



Maintenance Repair Overhaul (MRO) Solutions to Deliver Performance Assurances

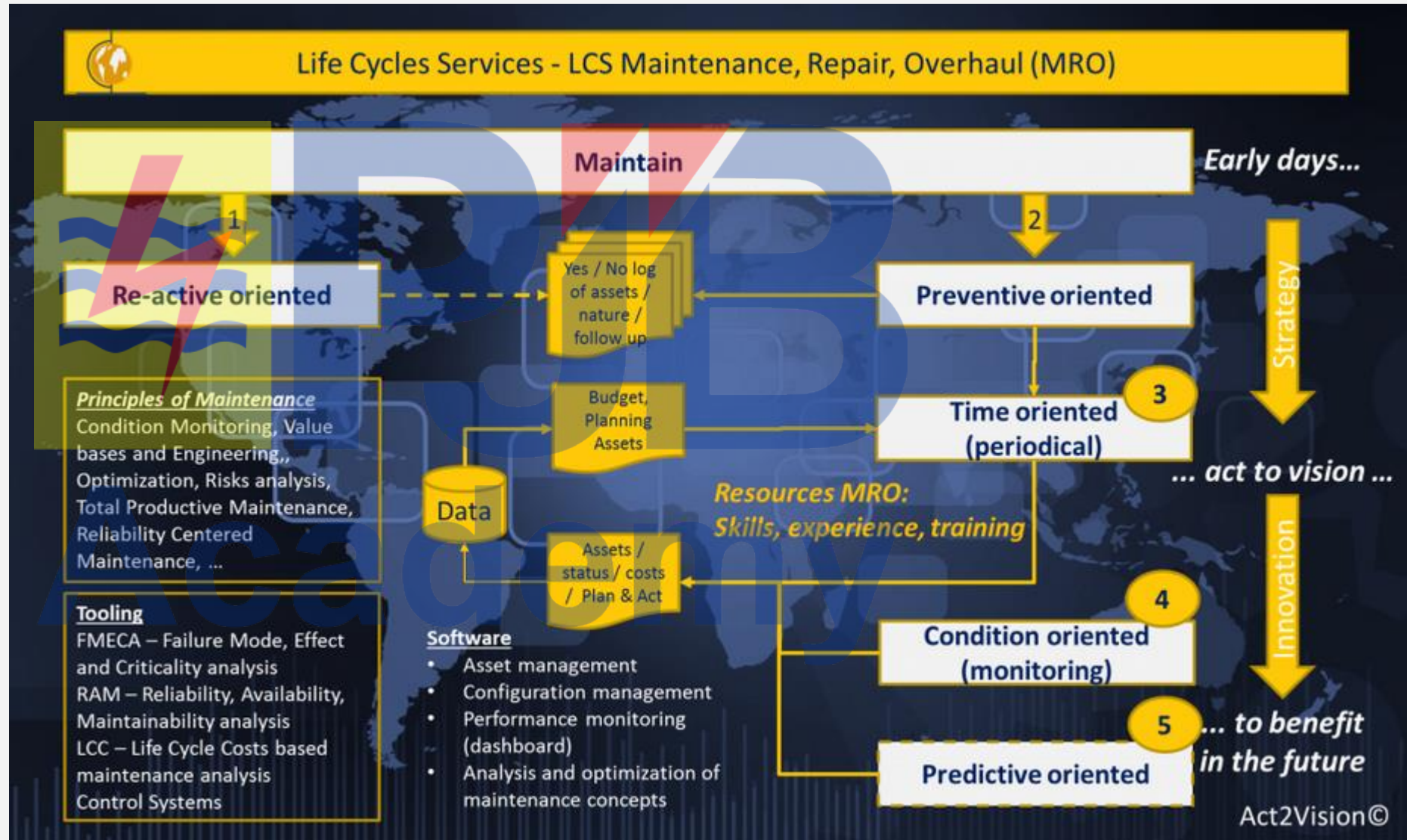


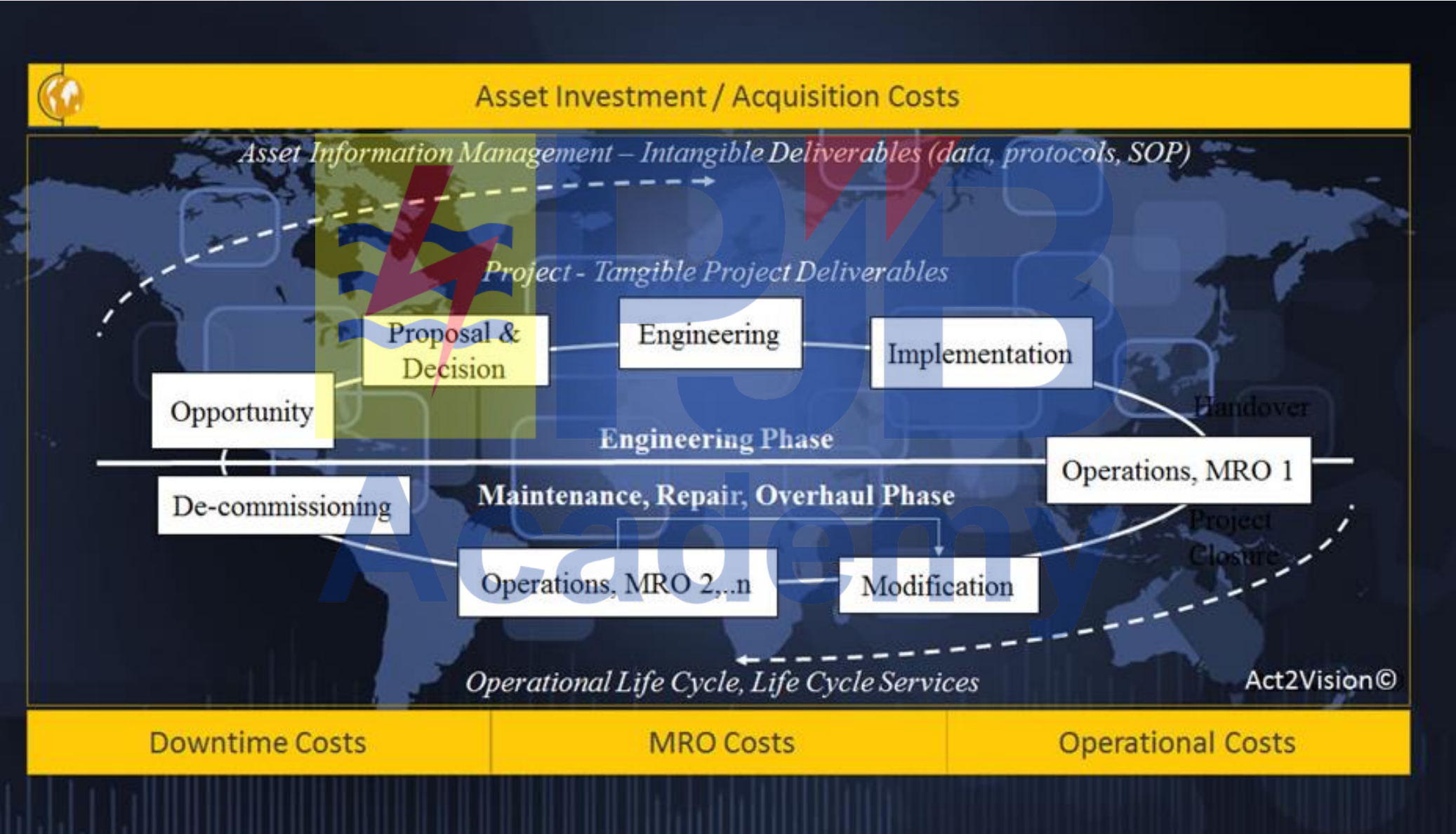
Academy

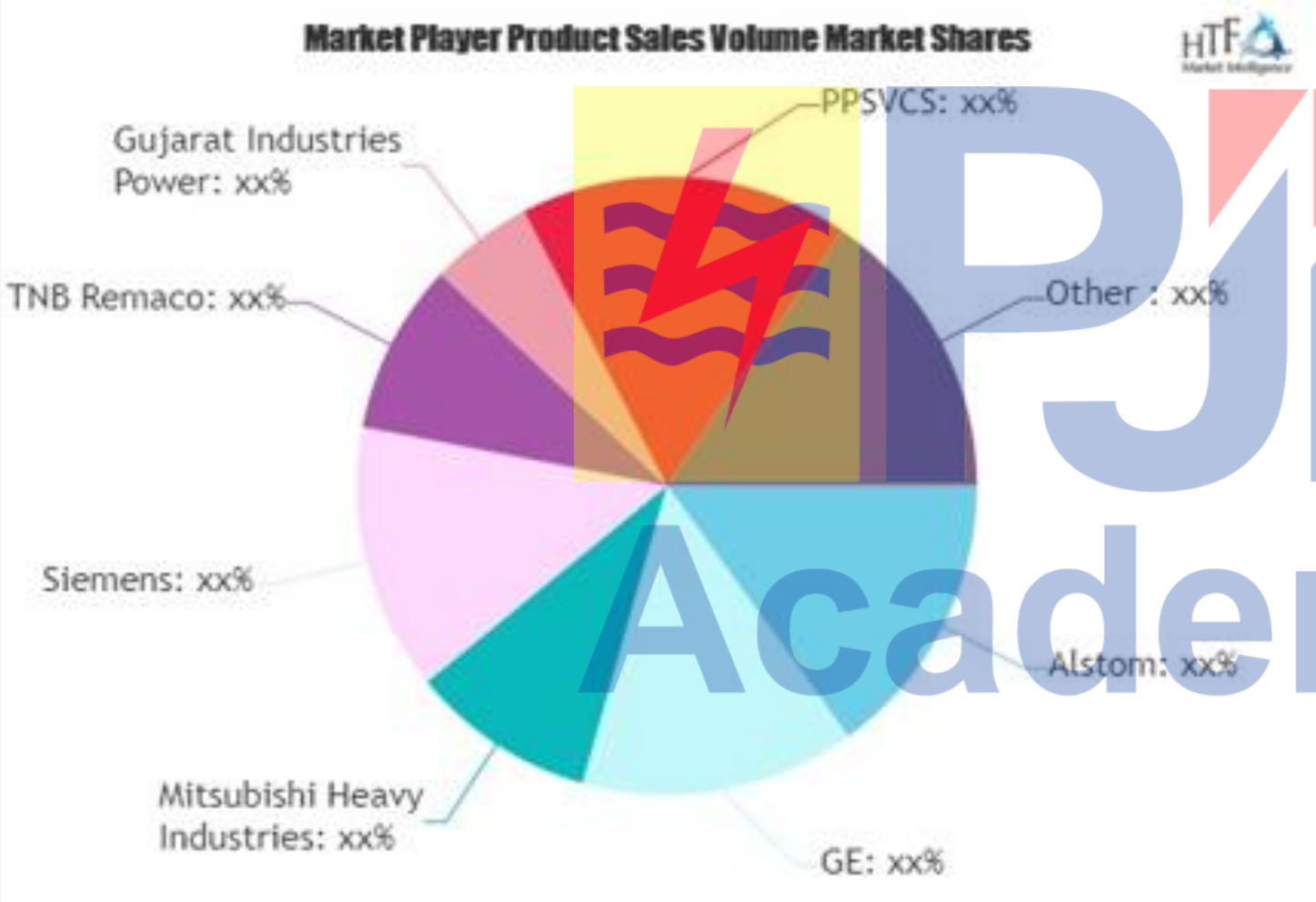


Site Plan PLTS Apung Cirata

“ Without MRO of your people, your assets life cycle will be shorter than planned, whatever principle, tool or software you use “





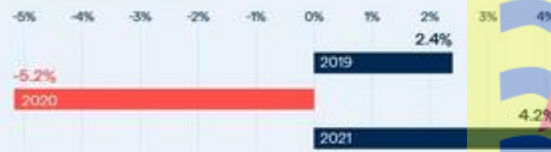


Global Power Plant Services
Market Forecast Study till 2026

The economic impact of coronavirus

