Hvad bør vedligeholdes og hvorfor?

Ex Forum

07-05-2019

Agenda

1. Generelt
2. Driftssikkerhed
3. Eksempel
4. Hvad bør vedligeholdes?
5. Omkostninger vs pålidelighed

Jesper Pedersen

Maskinmester

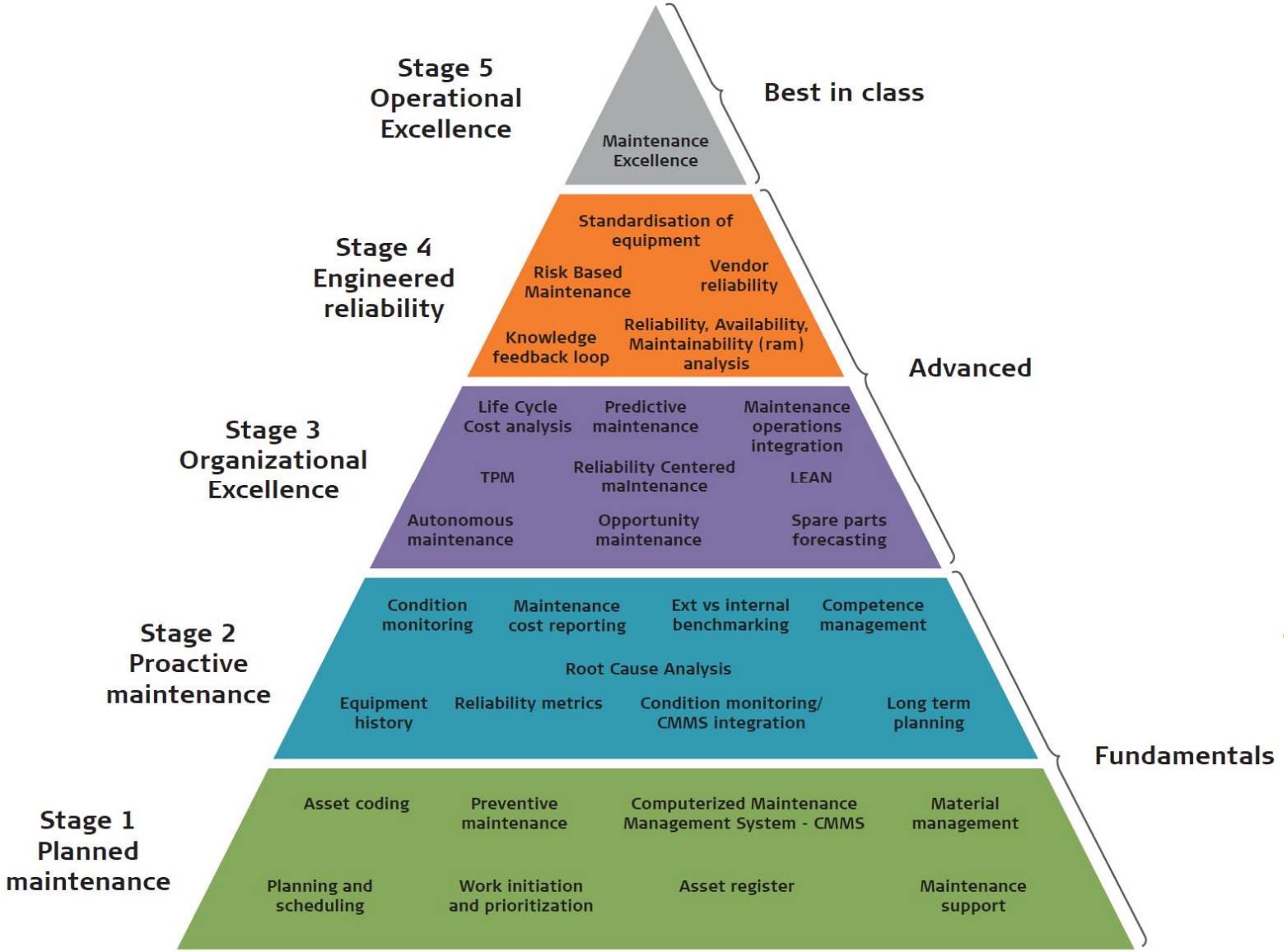
Diplom i Vedligehold

efnms
European Federation of National Maintenance Societies vzw

