Agenda

1. Markedsudvikling
2. Typiske skadeårsager og skade størrekser
3. Teknisk introduktion til WTG
4. Skadeeksempler – off shore
5. Skadeeksempler – on shore
6. Driftstabsopgørelse
7. Afslutning

AGENDA

SEDGWICK.COM

the TEAM

Morten H. Jensen – *Technical Manager, Consulting Engineer*

Morten är en ledande global specialist inom den gröna energisektorn, speciellt inom vind- och solenergi. Han har en bakgrund inom starkström, stöttar försäkringsbolag, OEM och enskilda företagare. Morten har hanterat ett brett spektrum av allvarliga incidenter världen över under sin karriär inklusive brandutredningar, orsaksutredningar av tornkollapser, rådgivningsarbete för drift och underhåll av vindkraftverk och vindkraftsparker, elektriskt infrastrukturarbete och skadehantering.

Theis Mariegaard – *Technical Expert, Wind*

Theis har arbetat inom vindkraftsindustrin i mer än 20 år. Han har en mekanisk bakgrund och har jobbat med installation, inspektion och underhåll av vindkraftsparker över hela världen – både on- och offshore. Theis har därför enorm praktisk erfarenhet och vet om någon vilka utmaningar som uppstår när nya turbiner ska byggas eller när större komponenter ska bytas ut. Han har varit anställd av Sedgwick sedan 2023 och har precis rätt erfarenhet för att ge råd och vägledning för både försäkringsbolag och skadelidande att komma tillbaka på rätt spår när det har gått fel.

Den moderne vindmølles fødsel

Vindmøllepioner Johannes Juul

Vindelektriker/strømingeniør

Juli 1957 opfører han ”Gedsermøllen”

Vindblæst sydspids af Falster

Begrænset anerkendelse af den ”nye” teknologi.

”Lad mig sig det straks. Forsøgsanlægget her repræsenterer ikke en sensationel, hidtil ukendt kraftkilde.
Med den rivende udvikling, der den seneste tid har fundet sted på atomenergiens område, er det derfor berettiget at spørge, om ikke tiden er løbet fra interessen for vindkraftens anvendelse”

– Robert Henriksen, Formand for Danske Elektricitetsværkers Forening ved indvielsen af Gedsermøllen

Den moderne vindmølles fødsel

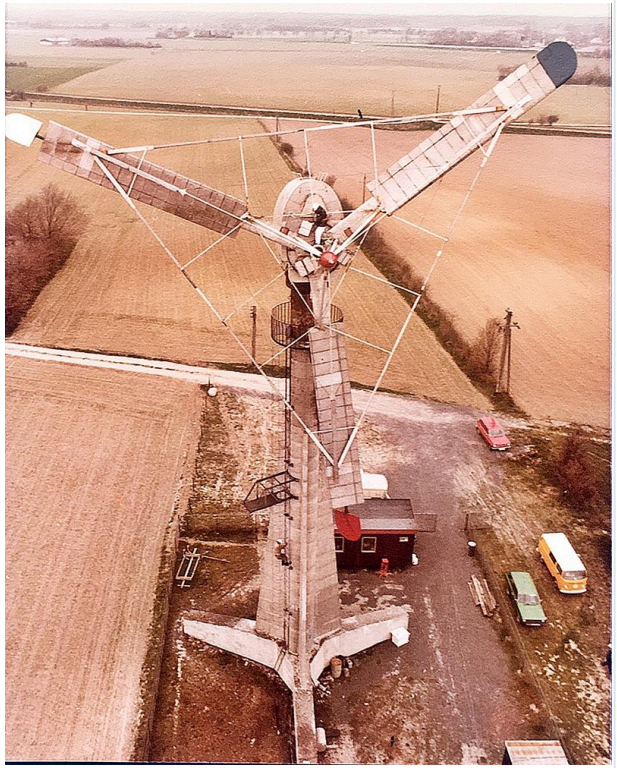
Opført 1957

På daværende tidspunkt en af verdens største

Blev dømt ude nærmest inden den var sat i gang

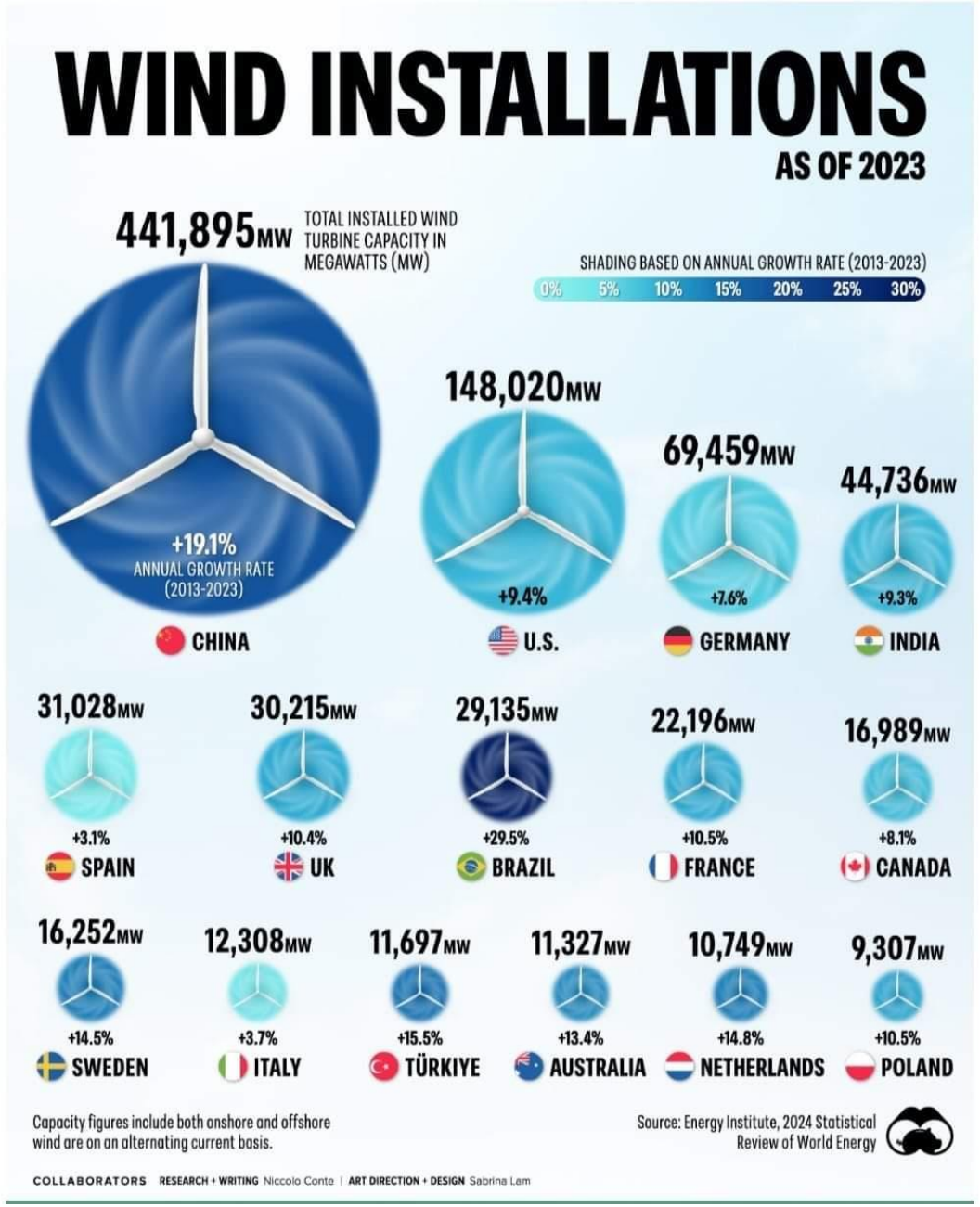
I 1970'erne interesse fra NASA

I 1975 renoveret med finansiering af NASA



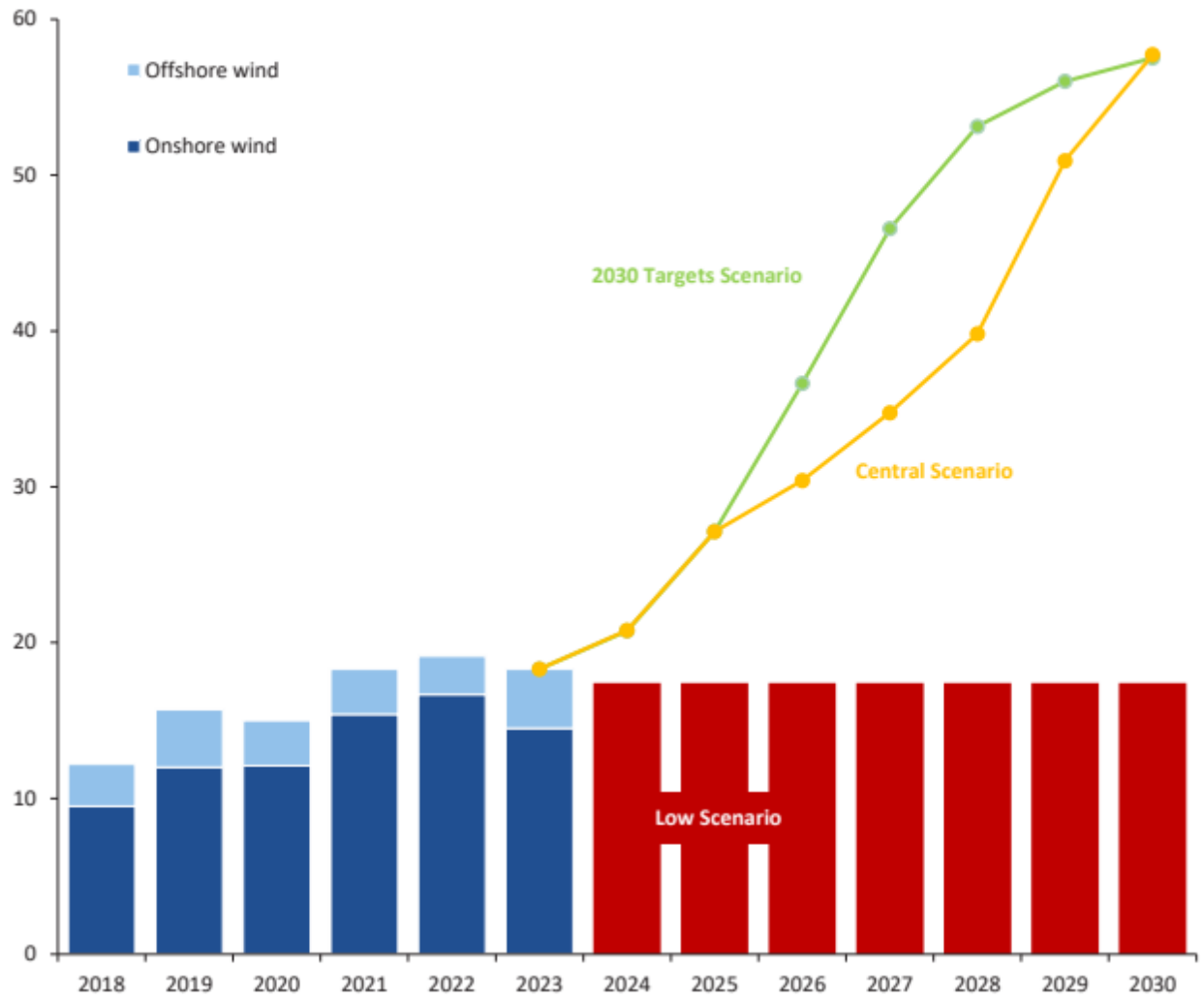
Total installed capacity as of 2023

app.



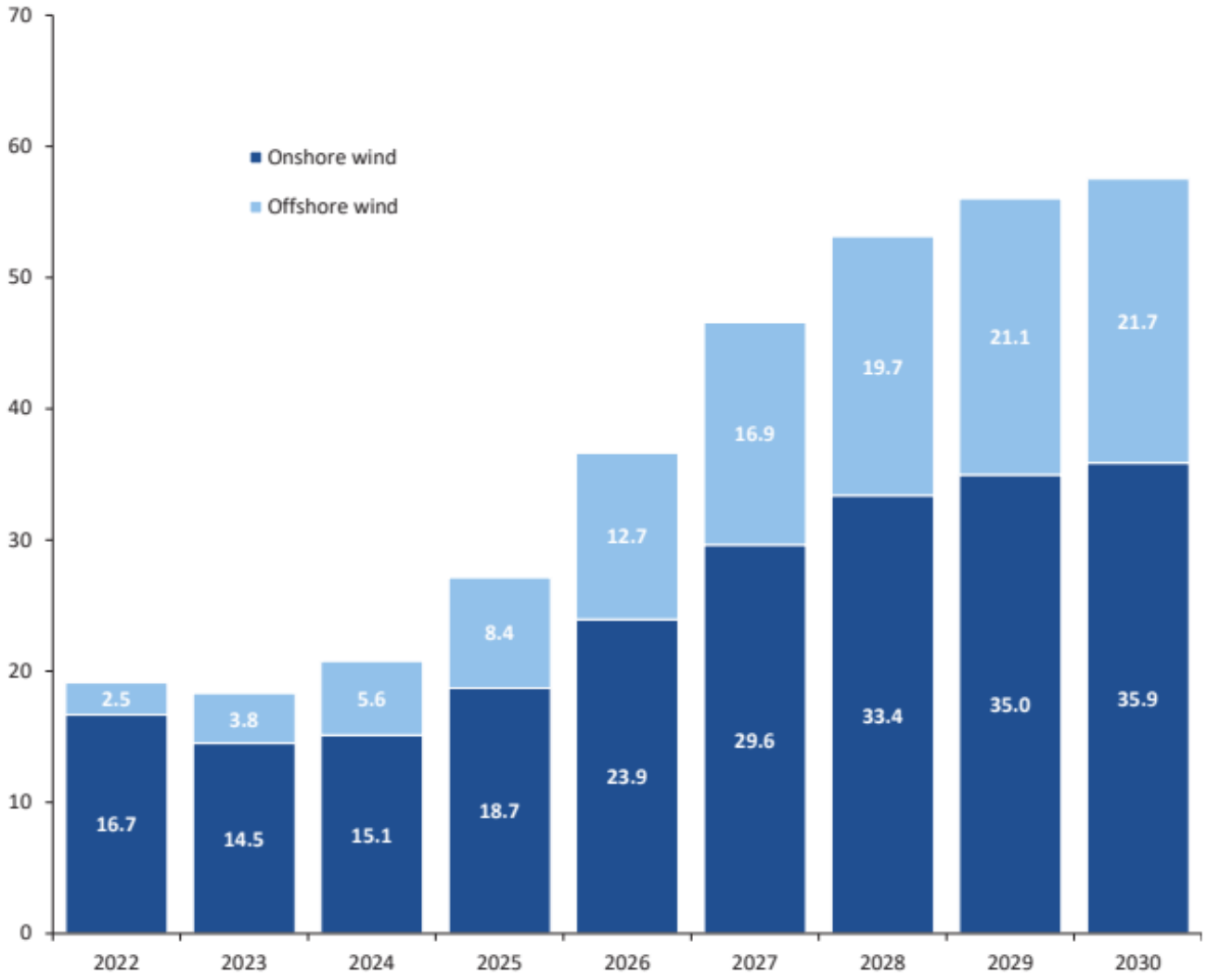
Outlook scenarios

Figure 16: Annual installed wind capacity in Europe by scenario, 2018-2030
Gigawatts (GW_{AC})



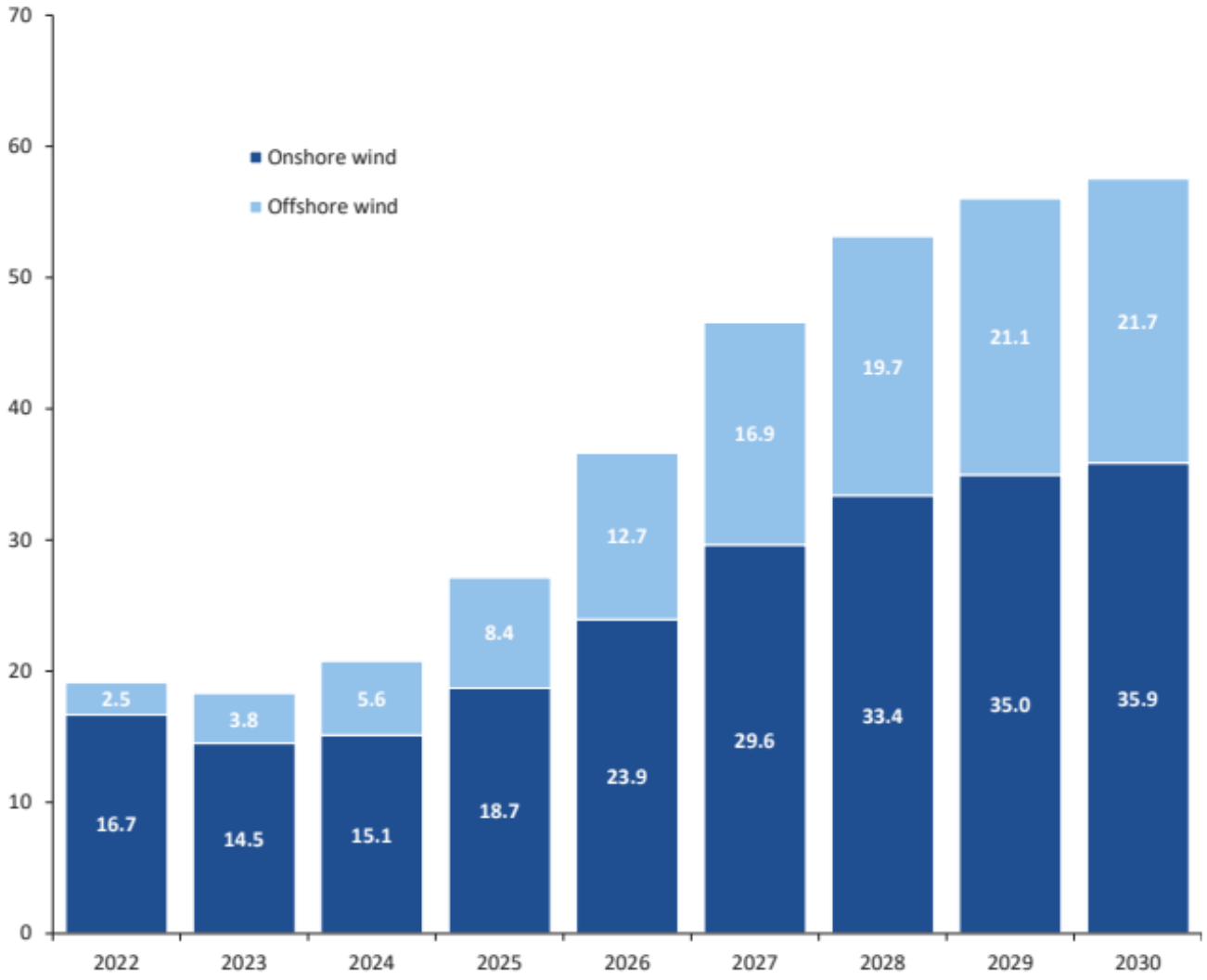
Target scenario

Figure 17: Annual installed wind capacity in Europe, WindEurope 2030 Targets scenario
Gigawatts (GW_{AC})



