The IEA Wind TCP Task 19: 19 years of cold climate wind research

Timo Karlsson Winterwind 2022 Conference, Skellefteå 21.4.2022

IEA Wind TCP Cold climate research

- Introduction
- IEA Wind TCP & Research Tasks
- History of cold climate @ IEA Wind
- Future

Introduction

- Timo Karlsson
- Operating Agent, Task 19
  - Decade + with wind power
  - First Winterwind in 2014

- Research Scientist, VTT
  Wind power Team

VTT

- 2,093 number of employees (2020: 2,129)
  - 32% doctorate or licentiate degree (2020: 33%)
  - 51 different nationalities (2020: 48)
- 1,160 customers (2020: 1,410)
  - of which 1,005 are domestic and international private sector customers (2020: 1,230)
- 254 M€ total revenue (2020: 244 M€)
- 45% of our turnover comes from abroad (2020: 45%)
- 430 patent families (2020: 440)
- 1942 year of VTT's establishment
- Owned by the Finnish state

Carbon neutral solutions

Sustainable products and materials

Digital technologies

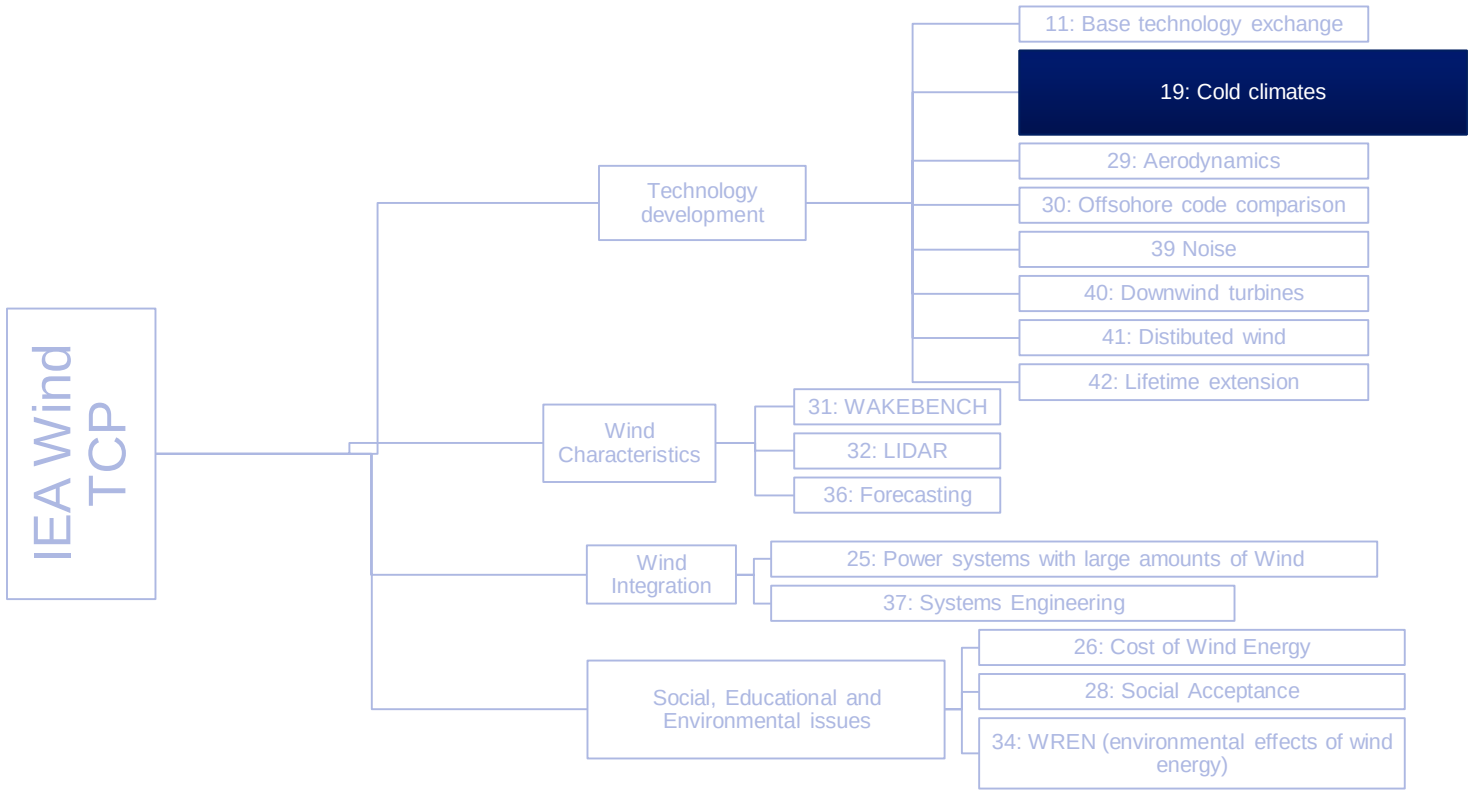
IEA Wind Technology collaboration platform