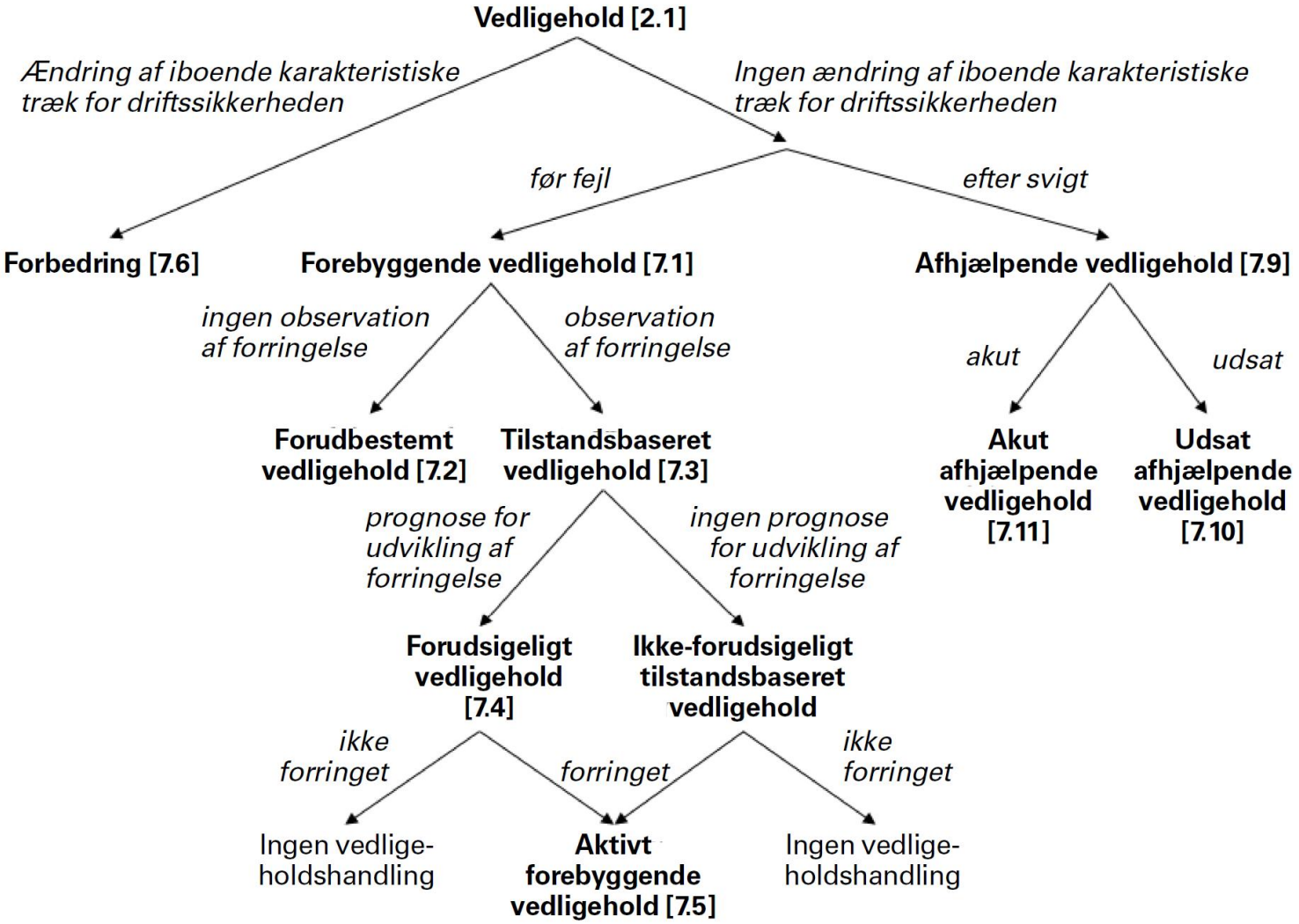
Europæisk Vedligeholdsekspert

DDV

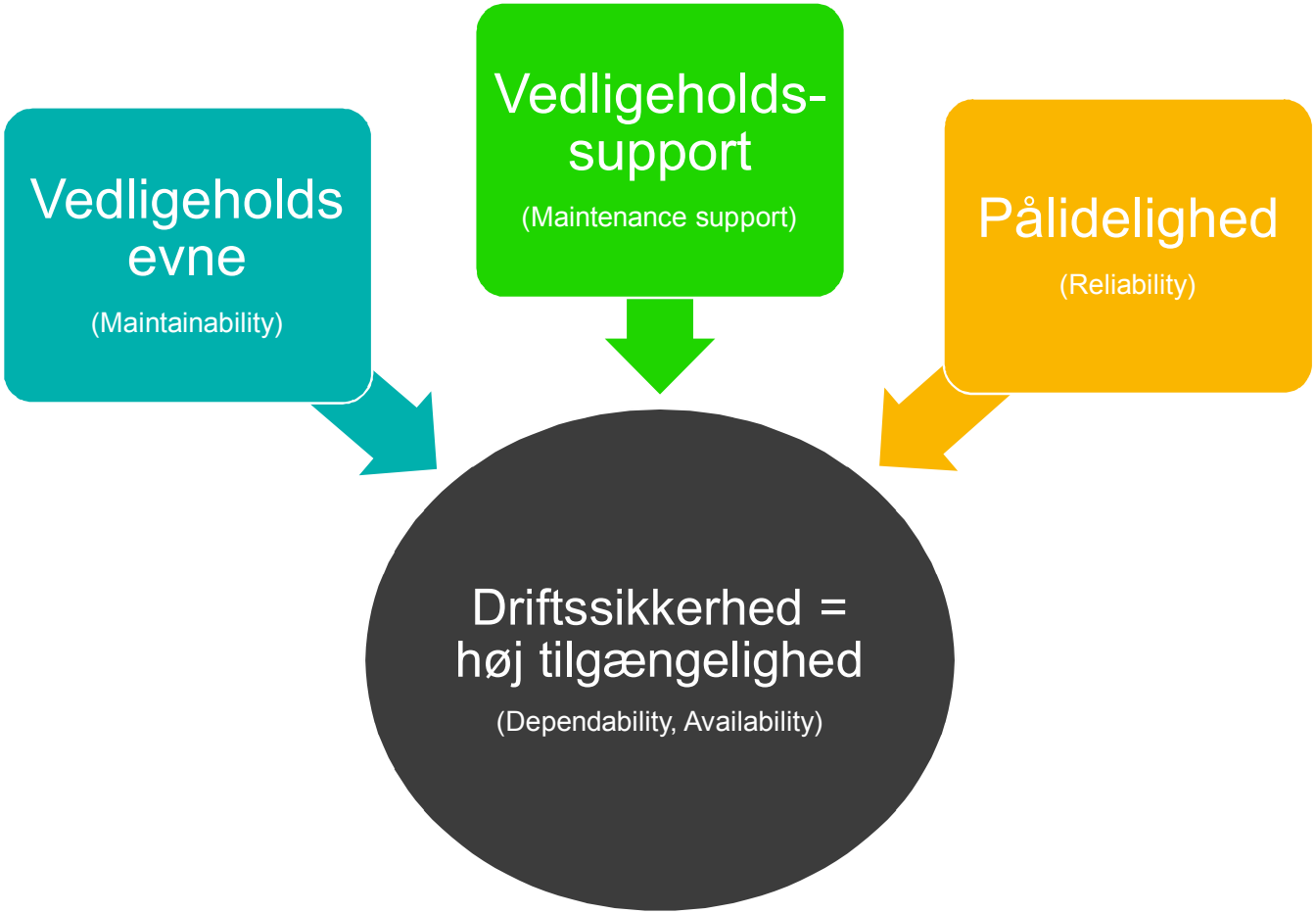
Maintenance Excellence



Vedligeholdstyper
EN13306:2017



Driftssikkerhed

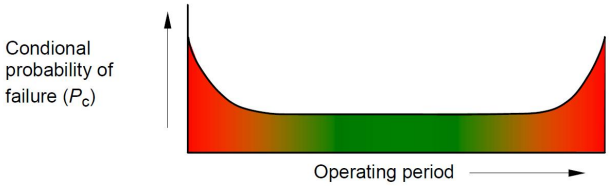


Eksempel på driftsikkerhed

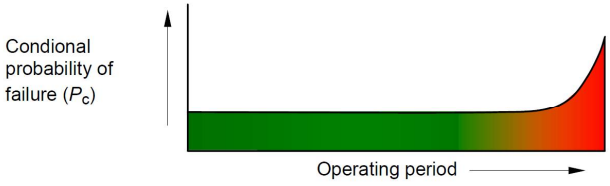
Udskiftning af generator på havvindmølle