Global GDP forecasts

Global GDP is forecast to fall by 5.2% in 2020 as a result of the coronavirus pandemic.¹



Global GDP in US dollars



How do these numbers compare to pre-crisis estimates?

Before the crisis, GDP was forecast to grow by 2.5% in 2020 to reach \$89.94 trillion.³



* The difference amounts to a drop of \$4.56 trillion³

How do the forecasts vary around the world?

The average fall is expected to vary according to countries' economic status.

Growth in advanced economies¹ (eg the US, eurozone and Japan)

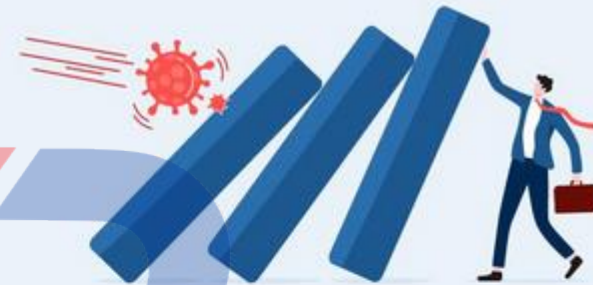
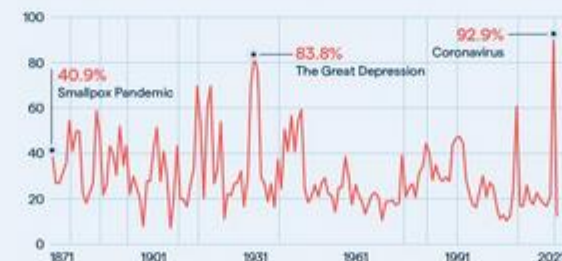


Growth in emerging markets and developing economies¹ (eg China, Nigeria, Bangladesh)



Share of economies in recession 1871-2020¹

A higher percentage of countries are forecast to go into recession in 2020 than at any other time since 1871 – the last time a global recession was triggered purely by a pandemic.



What shape will the recovery take?

Economic recovery will vary by region, and could take several different forms.