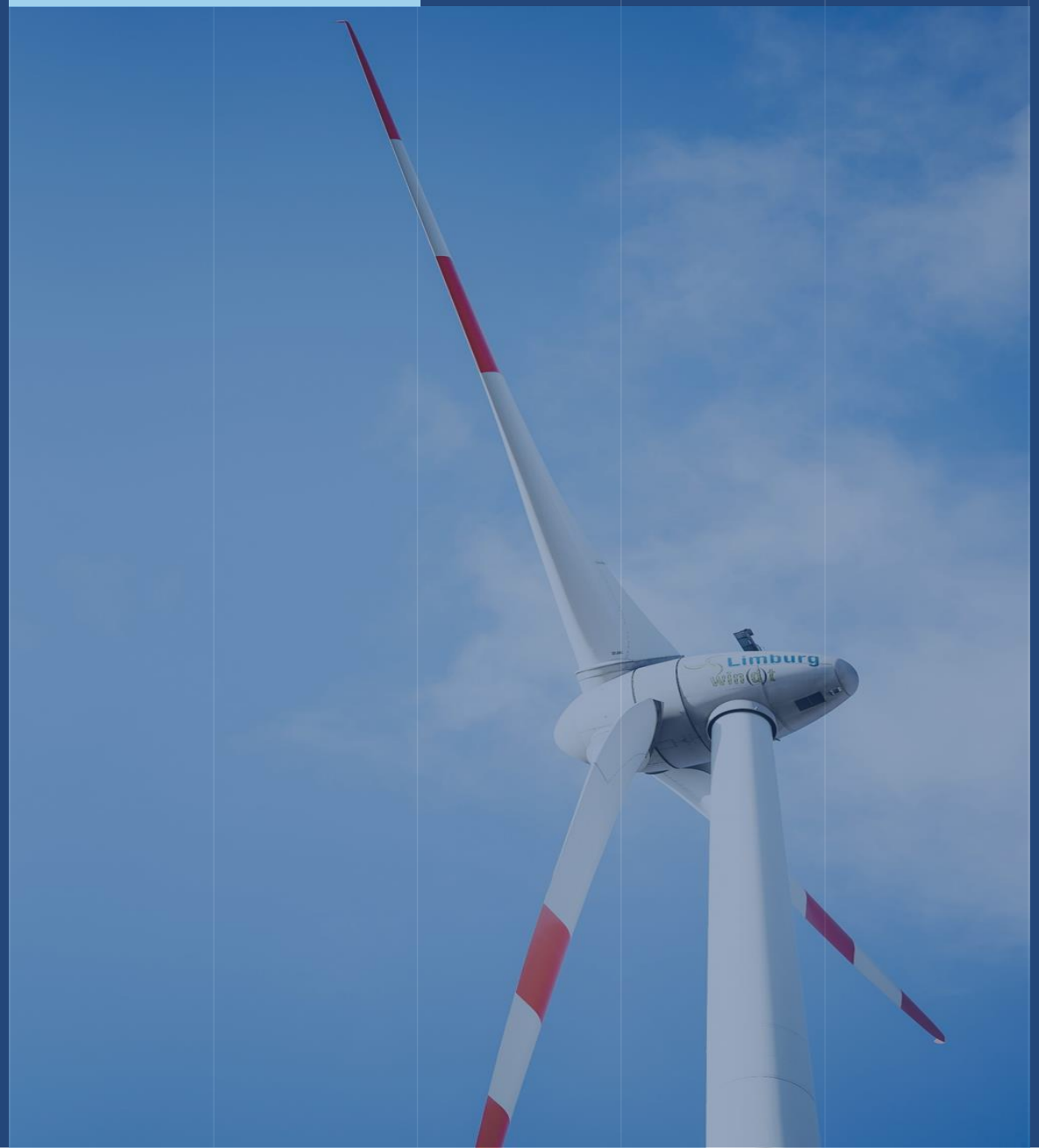
Central scenario

Figure 17: Annual installed wind capacity in Europe, WindEurope 2030 Targets scenario
Gigawatts (GW_{AC})



Renewable Energy Claims

Types of claims and trends



Technology

Onshore Wind

Offshore Wind

CLAIMS… ONSHORE WIND

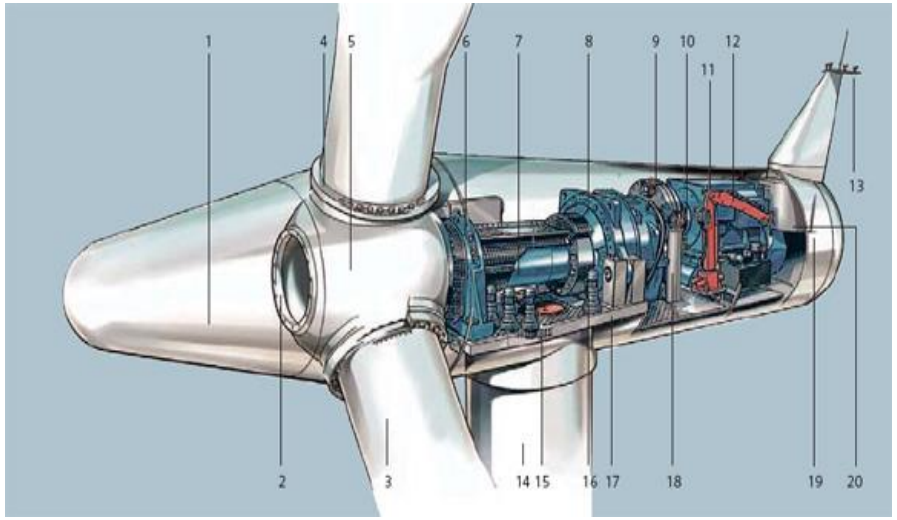
"I never make the same mistake twice I make it five or six times just to be sure.

"Bill Murray"

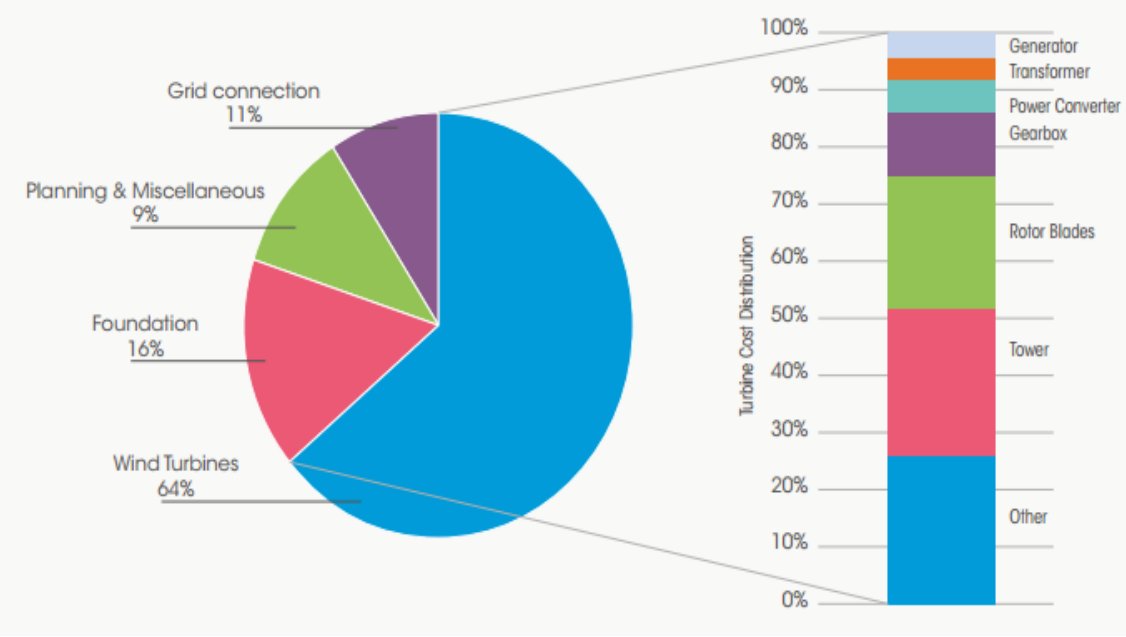
INTRODUCTION

NIKOLAJ, MORTEN OG THEIS

Onshore Wind
Main Components

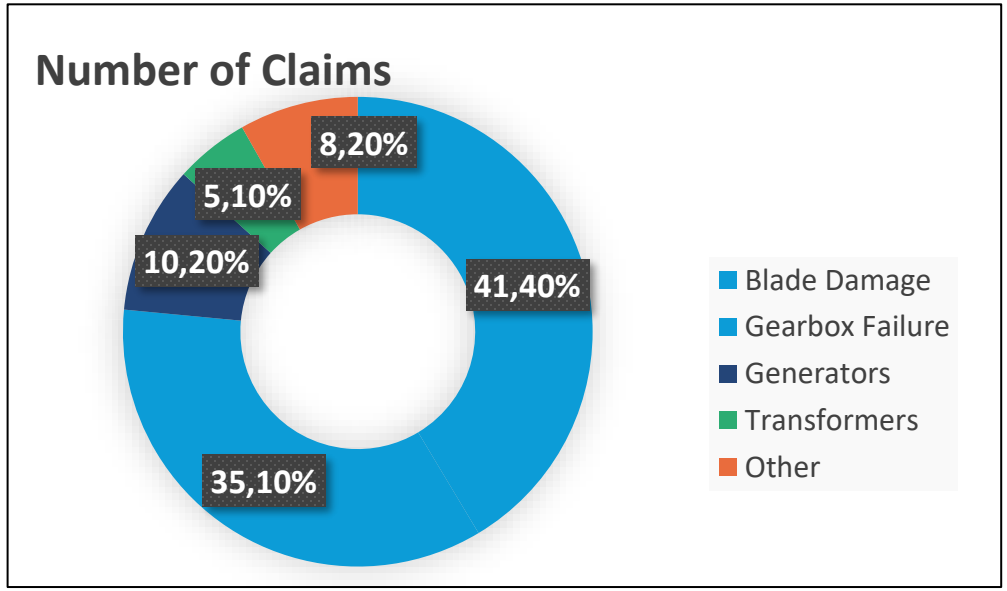


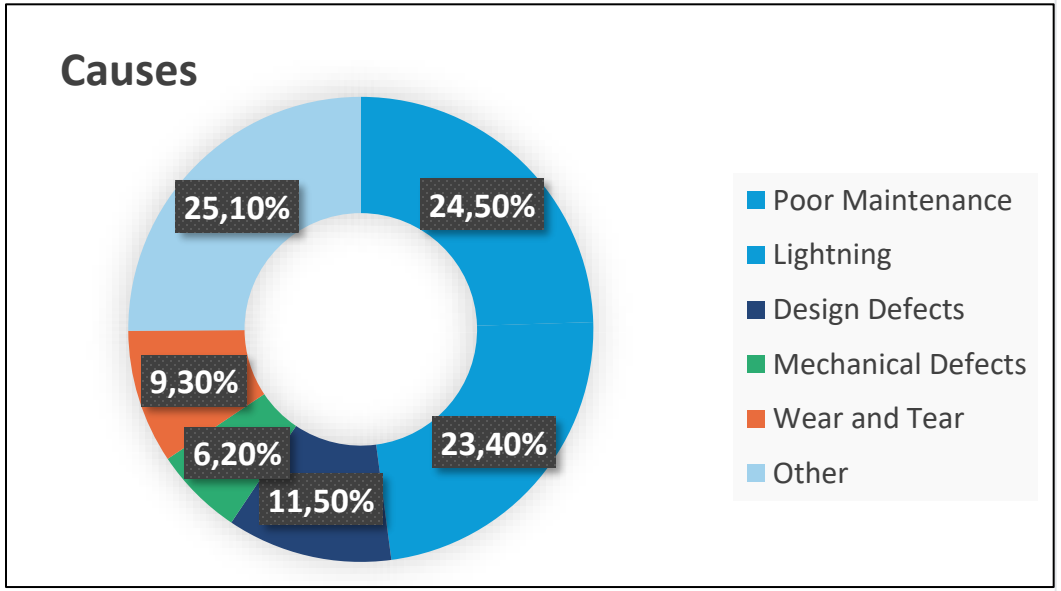
1. Spinner	8. Gearbox	15. Yaw ring
2. Spinner bracket	9. Brake disc	16. Yaw gear
3. Blade	10. Coupling	17. Nacelle bedplate
4. Pitch bearing	11. Generator	18. Oil filter
5. Rotor hub	12. Service crane	19. Canopy
6. Main bearing	13. Meteorological sensors	20. Generator fan
7. Main shaft	14. Tower	



Source: Bianco, 2009

Onshore Wind
Claims Statistics (OAR/CAR)





Average Claims Cost	
Gearbox	USD 350,000
Turbine Blade	USD 250,000
Foundation	USD 1,200,000

- Blade/Gearboxes = common losses
- Poor Maintenance & defects = common causes
- 90% of claims are below USD500k
- 80% of Wind claims (internal peril)

Onshore Wind CAR losses

Construction Claims:

- Testing commissioning failures

-Electrical issues leading to fires

-Transportation & Delivery issues

-Poor Workmanship / Installation issues

Onshore Wind OAR losses

Operational Claims:

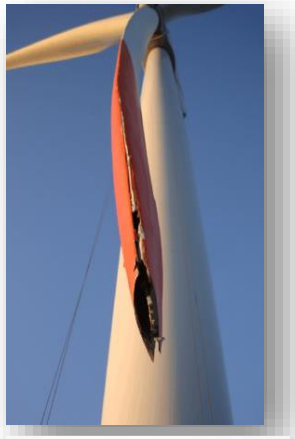
-Electrical failures, WTG & Grid connections

-Defects in Gearboxes, bearings & blades

-Lightning, ice, thermal cycling, moisture intrusion

-Arson, terrorism

-Nat Cat

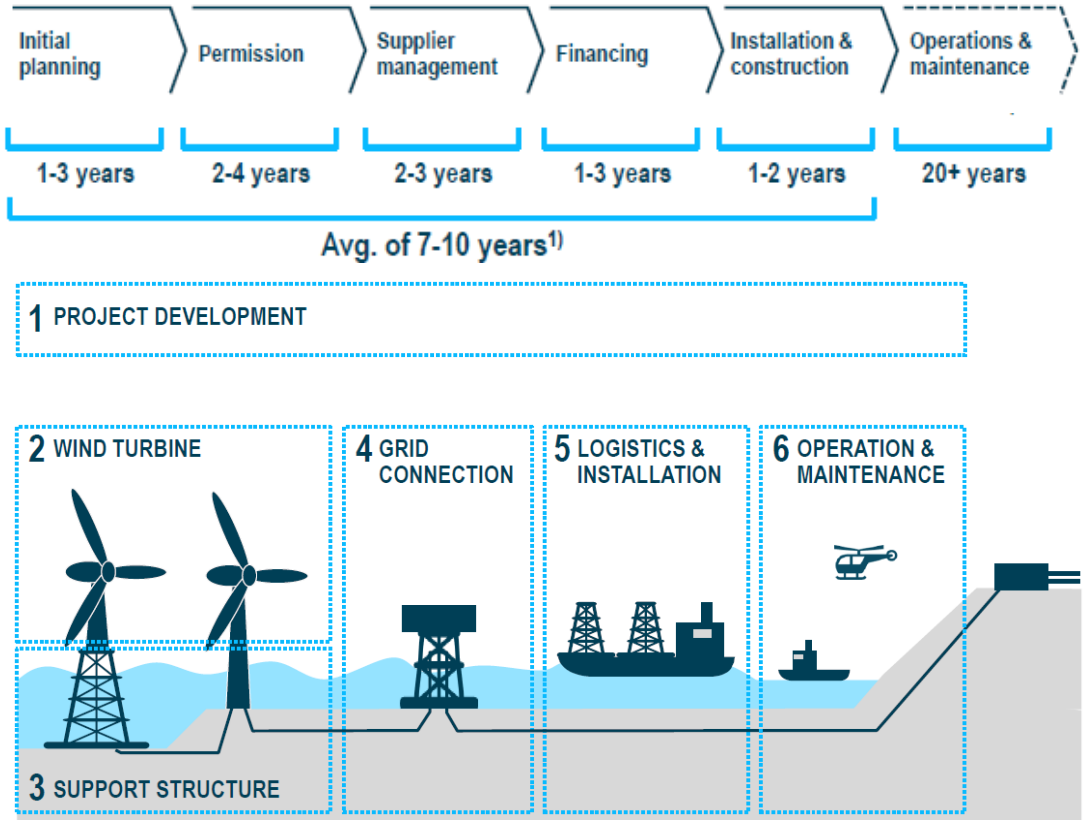


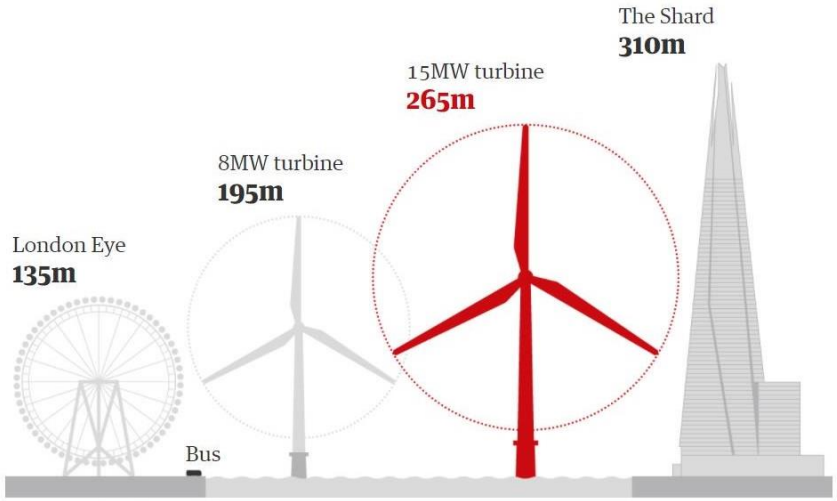
CLAIMS… OFFSHORE WIND

“We can’t direct the wind, but we can adjust the sails.

“Jimmy Dean”

Offshore Wind
Main Components





Guardian graphic | Source: WindEurope

Offshore Wind Claims Statistics

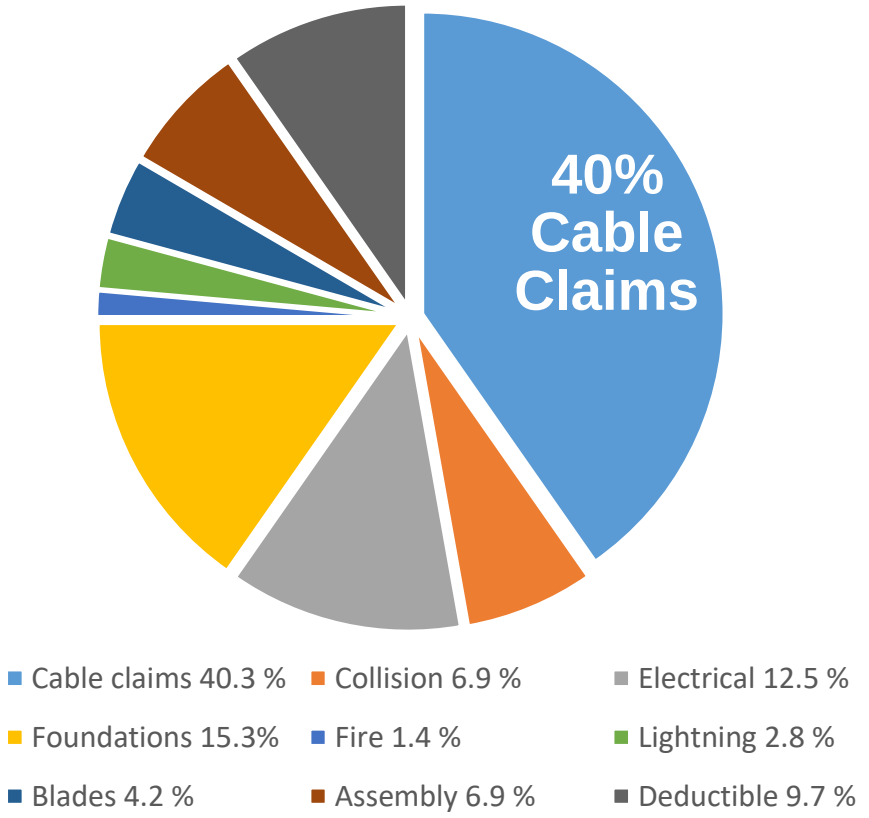
Average claim cost: USD 4m

Inter-array cable damage: USD 2m – 15m

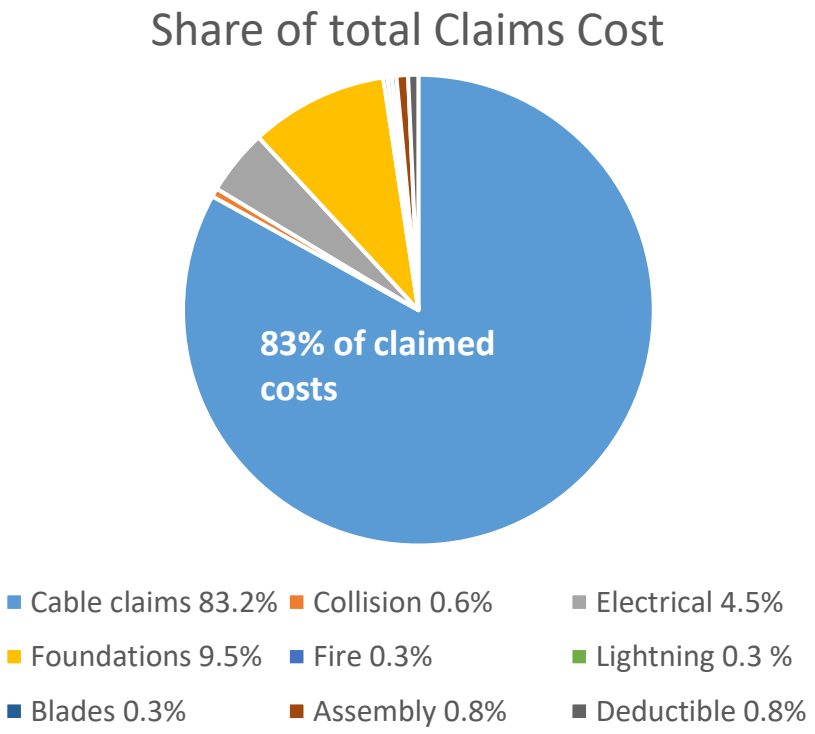
Export cable damage: USD 10m – 30m

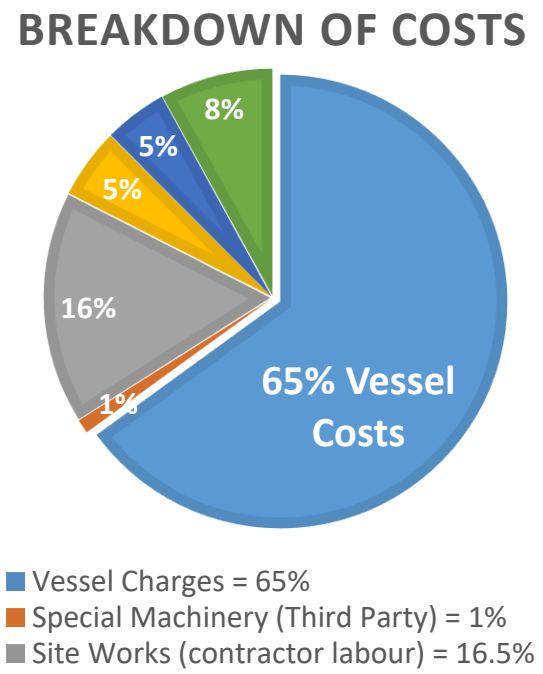
57 of the last 60 construction projects have experienced cable claims

