

# Kia ora koutou katoa





## Marine and Offshore

*Classification and Certification of Ships and Off-shore installations. IANZ Accredited Inspection Body under (HSAW: Petroleum Extraction and Pipelines Regulations)*



## Industry

*Inspection and Testing of Industrial Assets in Oil & Gas, Power & Utilities, Manufacturing, Process Industries & Mining. Inspection Body (HSAW: Pressure Equipment, Cranes & Passenger Ropes)*



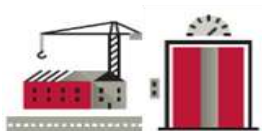
## Certification

*ISO system audits (QHSE, Food, Forestry, Other), Supply chain audits, Product Certification (S-Mark), Compliance auditing, Safety Audits (HSAW: Adventure Activities, Amusement Device)*



## Government Services & Int. Trade

*Pre-shipment inspections (apples, milk-powder), Destination X-ray scanning, Verification of Conformity, Single Window, Automotive Services, General Trade – Outsourcing Services.*



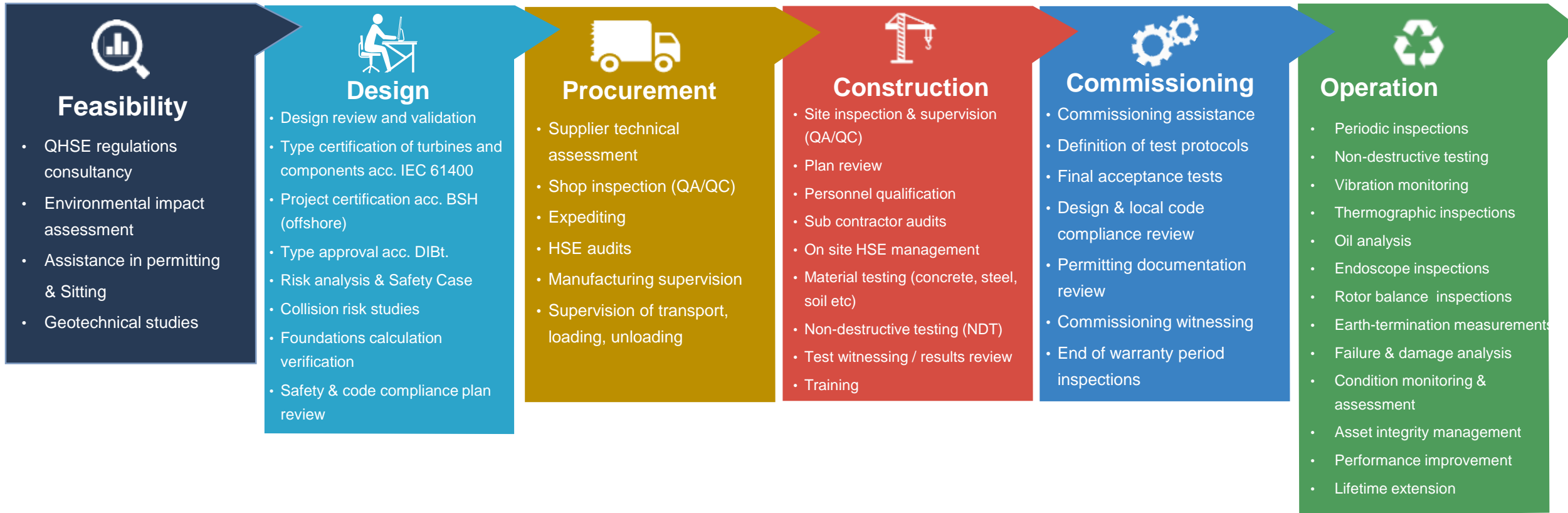
## Building & Infrastructure (Construct. & IVS)

*Building condition assessments, environmental assessments, fire safety, asbestos monitoring, Indoor air & water quality, Chemical exposure, Ergonomics assessment*



# INTERNATIONAL WIND ENERGY SERVICES

THROUGHOUT THE WHOLE VALUE CHAIN



← **Project Management / Construction Management / Integrated full scope packages** →