- Research collaboration platfor operating under International energy agency
- Platform for research collaboration
- Goal is to disseminate research in wind energy
- Promote international collaboration

Task 19

iea wind

Research tasks



Task 19

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Task 19 growth

CC market growth

- Wind in cold climates has grown
  - In 2002: Task 19 estimated total of 500 MW of wind ir cold climates
  - ~300x of growth in 20 year

Estimated cold climate wind market size in GW in 2020		Forecast for Cold climate wind market in GW for 2025	
Icing climate	Low temperature	Icing Climate	Low Temperature
118.6	74.0	162.2	111.4
Total 156.2		Total 223.6	

Growth estimates assume that the local share of cold climate remains similar through the forecast period.

Year-over-year growth, average	
Icing climate	8.7
Low Temperature	7.5
Cold Climate total	13.5

Practical role of Task 19

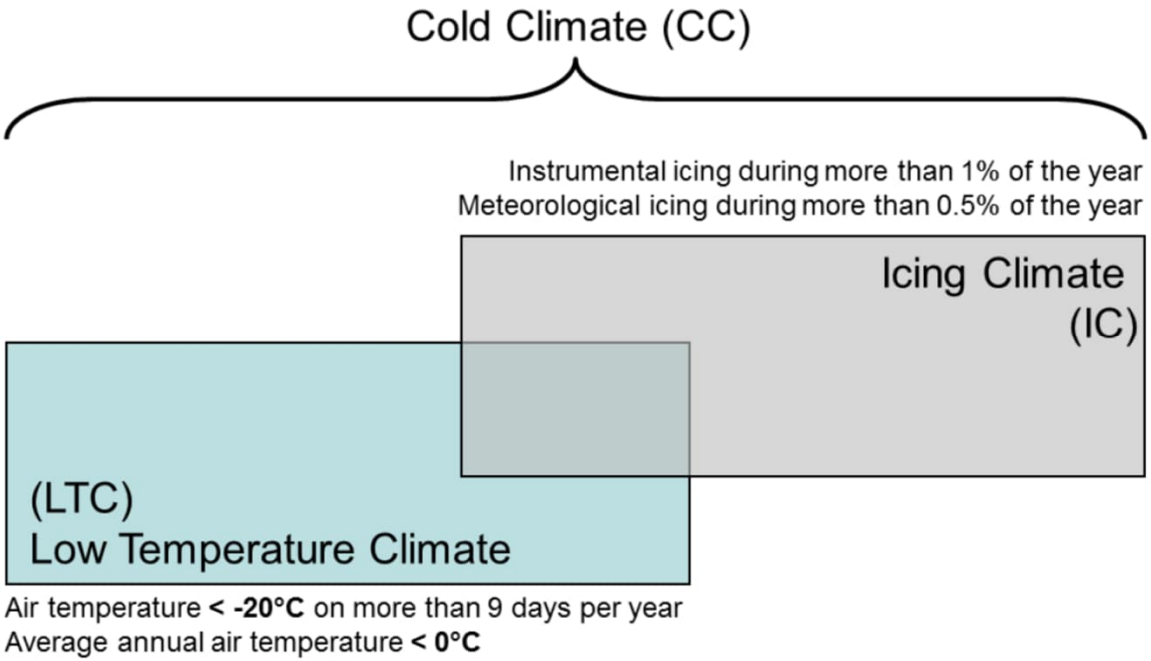
- Purpose of IEA research task is to be a forum to disseminate scientific research
- Task 19 also a forum for pushing forward common practices and terminology related to cold climate wind.
- Field has grown in a very hands-on way - practices have been developed as needed
- Development as been fast, but hands-on

