

Cold Climate Wind Power

IEA Wind TCP Task 54



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Electricity Transformation Canada 2023

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Technology Collaboration Programme

by **iea**

IEA Wind Technical Collaboration Program TCP



IEA Wind TCP

- Research collaboration platform operating under International Energy Agency (IEA)
- Platform for research collaboration
- Goal is to disseminate research in wind energy
- Promote international collaboration
- <https://iea-wind.org/>

IEA Wind TCP Contracting Parties



IEA Wind TCP Task 54 – Cold Climate Wind Power



IEA Wind TCP

Mission:

- *Improve large scale deployment of cold climate wind power in a safe and economically feasible manner*

Methods:

- Focus on standardization, reference solutions, gathering and disseminating information
- Provide tools to better understand and estimate the risks involved in cold climate wind

9 participating countries
Current term ends at end of 2024



Task 19/54 – Public references



IEA Wind TCP

October 2018, 2nd Edition

IEA Wind TCP Task 19

**Available Technologies
for Wind Energy in Cold
Climates**

September 2020

IEA Wind TCP - Task 19

**Performance Warranty
Guidelines for Wind
Turbines in Icing Climates**

October 2021

IEA Wind TCP Task 19

Technical Report

*Ice Detection Guidelines
for Wind Energy Applications*

April 2022

IEA Wind TCP Task 19

Technical Report

*International Recommendations
for Ice Fall and Ice Throw Risk
Assessments*

May 2022

IEA Wind TCP Task 19

Technical Report

*Definition of Best Practice
for Testing Icephobic
Surfaces*

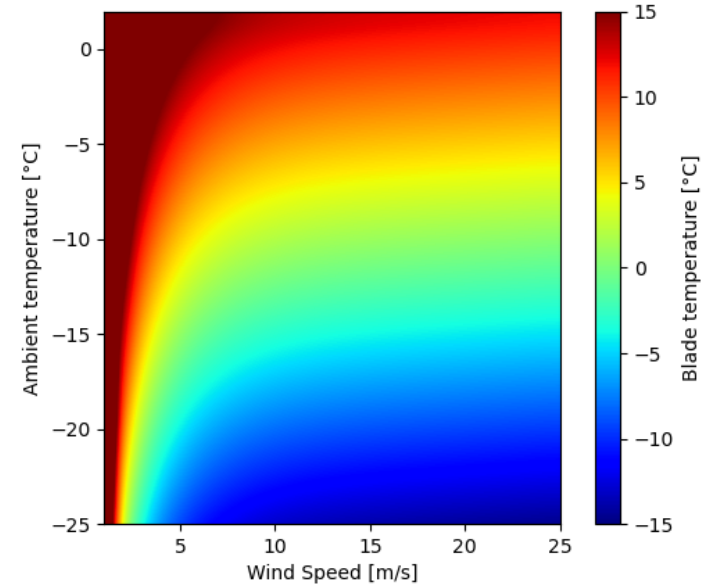
Available at: <https://iea-wind.org/iea-publications/>

Task 54 – Work plan 2022-2024



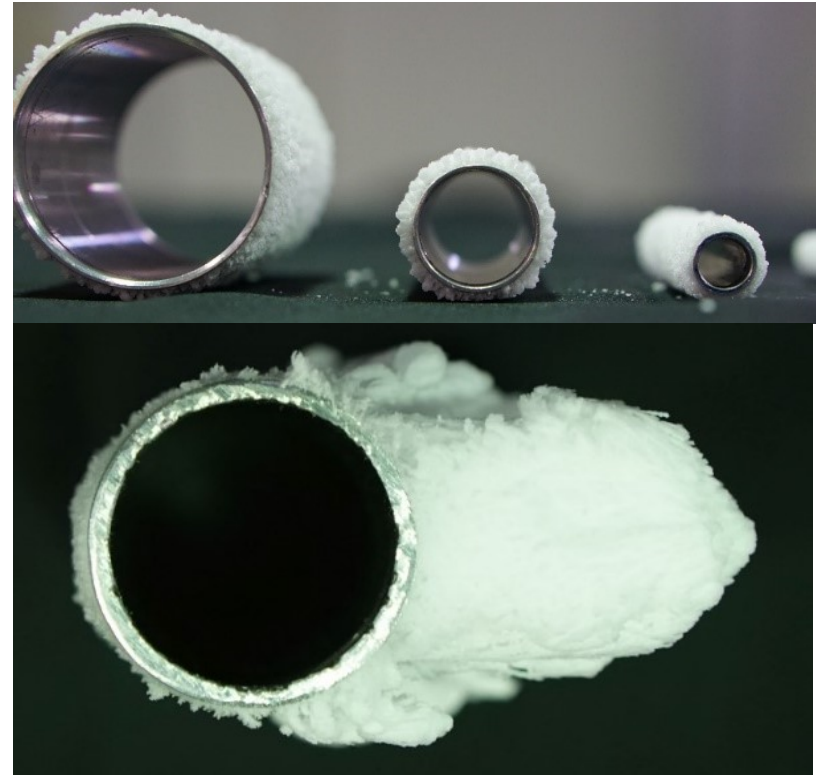
IFA Wind TCP

- 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



Task 54 – Work plan 2022-2024

- 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:
 - 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.