**BUREAU  
VERITAS**

# ASSET INTEGRITY MANAGEMENT

LESSONS FROM EUROPEAN & CHINESE WIND FARMS – TAKE AWAYS FOR NEW ZEALAND

DR GUY COTTERILL, APRIL 12TH 2017

# AGENDA

01

**O&M approaches in  
Wind Power – a  
short history**

02

**AIM – as a new  
driver for cost,  
quality and safety**

03

**Recent trends in  
Europe & China**

**Take aways for New  
Zealand**



**BUREAU  
VERITAS**

© Copyright Bureau Veritas



# 01

## O&M APPROACHES IN WIND POWER – A SHORT HISTORY



**BUREAU  
VERITAS**

© Copyright Bureau Veritas

# O&M APPROACHES IN WIND POWER – A SHORT HISTORY

## OPERATIONS & MAINTENANCE (O&M) - WHERE IT ALL STARTED

### PIONEER ERA

- 1990s to early 2000s
- Development of first O&M schemes
- Reactive maintenance approach

### GROWTH YEARS

- 2000 - 2015
- Subsidy schemes drive focus on growth and up-scale, less so on O&M
- O&M as part of the OEM package is the norm

### MATURITY

- Post 2015
- Market environment drives more diversity in business models

**O&M 100% driven by OEMs**

**All-in long term packages**

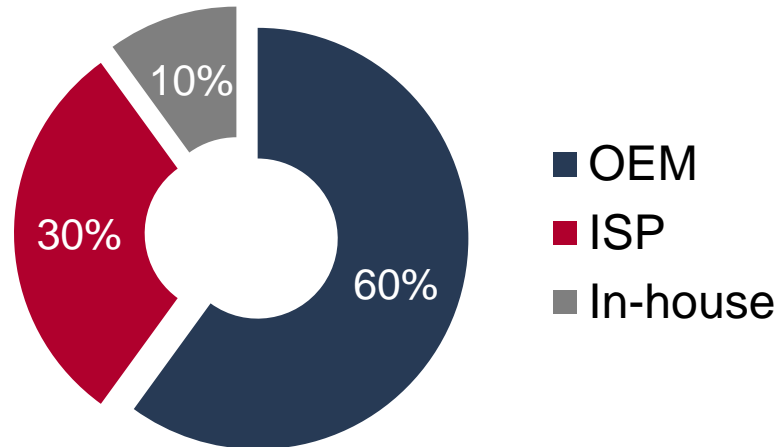
**Focused on reactive  
maintenance**

**Growth was more important  
than cost and reliability**

# O&M APPROACHES IN WIND POWER – A SHORT HISTORY

THE LANDSCAPE OF PLAYERS IS NOW CHANGING IN THE MATURE MARKETS

## SHARE OF O&M MARKET IN EUROPE (2017)



Source: BV Estimate

### WIND TURBINE OEMs

- Wind turbine OEMs still provide O&M services to ca. 60% of the market, but their role providing complete O&M is losing importance.
- Some have become ISPs (through acquisition or organically) to serve also competitor turbines.

### INDEPENDENT SERVICE PROVIDERS (ISPs)

- Have seen strong growth in last 5 years now serving about 30% of the market, totally focussed on Europe and US.

### IN-HOUSE SETUPs

- More advanced independent power producers (IPPs) have also started building in-house teams (ca. 10% of the market as per today). Some also act as ISPs serving other clients.
- This group is likely to grow further in the next years.