- Pålidelighed: MTBF xxx driftstimer
- Vedligeholdssupport: MWT 120 timer
- Vedligeholdsevne: MTTR: 72 timer

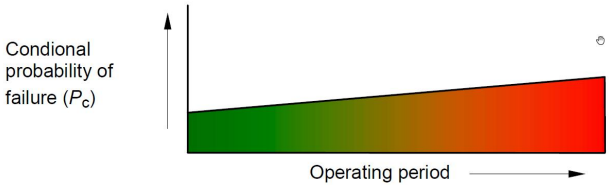
Hvad bør vedligeholdes?
- fejlmønstre



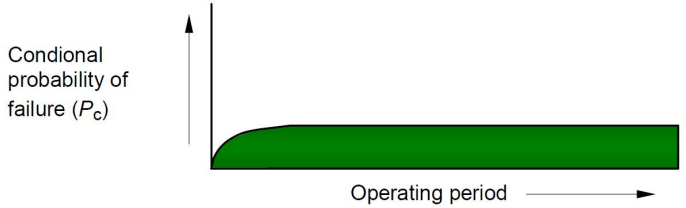
Pattern A – BATHTUB
Infant mortality, then a constant or slowly increasing failure rate followed by a distinct wear out zone



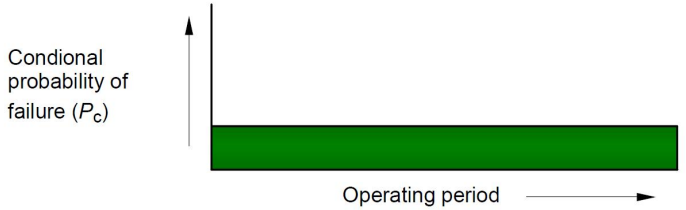
Pattern B – TRADITIONAL
Constant or slowly increasing failure rate followed by a distinct wear out zone



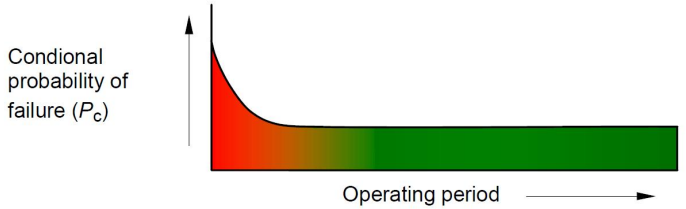
Pattern C
Gradually increasing probability of failure, but no distinct wear out zone