Vessel costs (USD 100k – 350k p/day)

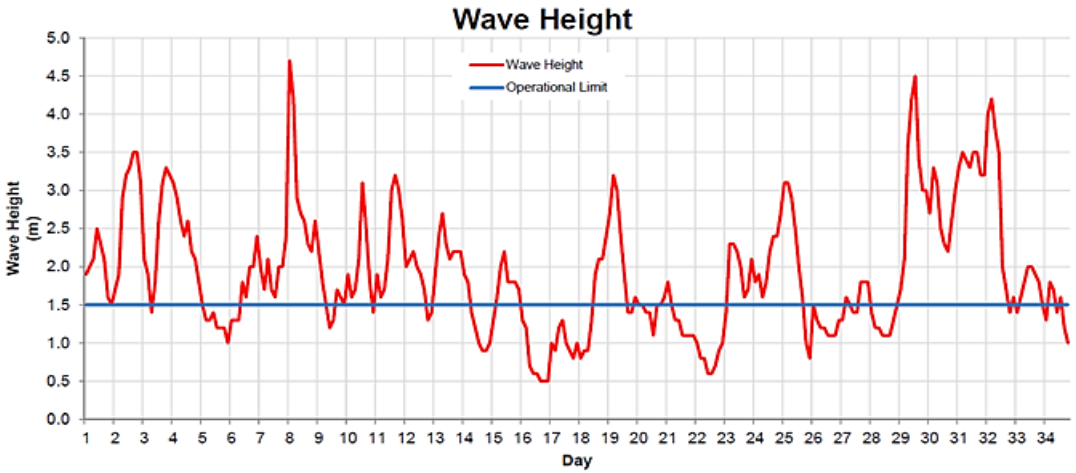


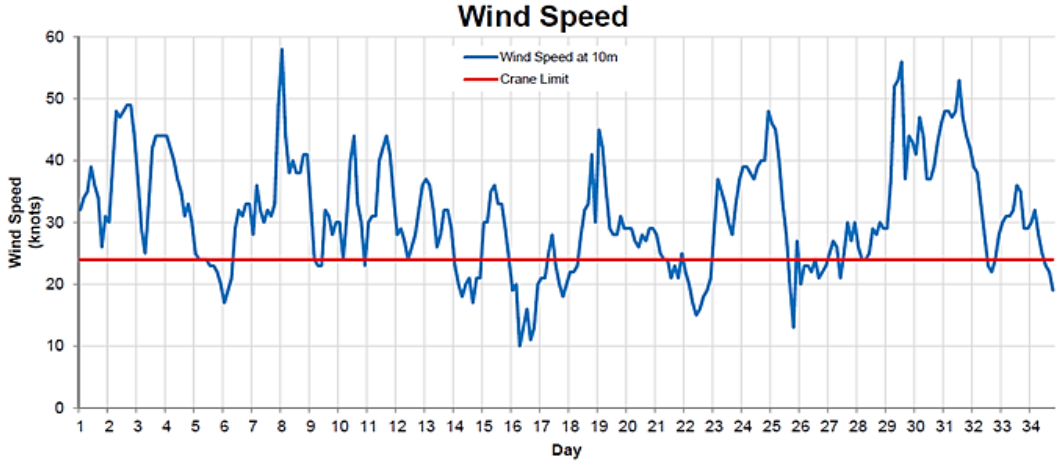
Offshore Wind Claims Statistics





Offshore Wind Claims Statistics





sedgwick

Examples of claims during offshore installation and operation

Monopile installation.

Transsission piece (TP) Installation.

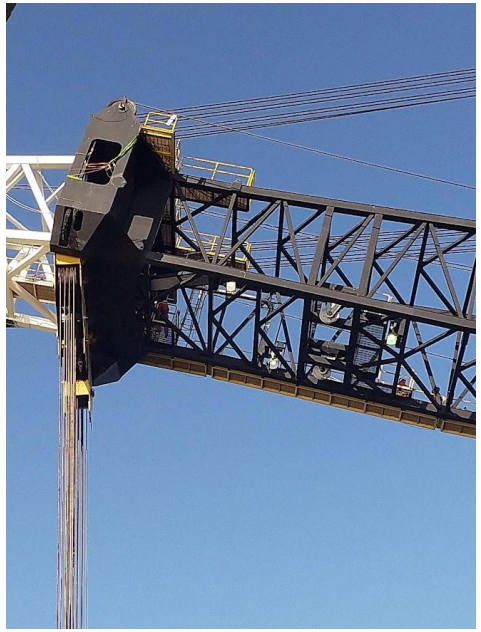
Offshore WTG Installation.

Theis Mariegaard

Crane fault during piling of monopile

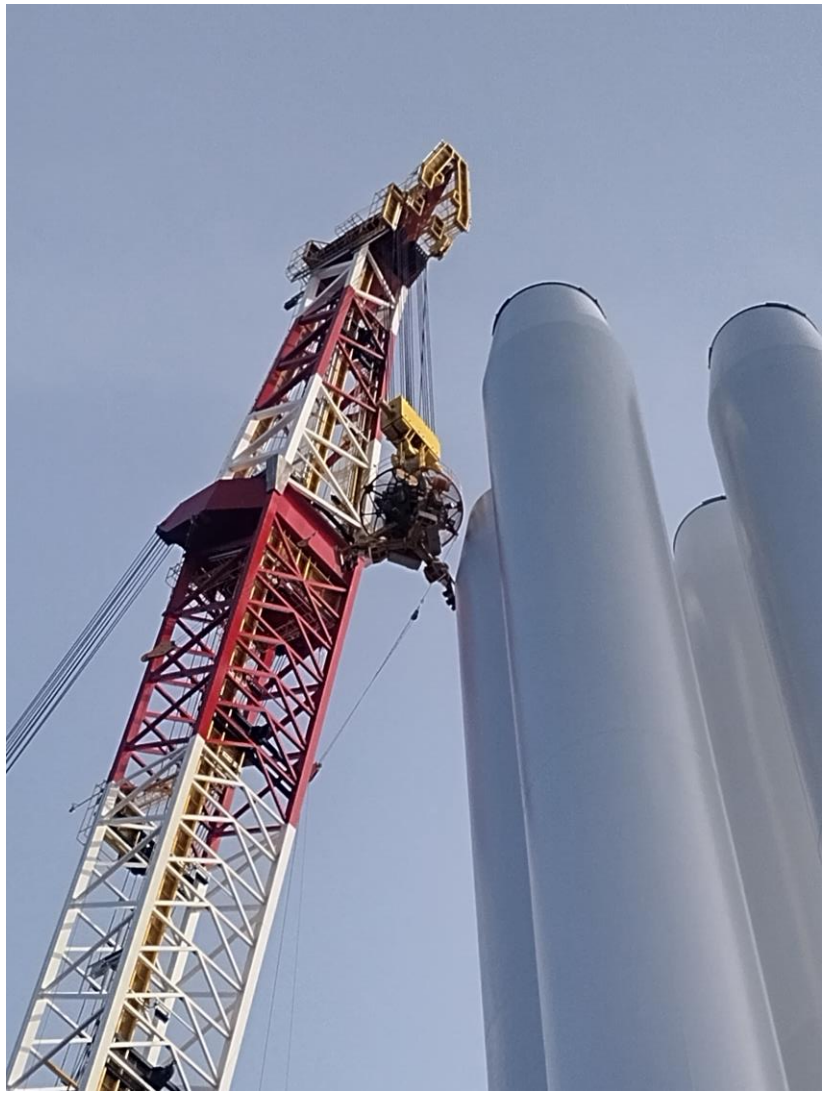
Bird nest in the crane wire.

- Robe access team went up to cut the bird nest.



Damaged WTG components and tools during installation.

- *Tower gribber damaged by the taglines.*



Tower gribber damaged by the taglines.

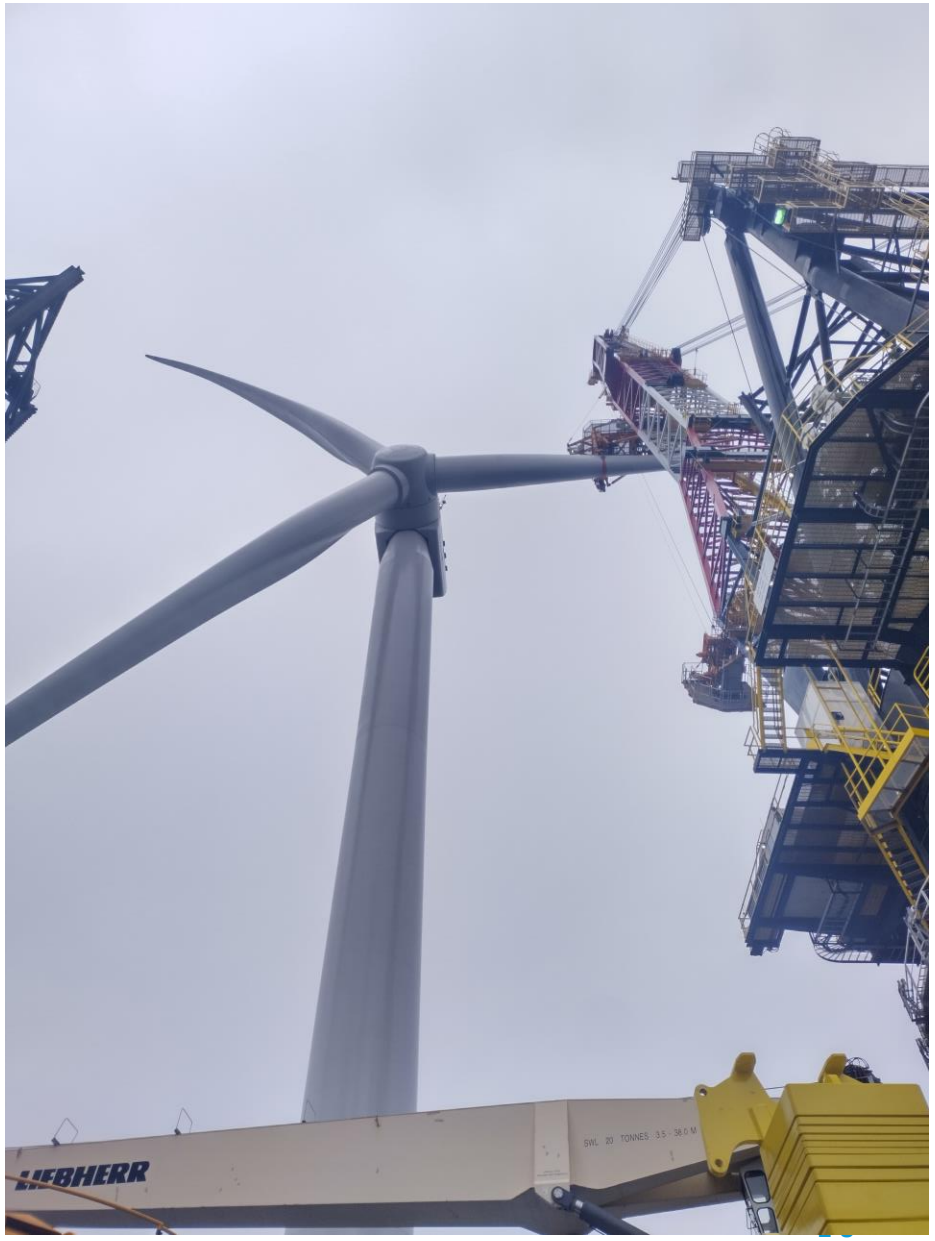
- *Tagline wire has cut into the steel*

Nacelle damaged/scratched

- *Nacelle damaged due to poor alignment when lifting*
- *Very narow space*
- *on deck.*

Blade dammage during loading and installation.