# O&M APPROACHES IN WIND POWER – A SHORT HISTORY

## CONDITION BASED MAINTENANCE HAS BECOME THE NORM

### REACTIVE MAINTENANCE

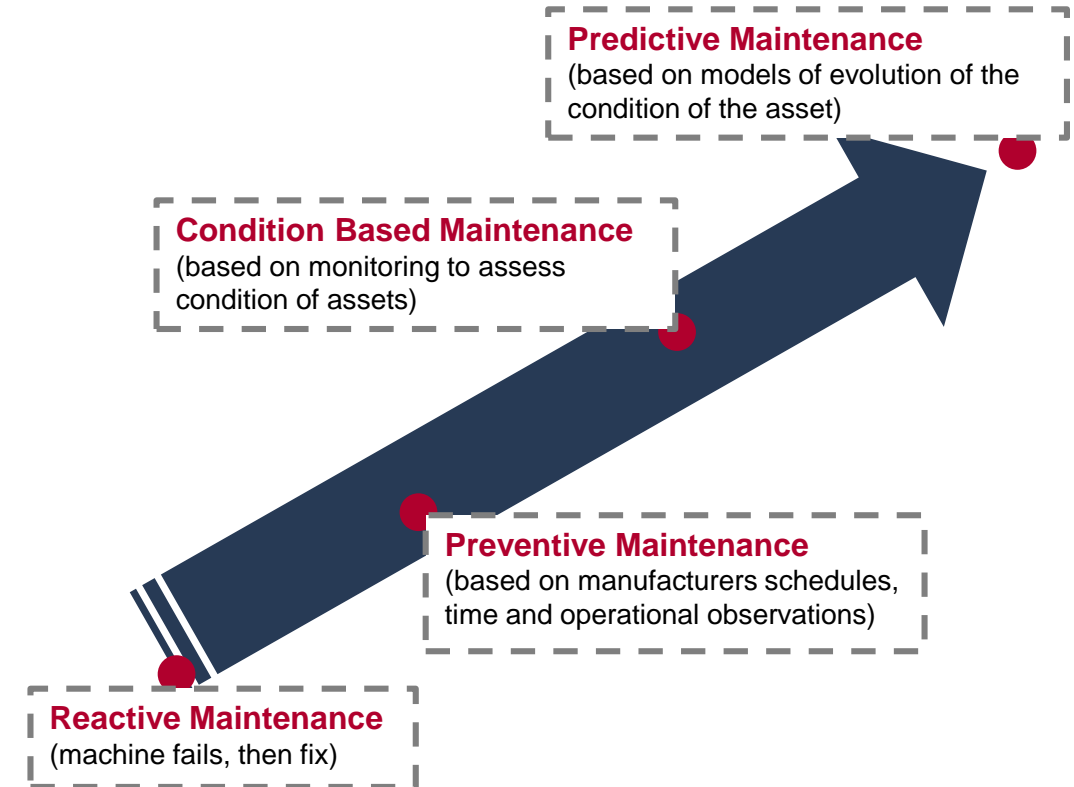
- Use to be the standard model for many years, but has disappeared almost completely now

### PREVENTIVE MAINTENANCE

- Has replaced reactive maintenance in the early 2000s and has brought big improvements throughout the supply chain

### CONDITION BASED MAINTENANCE

- Is today the norm
- On-line and off-line sensors and tests
- Monitoring and diagnostics tools have become mature and cover a diversified set of applications



