

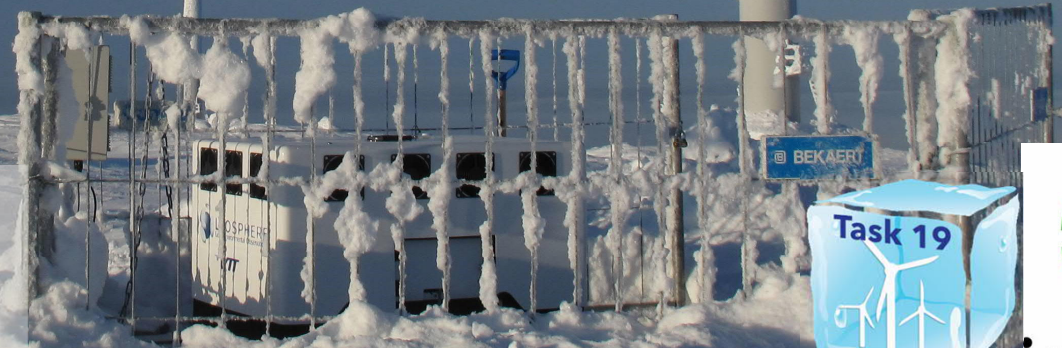
Cold climate wind market study 2020-2025

Winterwind 2020

Timo Karlsson

IEA Wind Task 19

VTT Technical Research centre of Finland Ltd.



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Introduction



- Timo Karlsson
- Decade+ with wind
- With VTT since 2012
- Cold climate issues mainly
- Operating agent of IEA Wind TCP task 19

IEA Wind TCP Task 19 – Wind Energy in Cold climates



Mission:

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

Method:

Gathering and disseminating information and research regarding wind energy in cold climates

International collaborative platform

Established under IEA (international energy agency)

