Seven Years on: Overview of the Technical and Economic Benefits of a Dedicated Condition Monitoring System and Services

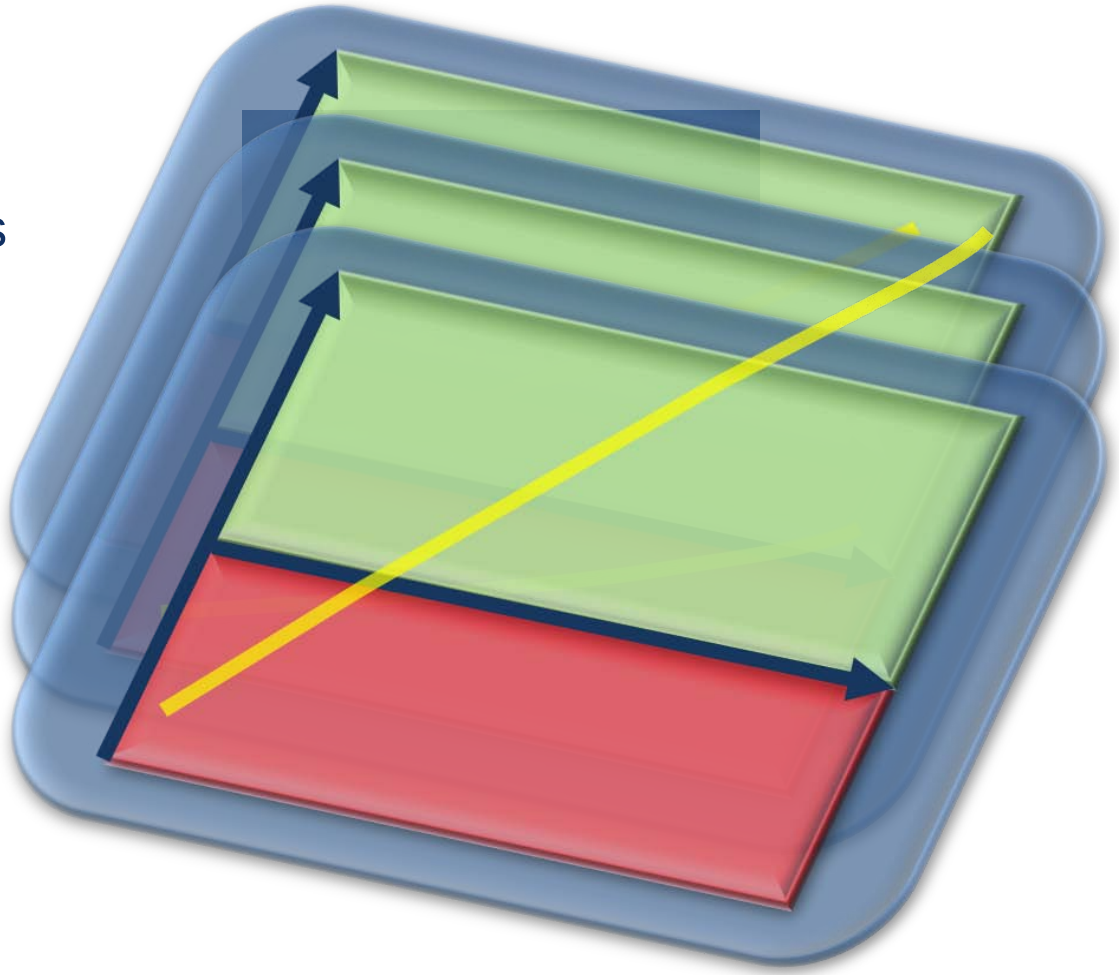
Presented by Mark Banks

Agenda

- Intro
- CMS Today
- The Study
- Case Story 1
- Case Story 2
- Key takeaway

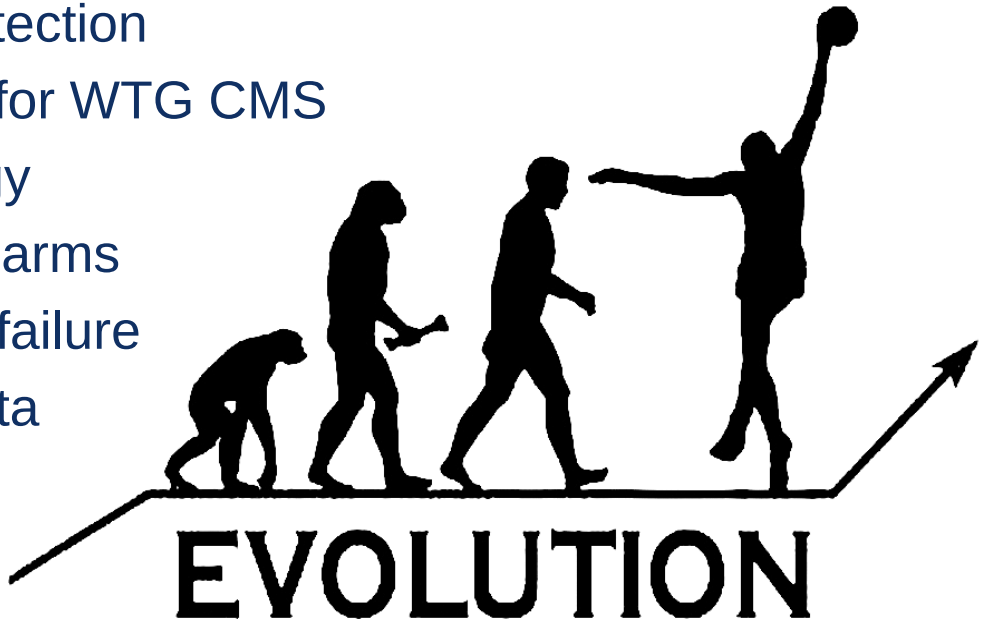
Introduction

- The big question?
- ROI of CMS on WTG's



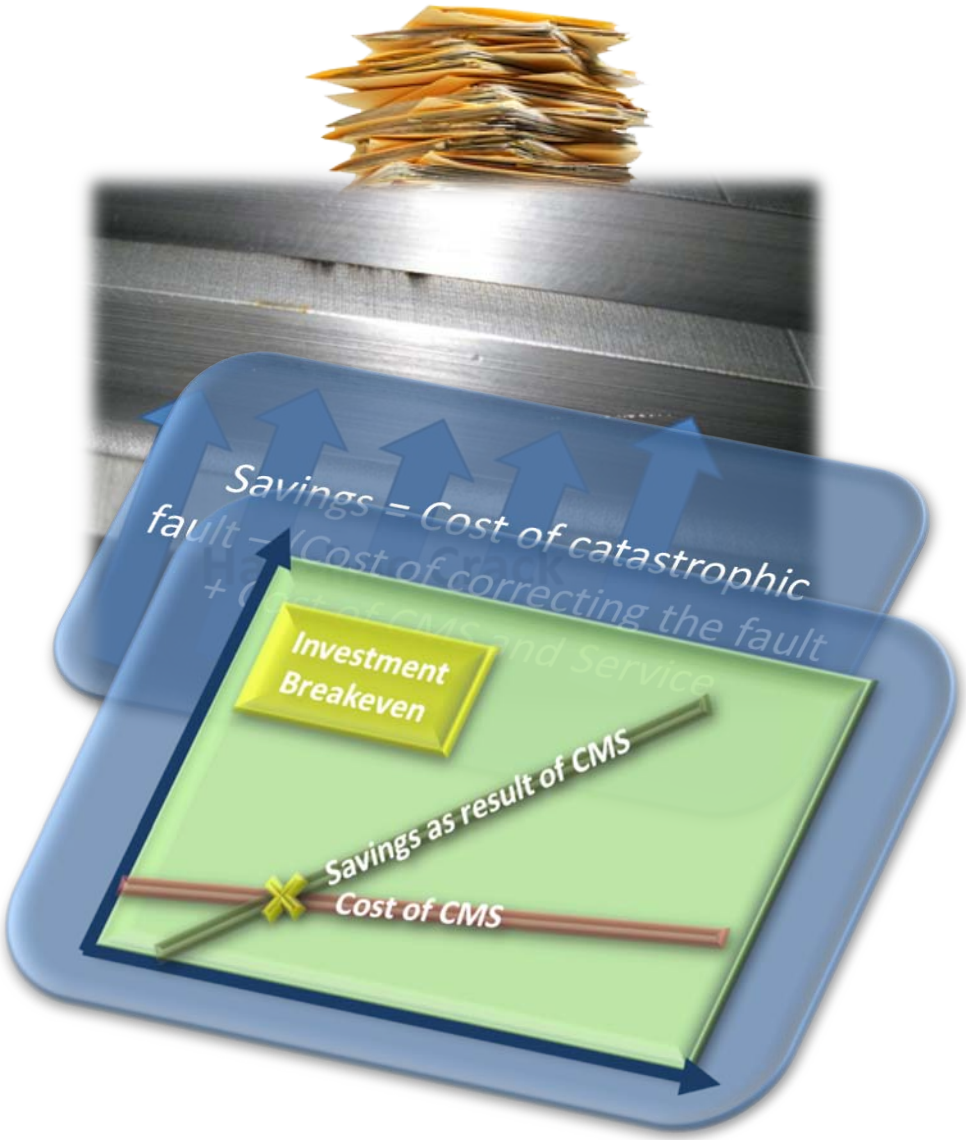
CMS Today

- Market acceptance
  - Early, reliable fault detection
  - Special requirements for WTG CMS
- Much improved technology
  - Reduced number of alarms
  - Accurate lead-time to failure
- Experience translating data to actionable information



The Study

- Real data from European 20 1.5MW WTG site
- Avoiding catastrophic failure by detecting fault early enough to replace only a bearing or tooth wheel rather than a GB or GEN
- Savings calculated as:
- Determine the breakeven of the investment



Actual data: 20 WTG Farm / 5 year period
ROI – Avoidable Failures

- 7 preventable failures
- 3 gearbox & 4 generators
  - 1 generator = $146,380
  - 1 gen. brg = $10,998
  - 1 gearbox = $268,580
  - 1 gearbox brg = $11,830
  - 1 shaft/gear = $33,280

- CM system + services = $390,000 (5 yrs)

