Business from technology

Recommended practices for wind energy in cold climates – resource assessment and site classification

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IEA Wind R,D&D Task 19 – Wind Energy in Cold Climates

- IEA Wind R,D&D – a vehicle for collaboration
- Research tasks with expert groups for problems defined by IEA Wind Executive committee
- Task 19 – Wind Energy in Cold Climates
  - New 3 year term started January 2013
  - Web site: **http://arcticwind.vtt.fi**
  - Countries (likely) participating:

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Why icing conditions should be taken into account?

- Reduced energy yield
- Increased component fatigue loading
- Risk of ice throw
- Increased noise emissions

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Measurement system for resource assessment

- High quality equipment and materials
- Properly designed* measurement mast
- Wind measurements
  - First class anemometers for ice free periods
  - Properly heated anemometers for icing periods
  - Properly heated mounting booms
- Recommended level of icing measurements
  - Meteorological icing e.g. camera or icing sensor.
  - Instrumental (component) icing e.g. one properly heated and one unheated anemometer.
- Site assessment gives invaluable information about energy yield, component fatigue loading, ice throw and noise emissions.

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*: ISO12494

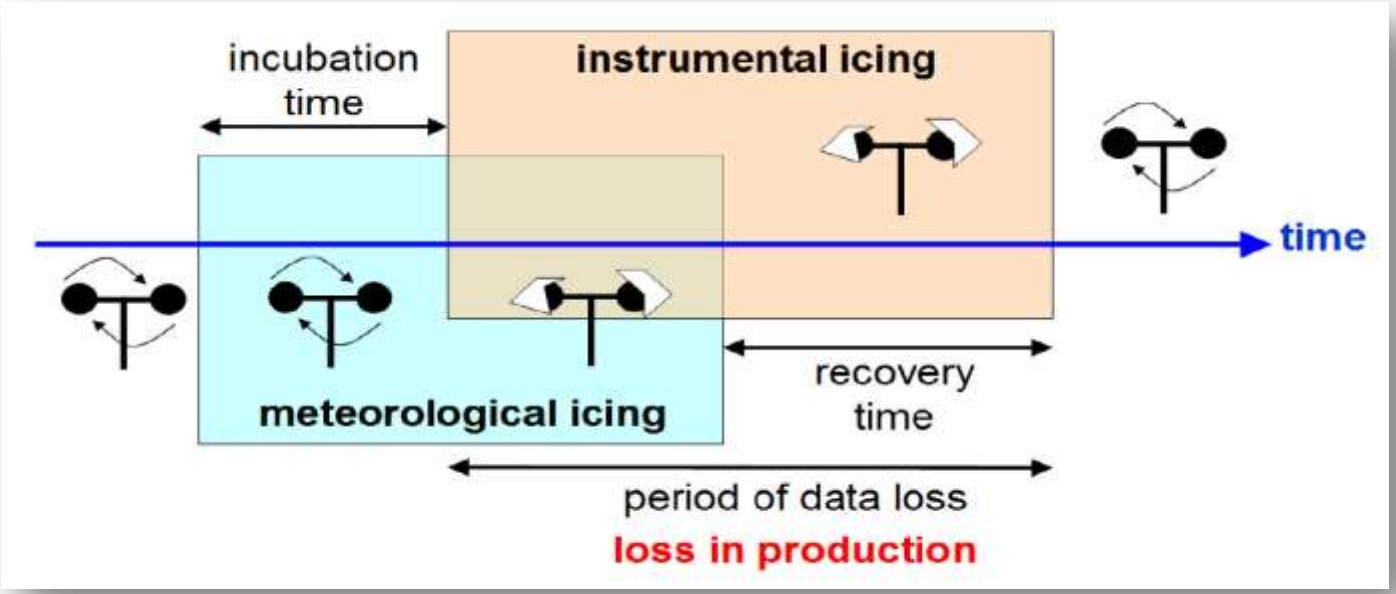
IEA Ice Classification for wind energy sites

- IEA Ice Classification classifies a site with respect to total duration of either

  Meteorological icing

  or

  Instrumental icing (a.k.a. component icing)



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IEA Ice Classification for wind energy sites

IEA Ice class	Meteorological icing	Instrumental icing	Production loss
	% of year	% of year	% of annual production
5	>10	>20	> 20
4	5-10	10-30	10-25
3	3-5	6-15	3-12
2	0.5-3	1-9	0.5-5
1	0-0.5	<1.5	0 - 0.5

- Instrumental icing in IEA Ice Classification is defined as the duration when an unheated standard cup anemometer is disturbed by ice.
- Input to new IEC61400-1 ed4

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Detailed resource assessment

- Wind conditions
  - Identify icing periods
  - Aim for a conservative estimate
  - Be aware of increased uncertainty due to reduced data availability
- Production loss estimation
  - Total duration of icing
  - Correlate icing events with wind speed and direction
- Ice throw risk assessment
  - Total duration of icing
  - Correlate icing events with wind speed and direction

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Choosing wind turbine technology

- Based on resource assessment, define if the site belongs to
  - Low Temperature Climate and/or
  - Icing Climate
- Low temperature package for the turbine
  - Suitable materials but also
  - Operation adjusted to low temperatures
- Anti- or de-icing if economically feasible or local regulations requires

Operation and maintenance in cold climate sites

- Maintenance should be done when weather is favourable
  - Conditions monitoring and preventing maintenance
  - Weather forecasting

- Minimize risk of ice throw
  - Reduce the amount of ice
  - Warning signs
  - Curtail turbine operation
  - Stop turbine if necessary

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Summary

- Cold Climate wind energy potential is exploitable with adequate measures:
  - Careful site assessment, including icing conditions
  - Adapted technology for wind turbines
    - Anti- and de-icing systems,
    - Low temperature materials,
    - Adapted operation and control
  - Minimize the risk of ice throw

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Recommended practices for wind energy projects in cold climates

Available at http://arcticwind.vtt.fi/

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VTT creates business from technology

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