Members from 10 Countries

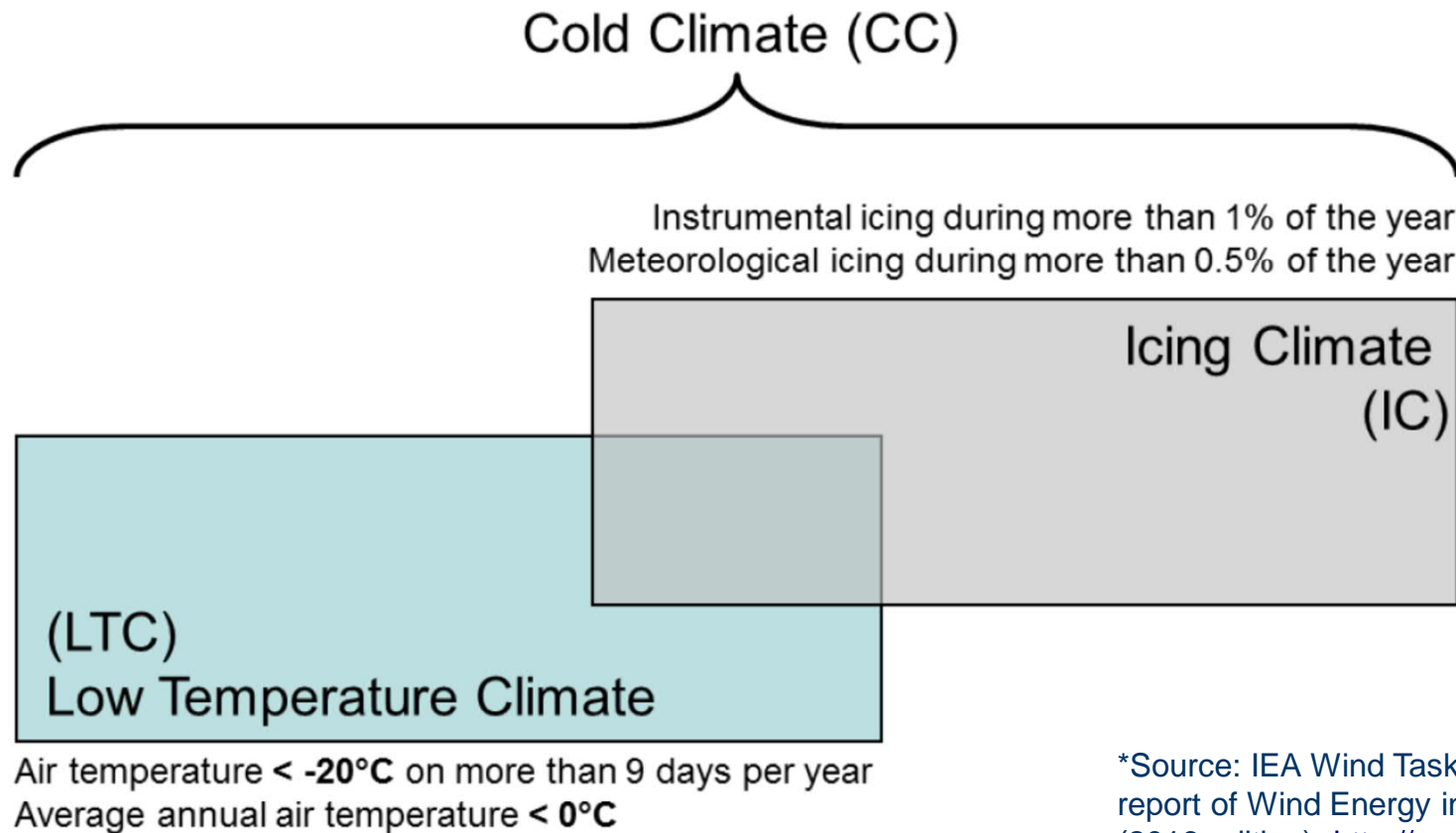
Cold climate wind market



Questions:

- How large is cold climate wind market?
- Where is it?
- How is it growing?