Pattern D
Low failure probability initially, then a rapid increase to a constant failure probability

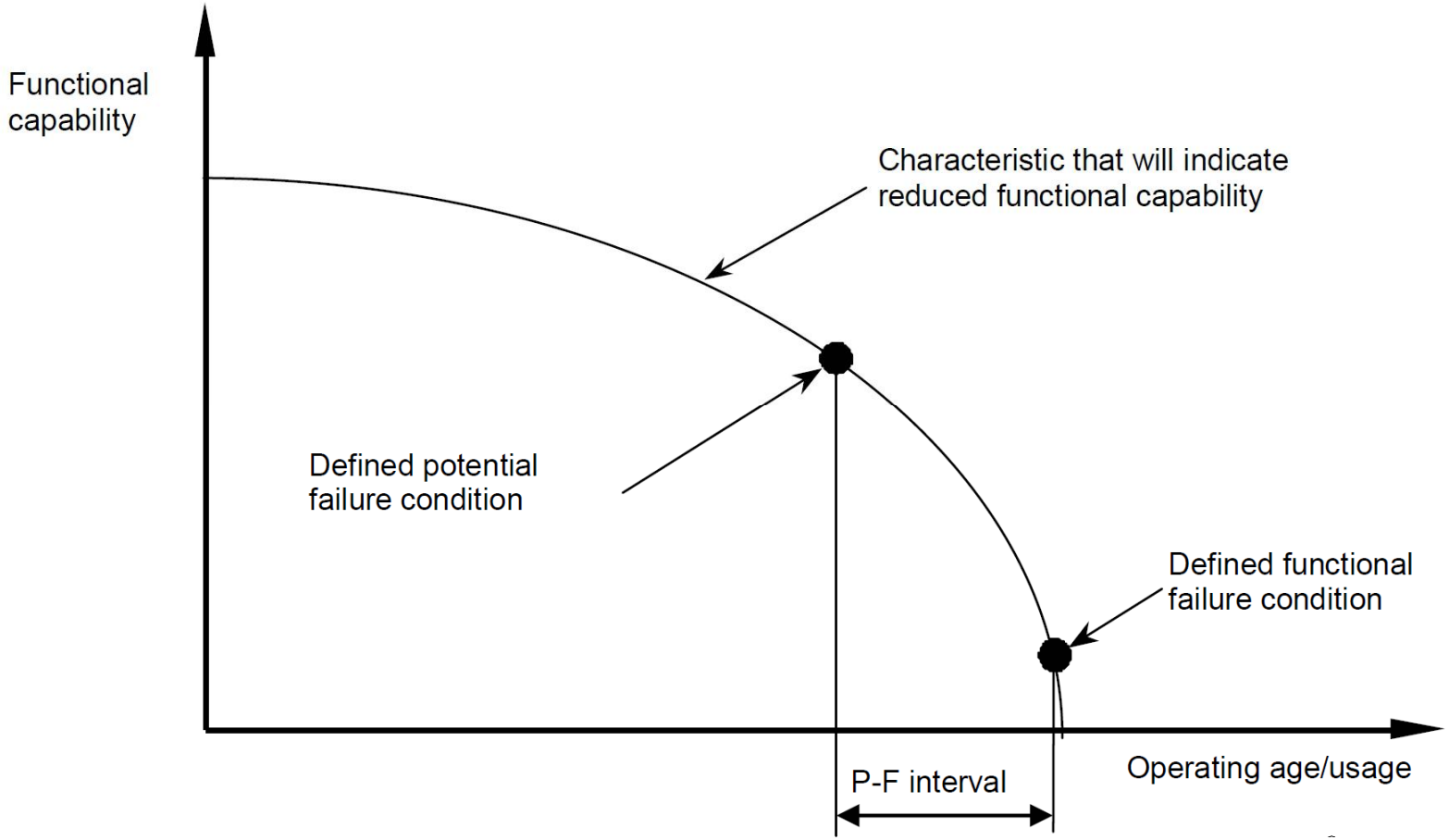


Pattern E – RANDOM FAILURE
Constant probability of failure in all operating periods