- *Tagline fault, blade turned at hit the crane boom.*



Crane boom collapsed backwards

- *The collapse happend during strong wind, no components or people got hurt*

MEP - JB 1

MEP - JB 1

sedgwick

• CONSULTANCY - SERVICE

Examples of failures and break-down situations

MORTEN H. JENSEN

USA

USA

- Nacelle fire

USA

- Nacelle fire

PORTUGAL

Portugal

- Main bearing failure – fire near miss

Portugal

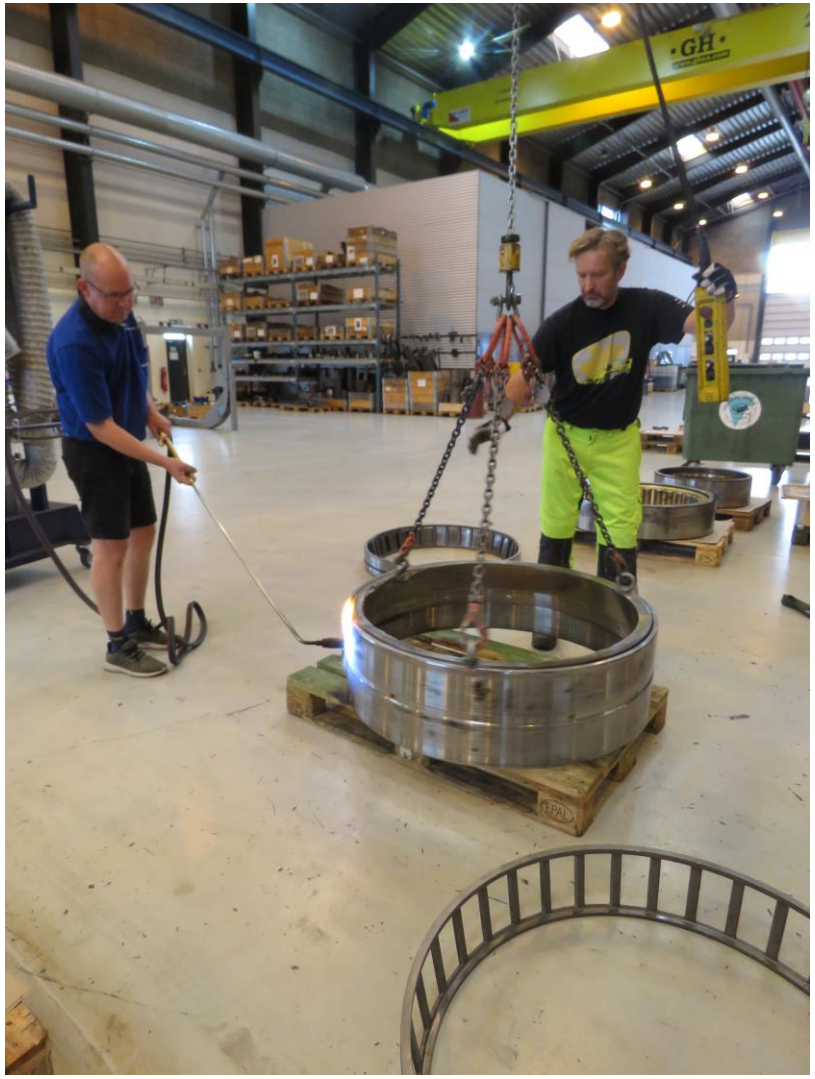
- Main bearing failure – fire near miss

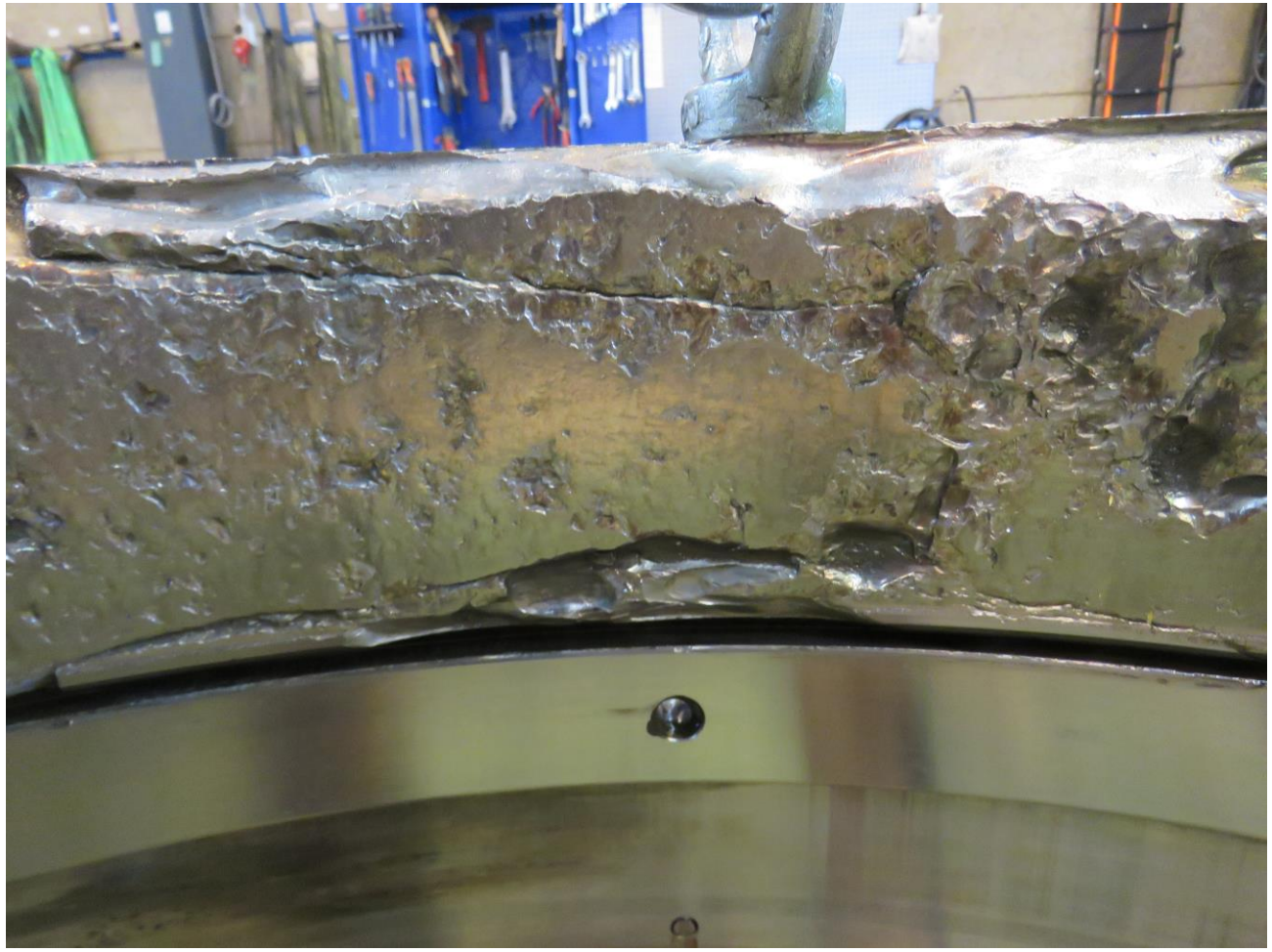
Portugal

- Main bearing failure – fire near miss

Portugal

- Main bearing failure – fire near miss





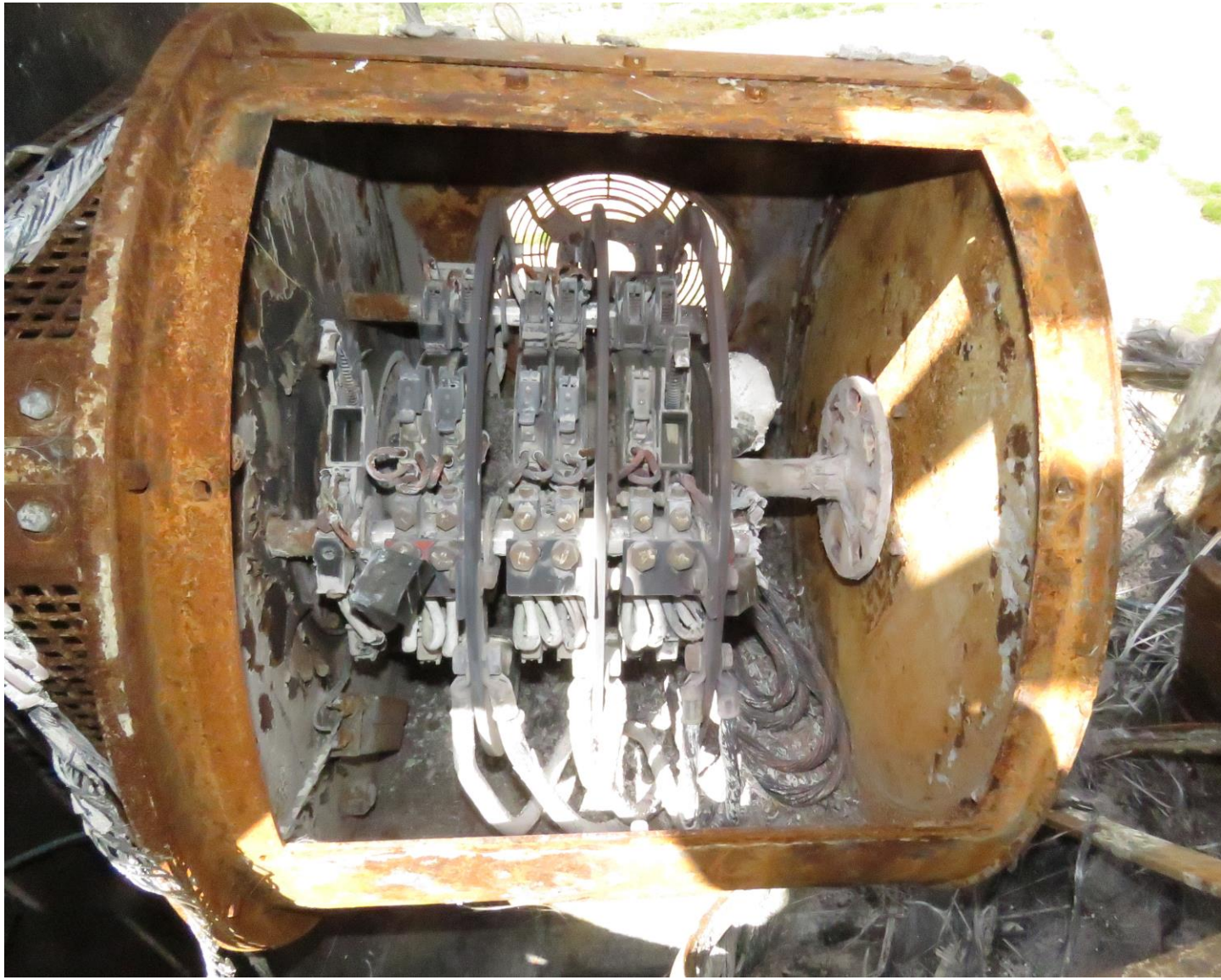
Portugal

- Main bearing failure – fire near miss

ITALY

Italien

- Nacelle fire – rotor cable



Italien

- Nacelle fire – rotor cable

USA

USA

- Nacelle fire

USA

- Nacelle fire

USA

- Nacelle fire

248-925-7474

MARKS

FRANCE

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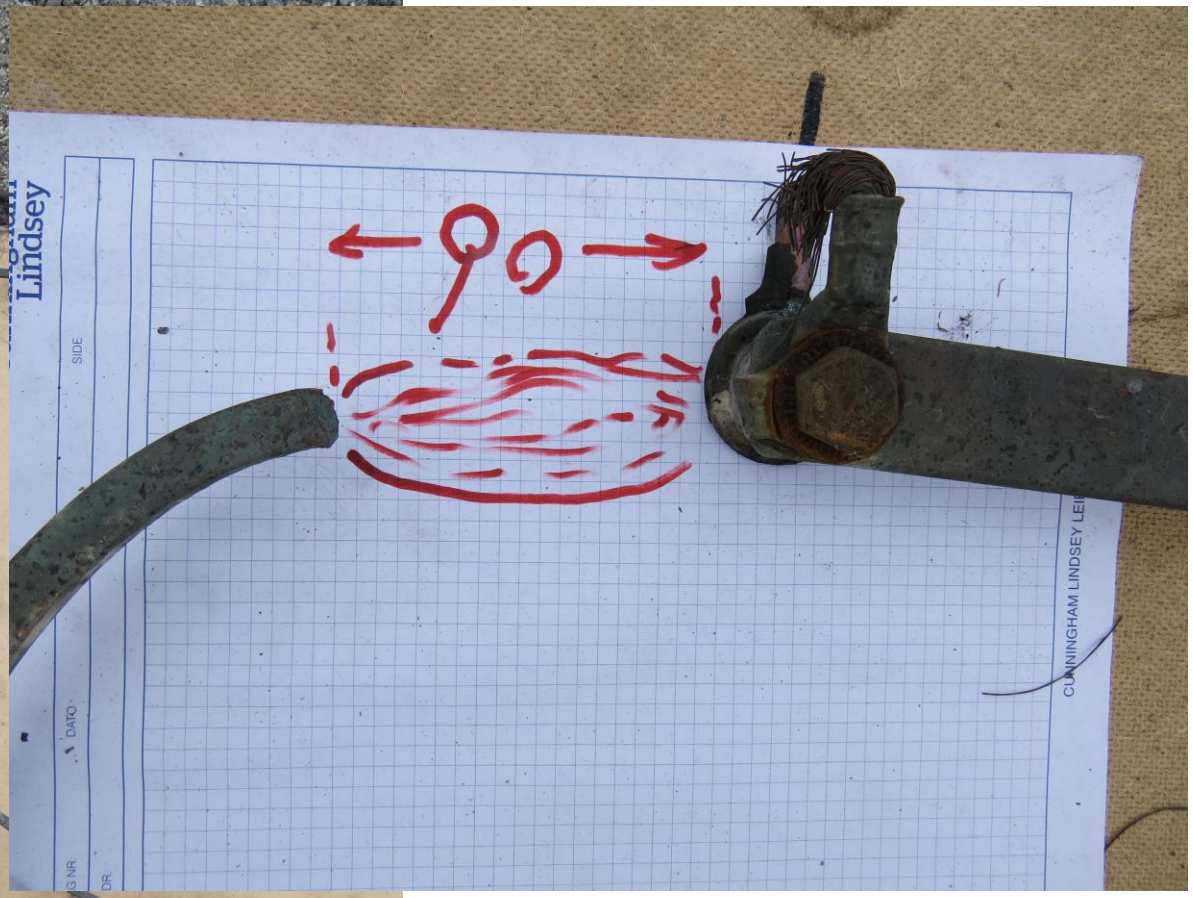
90
700
700
VRANICA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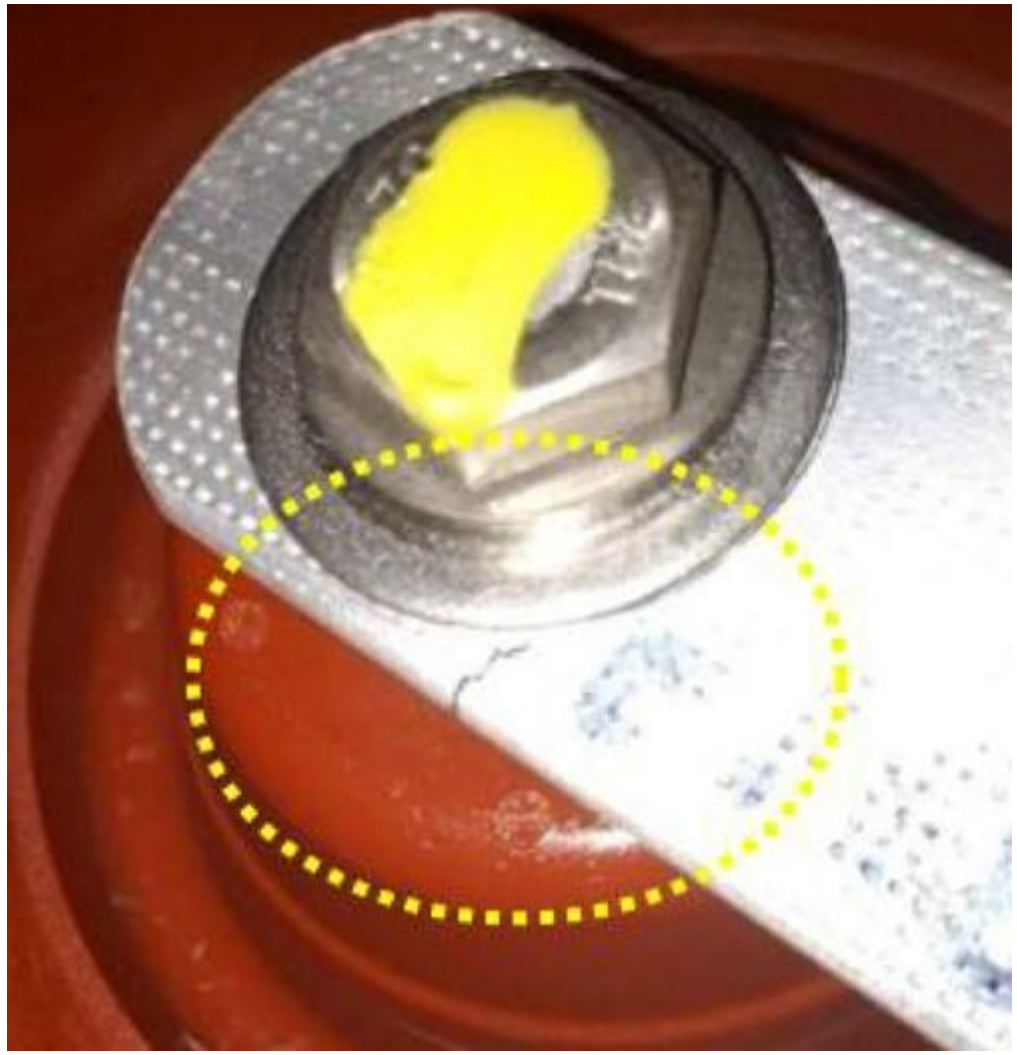

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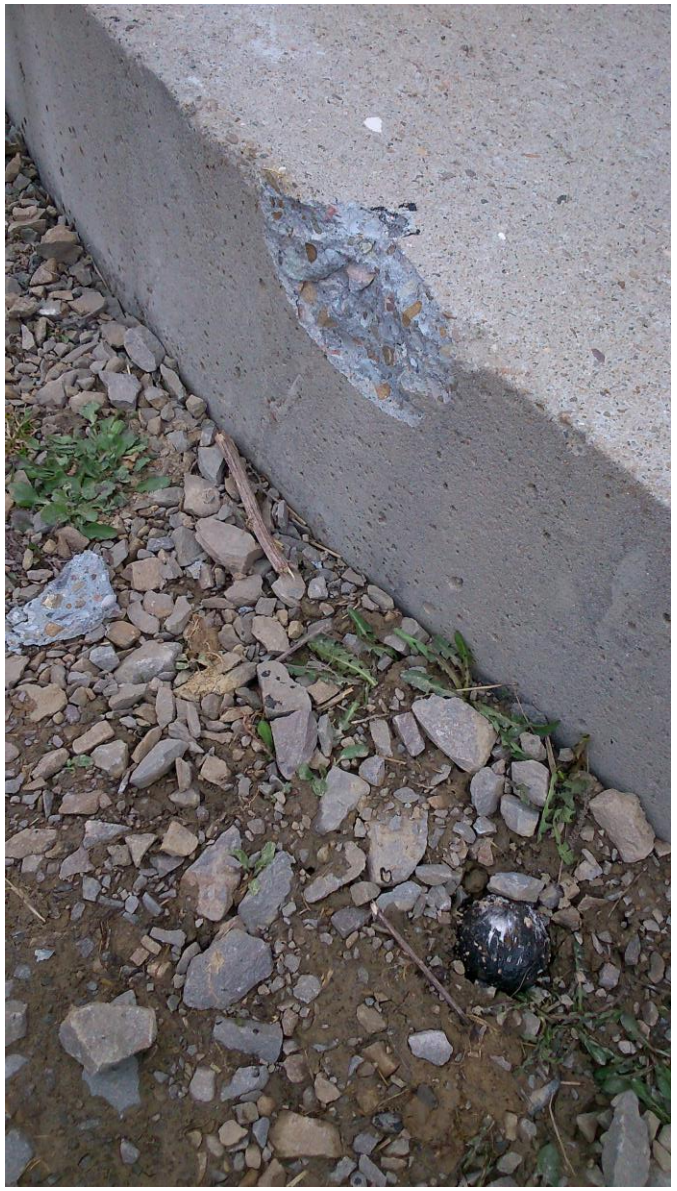

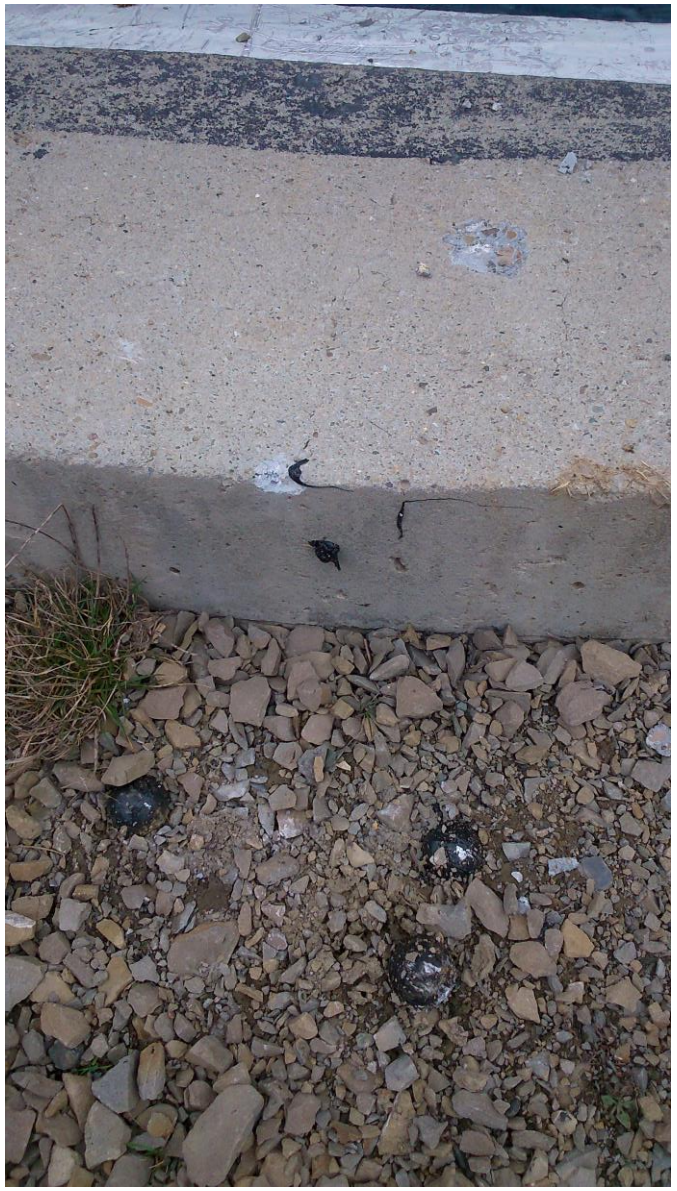

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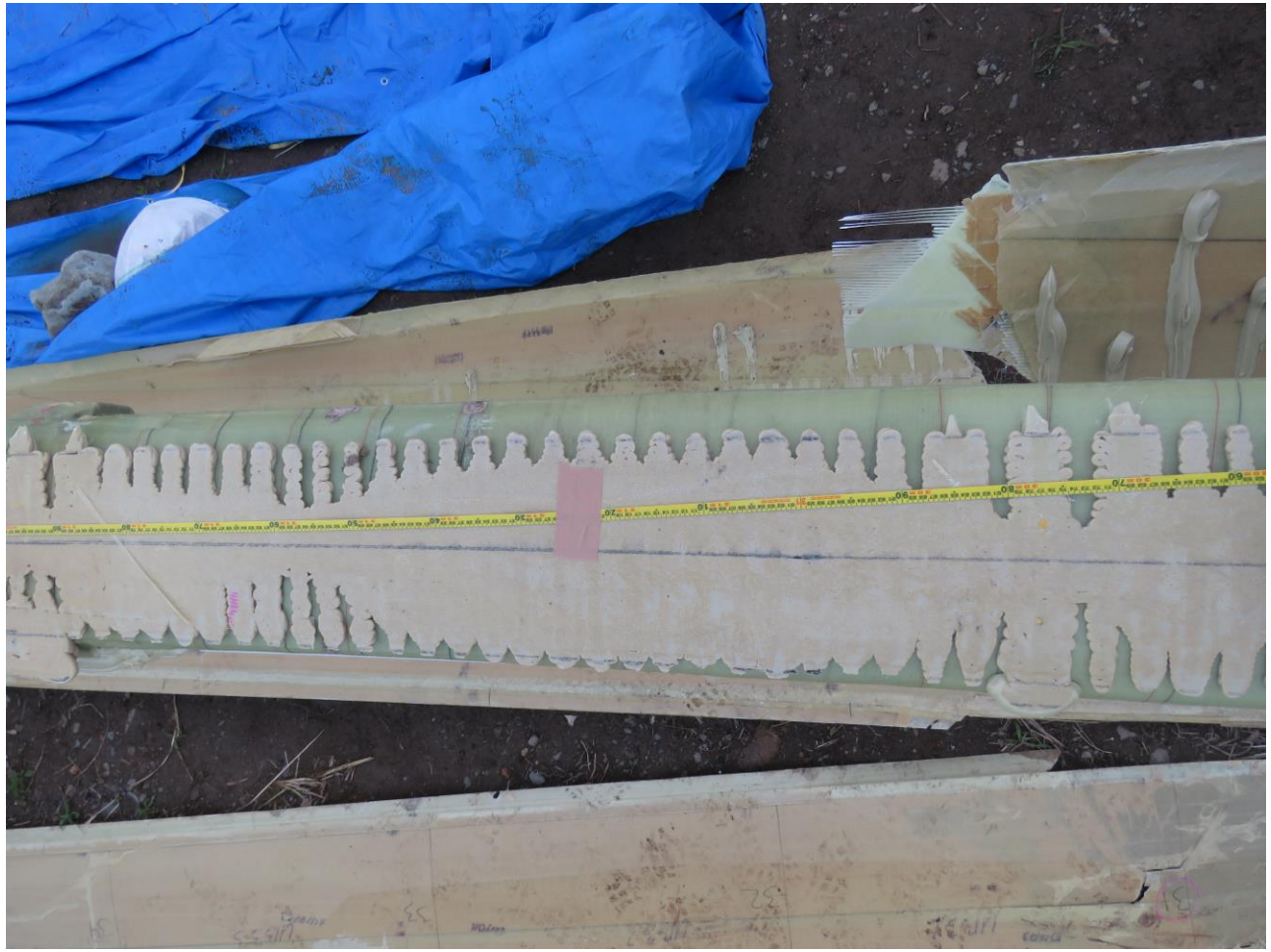