Cold climate wind



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

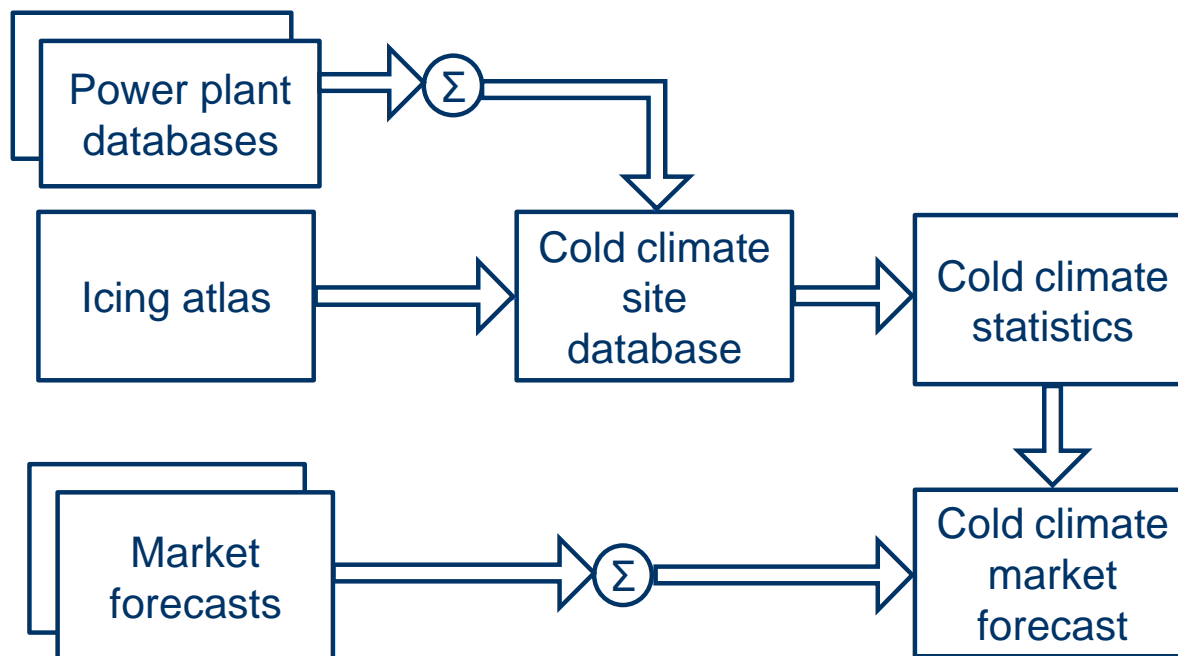
IEA Ice Classification¹



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

Method

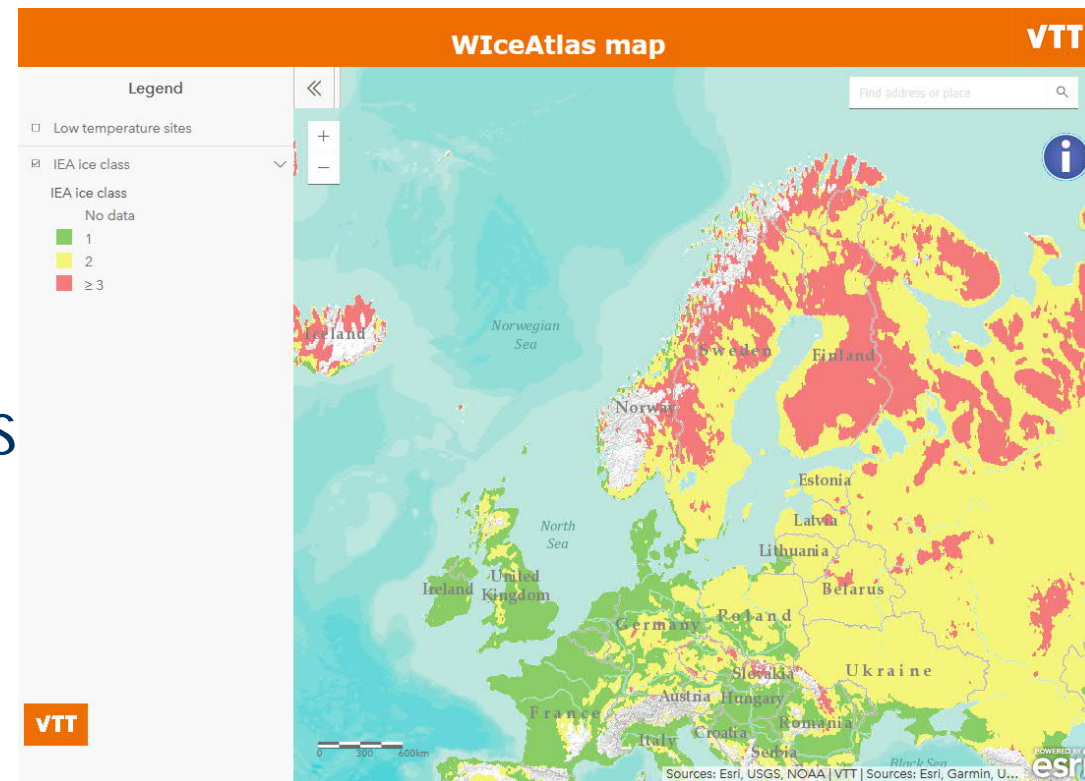


- Establish the current size of cold climate market
 - Use turbine databases and meteorological icing information
- Icing information from VTT Wiceatlas
- Combine the current estimate of the cold climate market with general wind market size growth estimates
- Use multiple data sources when possible

VTT World Icing atlas



- Global database of meteorological icing
- Based on weather observations
- Contains information on both icing and cold climate conditions
- [Wind Power Icing Atlas – WIceAtlas \(vtt.fi\)](#)



Data sources



Turbine data

- <http://www.thewindpower.net>
 - Commercial database, global
- Open power system data project
 - (<https://open-power-systems-data.org>)
- WRI World power plant database
- Natural Resources Canada
- USGS wind turbine database