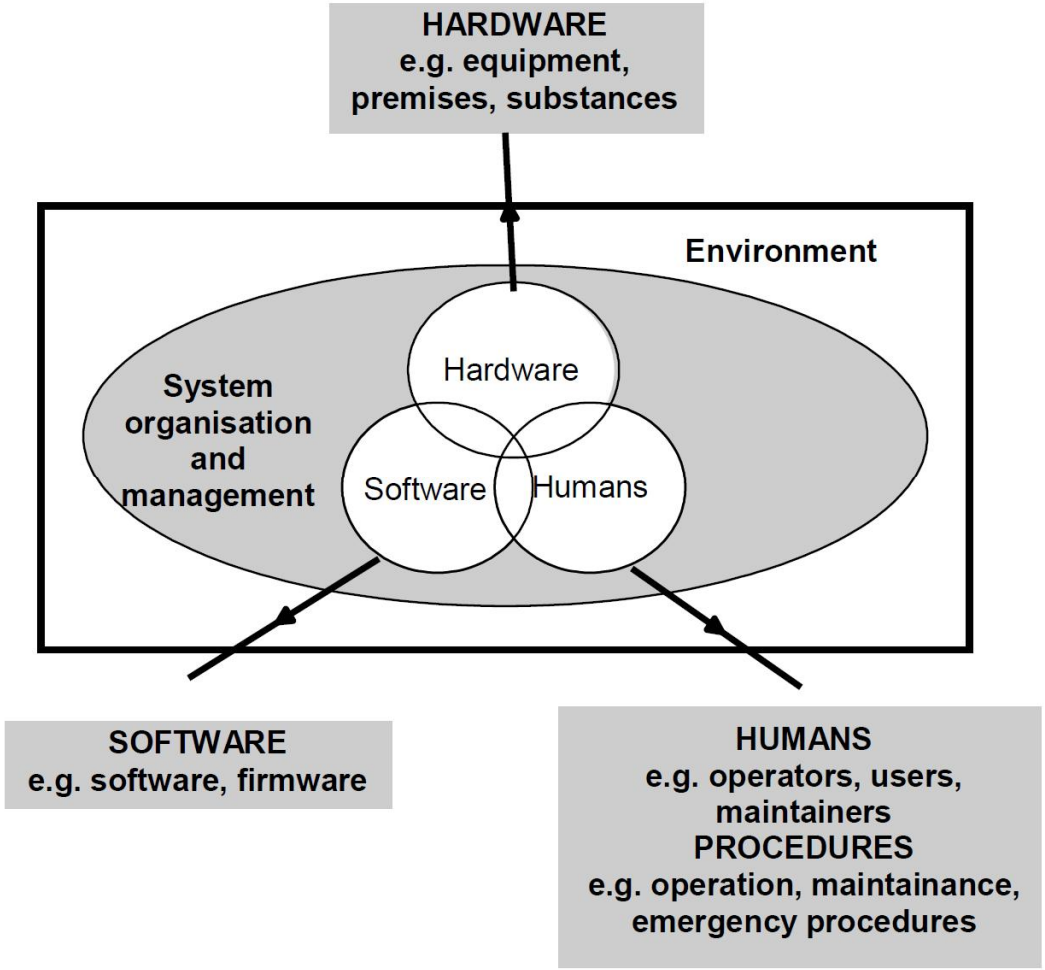


Pattern F – REVERSED J CURVE
High infant mortality followed by a constant or slowly rising failure probability