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GERMANY

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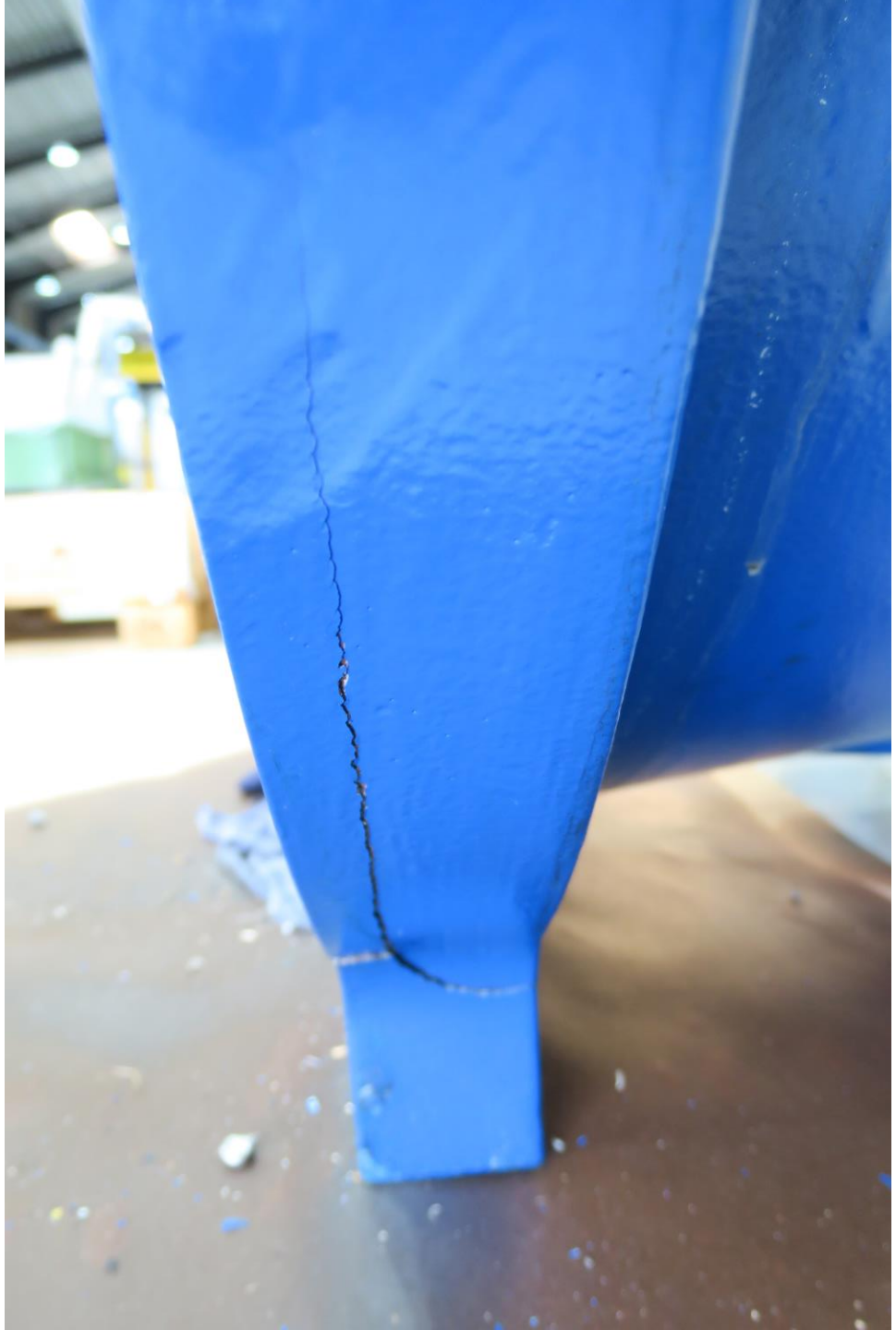
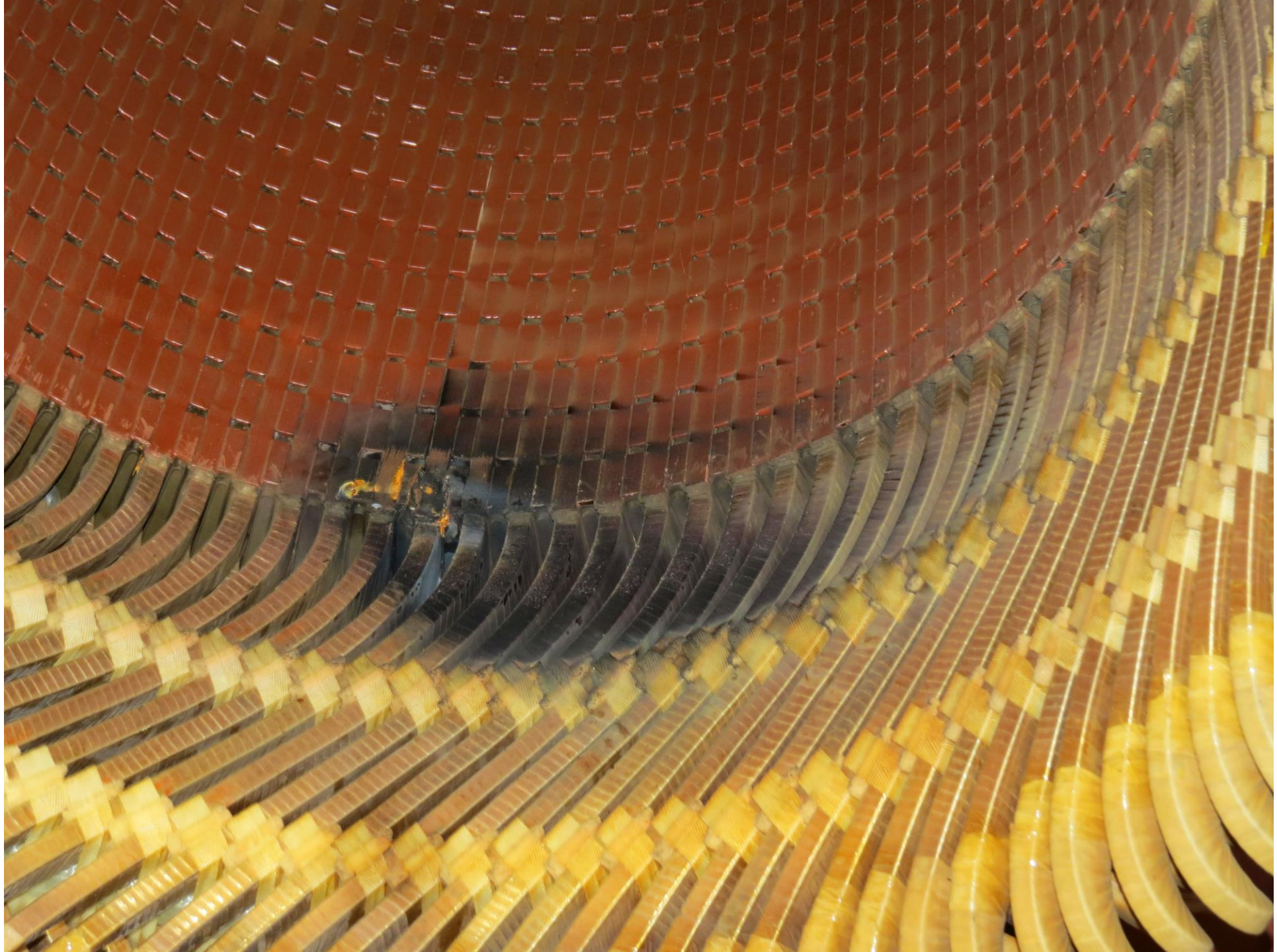
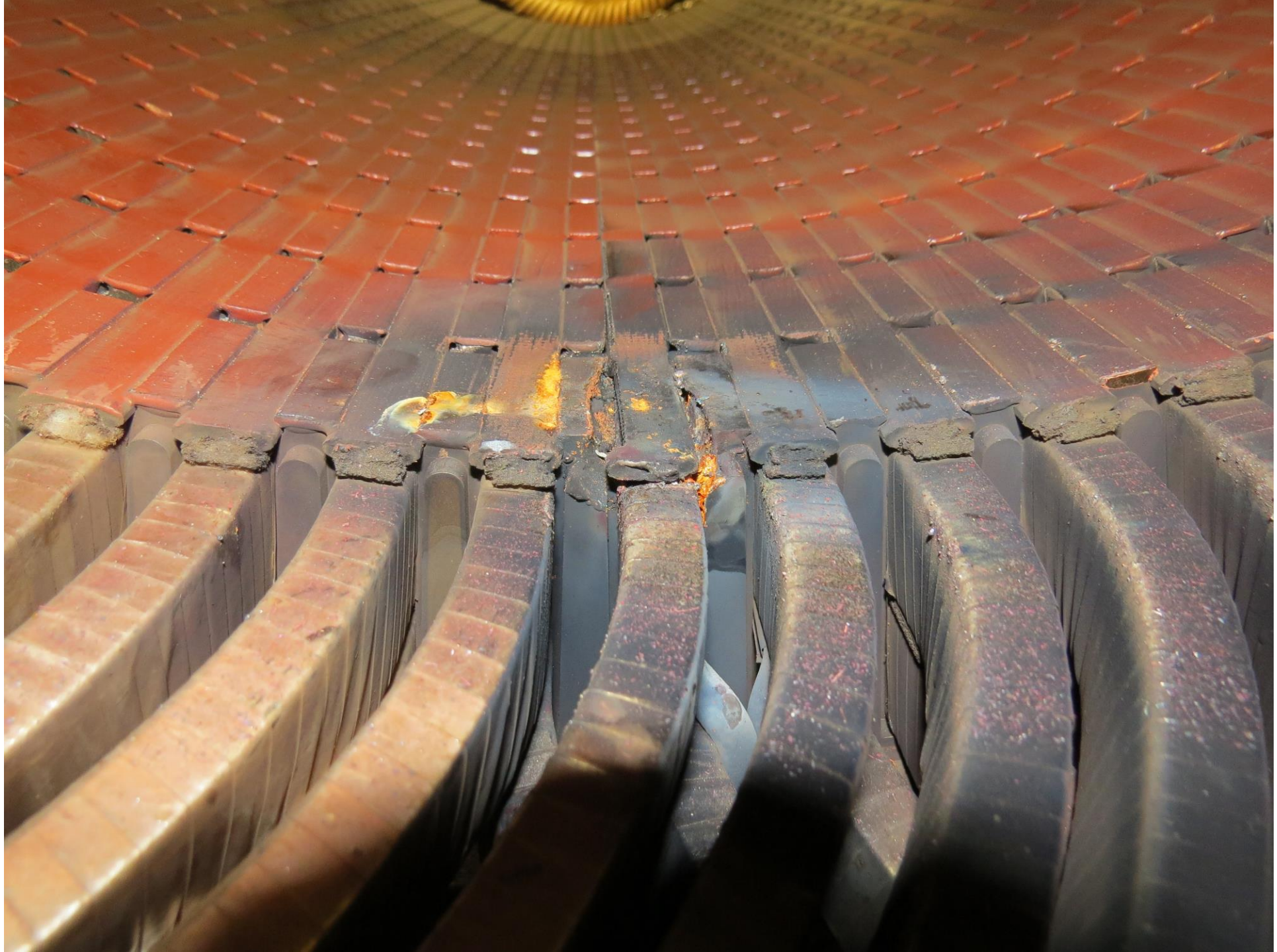
DENMARK

