



# Condition Monitoring to Boost Sustainable Operation and Maintenance

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# Content

## **Life Cycle**

What is necessary to get sustainable



## **Maintenance Journey**

Possibilities of maintenance and their costs



## **Condition Monitoring**

Challenges and innovation



## **Sustainability** in O&M

How are sustainability and O&M linked together



# Life Cycle

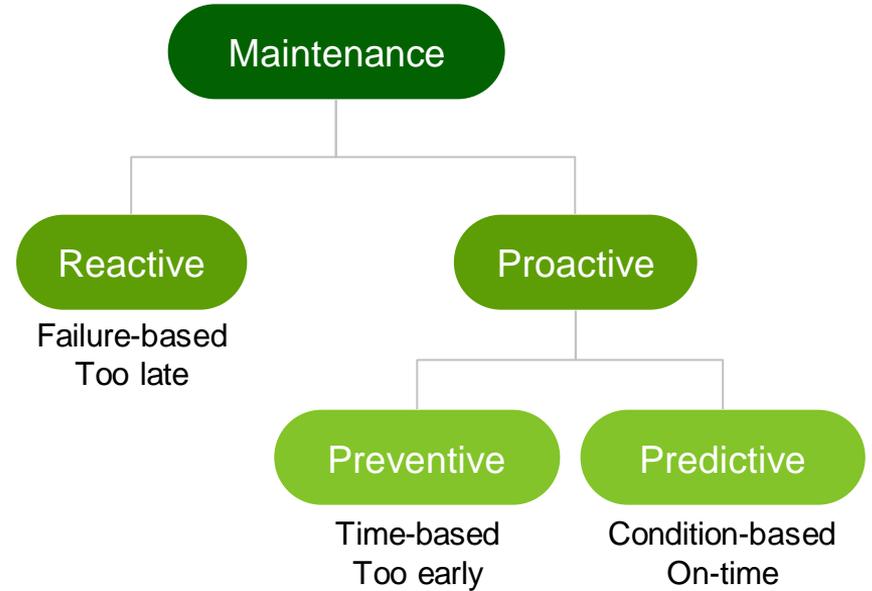


More than 70% of lifecycle greenhouse gas emissions for wind energy are produced during the development and production phase.

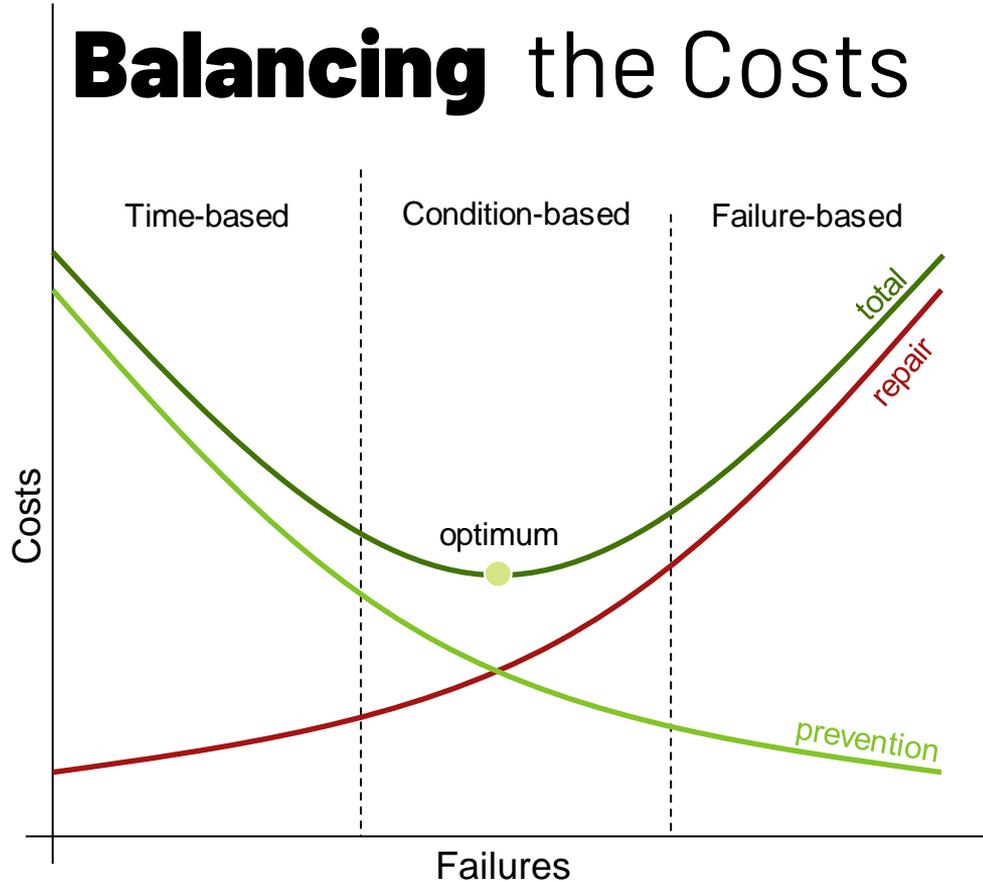




# Maintenance Journey



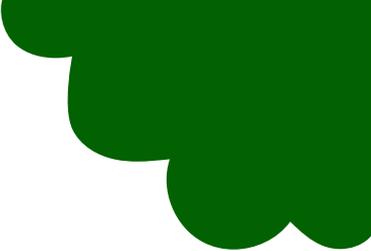
# Balancing the Costs



## It's not only money

The importance of non-monetary parameters must increase significantly.