V-shape: The economy recovers but only to pre-crisis levels



Tick-shape: The economy recovers to pre-crisis levels faster than it would in a U but more slowly than it would in a V



W-shape: The economy begins to recover but dips because of a second wave of infections



U-shape: The economy recovers to pre-crisis levels but more slowly than it would in a V



Z-shape: The economy is driven above pre-crisis forecasts due a surge of economic activity as lockdowns ease



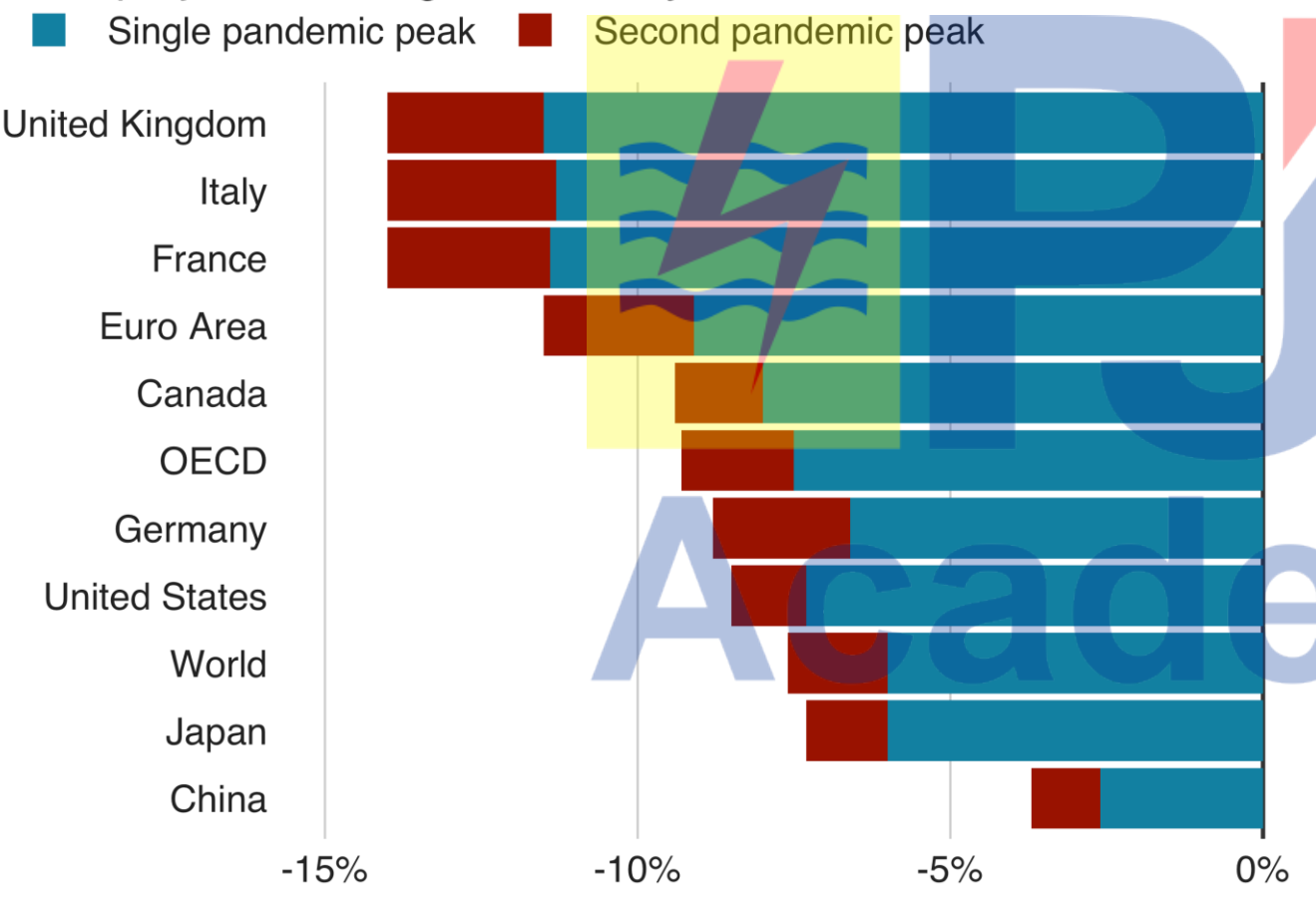
L-shape: The economy recovers too slowly to catch up pre-crisis GDP forecasts



¹ World Bank, 2020. Global Economic Prospects, June 2020. Washington, DC: World Bank. DOI: 10.1596/978-1-4648-1553-9. License: Creative Commons Attribution CC BY 3.0 IGO. ² World Bank, 2020. License: Creative Commons Attribution CC BY 4.0. ³ Estimated GDP figures for 2020 and 2021 were calculated using the global percentage growth forecasts from source 1 and the 2019 GDP estimate from source 2.