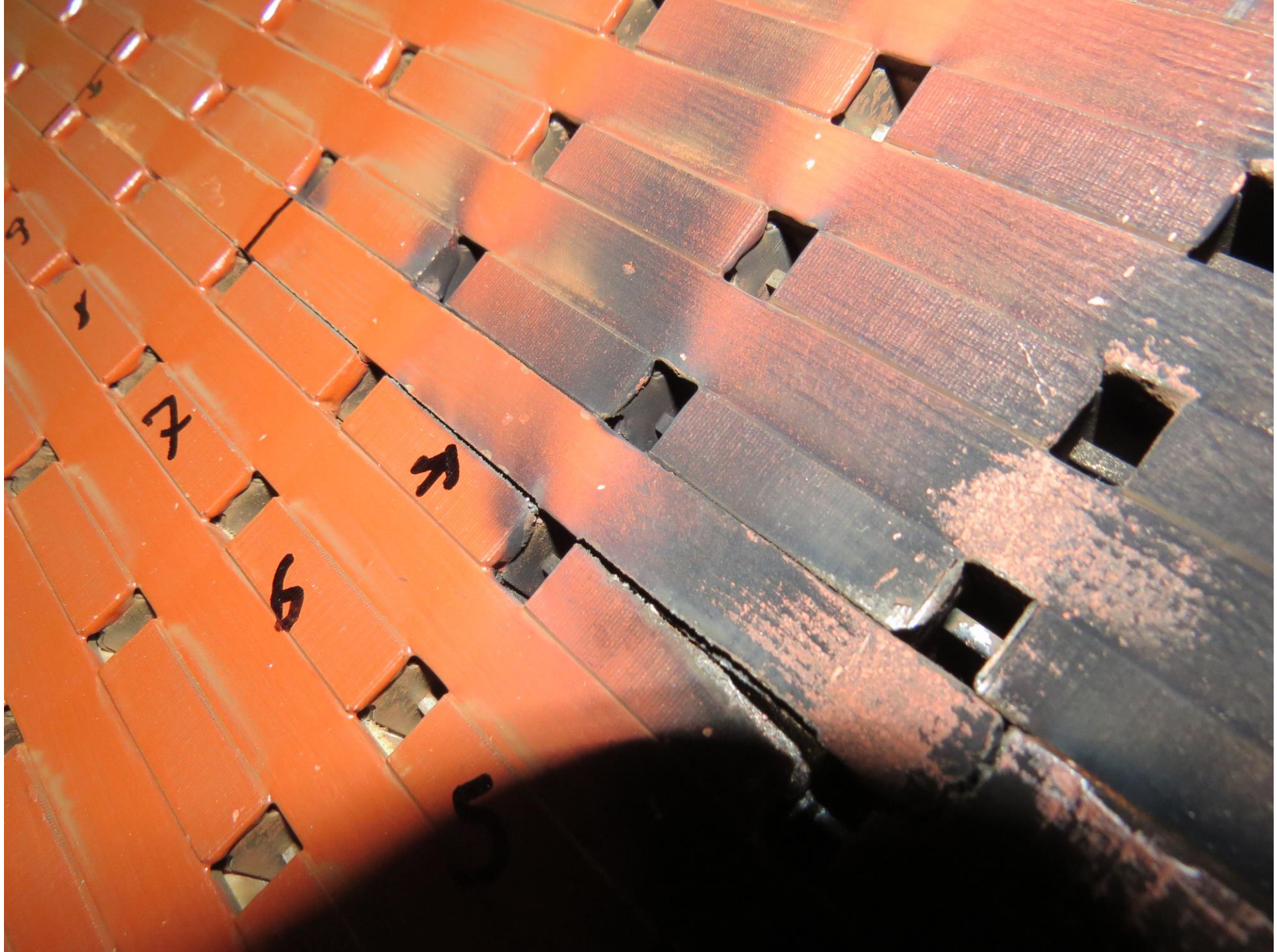
STENA

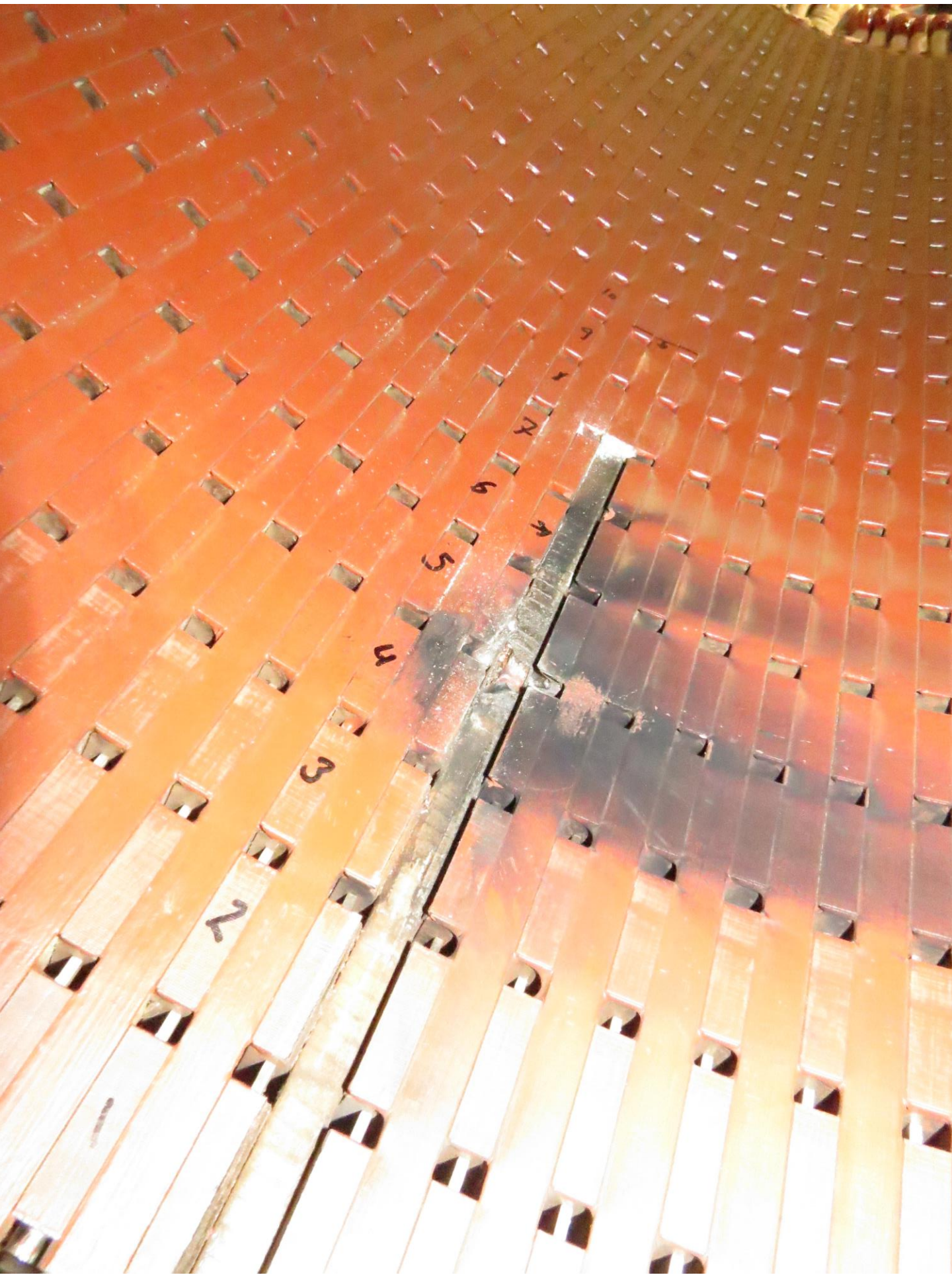


UK/FINLAND





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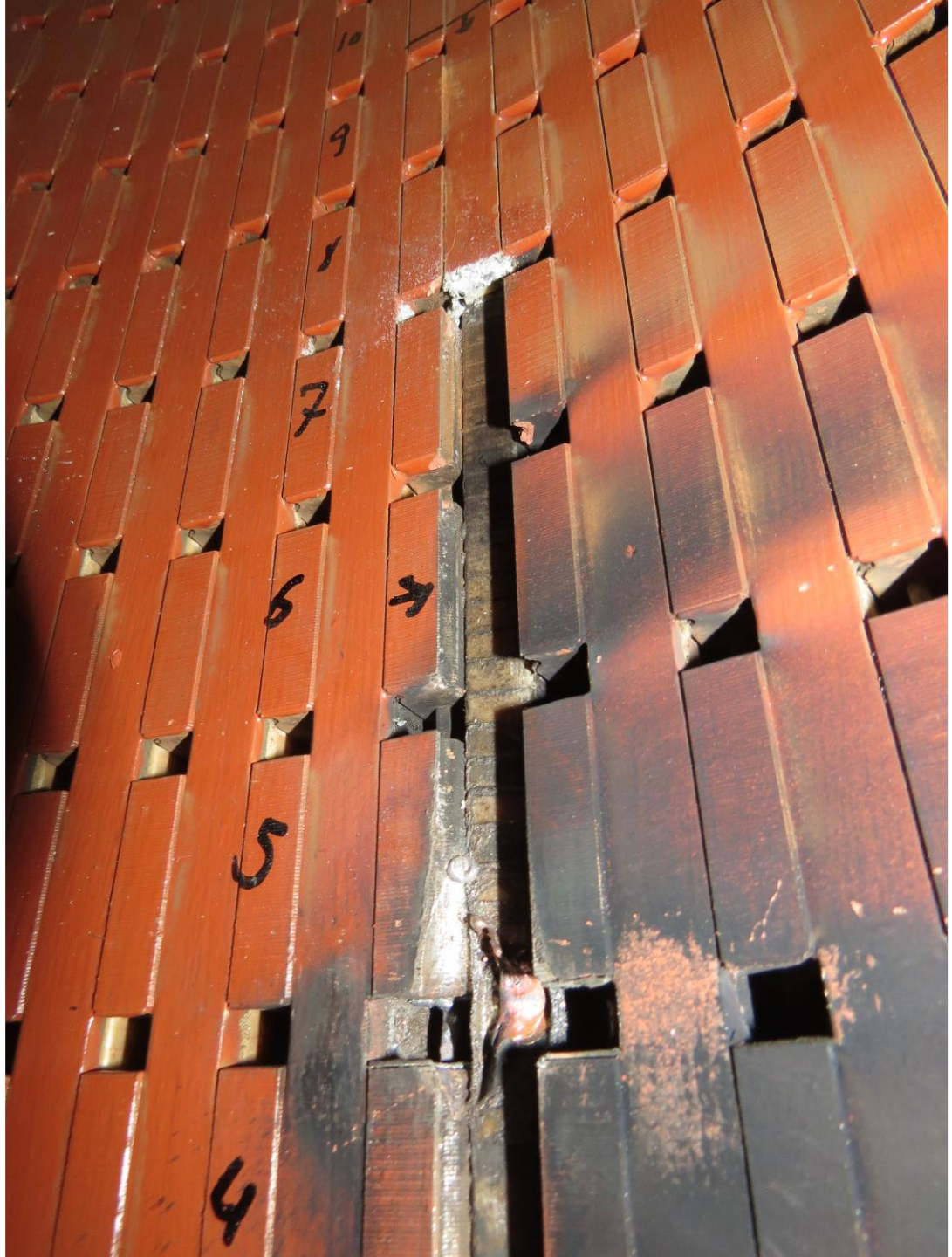
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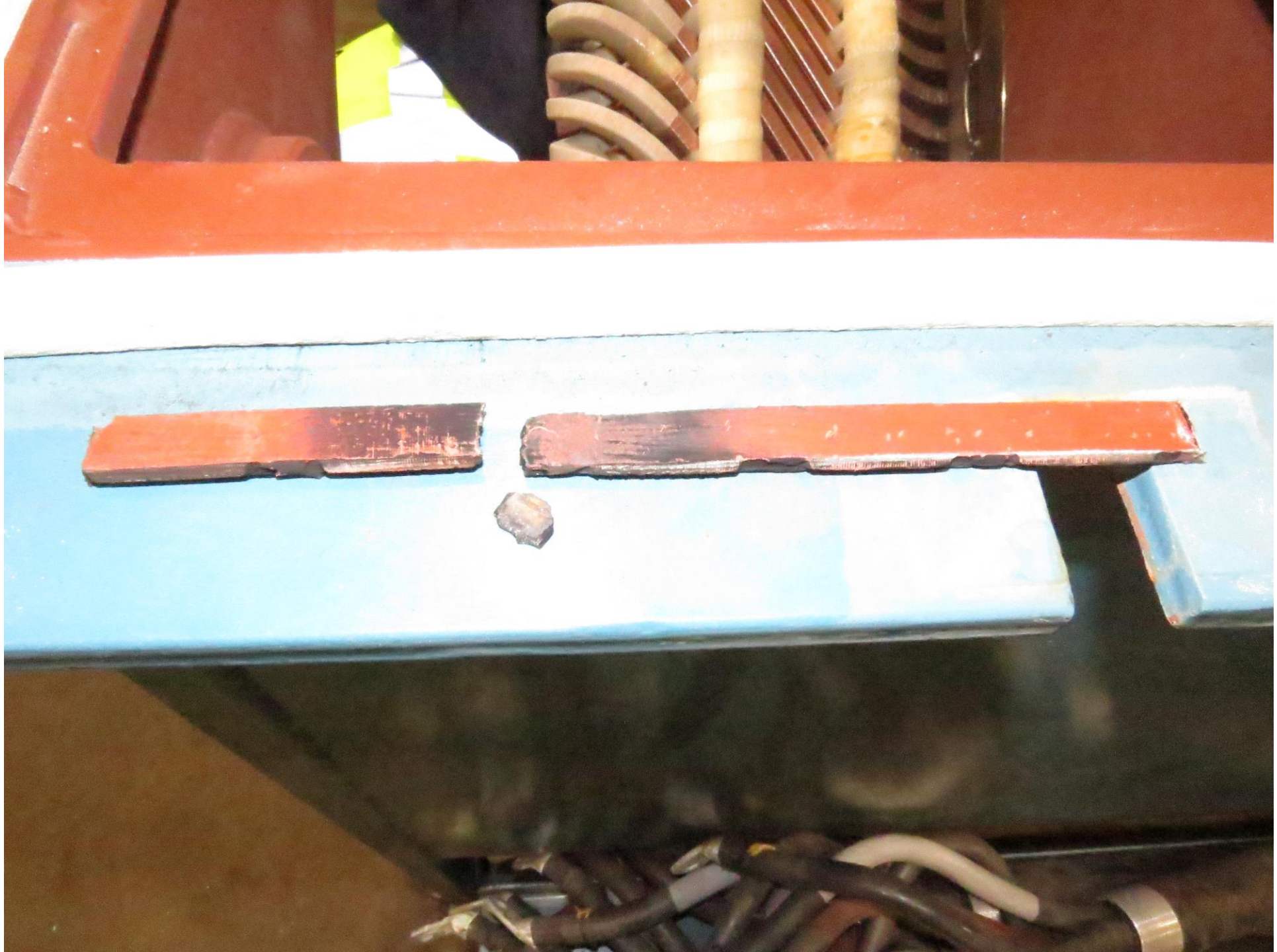


01

Blade failures and transformer failures

• NORDSEE OST

Background information

- With an installed capacity of 295 megawatts, Nordsee Ost is a large wind farm off the German coast.
- Insurance company requested us to do RCA-work on a failed blade and multiple transformers.

Turbine blade failure

RWE completed the project in January 2015, following the start of turbine installation in July 2014.

All 48 turbines were shut down following a blade failure at turbine no. 17 on June 20, 2015. Approximately half of the turbines are now back in operation.

Several ships and a helicopter were used in the salvage operation, after which the recovered parts were taken to Senvion's production site in Bremerhaven.

The cause of the incident is still unknown.

2015 Jun 19 04:14:36.848
B6-CAM-501 TD99
Staircase West Roof

RWE

Failed cast resin transformers

02

Tower / Nacel flange failure

SAMSØ OFF SHORE WIND

- *Morten H. Jensen was the owner's advisor covering operation and maintenance of the ten 2.3 MW wind turbines.*

03

Nacel fire claim

Fire damage to nacelle

In 2013 and 2014 fire occurred in turbines T32 and T8 respectively.

We were involved as Loss Adjusters on behalf of the insurer and as contact with Vattenfall, including Causal Investigation.

An extensive investigation identified the cause as an instant fire in capacitors for harmonic filters and single-phase fan motor.

Vattenfall has since used this information to ensure that no future losses from this type of fault can occur in future.

411
FRAGILE

04

Nacel fire RCA work

- RENEWABLE ENERGY

- The project was developed by Vindkompaniet and built in waters up to 10 metres deep.

Fire damage to nacelle

The turbines installed at Yttre stengrund were the former NEG Micon's first 2MW wind turbine. It was developed as a 1.5MW turbine and subsequently upgraded to 2MW.

The design was rather special, being the result of collaboration with B&O Designer Jacob Jensen in a move to create a new design for the wind-turbine industry.

The finished result was probably one of the best designs of nacelle and tower ever developed, and a total of approx. 100 of the turbines were built.

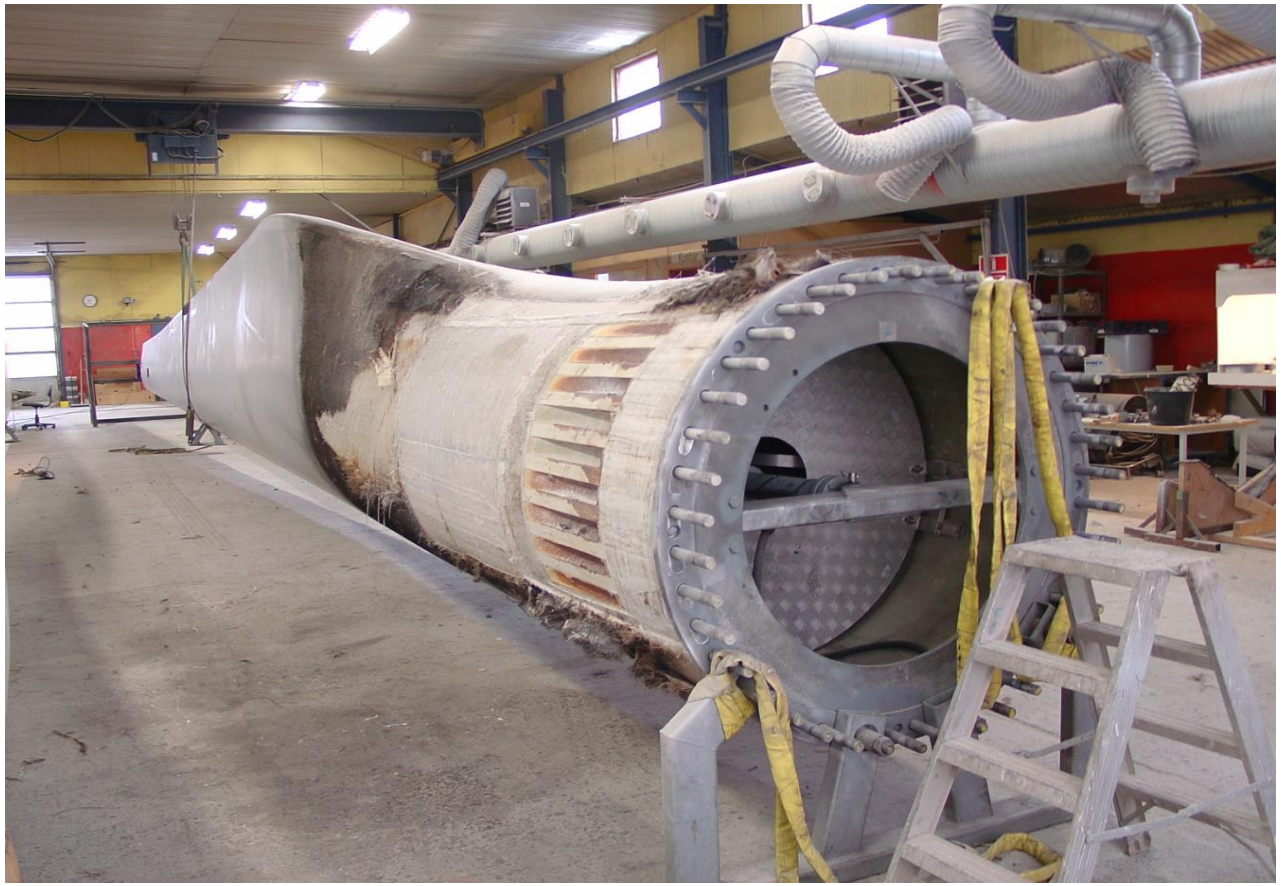
Investigation showed that the fire was the result of a transformer failure, and the nacelles were later fitted with additional monitoring equipment.