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So far adopted concepts in the industry

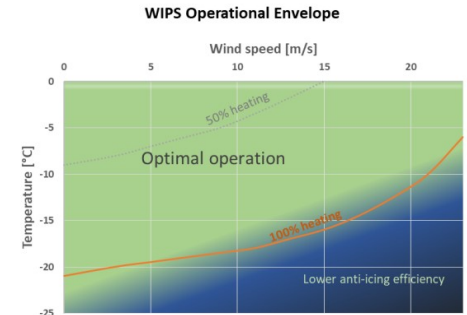
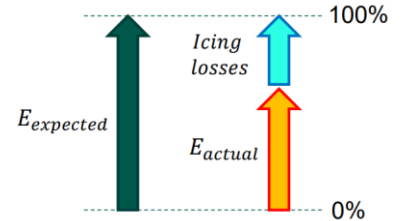
One general distinction can be made with respect to existing concepts:

- Economically driven definitions such as “production retention” and “Ice Production Ratio” related to the produced energy

➤ Already available with the IEA Wind TCP Task 19

“Performance Warranty Guidelines for Wind Turbines in Icing Climates” [5]

- Meteorologically/technically driven definitions such as functions of temperature, wind speed etc. related to a systems performance/efficiency

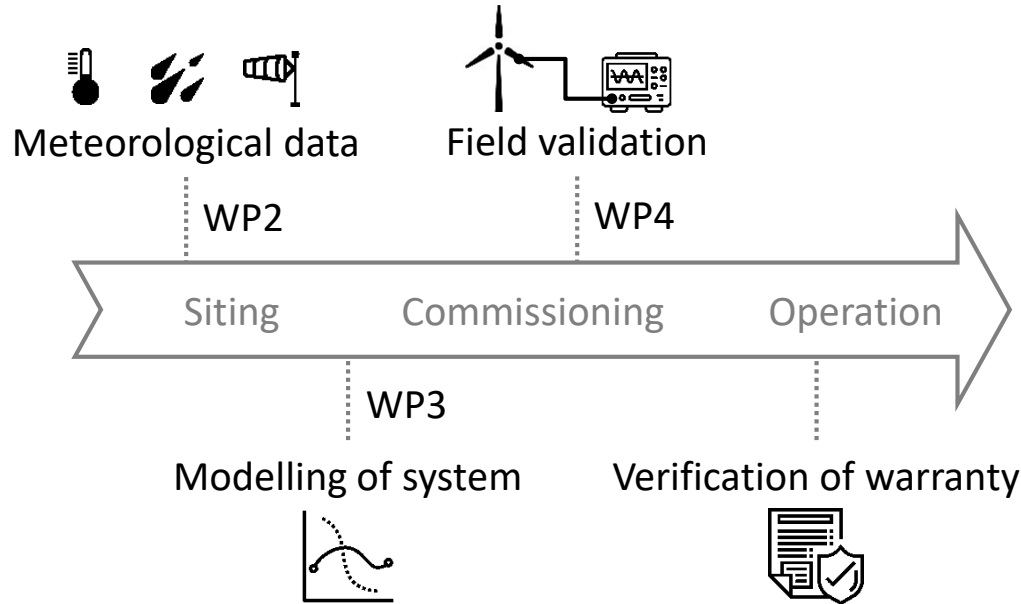


Performance envelope of blade heating systems focusses on the latter concepts.

