

MAST MEASUREMENTS IN COLD CLIMATE

CHALLENGES AND RECOMMENDATIONS

SÓNIA LILÉO

Mast Measurements in Cold Climate (MMCC)

~~2016~~, Ice Free Anemometers, Temerin et al.

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“Ice-free anemometers have to be used at wind power sites affected by icing to guarantee safe and economical power production.”

“Today some ice-free anemometers and wind vanes are available on the market, but there is a need to improve.”

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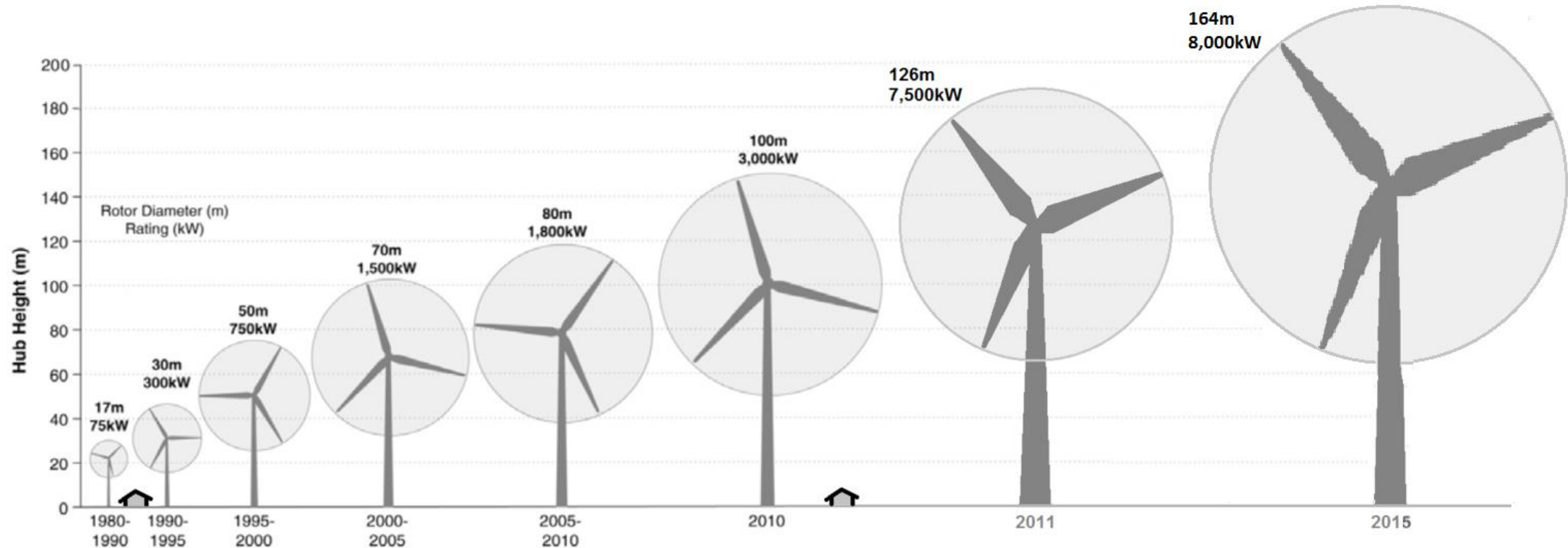
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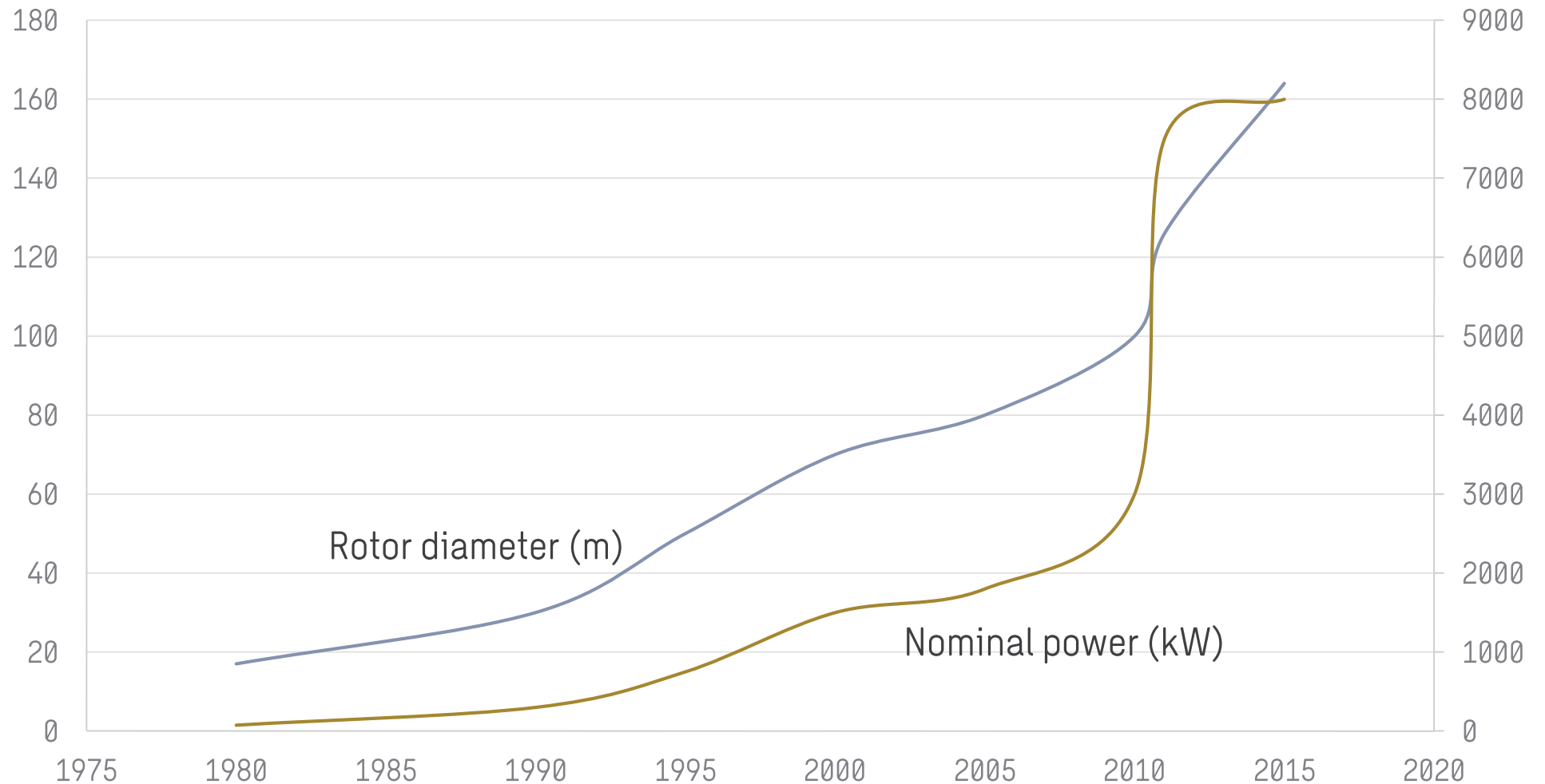