Pandemic hits UK economy the hardest

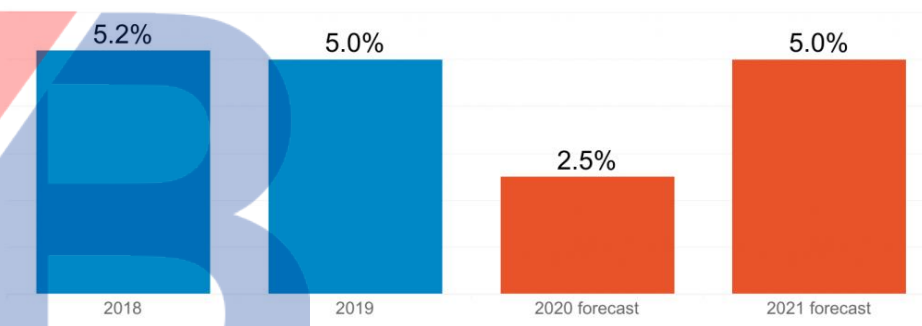
2020 projected change in GDP by scenario



Source: OECD

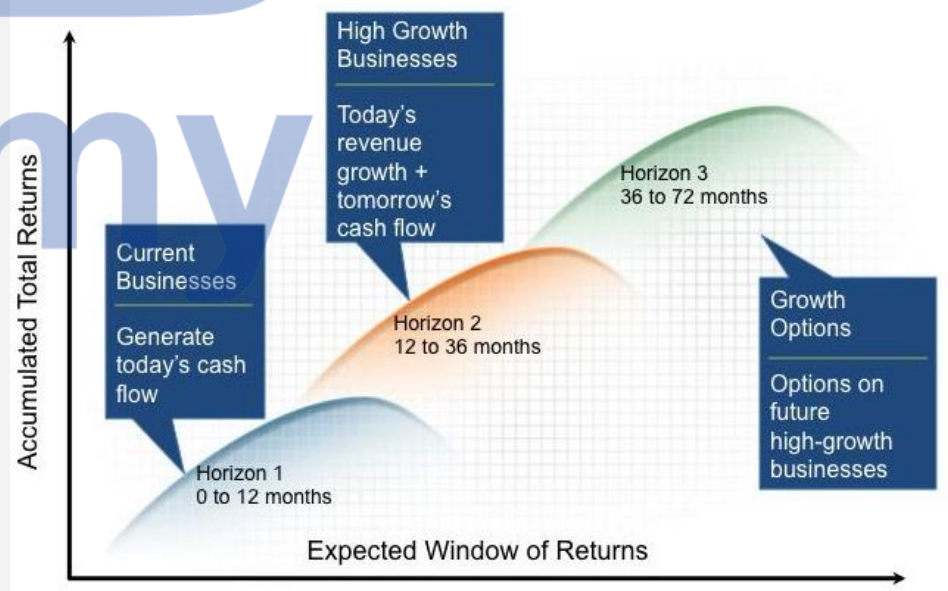


Indonesia GDP growth forecasts



Source: Asian Development Bank, Asian Development Outlook 2020 (April 2020)

#ADO2020 ADB





1. Improving Tactical Maintenance (PM, PdM)

2. Advance planned shutdowns (RBI, Repairs on-site & Extended Intervals)

3. Maximizing Resources Utilization (MRO Tools & Skills)

4. Specify Budget Cuttings (Wild Importance Goals)

5. Advance SCM (Right Spare - Just in Time)

IoT, CMIMS, cloud base

DIROP1



COST OPTIMIZATION
SUPPORT GO TO MARKET

DIROP 2



PLANT PERFORMANCE IMPROVEMENT

Strengthen the Core → Go to Market



1. i-Predict & Lvl 1 Assessment Pembangkit

Mengimplementasikan Program Digitalisasi PdM & Assessment level 1 pembangkit untuk mengurangi EFOR



2. Optimasi Asset

1. Mengoptimalkan biaya pemeliharaan dengan melakukan repair di workshop MRO sebagai maintenance supporting.
2. Mendukung unit untuk mengoptimasi scope work overhaul dengan metode Risk Based Inspection (RBI)
3. Meng-utilize idle asset tools, workshop dan sumber daya manusia (SDM) untuk meningkatkan produktifitas