# O&M APPROACHES IN WIND POWER – A SHORT HISTORY

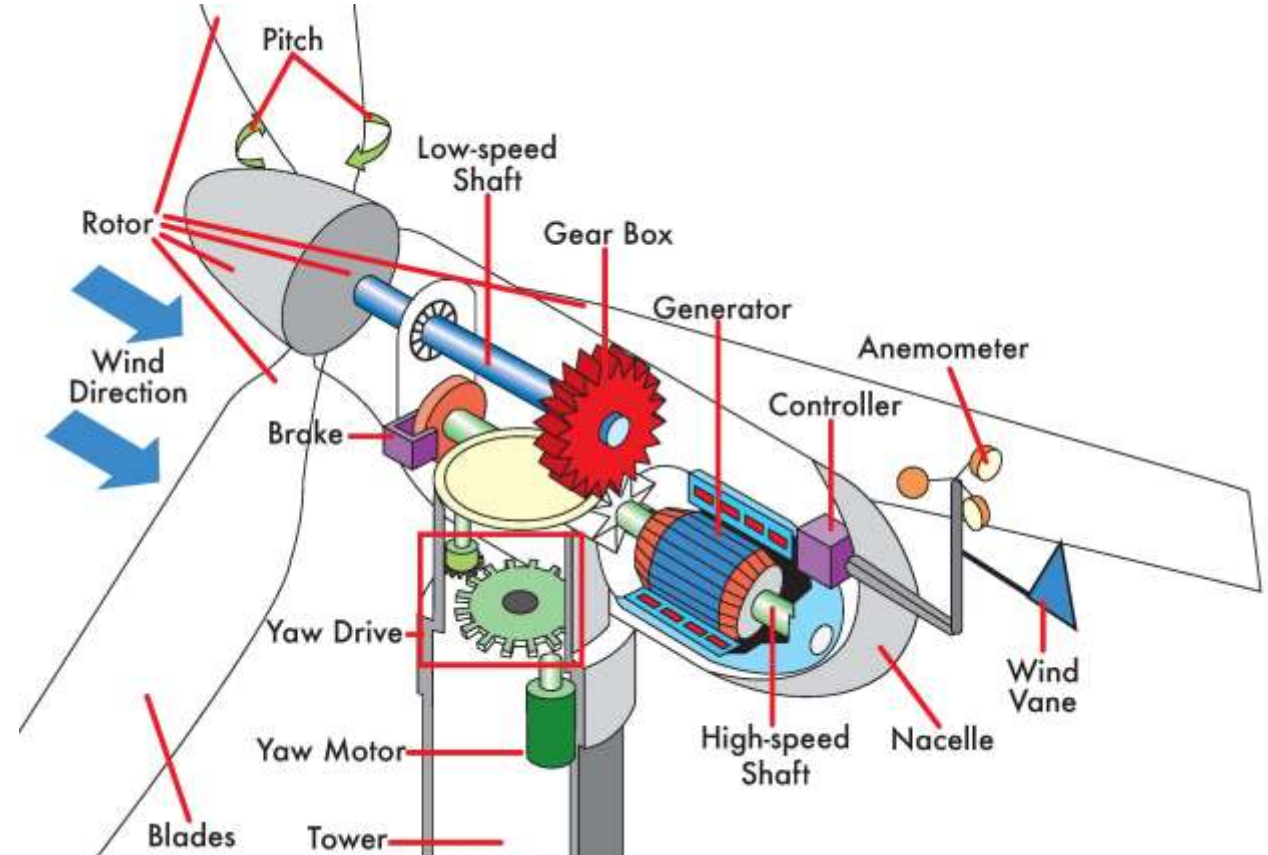
CONDITION BASED MAINTENANCE HAS BECOME THE NORM

## CONDITION MONITORING

- Vibration analysis
- Oil analysis
- Temperature measurement
- Structural health monitoring
- Thermography analysis

## NON-DESTRUCTIVE TESTING

- Ultrasonic testing techniques
- Radiographic inspection
- Visual incl. drone inspection
- Endoscope visual inspection
- Acoustic emission
- Etc...