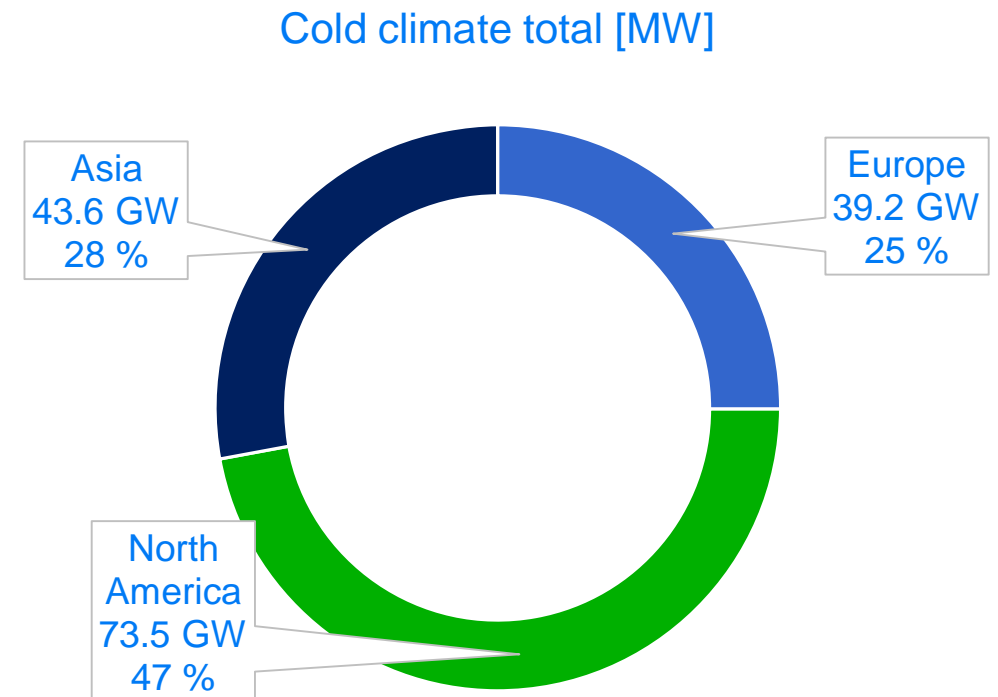
Market forecasts

- GWEC
- Windeurope
- Canada energy regulator

Current cold climate market



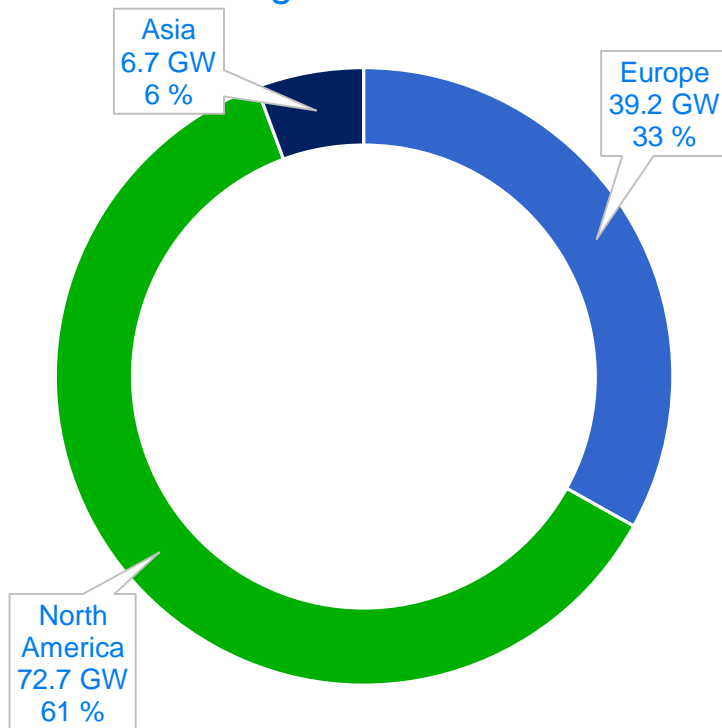
- Size of cold climate market is roughly $\sim 22 \pm 2\%$ globally
- Global onshore wind capacity in 2020 is ~ 700 GW (GWEC 2021)
- Size of cold climate market ~ 156 GW
 - 137 GW icing
 - 67 GW Low temperature