3. Pengembangan Bisnis

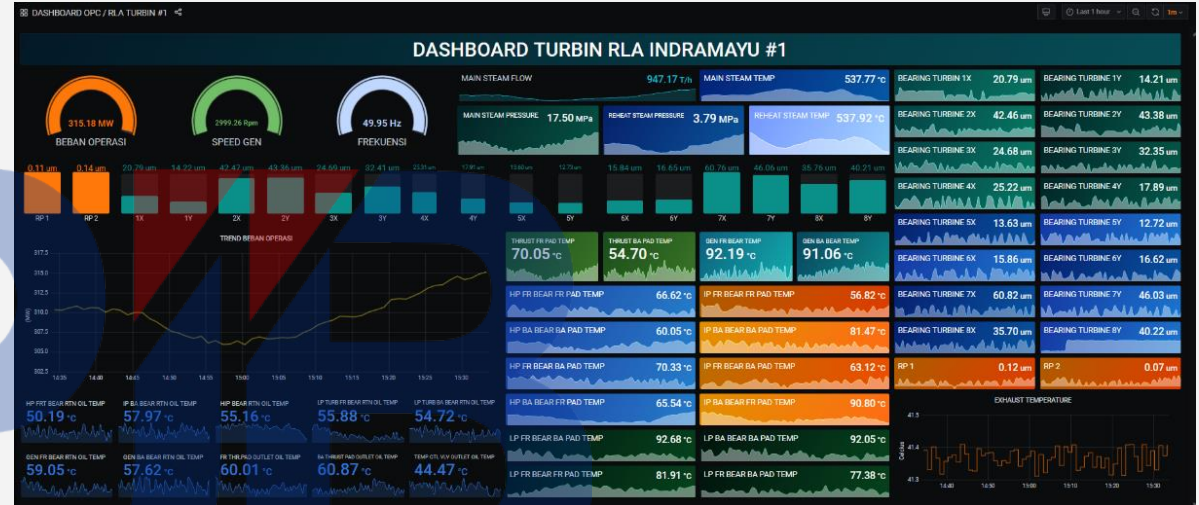
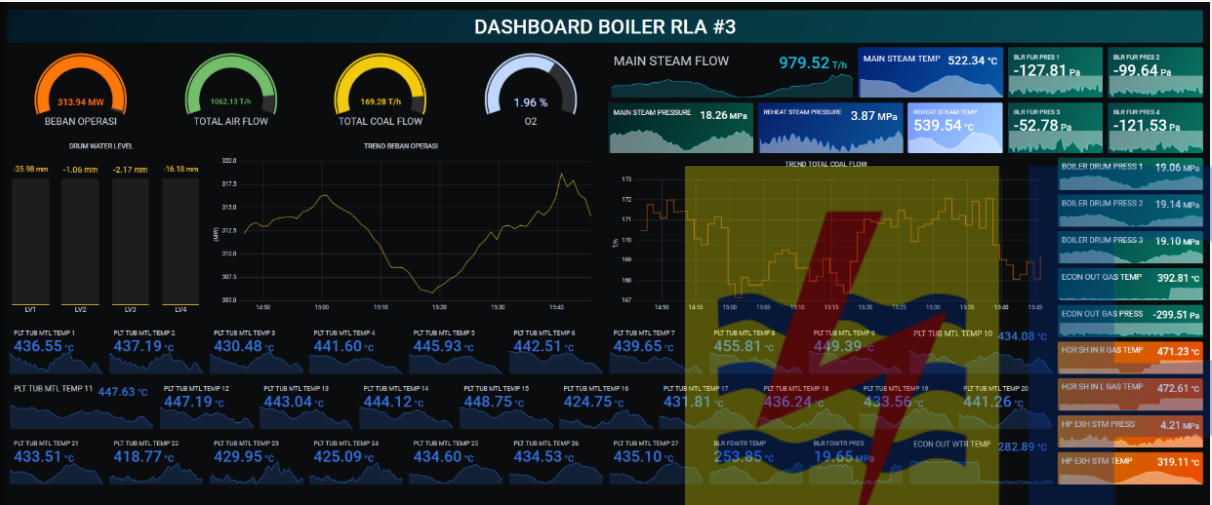
1. Menyiapkan workshop MRO dengan memperkaya portofolio repair untuk mendukung pengembangan bisnis MRO
2. Menyiapkan produk bisnis assessment pembangkit:
 1. Total plant assessment
 2. Partial plant Assessment
 - Online Assessment
 - Offline assessment