Shaft/gear
Bearings

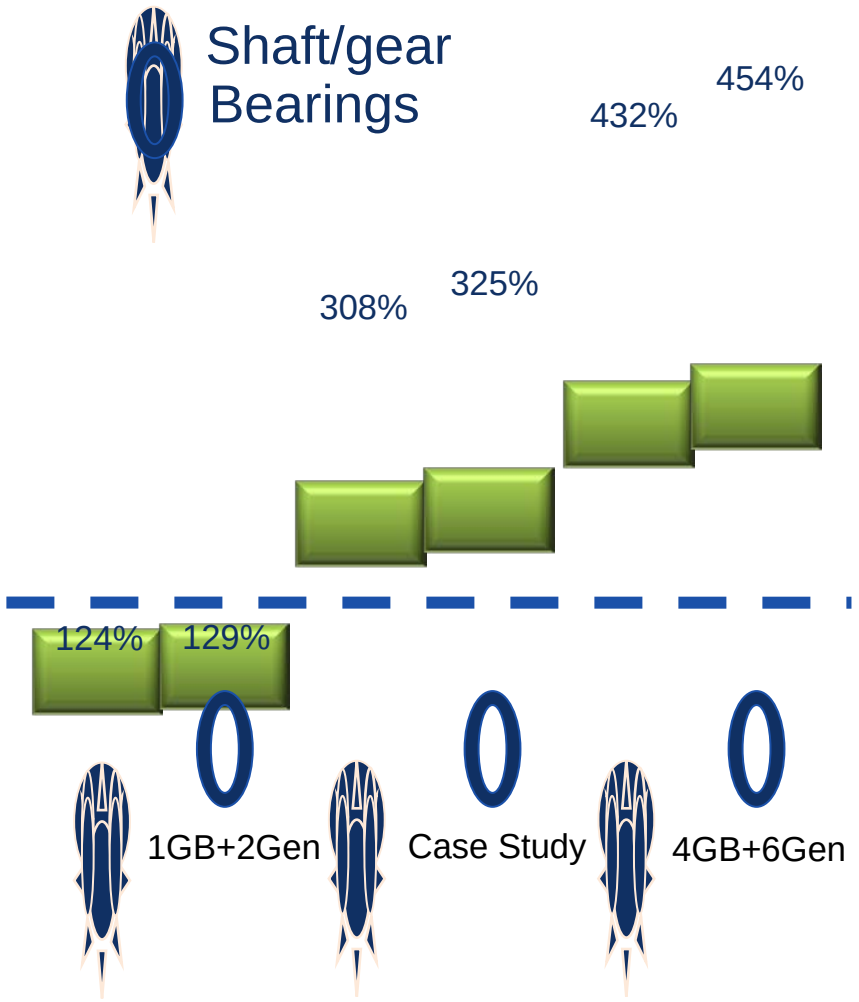
308%

325
%

Actual data: 20 WTG Farm / 5 year period ROI – Avoidable Failures

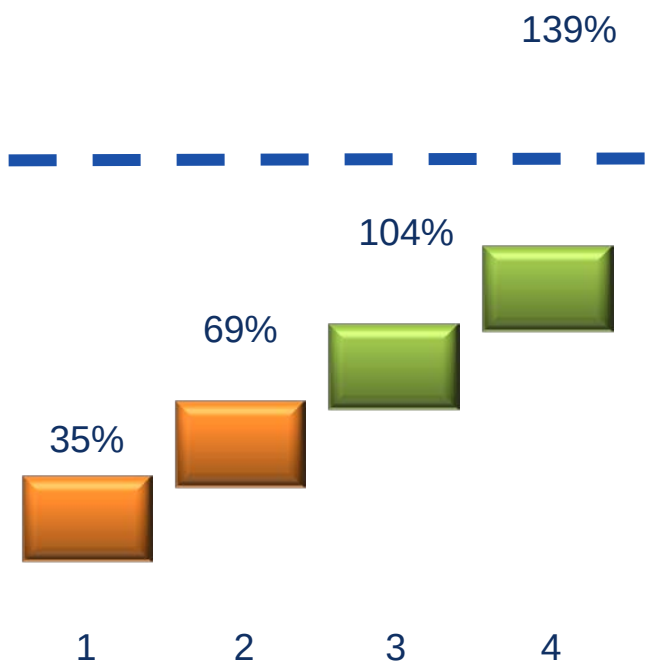
- Combinations of preventable failures
  - 1 generator = $146,380
  - 1 gen. brg = $10,998
  - 1 gearbox = $268,580
  - 1 gearbox brg = $11,830
  - 1 shaft/gear = $33,280

- CM system + services = $390,000 (5 yrs)



