

## **Vestas Cold Climate Solutions**

Vestas Wind Systems A/S

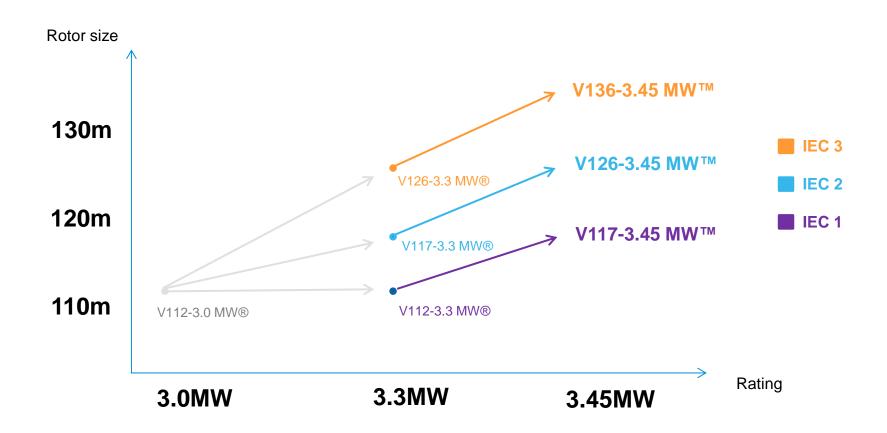
Winterwind 2016
Brian Daugbjerg Nielsen, Product Management

# **Agenda**

- 1. Vestas present work on climate solutions
- 2. Vestas experience and reflections
- 3. Vestas view on the main challenges for the future

## Strong: Boosting AEP performance in all wind classes

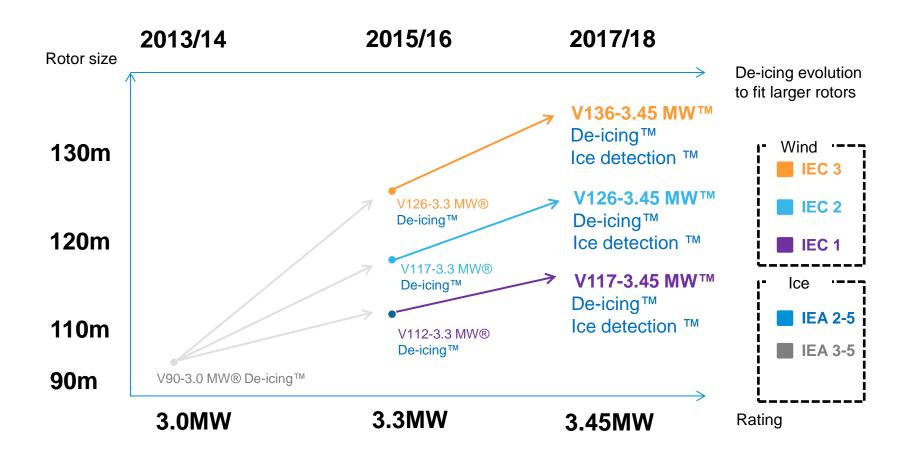
Platform upgrade enables wind class upgrade



<sup>\*</sup>AEP=Annual Energy Production. Actual figures depend on site specific conditions.

## Adding De-icing and Ice detection

Platform upgrade and de-icing evolution is enabling cold climate market



4 Classification: Public

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# Vestas De-icing System – Track record