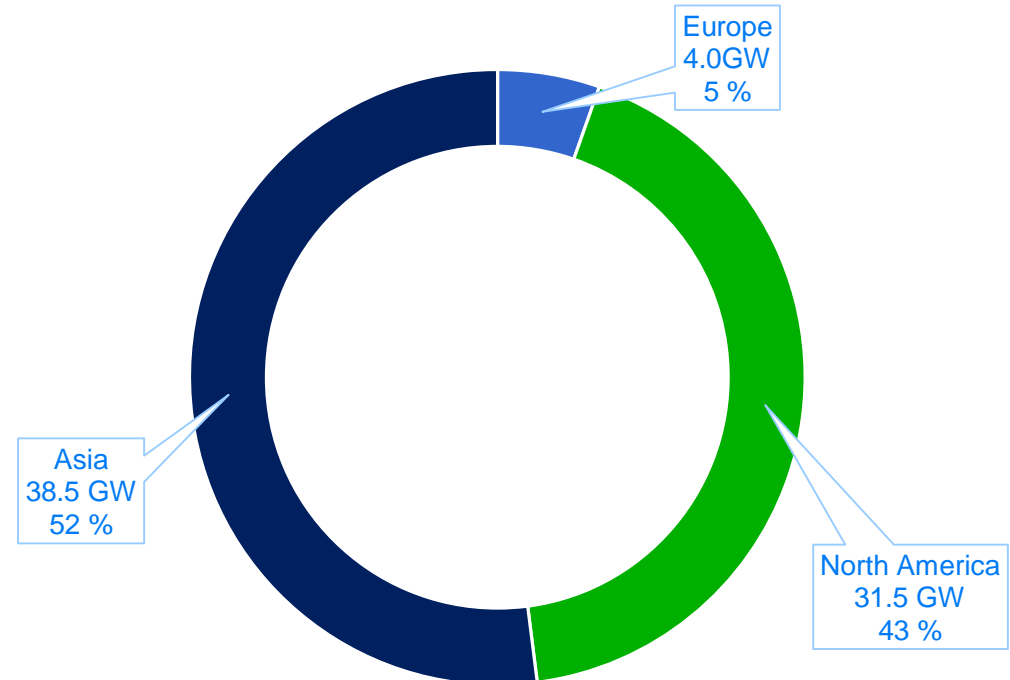
Current market



Icing Climate Total



Low Temperature total 2020



Cross-category overlap



- Some sites are both low temperature and icing, some are one but not the other
- In Asia, cold, dry climates common
- In Europe and North America all low temperature sites are all icing sites

Europe	Icing		
Low temperature		NO	YES
	NO	75.6 %	22.6 %
	YES	0.0 %	1.8 %
North America	Icing		
Low temperature		NO	YES
	NO	70.4 %	17.6 %
	YES	0.7 %	11.3 %
Asia	Icing		
Low temperature		NO	YES
	NO	87.1 %	1.3 %
	YES	11.3 %	0.2 %

Previous efforts



- Similar analysis has been done by task 19 twice now
- 2012
 - published in BTM world market update 2012
 - Presented in winterwind 2014
- 2016
 - Presented in winterwind 2017

2016 estimate



Cumulative installed capacity by end of 2015 [MW]		Forecasted capacity by end of 2020 [MW]	
Low temperature	Icing*	Low temperature	Icing*
40 500	86 500	62 500	123 000
Total 127 000		Total 185 500	

*: IEA Ice Classification ≥ 2 meaning $> 44\text{h/a}$ of meteorological (in-cloud) icing

+12GW/a -> 59GW of new installations to cold climates by 2020!