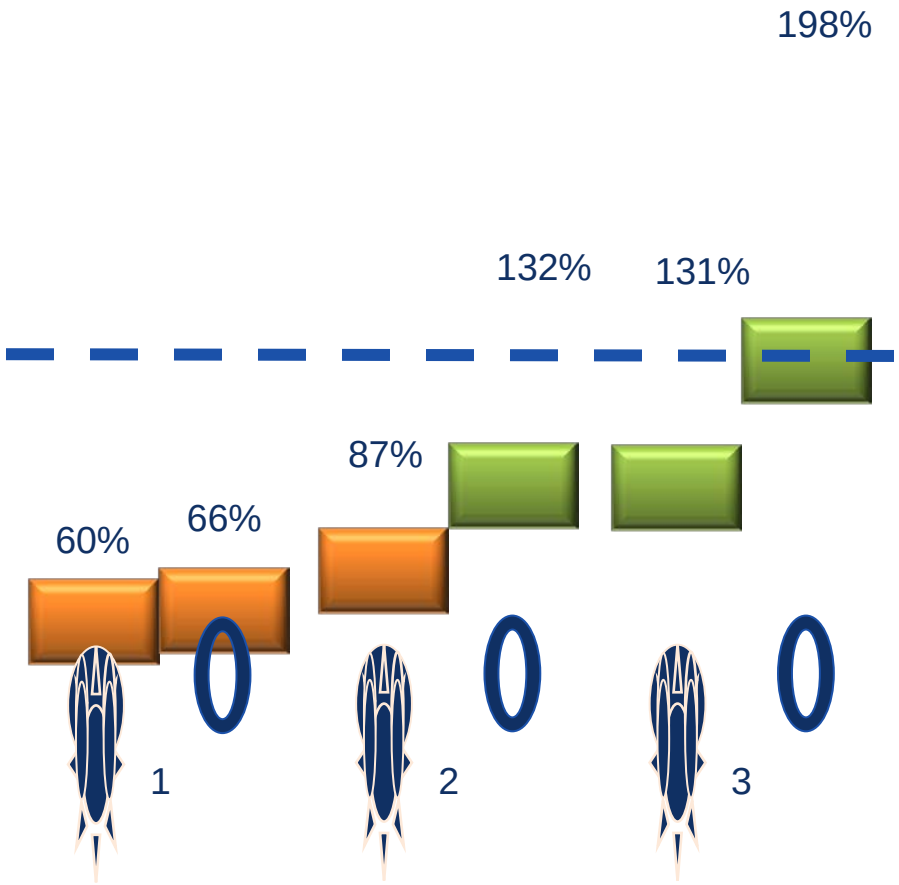
Actual data: 20 WTG Farm / 5 year period
ROI – Avoid Generator Failures

- 4 preventable failures
  - 1 generator = $146,380
  - 1 gen. brg = $10,998
- CM system + services = $390,000 (5 yrs)
- Breakeven after 2nd generator!



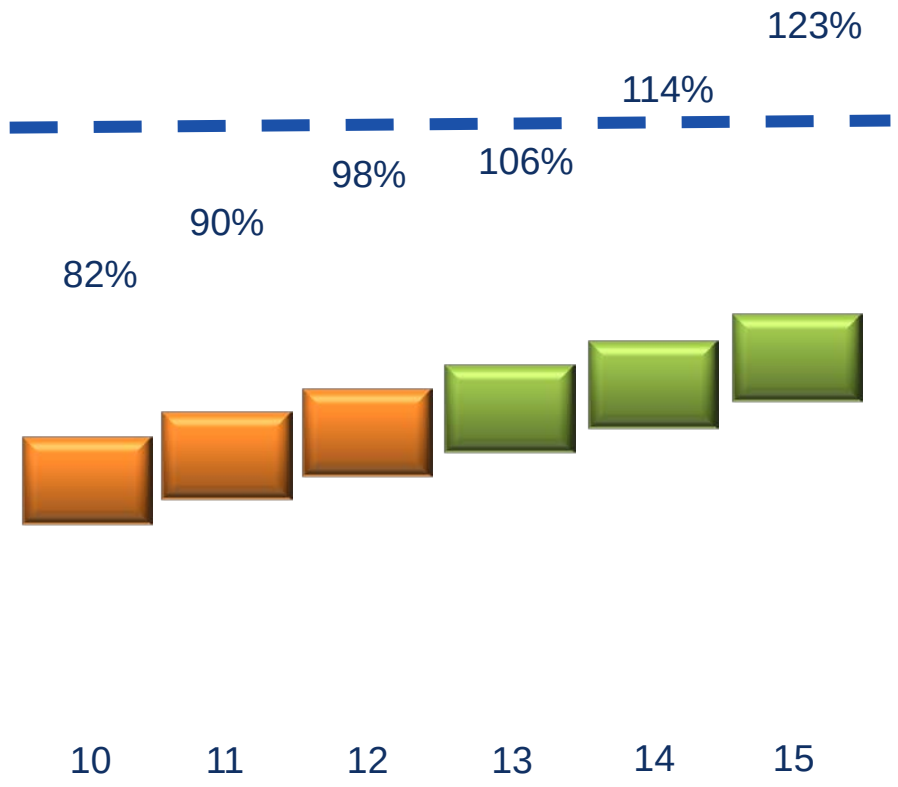
Actual data: 20 WTG Farm / 5 year period
ROI – Avoid Gearbox Failures

- 3 preventable failures
  - 1 gearbox = $268,580
  - 1 gearbox brg = $11,830
  - 1 shaft/gear = $33,280
- CM system + services = $390,000 (5 yrs)
- Breakeven after 2nd gearbox!