Performance envelopes of blade heating systems subtask



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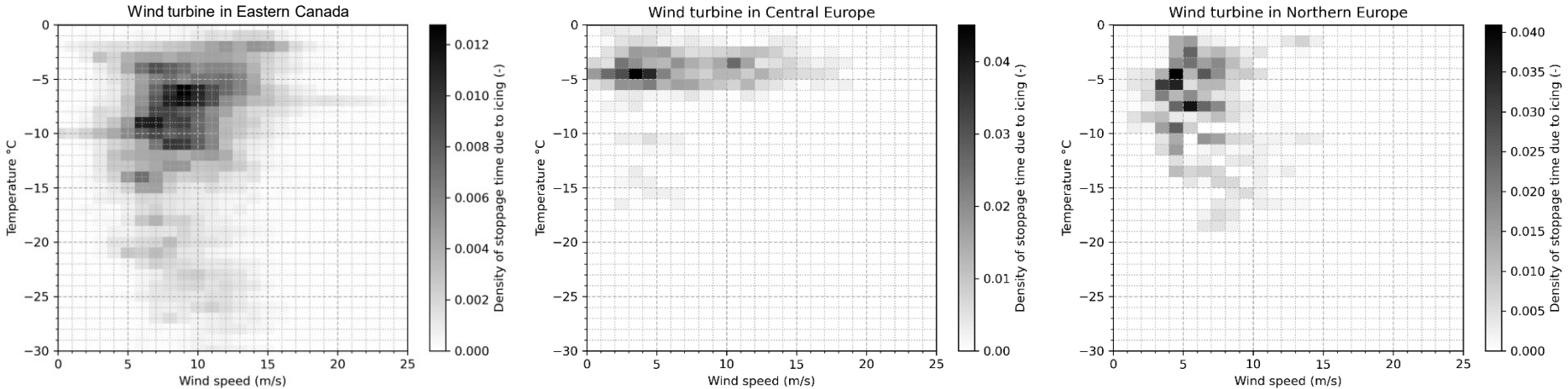


- WP1 – Terminology and definitions
- WP2 – Exemplary data of icing events
- WP3 – Modelling of IPS performance
- WP4 – Recommendations on field validation of IPS performance
- WP5 – Collaboration with wind tunnel subtask
- WP6 – Dissemination

Stoppage due to icing – different sites / different turbine types



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- Different patterns of icing conditions for different locations / different turbine types

Stoppage due to icing – different events (one site)



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All within one winter – Same site



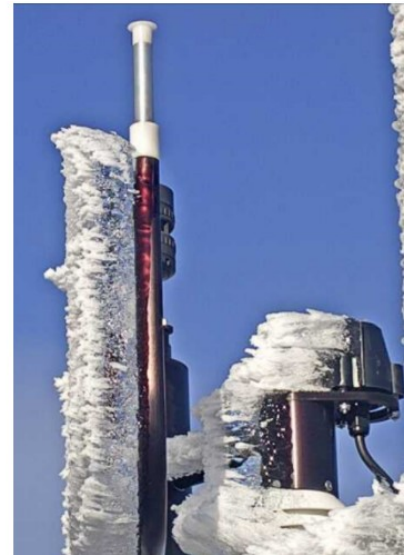
No ice



Glaze ice



Rime ice

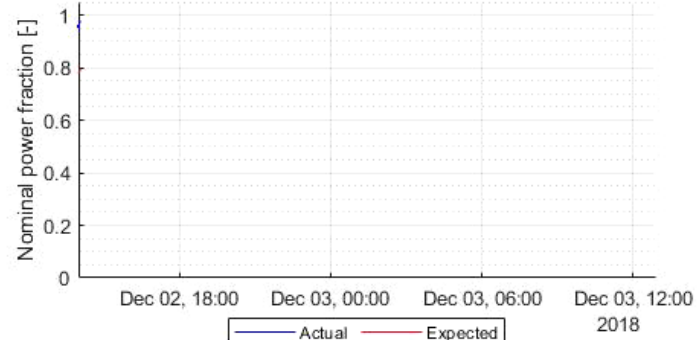
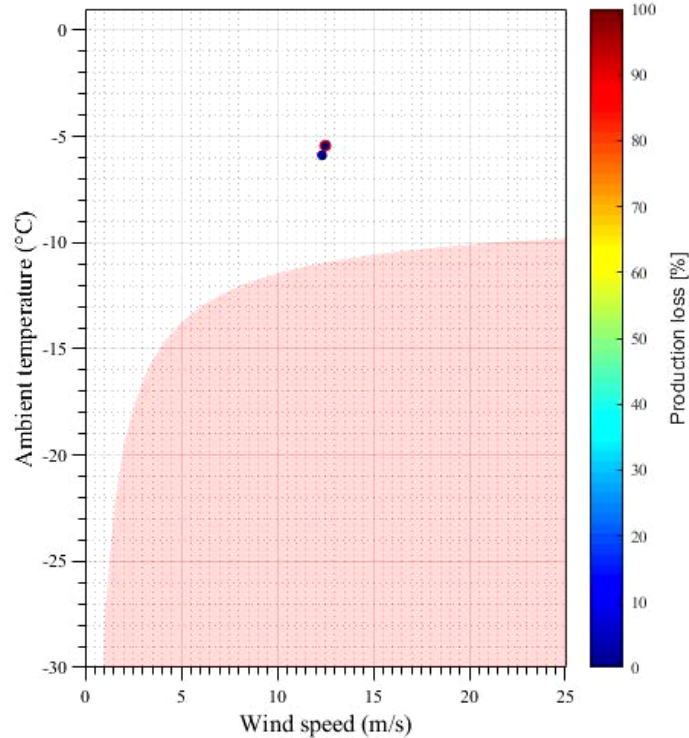