# 02

**ASSET INTEGRITY MANAGEMENT – A  
NEW DRIVER FOR COST, QUALITY AND  
SAFETY**

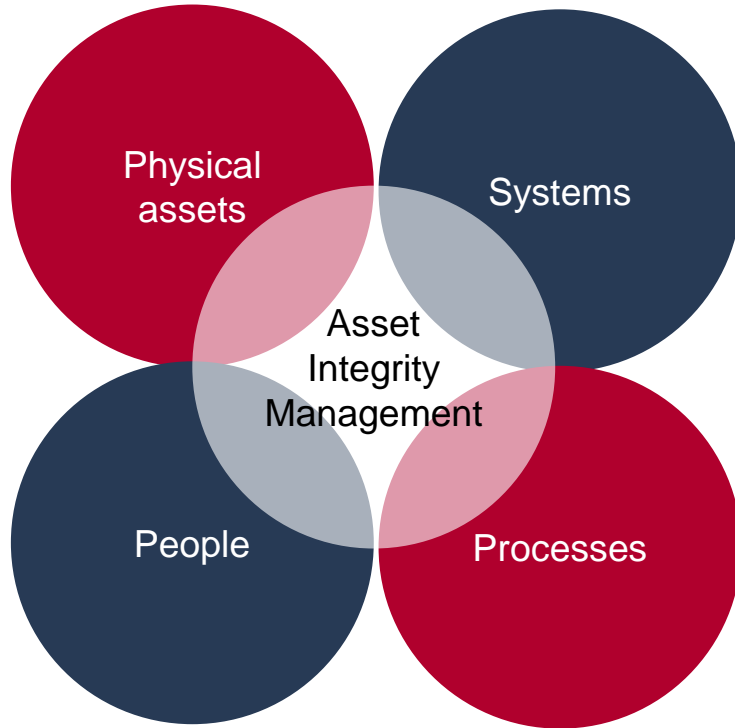


**BUREAU  
VERITAS**

© Copyright Bureau Veritas

# AIM – A NEW DRIVER FOR COST, QUALITY AND SAFETY

## THE BASICS



### WHAT IS ASSET INTEGRITY?

- “Asset Integrity” is the ability of an asset to perform its required function effectively and efficiently whilst safeguarding life and the environment.

### ASSET INTEGRITY MANAGEMENT?

- AIM ensures that the people, systems, processes and assets themselves which deliver integrity, are in place, in use and fit for purpose over the whole lifecycle of the asset.

### WHAT ARE THE KEY OBJECTIVES

- Safety improvement.
- Reliability improvement.
- Optimisation of maintenance and inspection activities to meet safety and business targets.

# AIM – A NEW DRIVER FOR COST, QUALITY AND SAFETY

## WHY IS THIS IMPORTANT IN THE CONTEXT OF WIND POWER O&M

### PHYSICAL ASSETS

- Risk assessment
- Risk based inspections (RBI)
- Optimisation of inspection strategy (RCM)

### SYSTEMS

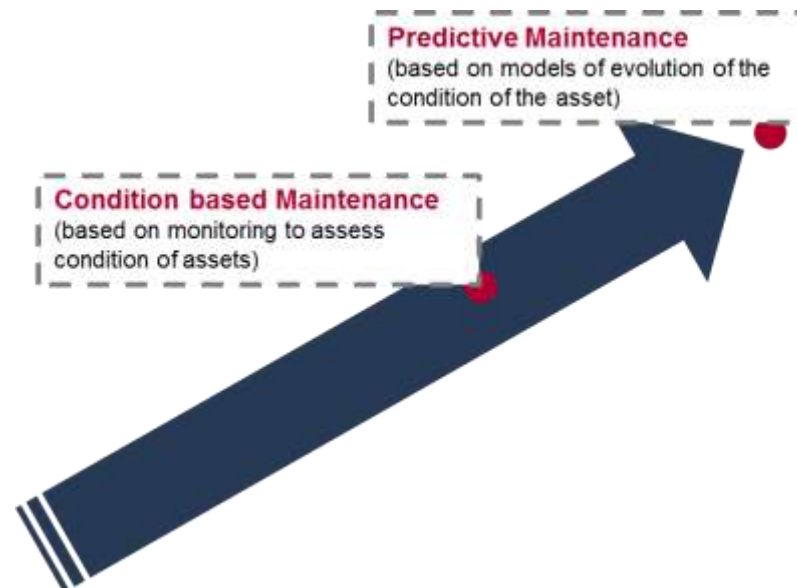
- CMMS

### PEOPLE

- Leadership & organisational framework
- Skills and competencies

### PROCESSES

- Data management & data analysis
- Optimisation of maintenance strategy



“

*AIM takes maintenance from condition based to predictive!*

”

# 03

## RECENT TRENDS IN EUROPE AND CHINA

R48103  
1



BUREAU  
VERITAS

© Copyright Bureau Veritas

# RECENT TRENDS IN EUROPE AND CHINA

## INCREASING FOCUS ON ASSET INTEGRITY MANAGEMENT

### PRESSURE ON OPERATING ASSETS IS GETTING HIGHER

- Need to increase performance, extend lifetime and provide leanest possible O&M.
- Safety remains non-negotiable.

### ASSET INTEGRITY MANAGEMENT IS SEEN AS A MORE HOLISTIC APPROACH

- Past endeavours were merely looking at isolated problem solving and incremental improvements.
- The need for early stage implementation of AIM to develop full potential is now a recognised fact.



# RECENT TRENDS IN EUROPE AND CHINA

## THE QUESTION OF REPOWERING VS. LIFE TIME EXTENSION



### THIS IS AN IMPORTANT QUESTION

- Design life will end for 4.5 GW of installed capacity in Germany within the next 3 years. Elsewhere the situation is similar.