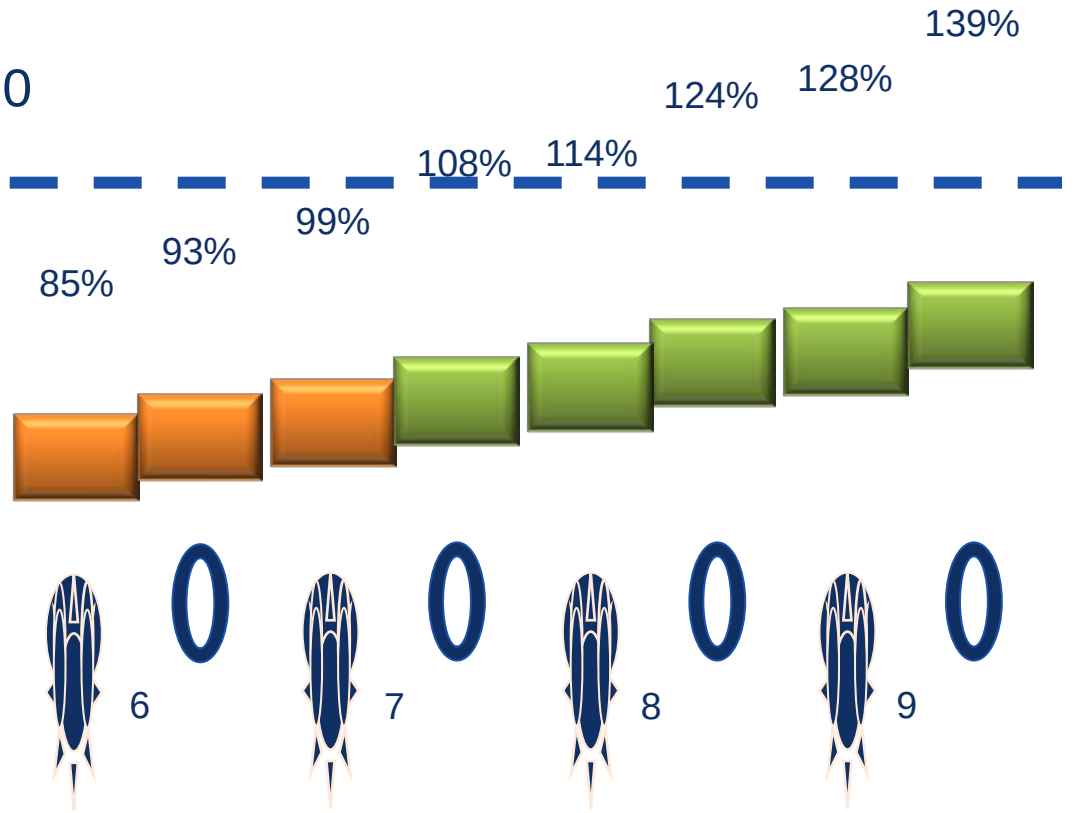
Projections for 100 Turbine Park
ROI – Avoid Generator Failures

- 20 Preventable failures
  - 1 generator = $146,380
  - 1 gen. brg = $10,998
- CM system + services = $1.65m (5 yrs)
- Breakeven at 13th generator!



Projections for 100 Turbine Park ROI – Avoid Gearbox Failures

- 9 Preventable failures
  - 1 gearbox = $268,580
  - 1 gearbox. brg = $11,830
  - 1 shaft/gear = $33,280
- CM system + services = $1.65m (5 yrs)
- Breakeven at 8th gearbox!