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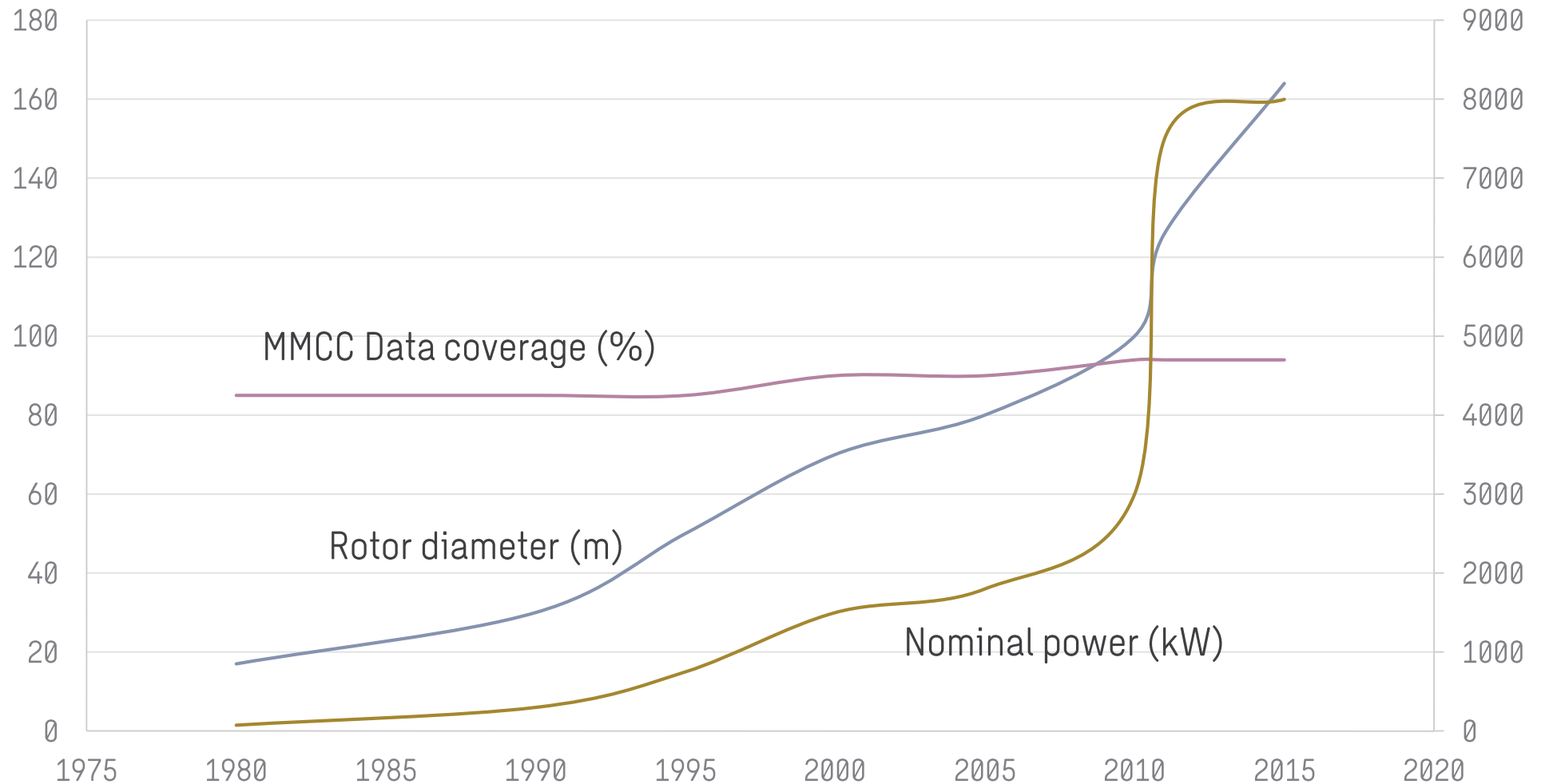
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The development within MMCC has been relatively weak