### THE CASE FOR REPOWERING

- Whilst repowering seemed to be a big market some time ago, recent trends in European subsidy schemes don't give it priority any more.

### THE CASE FOR LIFE TIME EXTENSION

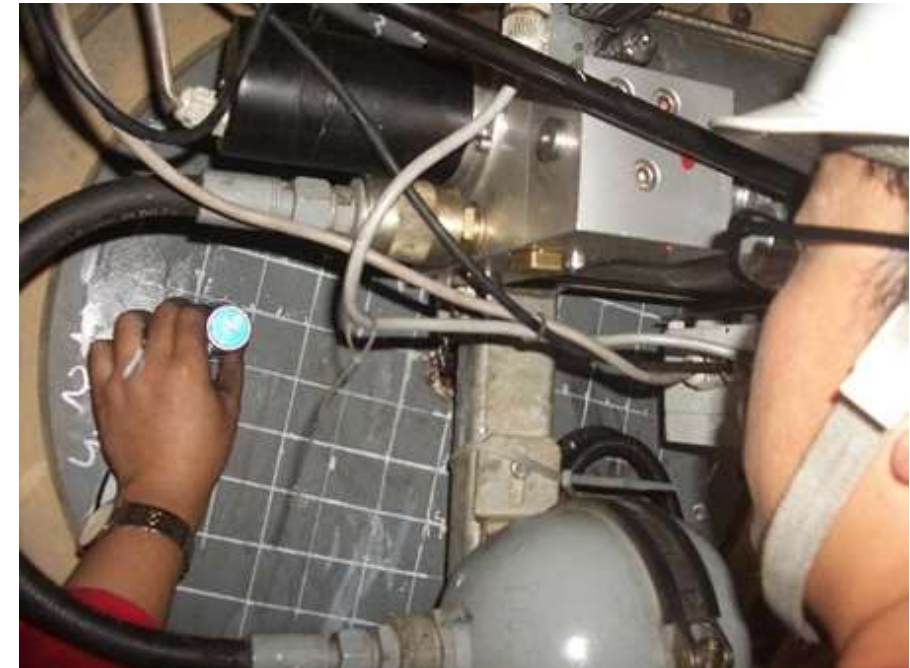
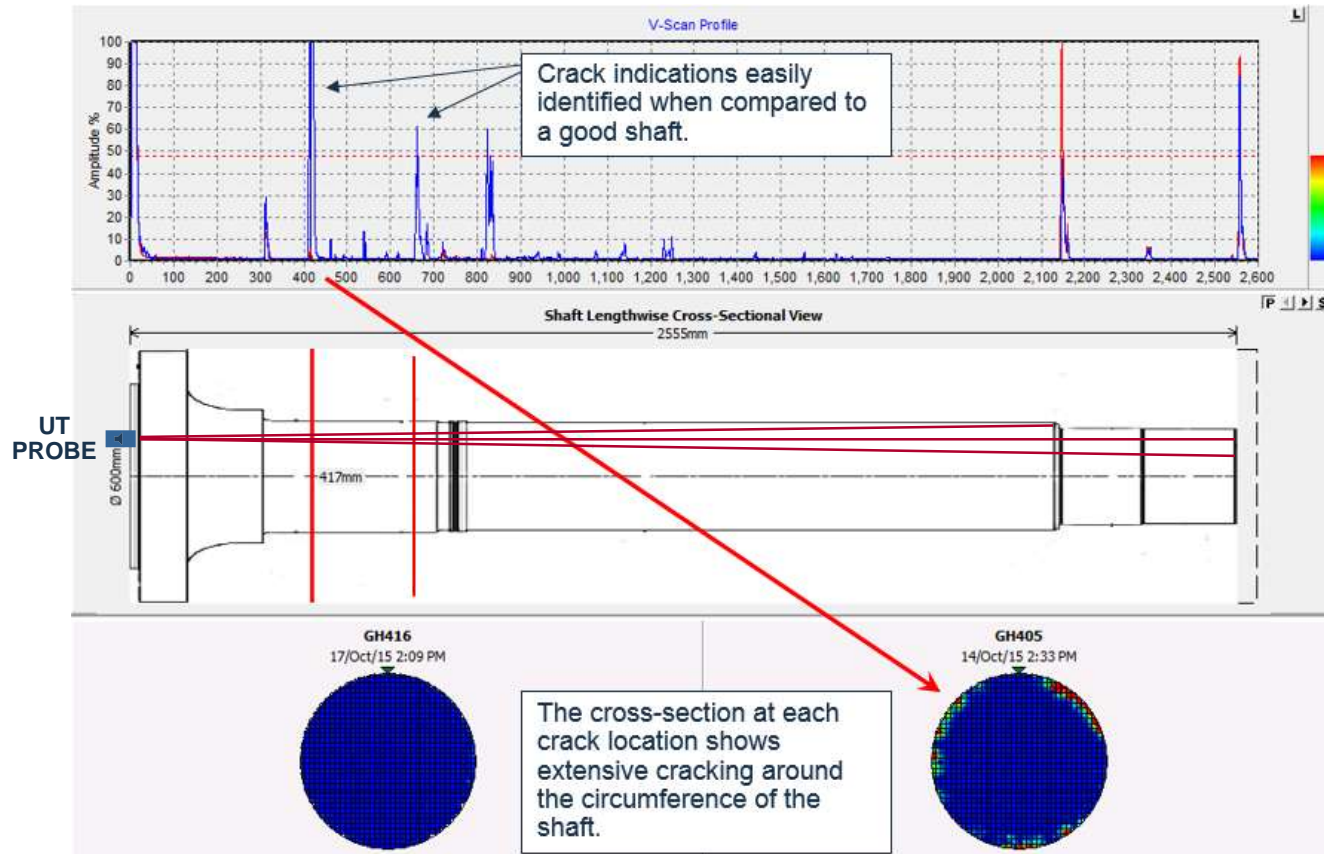
- LTE is now evolving as the more sustainable solution.
- The importance of early stage implementation of AIM is vital.