Practical role of Task 19

- Solution-first approach in the field leads to quick development
- Issues:
  - Commercially: lack of standards
    - Difficulty in comparing products
  - Research: lack of common terminology
    - Difficulty in comparing results
- There's a clear need for some neutral body to push for industry standards
  - Task 19 has filled this niche

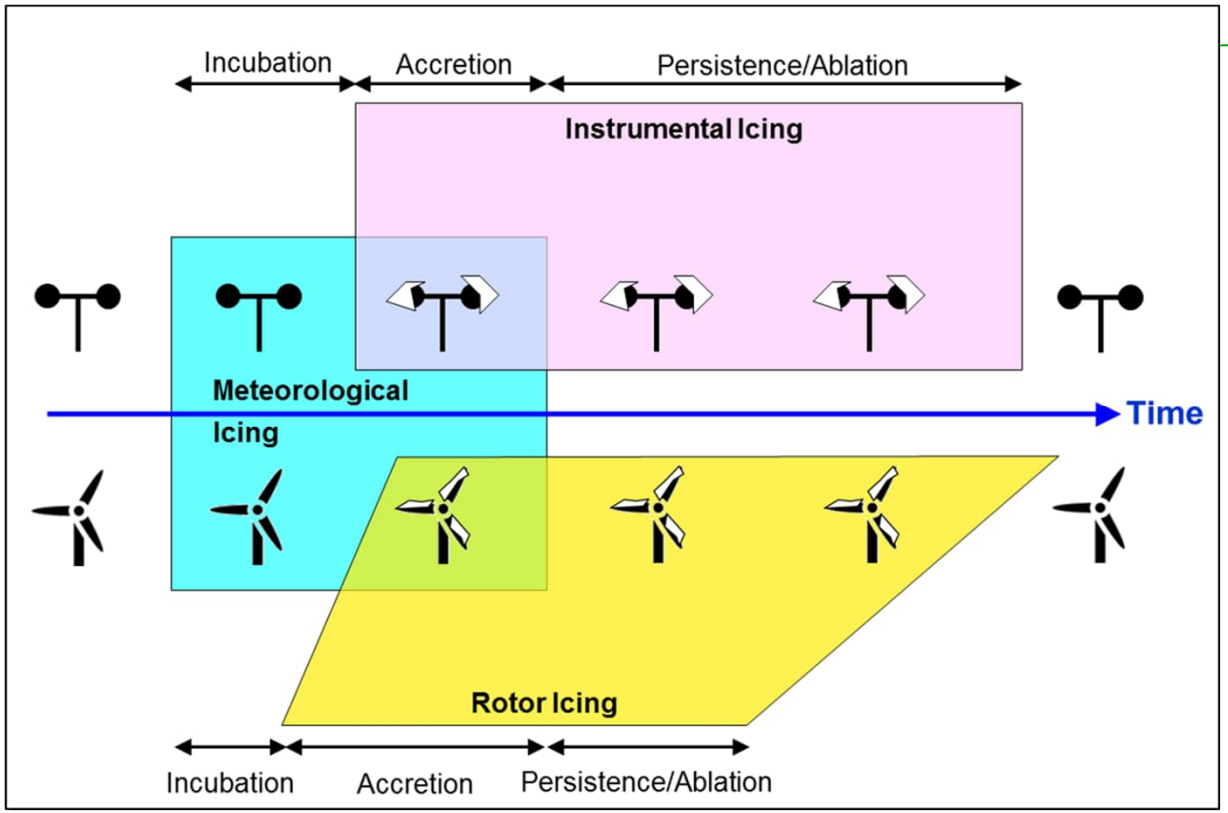
Highlights

Cold Climate*



*Source: IEA Wind Task 19 Available Technologies report of Wind Energy in Cold Climates (2016 edition): http://www.ieawind.org/task_19.html

Icing event*



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IEA Ice Classification[1]

IEA Ice Class	Duration of Meteorological Icing [% of Year]	Duration of Instrumental Icing [% of Year]	Production Loss [% of AEP]
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