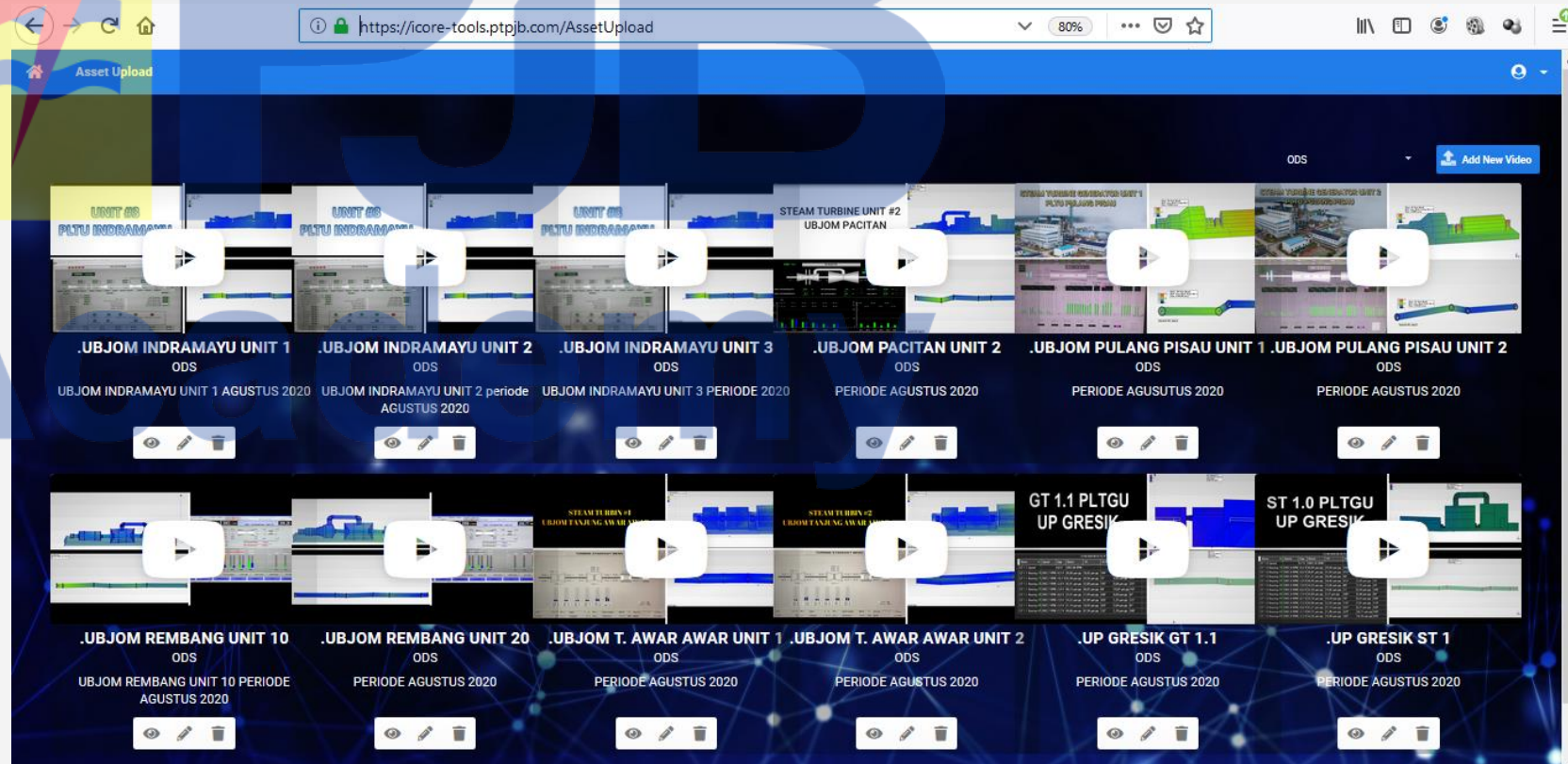
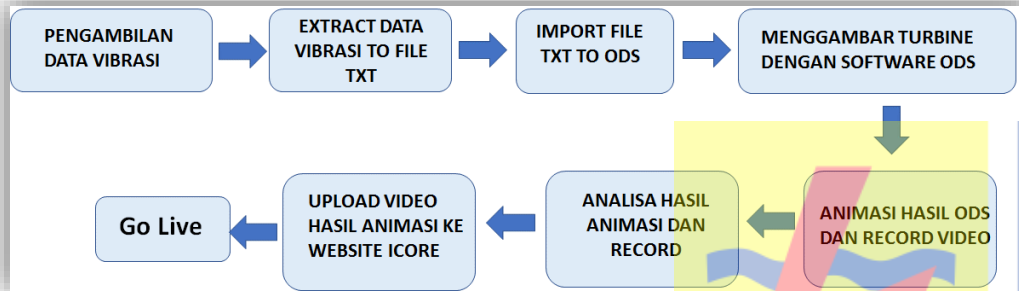
4. Recovery Supporting & Creating Expert

1. Memverifikasi RCFA Top 20 Pareto Loss Output – Workshop RCFA
2. Memberikan support recovery pembangkit dengan menurunkan expert (create expert unit) untuk percepatan down time

RLA Level 1



PdM : ODS on i-Core



PJB Total Services Solution provides integrated solutions such as Maintenance, Repair and Overhaul for **power generation and other industrial utility**. Supported by experienced competency resources with certification of expertise and tools for assembly / disassembly, measurement, calibration, online maintenance, assessment and repair. We are ready to provide services of the highest quality according to needs and cost-effective.

Products and its derivative:

Maintenance & Assessment



1. Predictive maintenance (PdM)
PdM Setup, Training & Analysis.
Field Balancing
2. On/off-line maintenance
online oil purifying, online HRSG/Boiler Cleaning
3. Plant / Equipment Assessment
Complete Plant Assessment or Equipment Assessment:
Boiler, Turbine, Transformer, Generator, Civil
Equipment, Coal Handling Facility, Fire Protection
4. Technical Advisor

Repair & Calibrations



1. In-situ Repair
Rotor turbine/ generator welding,
straightening, polishing & Balancing.
Motor Rewinding, resetting valve & repair,
2. Workshop Repair
Support with lathe manual/CNC, Welding,
Cutting, Drilling, rolling plate , bend
plate/tube on workshop