10 project firmed: 365MW with De-icing in Sweden, Finland & Austria

Up to date: 65 turbines installed



#### Glötesvålen

 $30 \times V90$ -3.0MW HH80m - In operation since Q4 2014

### **Rödstahöjden**

6 x V112 3.3MW HH94m - In operation since Q4 2015

#### <u>Fäbodliden</u>

24 x V112 3.3MW HH129m - In operation since Q4 2015

#### <u>Puuska II</u>

 $5 \times V1123.3$ MW HH119m -In operation since Q2 2015

### Alavieska Saarenkylä

1 x V126 3.3MW HH137m - In operation Q12016

#### Posio I

7 x V126 3.3MW HH137m -In operation Q3 2016

#### Tohkoja

22 x V117 3.3MW HH137m - In operation Q3 2016

#### Maevaara

 $10 \times V126$ -3.3MW HH117m - In operation Q3 2016

#### **Jouttikallio**

6 x V126-3.45MW HH147m - In operation Q42016

### **Sternwald**

2 x V112-3.3MW HH119m - In operation Q2 2016

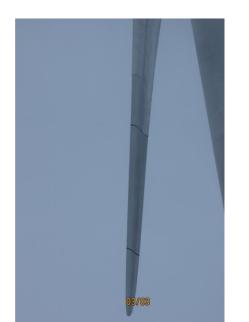
## **De-icing System – Winter 2014/15**

De-icing performance assessment – V90-3.0 MW, Northern, SE

						During Run		Post Run		
								Temp Range		
Event	Date	Turbine		Time	Trigger	Avg Temp (°C)	Avg Wind (m/s)	(°C)	Wind Range (m/s)	Recovery Max
1	1/8/2015		12	6:03:24	70	% 0.00	10.29	-0.25 to + 0.25	9 to 10	100%
2	1/29/2015		26	3:13:48	50	-3.03	11.14	-2 to -4	8 to 9	85%
6	2/25/2015		29	10:43:39	50	% 0.14	9.90	-0.75	10 to 6	80%
7	2/3/2015		29	11:53:33	50	% 0.06	9.41	-1	9 to 5	85%

### ...the minimum recovery is 80%

VDS Blade after de-icing cycle



Blade from reference turbine



Clear removal of ice

Winter 2015/16 performance data is being tracked...

## Risk vs. Reward

Designing and Building cold climate turbines has challenges

### **Pre-Sales**

## Negotiation

### Installation

## Operation

- What is the risk?
- Prediction of AEP % losses due to ice
- Ice throw risk

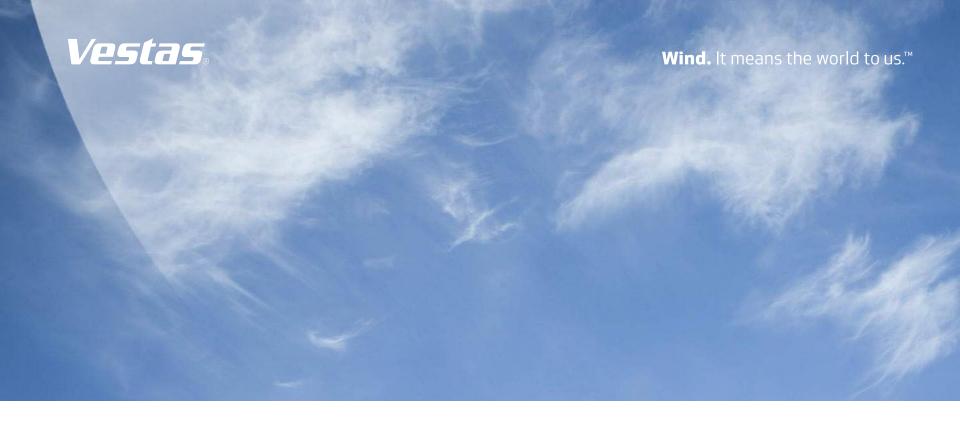
- What is the requirements
- **Building permits**
- Track record
- **Documentation**
- De-icing/ice sensor investment
- Warranties

- Winter window
- How to operate cold climate turbines
- How to calculate the losses due to ice

### Risk vs. Reward

Designing and Building cold climate turbines has challenges

#### Negotiation Installation Operation **Pre-Sales** What is the risk? What is the Winter window How to operate Prediction of A requirements cold cli % losses d Building permits turb Track record ice culate **Documentation** Ice the es due to De-icing/ice se investme Warrantie Design Field test Manufacturing requirement Lab test spec. What to design for? Expensive Ramping up How to model and Lack of standards Resource demanding Impact on factories lab test Lack of acceptance Short window of Training and How to build of failures competences testing confidence in lab Competence Risk of "good" winter test development season Test site identification Classification: Public



# Thank you for your attention

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