# RECENT TRENDS IN EUROPE AND CHINA

## ADVANCED NDT TECHNIQUES

- ▶ ShafTest<sup>®</sup> is an ultrasonic (UT) test method. It was originally developed by **BV Australia** and is a registered trademark of Bureau Veritas.
- ▶ ShafTest<sup>®</sup> examines the main shaft from the rotor end and builds an ultrasonic volume map of the whole shaft that allows monitoring between inspections or between similar design shafts.



# RECENT TRENDS IN EUROPE AND CHINA

## ADVANCED NDT TECHNIQUES

### A CASE STUDY



- ▶ The main shaft of #14 WTG fractured and the hub and blades were destroyed in one wind farm located in Zhenjiang Province, China.

- ▶ The wind farm owner requested BV to inspect the other 32 main shafts to determine whether there were potential risks without disassembly of wind turbines.

---

- ▶ ShafTest<sup>®</sup> detected cracking in two of the 32 shafts tested.

- ▶ Similar cracking has also been detected for other operators from a different manufacturer.

- ▶ More recently several similar failures have occurred in Europe which initiated a ShafTest<sup>®</sup> inspection campaign at a number of wind farms in France.

# 04

TAKE AWAYS FOR NEW ZEALAND



**BUREAU  
VERITAS**

© Copyright Bureau Veritas

# TAKE AWAYS FOR NEW ZEALAND

## SOME LAST THOUGHTS



*TARGET  
20% wind  
power by  
2030!*



### **WIND O&M IS NOW A MATURE INDUSTRY**

- The learning curve from Europe and China has been incredibly steep and NZ can tap into this knowledge.

### **WE LIVE IN A POST “LIFE CYCLE BLACK BOX” WORLD**

- Many operators have stepped away from the all-in black box O&M contract model to explore more innovative and cost efficient solutions.

### **THE INDUSTRY LANDSCAPE IS GETTING DIVERSIFIED**

- Independent service providers and in-house setups have taken away market from the OEMs and this trend is likely to continue.
- The trend towards new ways of how the supply chain works together in O&M will continue.

### **BEYOND SIMPLE MAINTENANCE**

- Predictive maintenance and asset integrity management are now the norm.



**BUREAU**  
**VERITAS**

***Move Forward with Confidence***