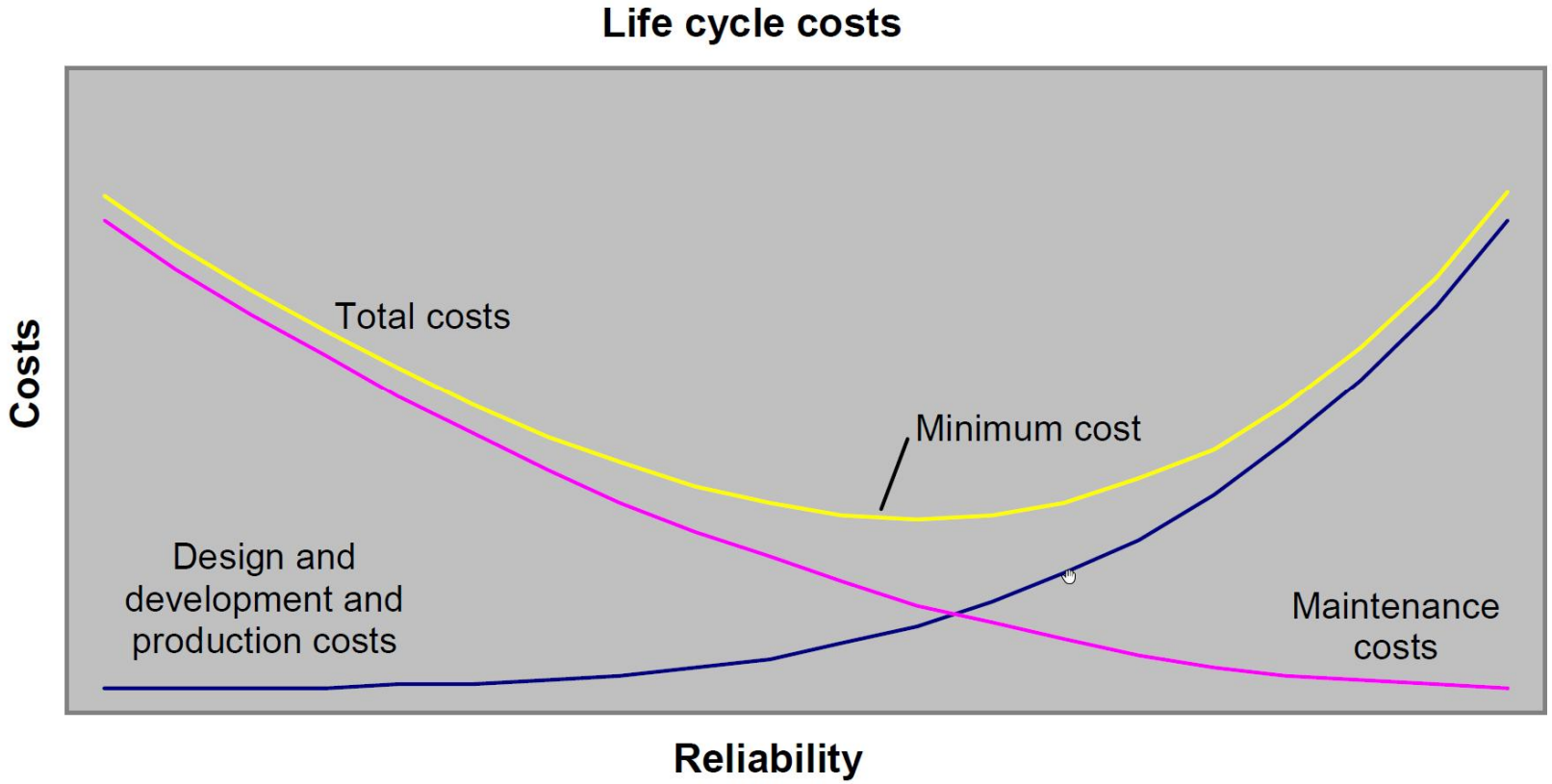
Udviklingen af fejl – tilstandsbaseret vedligehold