➤ Compare: new offshore +4GW/a -> 20GW by 2020

<http://www.windpowermonthly.com/article/1403504/emerging-cold>

2016 estimate

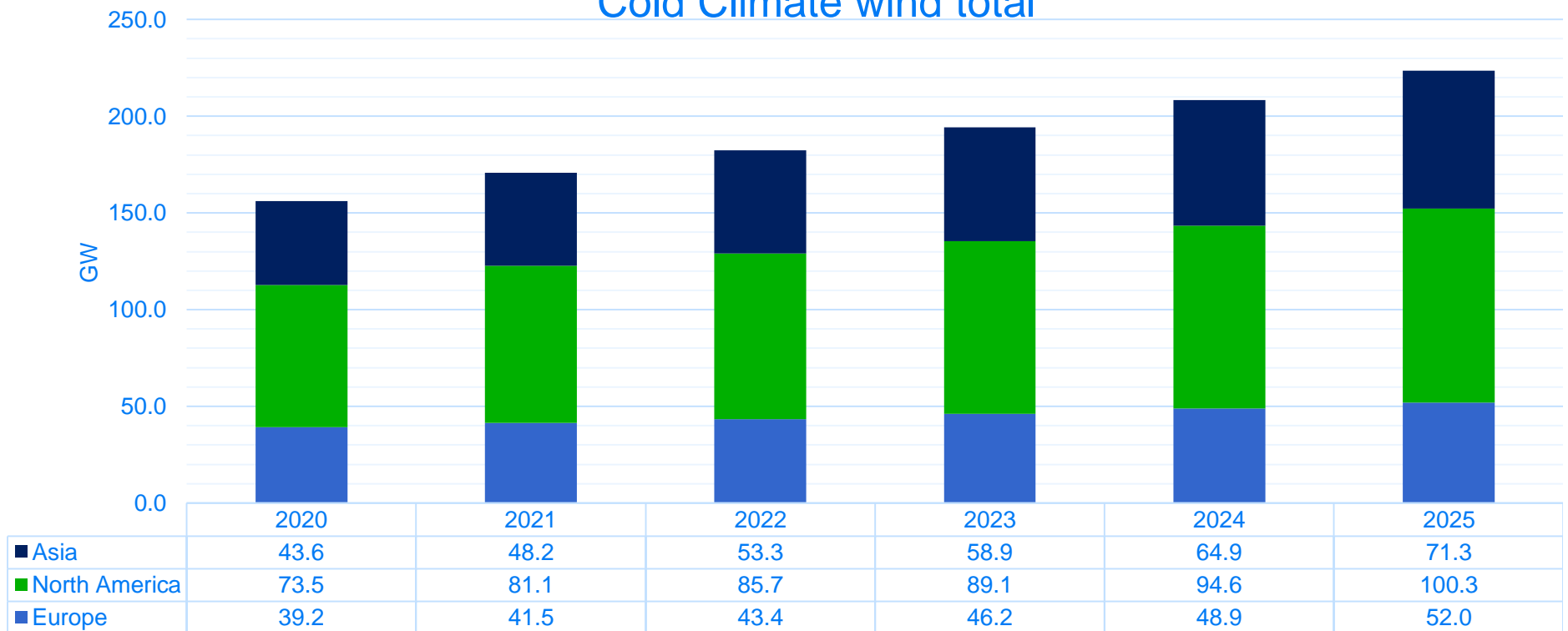


- The 2016 forecast overshoots the current market size estimate
- Updates to the icing database
- Better estimation of the overlap
- Source forecast overestimates the growth that happened
 - Total market size in the forecast was bigger than actual in 2020

