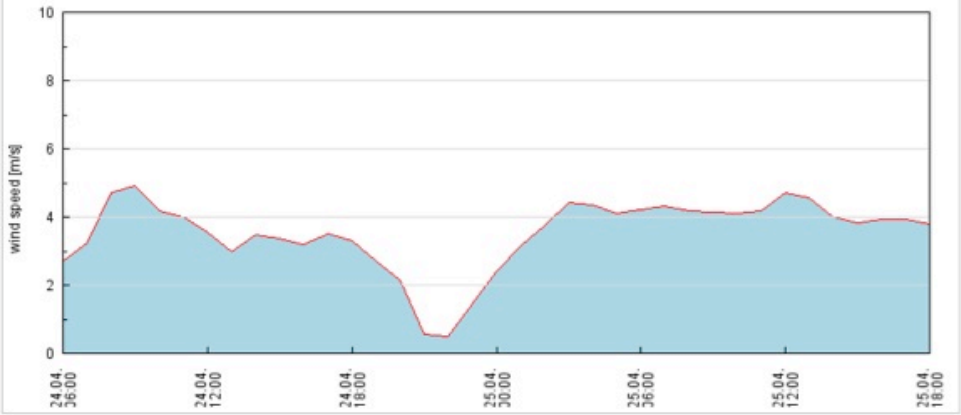


Wind Direction Plaffeien
last update: 18.04.2008 08:00

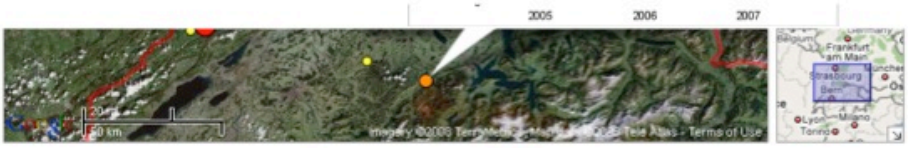


Legend: SwissMetNet station · temporary/other station

Wind Forecast: Feldmoos
Start of the model run: 23.04.2008 18:00 UTC



The continuously updated wind forecasts are a raw model output of Meteotest's weather forecast model. Currently, a forecast system for optimized wind power forecasts for operational use by wind power operators is being developed by Meteotest and MeteoSwiss on assignment of the Swiss Federal Office of Energy.



Legend: small wind turbine < 300 kW · big wind turbine > 300 kW · wind park

Frequency of icing

Of the located sites of the concept "Wind Energy Switzerland", 90 % are in cold climatic regions

Altitude [m]	Icing probability north of alps [days per year]	Icing probability south of alps [days per year]
< 700	< 20	< 15
700 – 1'000	20 – 40	15 – 20
1'000 – 1'600	40 – 60	20 – 30
1'600 – 2'300	60 – 90	30 – 40
> 2'300	> 90	> 40

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Research projects

Site assessment under cold climatic conditions (Gotthard pass 2'100 m a.s.l.)

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Enercon E40, Mt. Gutsch 2'300 m.a.s.l.

"Alpine Wind Test Site"

- 600 kW wind turbine Enercon E-40
- test bench as a test station for ice detector
- COST727 action:
  "Measuring and forecasting atmospheric icing structures"