Krav til pålidelighed



Omkostninger vs pålidelighed



Kritikalitet og FMECA

Criticality Risk Matrix								
Severity ranking	Severity				MTTF (years)			
	Operations (OC)	Safety (SC)	Environment (EC)	Cost to restore (CC)	> 10 (1)	5 < x < 10 (2)	1< x < 5 (3)	< 1 (4)
3	Turbine shutdown	Potential for serious injury or fatality. High effect on safety systems.	Impairment of ecosystems function. Requires response from trained team. Event needs to be reported to local environmental agencies.	Requires external crane	M	H	H	H
2	Reduced rate of operation or intermittent shutdowns	Potential for injury requiring medical attention. Limited effect on safety systems	No impact to ecosystems function. Requires response from trained team. No need for reporting to local environmental agencies	Does not require external crane Maintenance action cannot be deferred to next planned visit	L	M	M	H
1	No immediate effect on operation	Potential for injury is low. No effect on safety systems.	No impact to ecosystems function. Requires only simple cleaning. No need for reporting to local environmental agencies.	Does not require external crane Maintenance action can be deferred to next planned visit	L	L	M	M

Function (RDS-PP T32)		Component (RDS-PP T32)		Criticality					
RDS-PP code	Basic Function Description	RDS-PP code	Product Function Description	OC - Operations (1-3)	SC - Safety (1-3)	EC - Environment (1-3)	CC - Cost (1-3)	MTTF (1-4)	Criticality
BL001	Level Gauge, Hydraulic Oil Tank			1	1	1	1	1	L
BP001	Pressure, Hydraulic Oil			1	1	2	1	1	L
BP005	Pressure, Hydraulic Oil Filter Return			1	1	2	1	1	L
BU001	Multi-variable Level/Temp, Hyd Oil Tank			1	1	2	1	1	L
CM001	Hydraulic Oil Tank			1	1	2	1	1	L
CM001	Hydraulic Oil Tank	-MM001	Hydraulic Oil, Central Hydraulic WTG	1	1	1	2	1	L
CM001	Hydraulic Oil Tank	-QM002	Oil Drain, Hydraulic Oil Tank	1	1	1	1	1	L
CM001	Hydraulic Oil Tank	-WP001	Sump, Hydraulic Oil Tank	1	1	1	1	1	L
CM002	Accumulator 1, 12l, Central Hyd System			1	1	1	1	1	L
EQ001	Hydraulic Oil Cooler, Air Cooled			2	1	1	2	2	M
FL001	Pressure Relief Valves, Central Hyd Sys			1	3	1	1	1	M
FL001	Pressure Relief Valves, Central Hyd Sys	-FL010	Pressure Relief Valve, Hyd Oil Pump	1	3	1	1	1	M
FL001	Pressure Relief Valves, Central Hyd Sys	-FL013	Pressure Relief Valve, Accumulator	1	3	1	1	1	M
FL001	Pressure Relief Valves, Central Hyd Sys	-FL034	Pressure Relief Valve, Hatches	1	3	1	1	1	M
GP001	Hydraulic Oil Pump 1, Central Hyd Sys			1	1	1	1	2	L
GP001	Hydraulic Oil Pump 1, Central Hyd Sys	-FC001	Circuit Breaker, Hydraulic System	1	1	1	1	2	L
GP001	Hydraulic Oil Pump 1, Central Hyd Sys	-GP001	Pump, Hydraulic Oil Pump 1	1	1	1	1	2	L
GP001	Hydraulic Oil Pump 1, Central Hyd Sys	-MA001	Motor, Hydraulic Oil Pump 1	1	1	1	1	2	L
GP001	Hydraulic Oil Pump 1, Central Hyd Sys	-RM001	Check Valve, Hydraulic Oil Pump 1	1	1	1	1	1	L

Tak!

Jesper Pedersen
Advisory Key Expert, O&M
Mobil +45 3037 6710
jesper.pedersen.jp@siemensgamesa.com

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