# Condition Monitoring



**01**

## Indicators

Select significant conditions

**02**

## Acquisition and Analysis

Collect data and find correlations

**03**

## Interpretation

Decide whether or which maintenance is needed

**04**

## Action

Initiation of maintenance steps



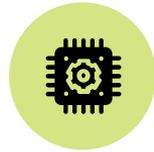
# Challenges and Innovations of CM



## Maintenance strategies

Complex processes

1



## Data collection

Installation and getting relevant data

3

2

## Data analysis

Correlation is not causality



4

## Costs

Barrier to use helpful tools



## Innovations

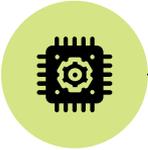
IoT, AI, AR, ...





# INMOX

Intelligent monitoring systems



## **New sensor technology**

detection and characterization of wear and tear



## **Direkt parameter**

Specific indicator for damages in powertrains



## **Full value chain**

Data acquisition, analysis and interpretation  
with hardware and damage models



# Sustainability in O&M



## Potential of IoT

Predictive maintenance could reduce maintenance costs by up to 40% and can reduce downtime by up to 50%. Estimated economic impact of nearly \$630 billion per year.

**Optimized  
maintenance**

**1**

**Reduced energy  
consumption**

**3**

**2**

**Extended lifespan**

**4**

**Improved safety**

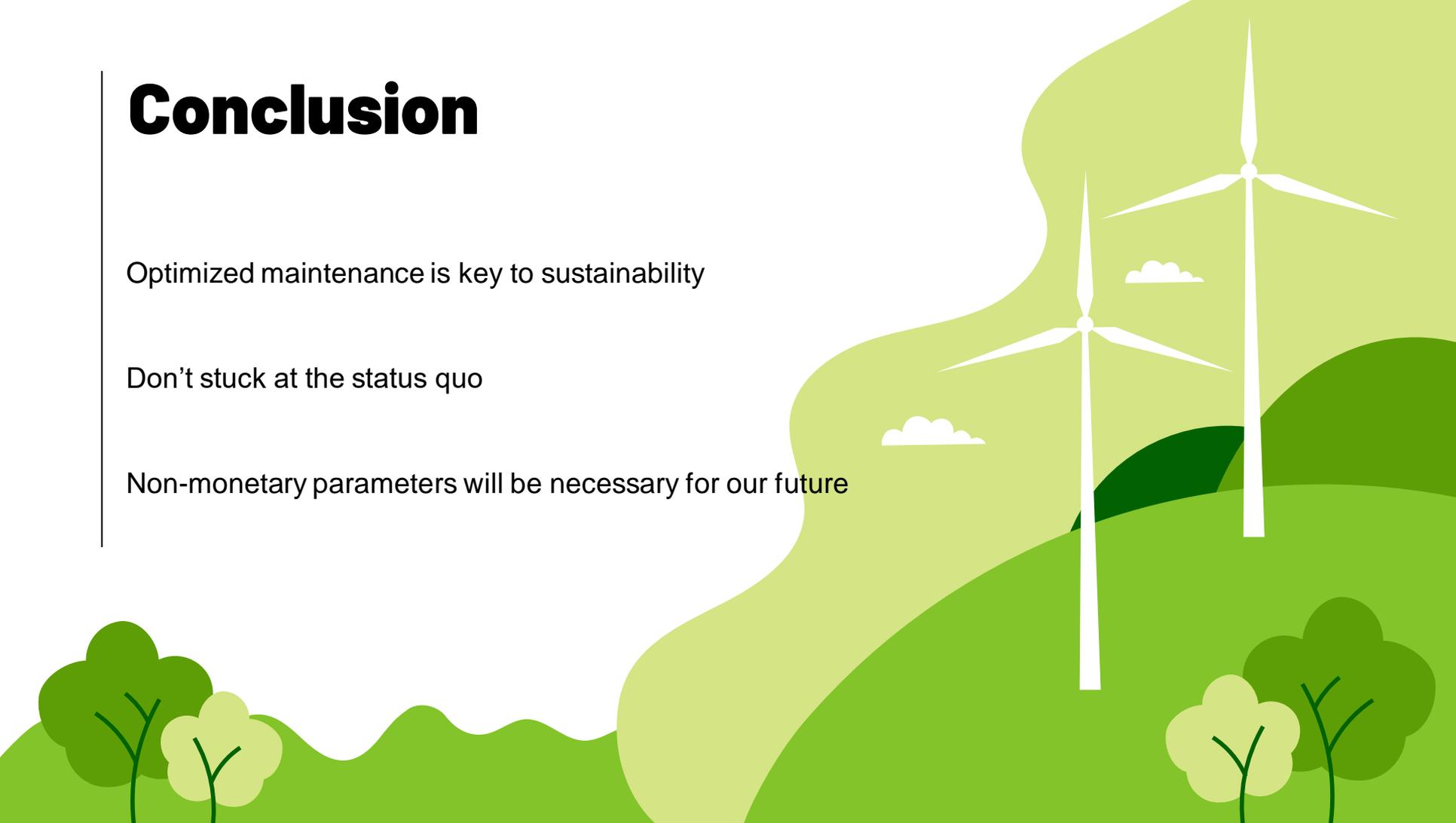


# Conclusion

Optimized maintenance is key to sustainability

Don't stuck at the status quo

Non-monetary parameters will be necessary for our future





# THANKS!

## DO YOU HAVE ANY QUESTIONS?



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