Total collapses

OY-HSJ

https://www.youtube.com/watch?v=9QSrS4rRSrQ

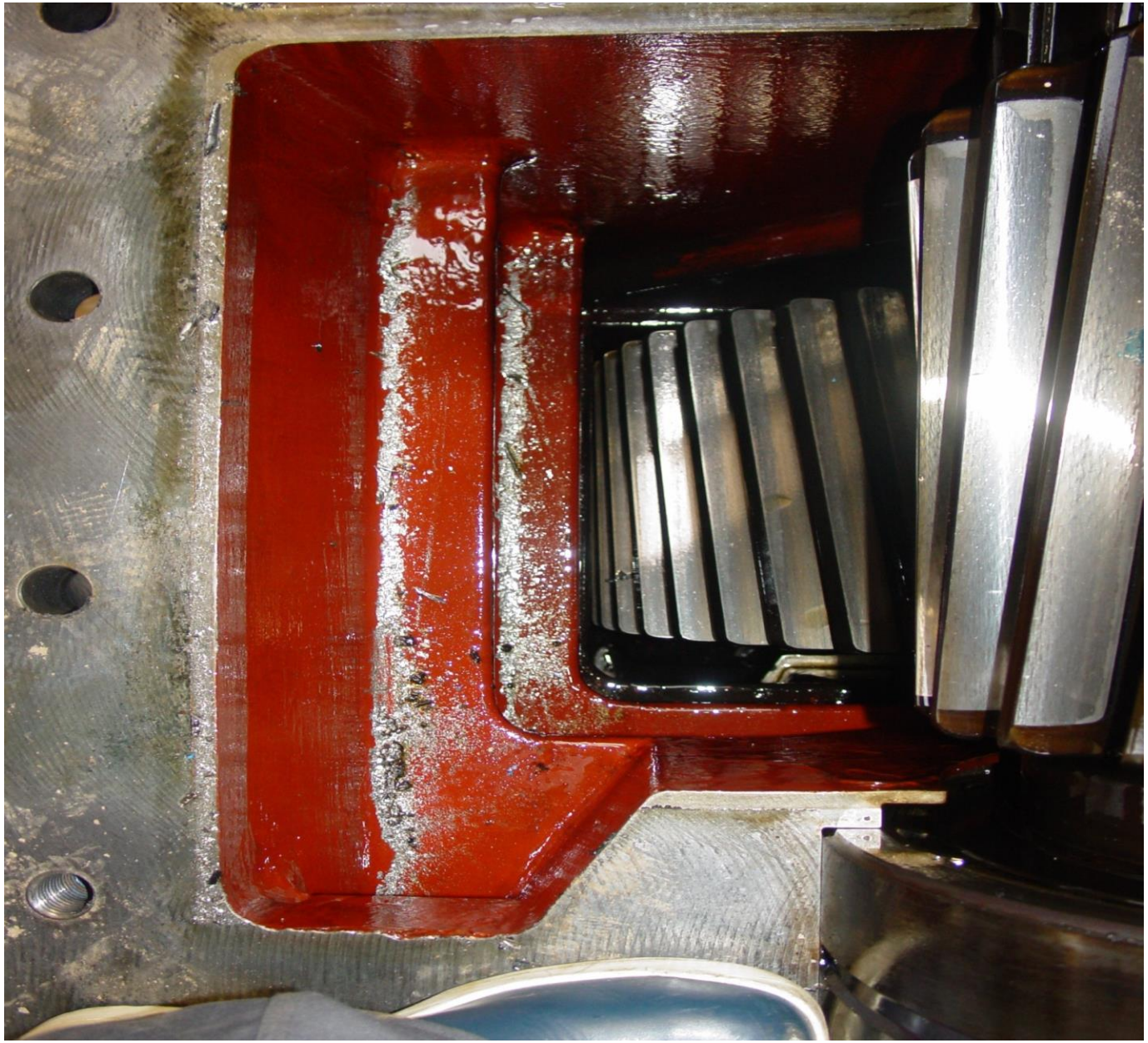
Nacelle fire

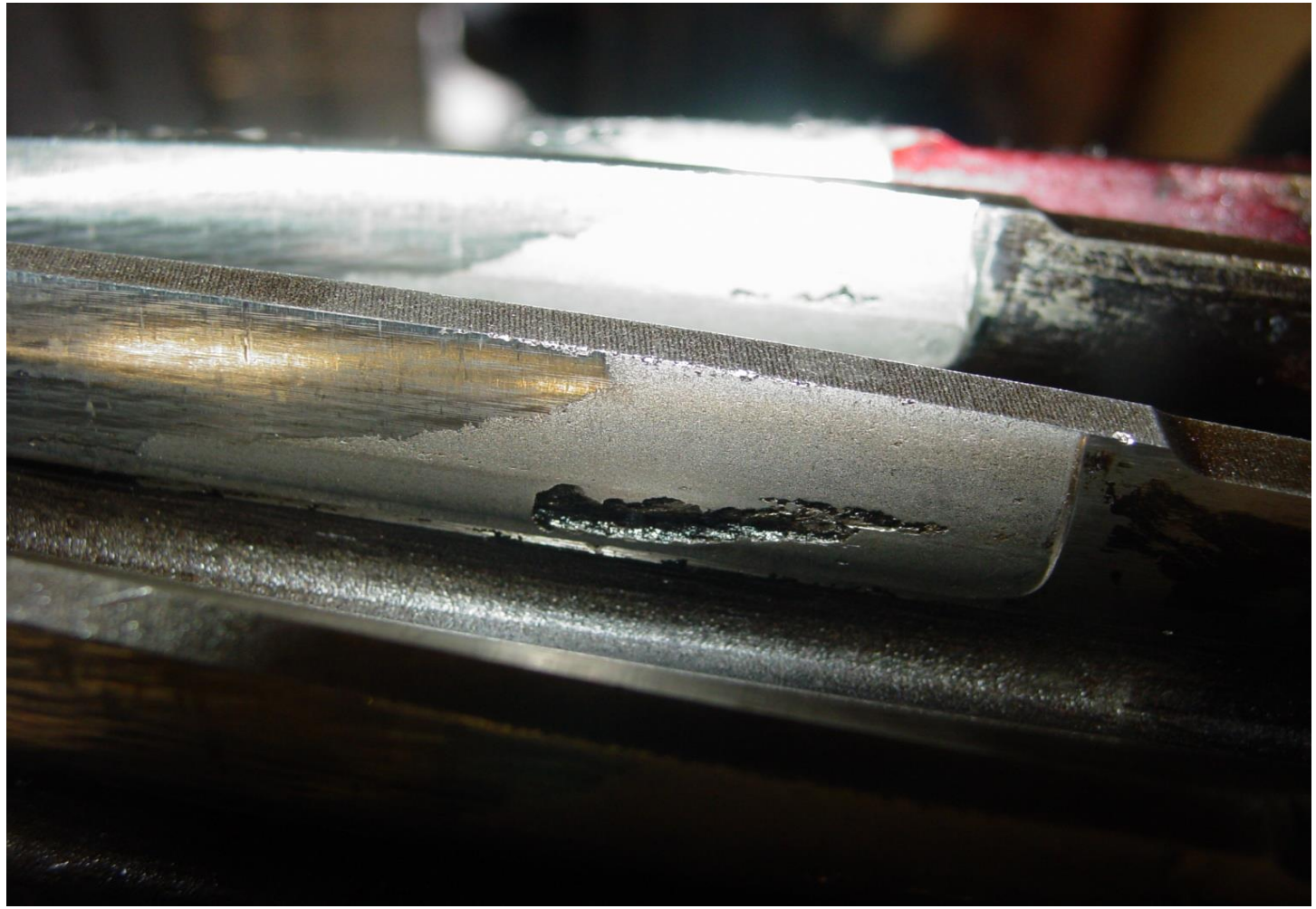


CELLPLAST
DIREKT

Vestas®

Mechanical failures in transmission





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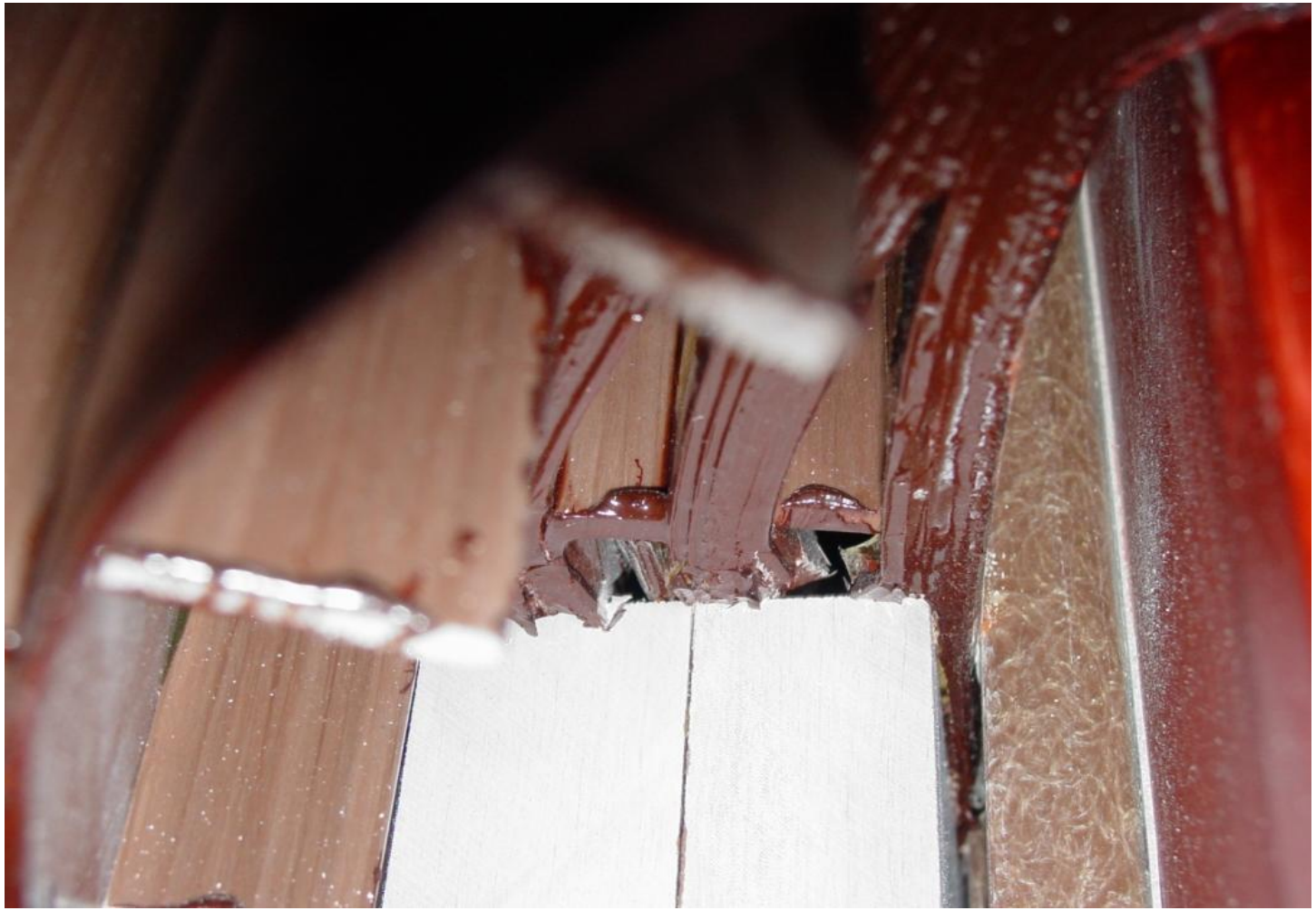
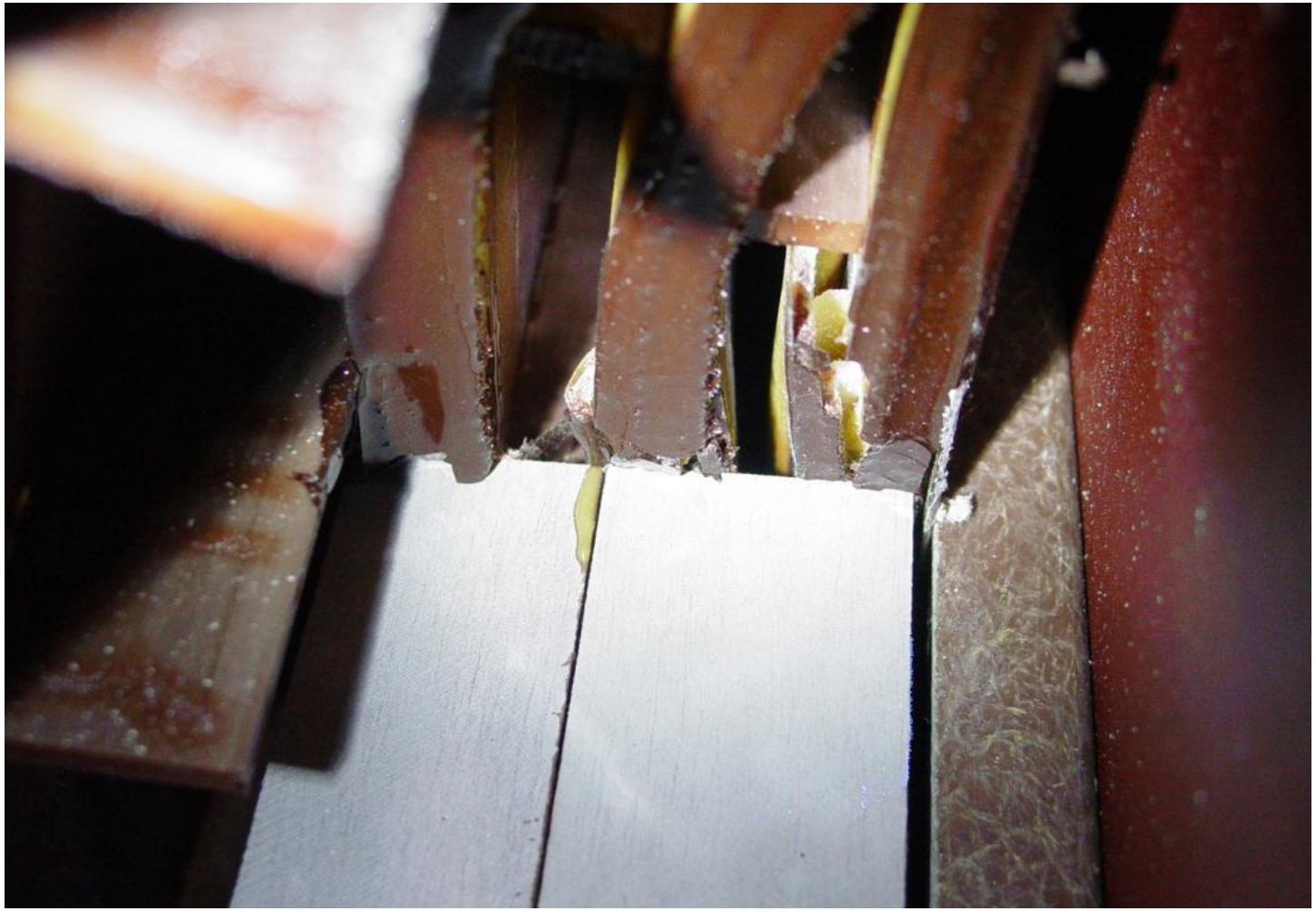
Generator failures

Transformer failures

1U





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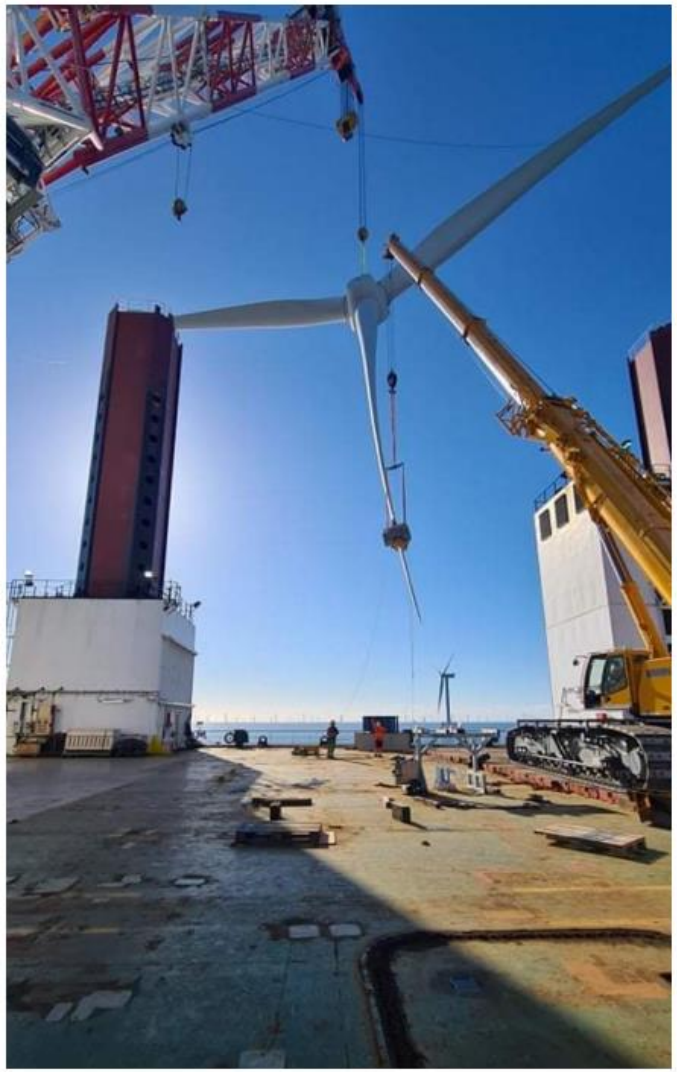
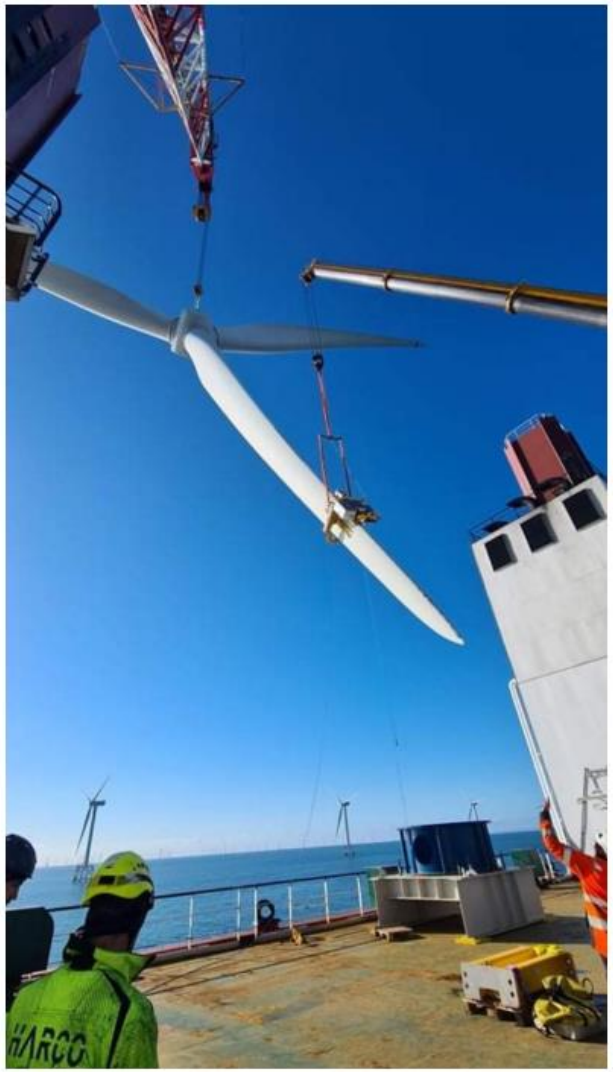
Handling failures




HARCO

https://www.youtube.com/watch?v=Lc-ATd80qdo

sedgwick

• 08/10/2024

Business Interruption - WTG

NIKOLAJ KULLESBECH

01

- Hvad er produktionstabet og hvilke faktorer har indflydelse på opgørelse af produktionstabet

02

- Hvad er den tabte omsætning relateret til produktions tabet og hvilke faktorer har indflydelse på prisen

03

- Det samlede driftstab er en kompleks størrelse at opgøre. Der er en høj grad af kompleksitet I bade bestemmelse af produktionstab og omsætningstab.

Standard Revenue

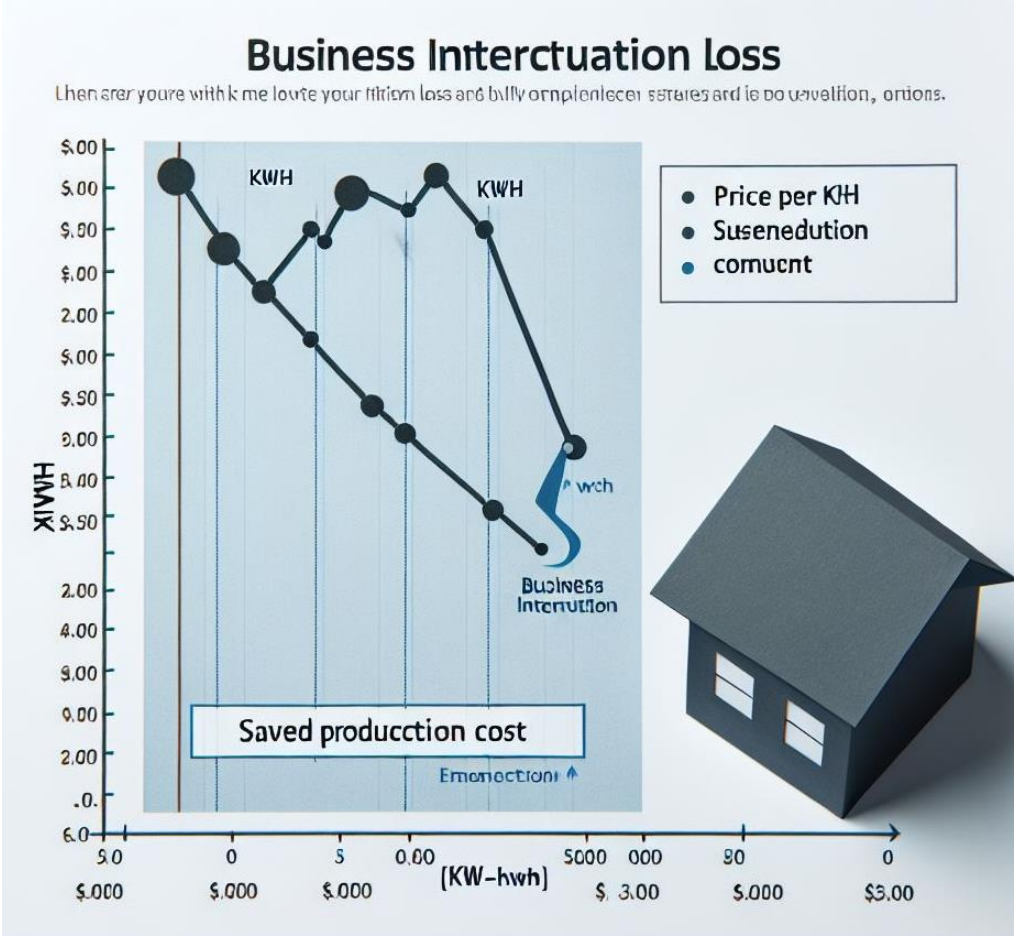
The Revenue during that period in the twelve months immediately before the date of the Insured Event which corresponds with the Indemnity Period to which such adjustments shall be made as may be necessary to provide for the trend of the Business and for variations in or other circumstances affecting the Business either before or after the Insured Event or which would have affected the Business had the Insured Event not occurred

so that the figures thus adjusted shall represent as nearly as may be reasonably practicable the results which but for the Insured Event would have been obtained during the relative period after the Insured Event

Calculation of lost production

Simplified calculation model

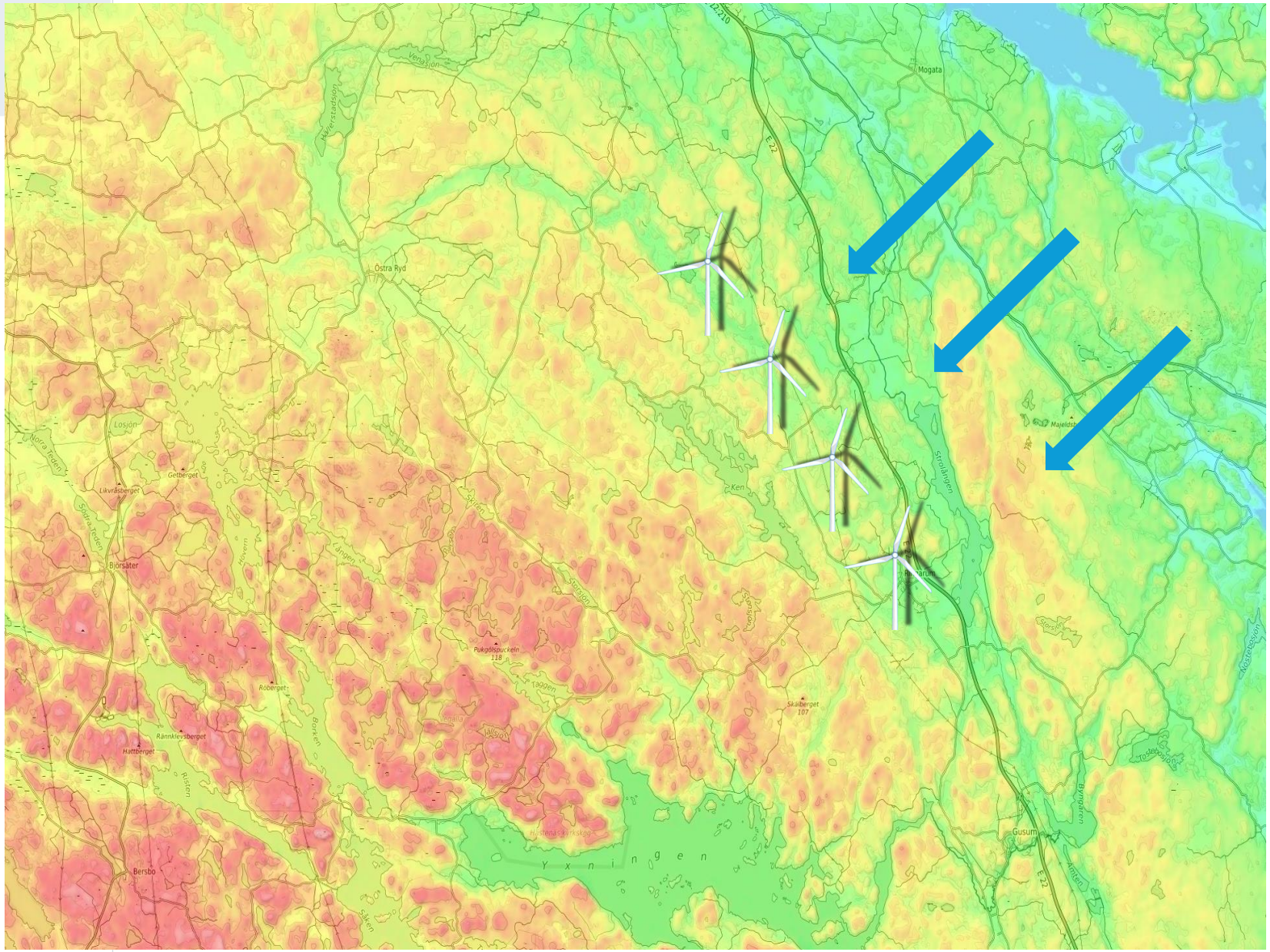
(KWh x price) – saved production cost = Business Interruption Loss