How have MMCC developed during the last decades?



1998

1998, Ice Free Anemometers, Temerin et al.



2015

2015, <https://youtu.be/wSzE4sWo8M>

How have MMCC developed during the last decades?

IEA Wind Task 19 – An important initiative

“IEA Wind Task 19 Wind Energy in Cold Climates began work in 2002.

Purpose: gather and provide information about wind energy in cold climates, including project development, operation and maintenance (O&M), health, safety and environment (HSE), operational experiences, and recent research.

The current term continues until end of 2015. An extension will be proposed for 2016-2018.”

IEA Wind Recommended Practices 13. Wind Energy Projects in Cold Climates, 1. Edition 2011

A pre-normative recommended practice that includes actions and procedures for wind energy projects in cold climates recommended by the experts involved in the Task 19.

IEA Wind Task 19 State-of-the-Art of Wind Energy in Cold Climates, 2012 Edition

Summarizes existing experiences and state-of-the-art technology and research in wind energy in cold and icing conditions.

How have MMCC developed during the last decades?

IEA Wind Task 19 – An important initiative

”As a rule, **fully heated sensors are recommended** at sites with potential icing”

”The readings of shaft heated instruments are difficult to be filtered with regard to icing, as in many cases, the sensor is still rotating at a lower wind speed. **If no fully unheated sensor is available, it is not possible to extract the disturbed values.**”

”Equipping the measurement mast with **one properly heated and one unheated anemometer** to estimate wind resource measurements **is relatively inexpensive and highly recommended.**”

”Because most heated sensors have disadvantages like high mass or sensitivity to vertical wind, **conventional cup anemometers that fulfil the IEC recommendations should also be used.**”

”The use of redundant and heated anemometers will not guarantee accurate wind resource data collection. Additionally, other parameters such as outside air temperature, ice accumulation and ice duration should be measured” ... **”with a camera system, meteorological icing, maximum ice load, type of ice and icing rate can also be assessed”.**

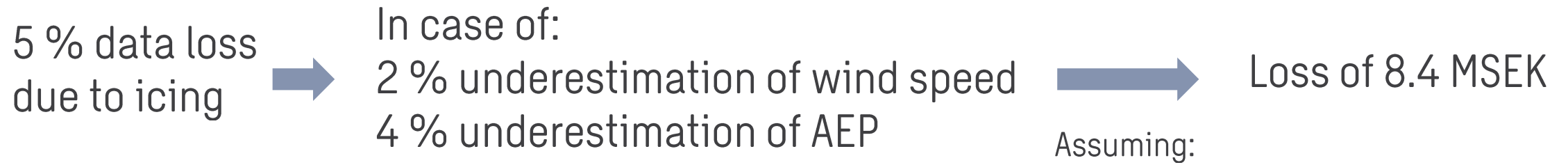
How are MMCC today?

In spite of the occurred sensor development, and definition of recommended practices, data loss due to icing is, in average, still surprisingly high!

Mast	Data coverage of the main sensor (after filtering and eventual data replacement)
1	88 %
2	89 %
3	97 %
4	95 %
5	97 %
6	99 %
Mean	94 %

↙ Illustrative sample

The cost of data loss can turn extremely high!



Wind farm with 10 WTGs
 Wind farm AEP = 60 GWh
 Investment cost = 3.5 MSEK/GWh

Assuming one met mast, the total cost of the mast measurement campaign is:

Original cost = 1.2 MSEK

Additional cost = 8.4 MSEK

What is our vision for MMCC in 2020?