Combined Events
ROI – Avoidable Failures – 5 year period – 100 turbines

Shaft/gear

10	176%	184%	192%	201%	209%	217%	225%	233%	241%	250%
9	159%	167%	176%	184%	192%	200%	208%	216%	225%	233%
8	142%	151%	159%	167%	175%	183%	191%	200%	208%	216%
7	126%	134%	142%	150%	158%	166%	175%	183%	191%	199%
6	109%	117%	125%	133%	142%	150%	158%	166%	174%	182%
5	92%	100%	108%	117%	125%	133%	141%	149%	157%	166%
4	75%	83%	92%	100%	108%	116%	124%	132%	141%	149%
3	59%	67%	75%	83%	91%	99%	108%	116%	124%	132%
2	42%	50%	58%	66%	74%	83%	91%	99%	107%	115%
1	25%	33%	41%	49%	58%	66%	74%	82%	90%	98%
	1	2	3	4	5	6	7	8	9	10

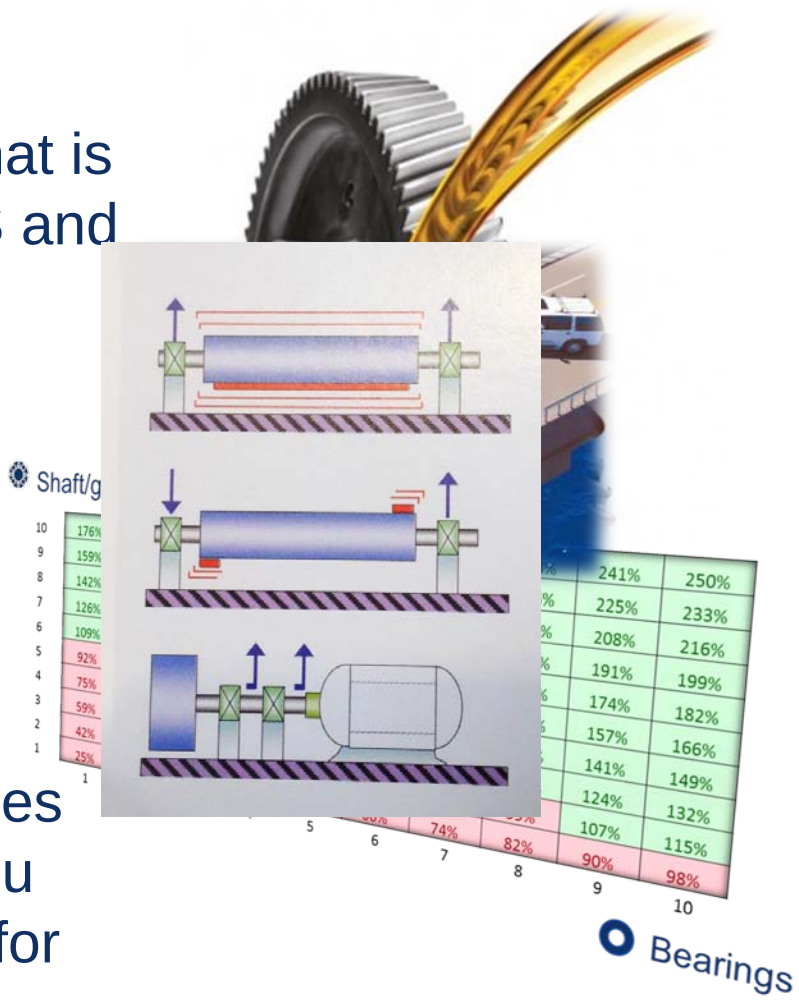
0 Bearings

Conclusion

- Investment payback by avoiding small number of catastrophic failures
- Based on conservative values using:
  - Lowest component costs
- Not taking in consideration:
  - Reduced insurance premiums
  - Production bonuses
  - Reduced spare parts stock
  - Reduced unplanned down-time

Conclusion

- Nor does it include other faults that is detectable with a dedicated CMS and service, such as:
  - Lubrication issues
  - Misalignment
  - Unbalance



- If you can identify your S&M values in the green area of this table, you have a very solid business case for a dedicated Condition Monitoring System and Service

Thank you for your time!

Please visit us at booth 7220 for more information