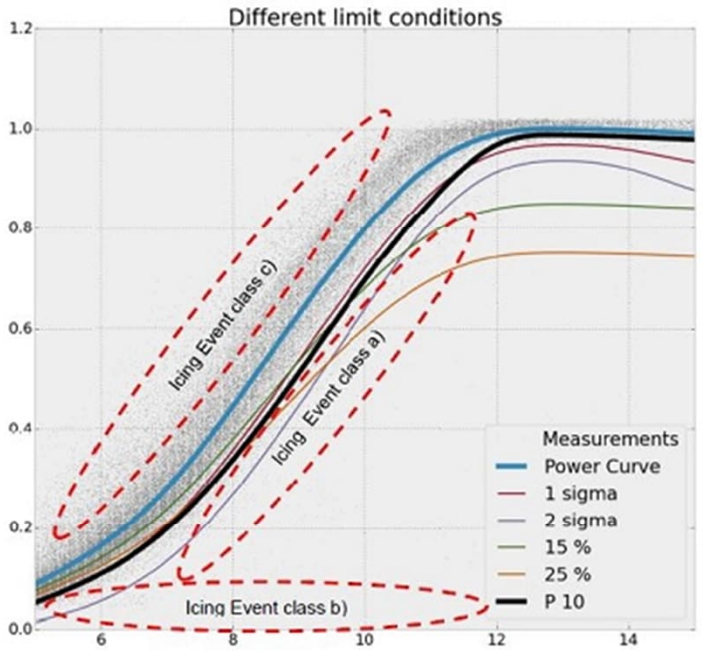
[1]: IEA Wind Recommended Practices for wind energy projects in cold climates edition 2011

Guidelines

- Recommended practises for wind power projects in Cold climates
- Available technologies review
- Ice throw risk assessment
- Warranty guidelines
- Ice detector testing
- Icephobic coating testing

T19IceLossMethod

A standardized method for assessment of production losses due to icing from wind turbine SCADA data



An open source Python code has been developed by Task 19 as a reference implementation of the method. The software and it's documentation is available for download on Github.

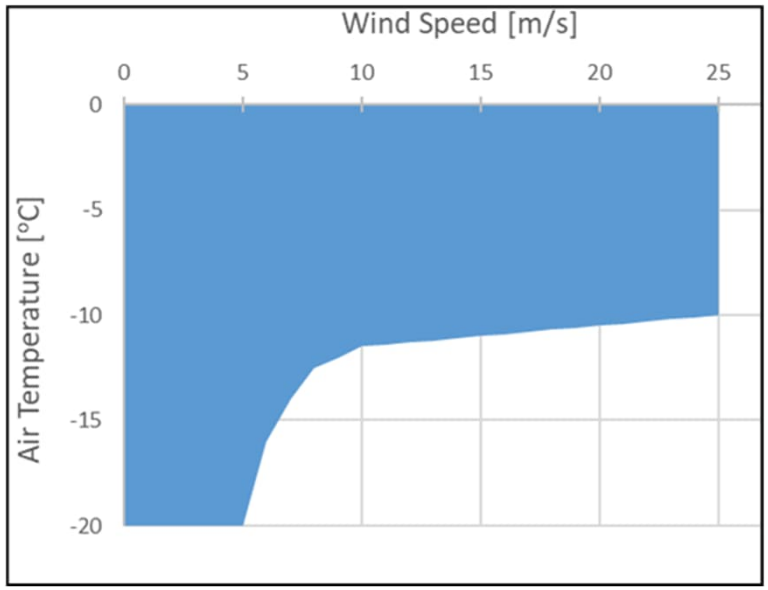
Future

Work is not done

- Despite good progress, cold climate wind not solved problem
- IEA cold climate work will continue as Task 54
  - IEA policy, to eliminate ”perpetual” research tasks
- Team so far:

Topics for new term

- Uncertainty quantification
- Performance envelope for blade heating systems
- Control of iced wind turbines
- Safety and acceptance
  - Reference ice throw tool
  - Noise and icing
- Distributed wind in cold climates



Topics for new term

- Testing and modeling
  - Icing wind tunnel testing practices / icing wind tunnel comparison
  - Icing model benchmark
- Markets and grid and icing
  - Impact of icing on markets
- In addition:
  - Continuation on IEC61400-15 standard preparation
  - Future-proofing cold climate references
    - Make sure all the relevant materials are available citable, have DOIs, can be discovered also in the future, regardless of the existence of a cold climate task.

High-level goal

- Ultimately the goal is that industry players and researchers in the field are speaking the same language using the same terms.
- This kind of standardization of language and methods will lead to research results that can be compared to one another
- Commercially, it will lead to products and projects that can be better evaluated using common terms.
- In the long run, this benefits everyone in the industry.

Thank you

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