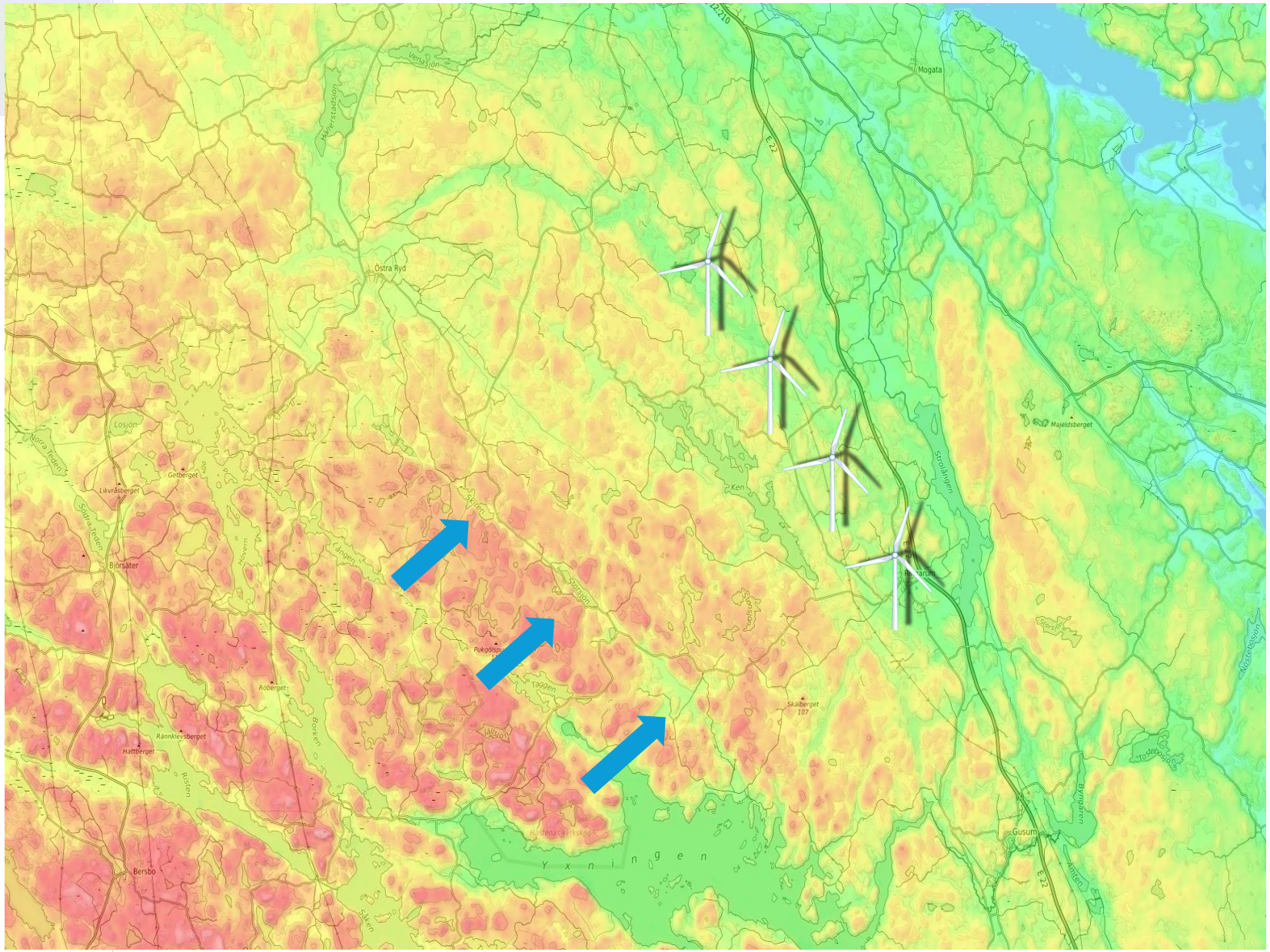
• CALCULATION OF LOST PRODUCTION

Production

- The out-put of a wind turbine is the wind (air movement) converted to kwh
- Main factors that impact the out-put
  - Wind direction
  - Wind speed

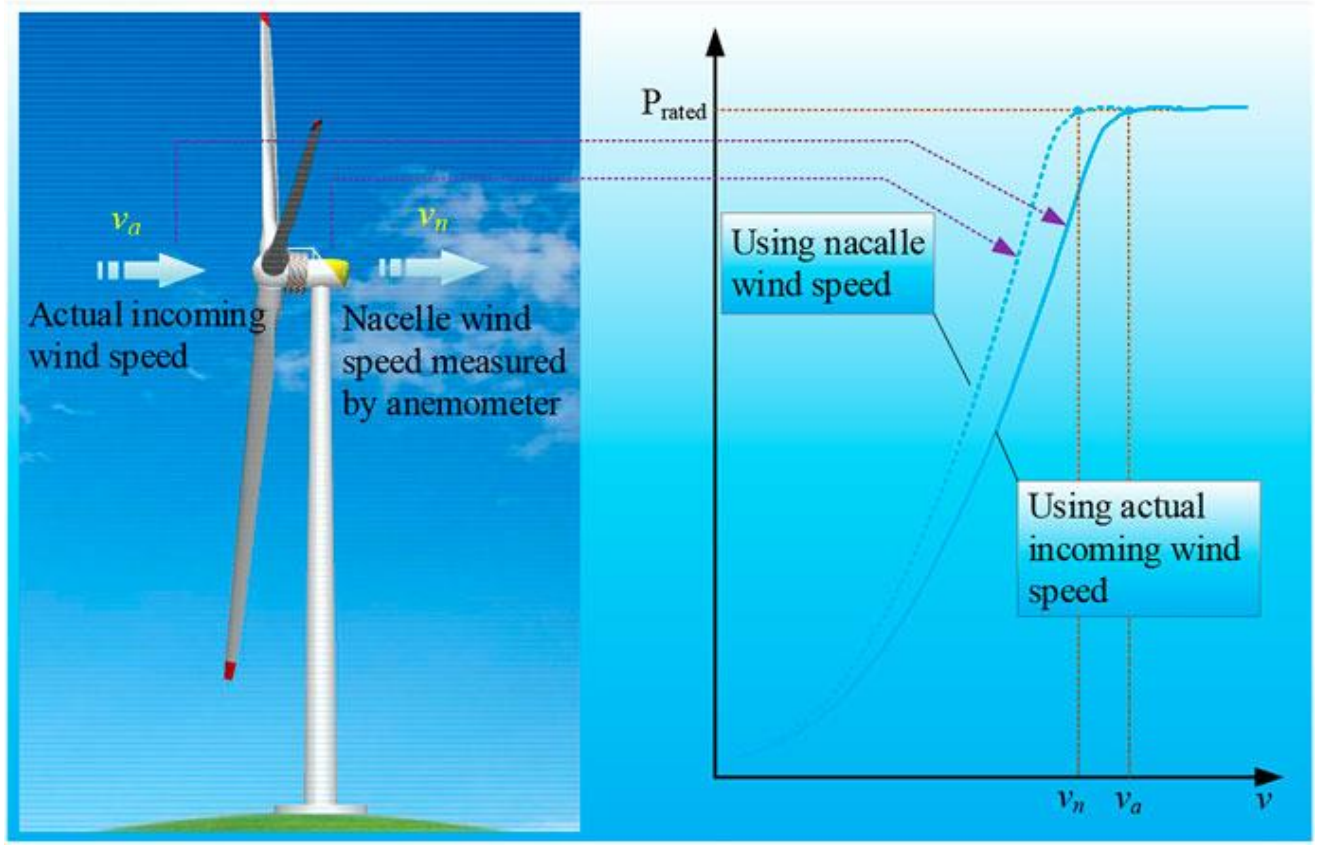


- Wind data publicly available during the break-down period taking into consideration predominant wind direction, average wind speeds and topography.



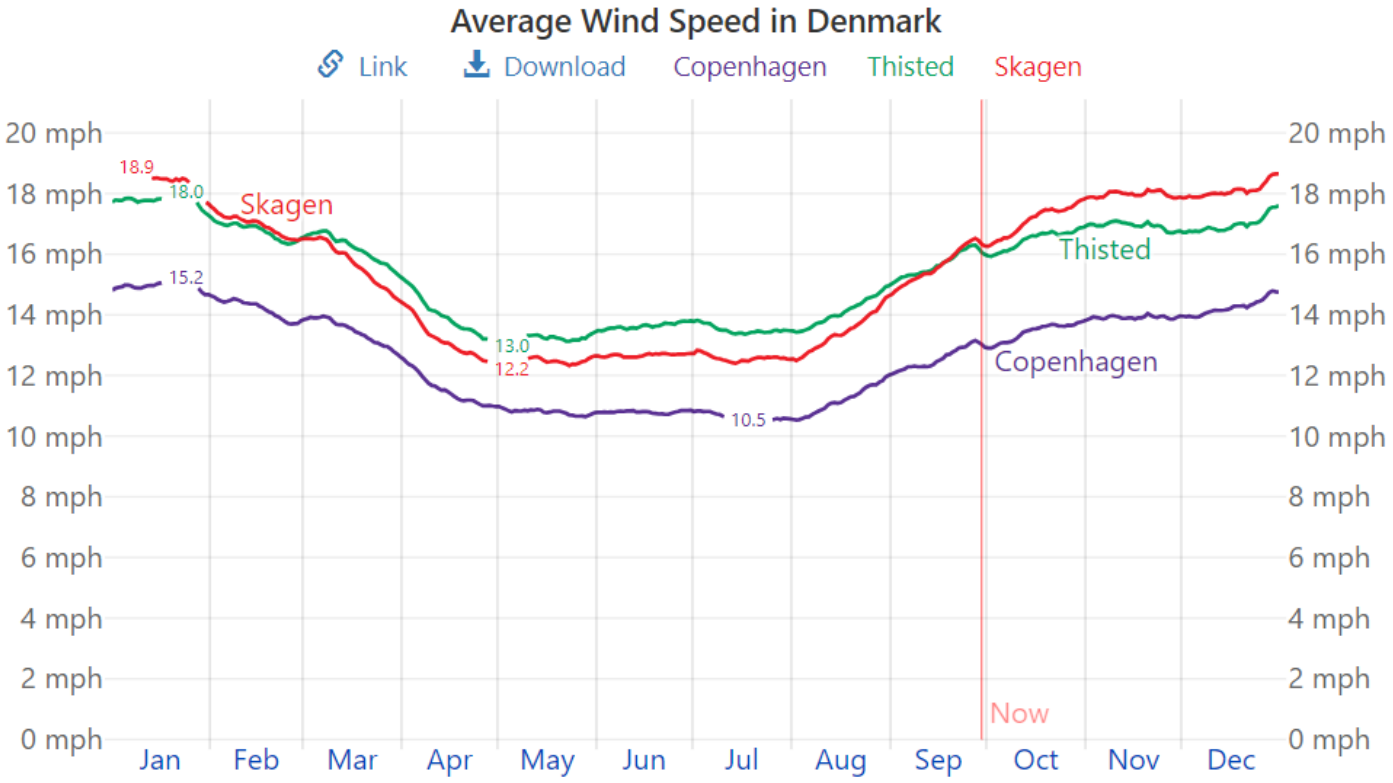
- Wind data publicly available

SCADA anemometer and Meteorlogical towers



- Neighbouring wind turbines but you need to be aware of the impact of the wake effect and difference in out-put historically

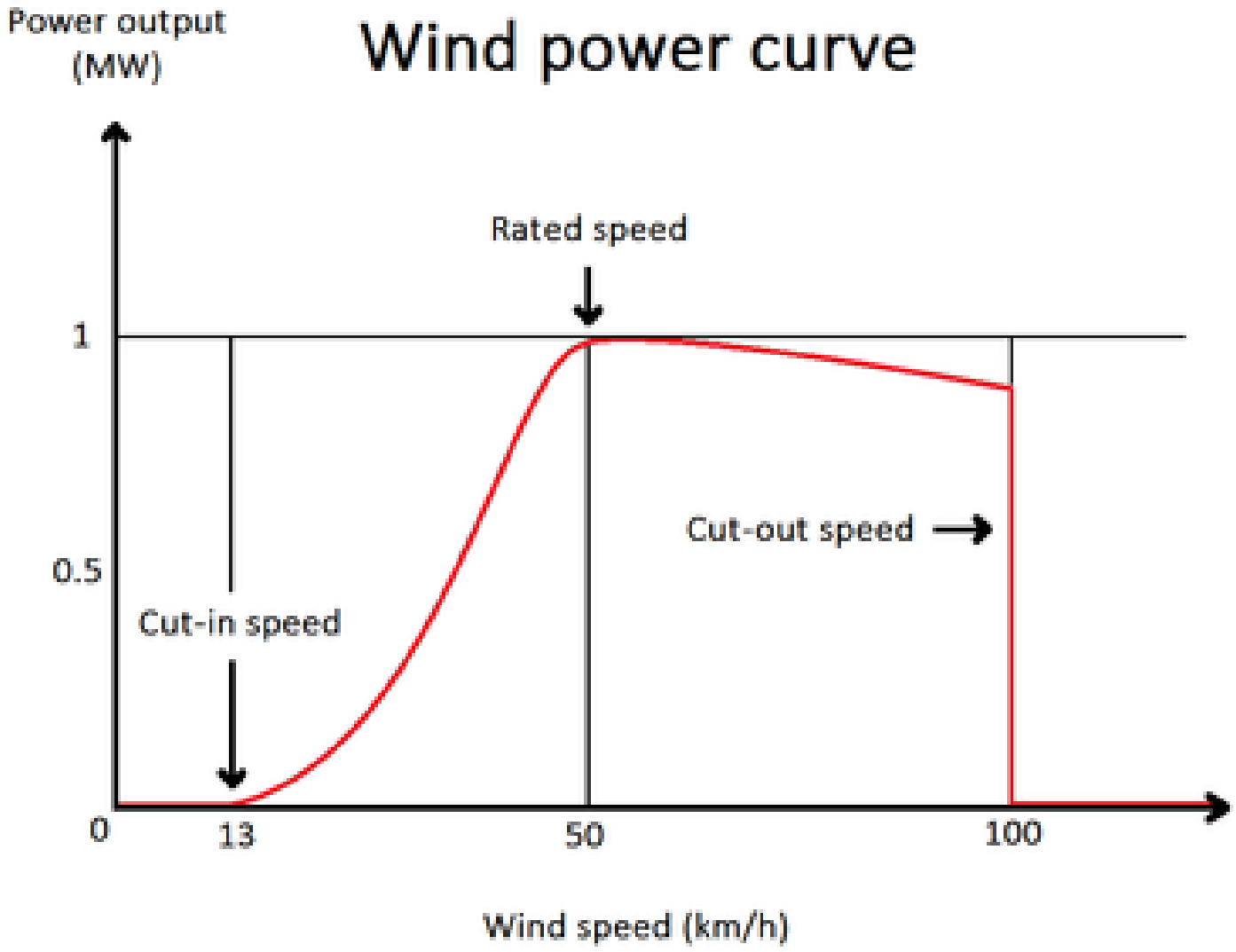
Prior year generation is less valid but could give some sort of indication



The average of mean hourly wind speeds at 10 meters above the ground.

Wind Speed (mph)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Copenhagen	15.0	14.2	13.4	11.5	10.8	10.8	10.6	11.2	12.6	13.4	13.9	14.3
Thisted	17.8	16.8	16.2	13.9	13.2	13.6	13.5	14.1	15.7	16.5	16.9	17.0
Skagen	18.5	17.0	15.7	13.1	12.4	12.7	12.6	13.4	15.6	17.1	18.0	18.1

- Convert using power curve



Pricing models and rates

• Whole year fixed

- Same rate over the entire year
- Easy to use as basis of calculation as there is no variation over time

• Seasonal fixed

- Typically, there is a fixed rate for summer and one for winter
- If the breakdown period stretches over seasons more rates needs to be taken into consideration when calculating the loss

• Market spot rates

- Rates follow the market prices
- The extensive calculation as rates may change hour by hour
- Impacted by the market conditions
- Production from other sources
- Export/import from other countries
- Weather has a huge impact
- Consumer use of power/peak periods

• LOSS CALULATION

Whole year fixed rate

- *9 month break-down period*
- Loss of production x rate = revenue loss
- For example:
- 100.000 kwh x SEK 2.75 = SEK 275.000

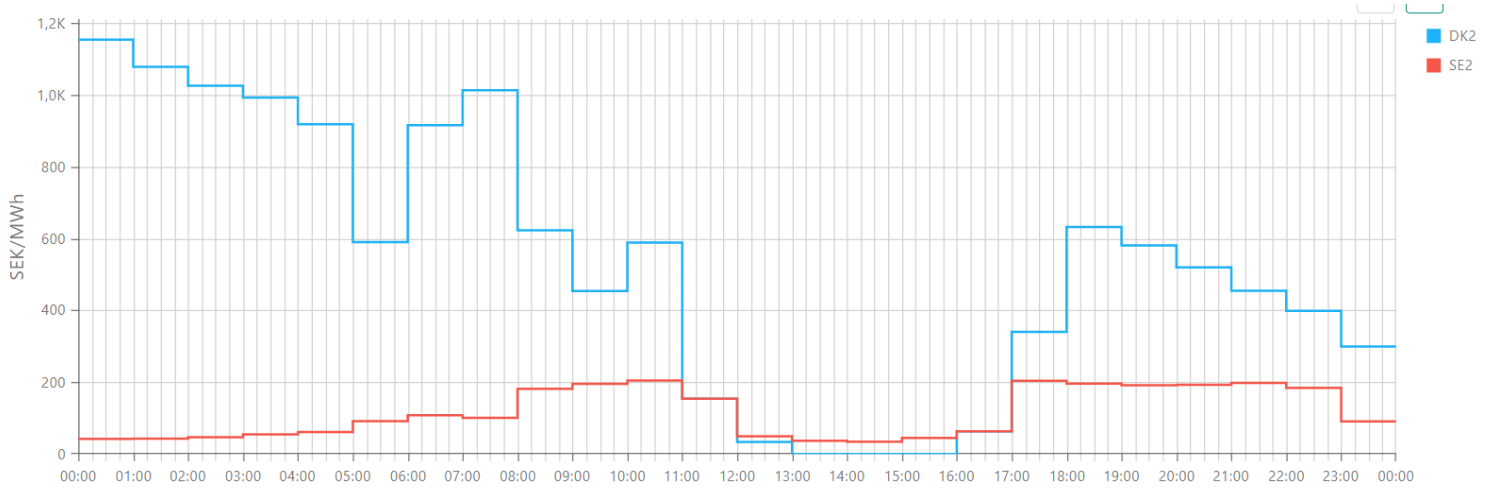
Seasonal fixed rate

- *9 month break-down period*
- (Loss of production 1 x rate 1) + (loss of production 2 x rate 2) = revenue loss
- For example:
- (60.000 kwh x SEK 1.75) + (40.000 kwh x SEK 4) = revenue loss
- (SEK 105.000) + (SEK 160.000) = SEK 265.000

• LOSS CALULATION

Market spot rate

- *9 month break-down period*
- (Loss of production 1 x rate 1) + (loss of production 2 x rate 2) + (loss of production 3 x rate 3) + ……. = revenue loss



Delivery period (CET)	DK2 (SEK)	SE2 (SEK)
00:00 - 01:00	1 154,37	42,29
01:00 - 02:00	1 078,34	43,09
02:00 - 03:00	1 025,91	46,85
03:00 - 04:00	992,96	54,94
04:00 - 05:00	918,41	61,21
05:00 - 06:00	590,47	91,53
06:00 - 07:00	916,36	108,29
07:00 - 08:00	1 013,14	100,88
08:00 - 09:00	623,18	181,93
09:00 - 10:00	454,36	195,49
10:00 - 11:00	588,76	205,07
11:00 - 12:00	154,11	154,11
12:00 - 13:00	33,40	49,24
13:00 - 14:00	0,11	36,93
14:00 - 15:00	0,11	34,54
15:00 - 16:00	0,11	45,14
16:00 - 17:00	63,38	63,38
17:00 - 18:00	340,03	204,27
18:00 - 19:00	632,64	196,18
19:00 - 20:00	581,35	191,73
20:00 - 21:00	520,25	192,87
21:00 - 22:00	455,05	198,11
22:00 - 23:00	398,85	184,32
23:00 - 00:00	299,22	90,85
Min:	**0,11**	**34,54**
Max:	**1 154,37**	**205,07**
Average:	**534,79**	**115,55**

Watch out

THINGS TO WATCH FOR

- Insurable Interest – is it correct?
- Liquidated damages clauses
- Planned maintenance period
- Claimed sudden increases in expected generation

SUMMARY

- Renewable energy is a rapidly growing industry
- Understanding the key risks is very important for all parties
- Familiar technology, but is constantly evolving
- As technology evolves, so does the way in which revenues are earned
- Accurate assessments of business interruption can be calculated, but dependant on data
- Increasing lender requirements – greater amount of cover being purchased
- Constantly evolving policy wordings to meet expectations
- NatCat capacity will be harder to find as climate change brings on more severe weather conditions

QUESTIONS

THANK YOU

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