www.meteotest.ch/cost727/index.html

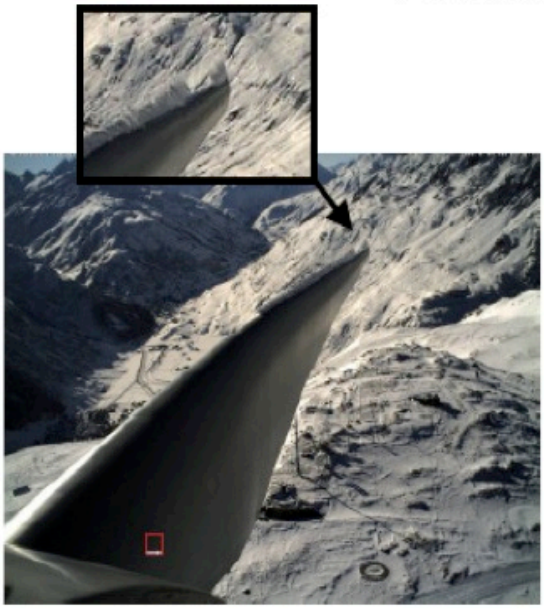
Alpine Test Site Gütsch

Monitoring einer Windkraftanlage unter Vereisungsbedingungen

René Cattin, Meteotest

Monitoring einer Windkraftanlage unter Vereisungsbedingungen

2 Webcams auf WKA



Rotorblatt

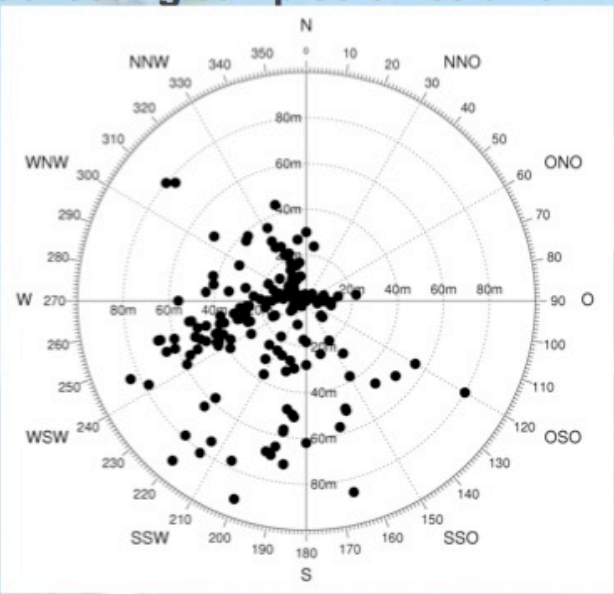
Gondelanemometer

Eis und Fels 07, Andermatt, Schweiz, 21. Juni 2007

Blade repair „on site“

COST 727 and Gütsch

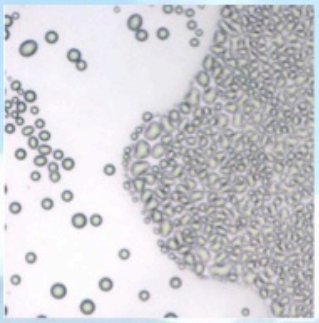
- Collecting samples of ice throw

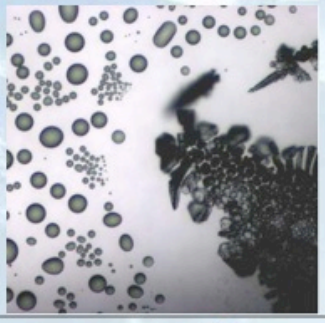


Anti-freeze coating for rotorblades

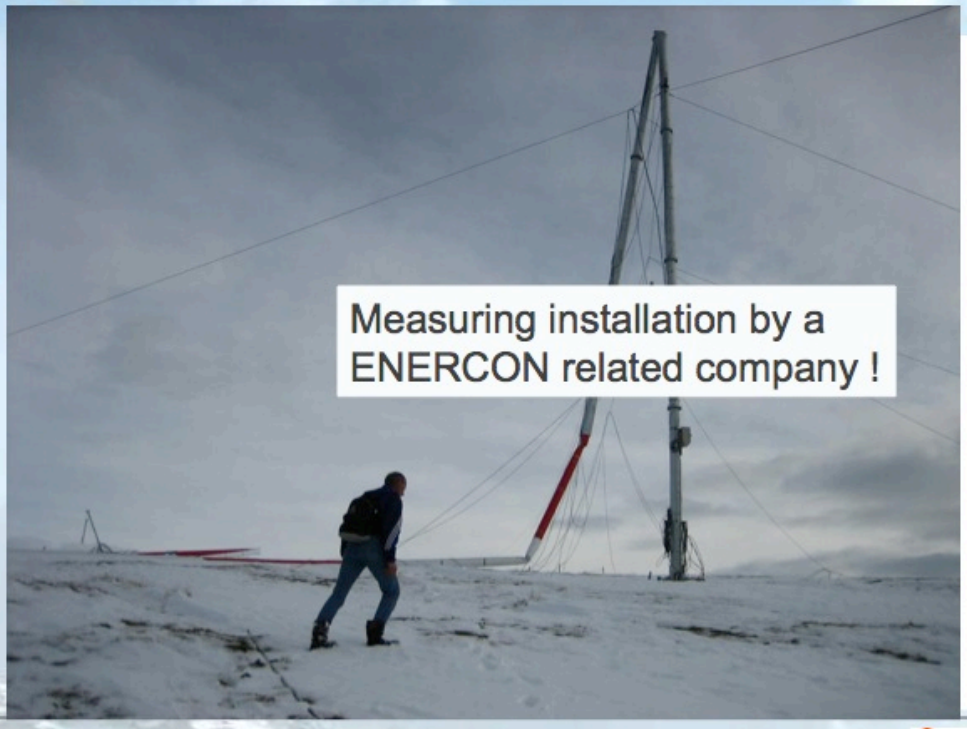
The Zurich University of Applied Studies is