Glaze to rime ice
(Mixed)

Stoppage due to icing – temporal evolving during event



Wind TCP

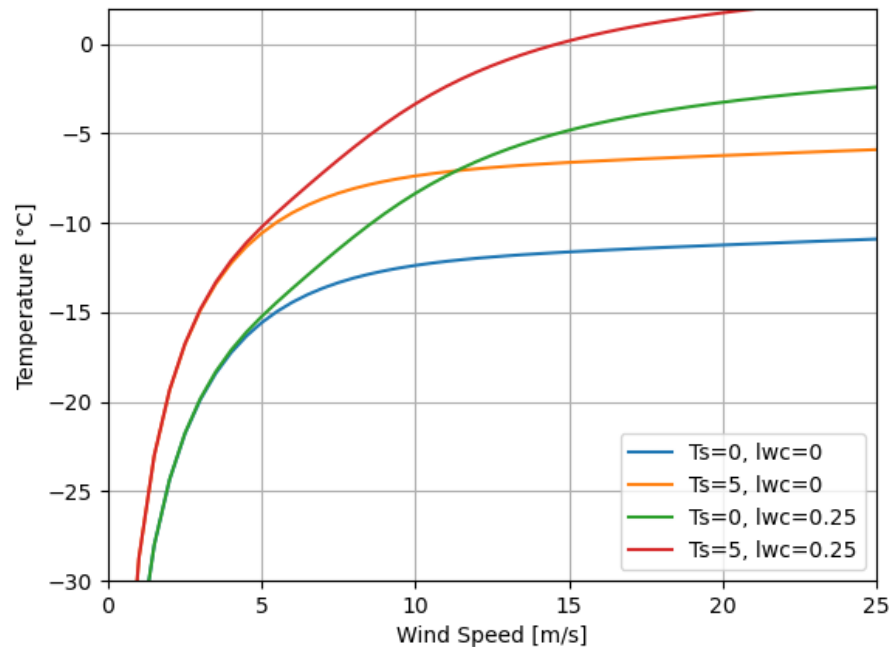
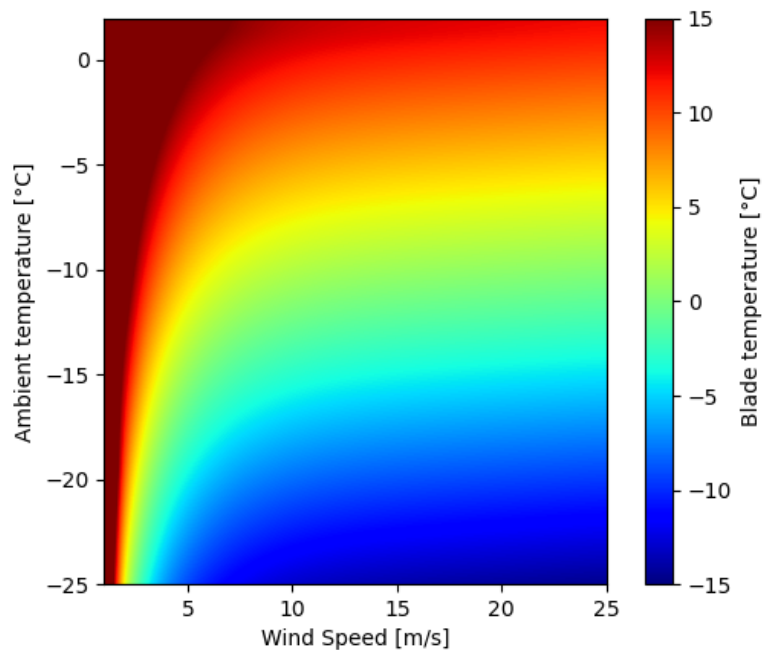


Performance envelopes of blade heating systems



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LWC = 0 g/m³





Performance envelopes subtask outlook

- WP2 – Exemplary icing events
 - Continuation of data gathering on icing events
 - Creation of publicly available data sets, if possible for different regions
- WP3 – Modelling
 - Preparation of recommendations on modelling procedure
 - Creation of generic code examples for individual system aspects
- WP4 – Field validation
 - Validate proposed method using operational data from system manufacturers and project owners that are willing to share data
 - Provide guidelines on procedure/tools required to implement validation method

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Thank you for your attention!

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