99 %
Mean data coverage of
the main sensor

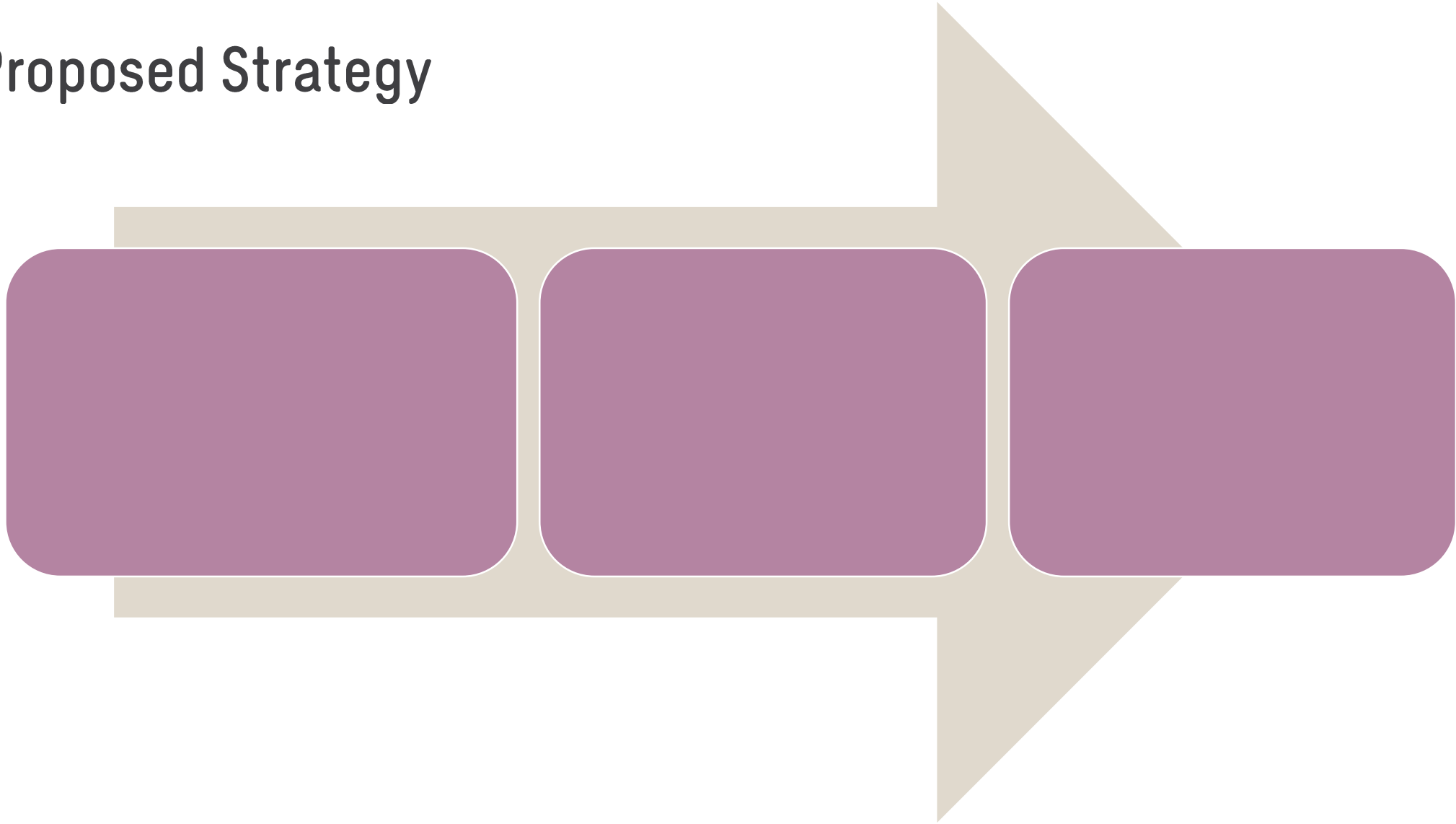
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Requires a better understanding of:

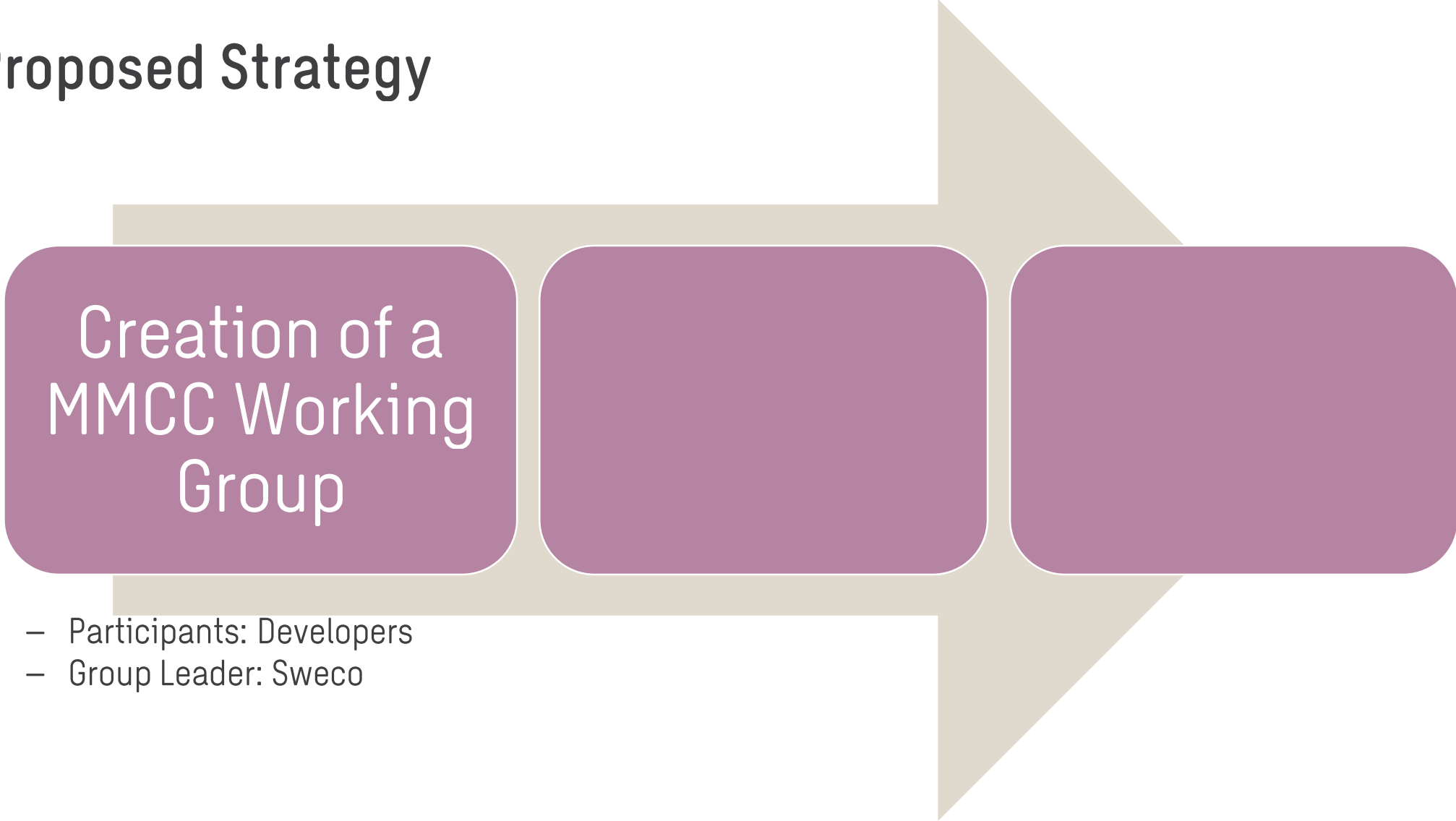
- Why heated sensors freeze/stop working
 - Not enough power?
 - Problems with power cables?
 - Problems with power supply?
- Heating of the supporting top spire/booms
- Data replacement
 - Required mast configuration
 - Required methodology

Requires sharing experiences

Proposed Strategy



Proposed Strategy



Creation of a
MMCC Working
Group

- Participants: Developers
- Group Leader: Sweco

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MMCC
Common
Logfile

- Common web-based logfile
- Developers report issues on a regularly basis during 2016
- Sweco compiles logfiles from previous years into the Common Logfile

Proposed Strategy

Creation of a MMCC Working Group

- Participants: Developers
- Group Leader: Sweco

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Share of results

- Workshop with sensor manufacturers and mast operators
- Share of results on Winterwind 2017
- Definition of next steps

Proposed Strategy

What's your opinion?

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