- studying polymers with freezing point depression properties
- binding such polymers to surfaces
- testing anti-freeze coated surfaces
- Results in laboratory conditions: Reduction of freezing point up to 30° C
- Development of final product in collaboration with wind power – and Swiss polyester company

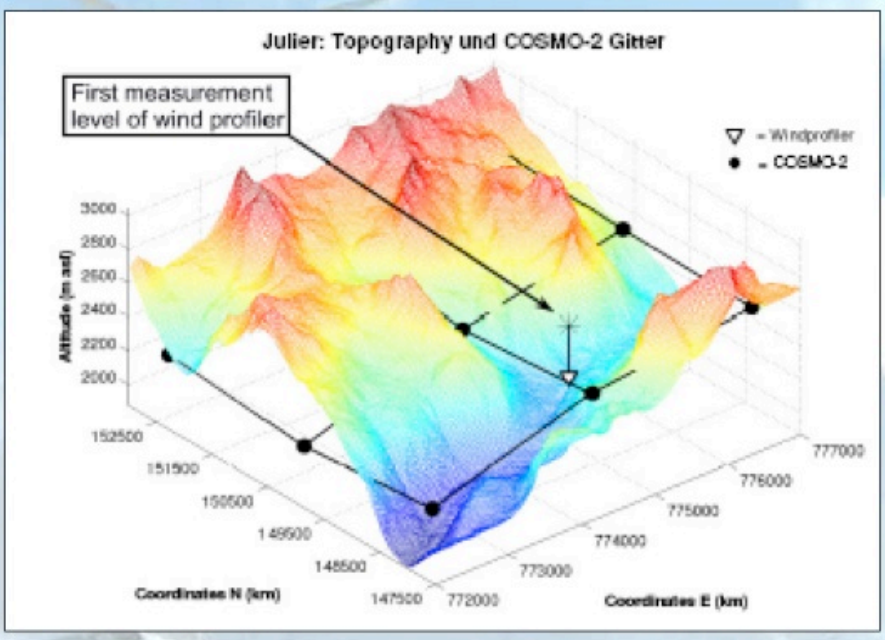




Tower Collapse at Schwyberg



Fore- and Nowcasting of Wind Energy Production in complex Terrain



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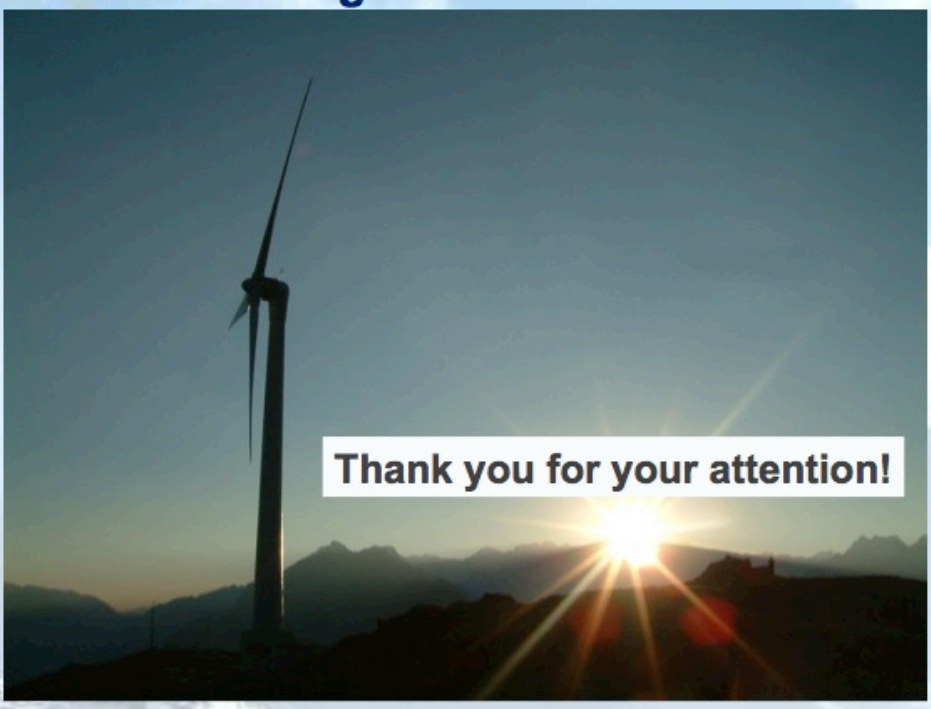
Proposition of a Task 28 within IEA RD&D Wind:

Social Acceptance of Wind Energy Projects

„Winning Hearts and Minds "

Outlook is bright!!



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