Forecast 2020-2025



Cold Climate wind total



Forecast 2020-2025

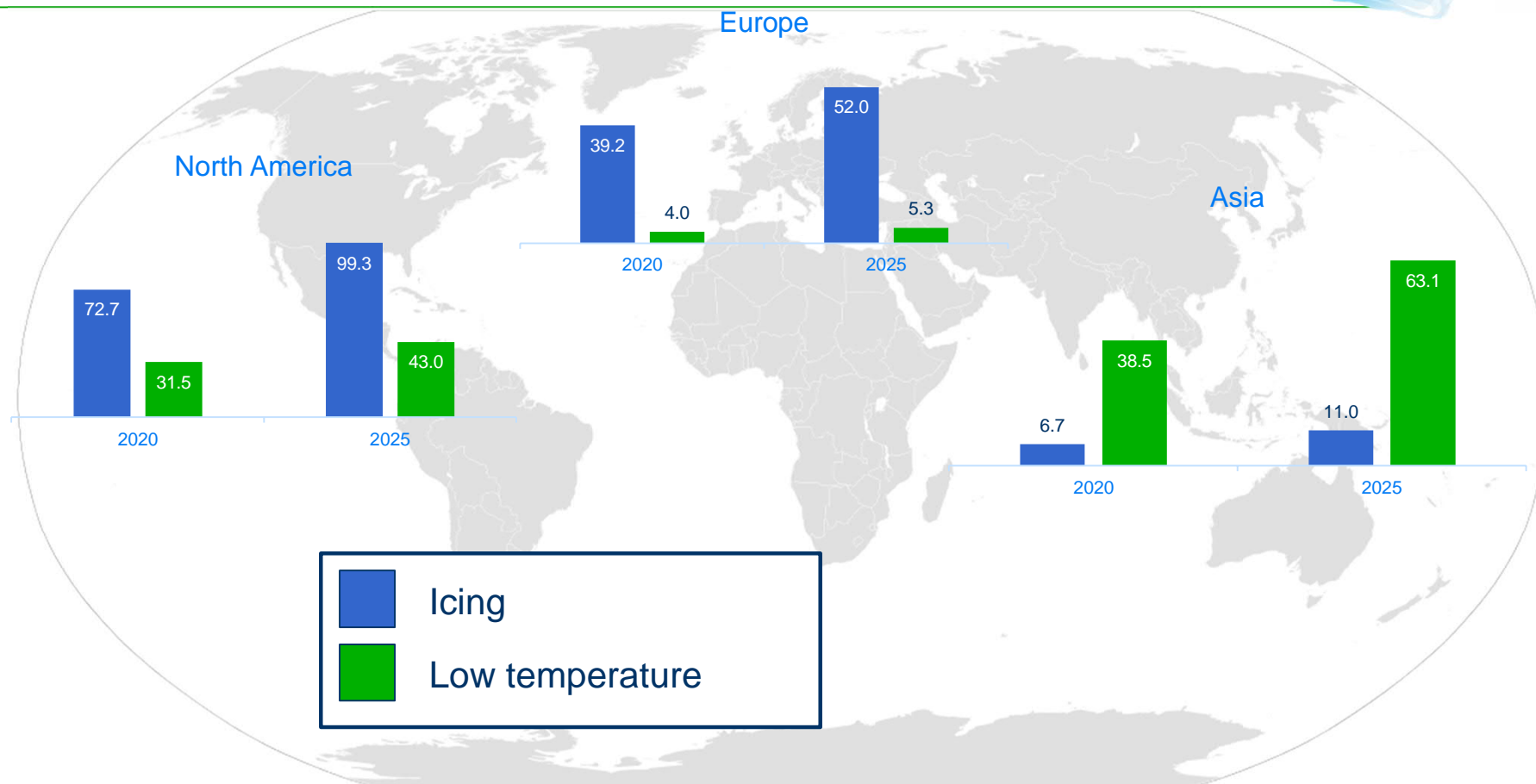


Estimated cold climate wind market size in GW in 2020		Forecast for Cold climate wind market in GW for 2025	
Icing climate	Low temperature	Icing Climate	Low Temperature
118.6	74.0	162.2	111.4
Total 156.2		Total 223.6	

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

Forecast 2020-2025



Conclusions



- Cold climate is the largest "special" wind power market today
- 20 %, Onshore
- Majority of cold climate sites are in ice class 2
- Mild overlap between low temperature and icing
- Europe, North America majority of the icing market

Timo Karlsson
timo.karlsson@vtt.fi



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