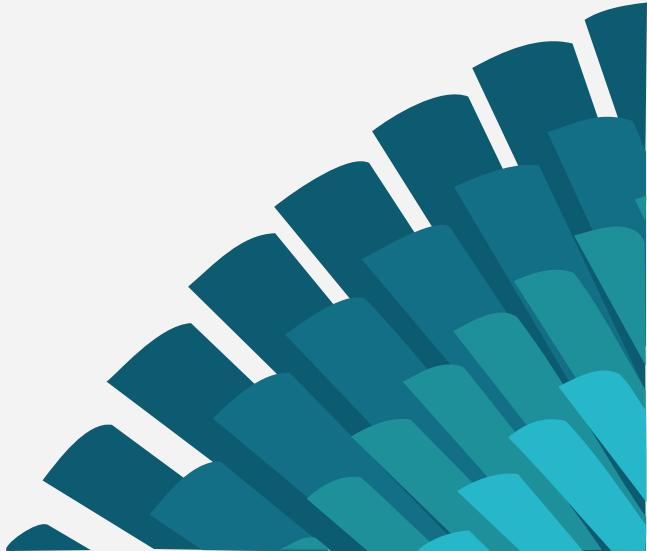
Overhaul & Technical Supporting Services



Experienced Overhaul / Inspection for
wide range Steam, Combine Cycle, Hydro,
Coal, Solar Power Plant Turbine from < 50
MW , 50 – 300 MW & > 300 MW.



WORKSHOP REPAIR





IDEATION PROCESS

ASSETS

Expert (Field Services / Engineering)
Subject Matter Expert
Experiences over 25 yrs.



Resources

> 100 jenis tools assy / disassy, machining, welding, repair valve, dan rewinding motor, serta 1 unit lab



Tools

34 workshop diseluruh unit yg dikelola tersebar di seluruh Indonesia



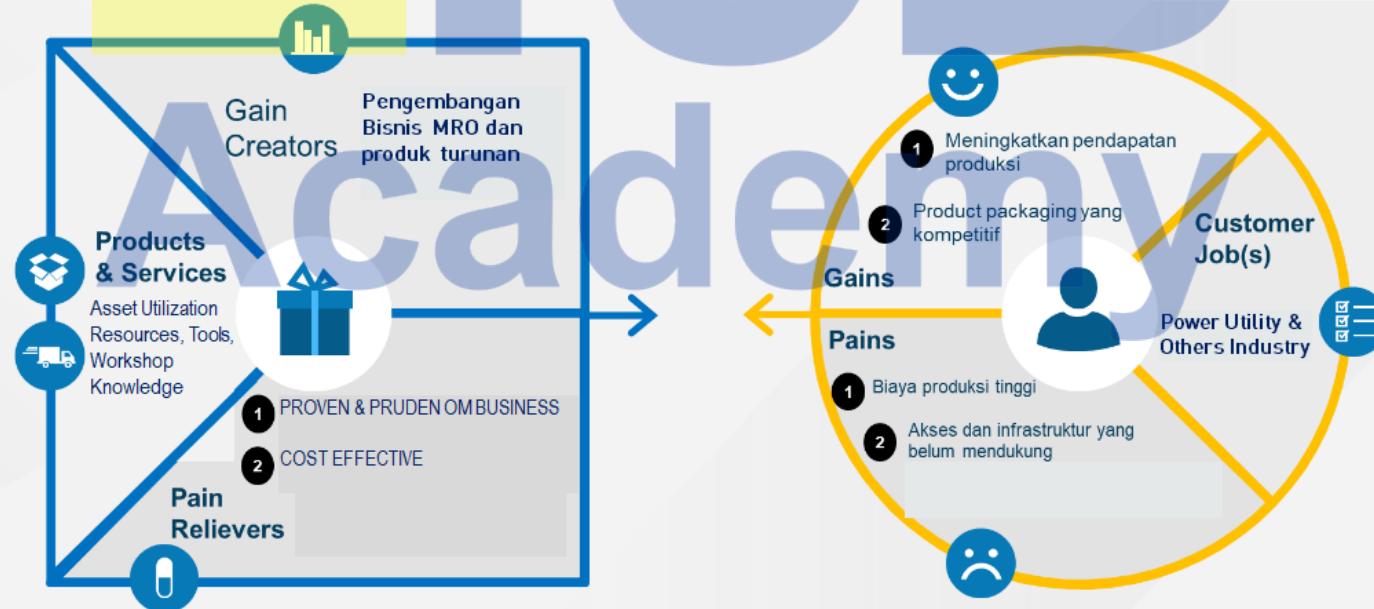
Workshop

Know-how Overhaul, Inspection, Assessment, Repair, Fire Protection, etc



Knowledge

PETA EMPATI BERBASIS VALUE PROPORTIONAL CANVAS



WORKSHOP REPAIR MUARA KARANG



- Precision
- Calibration
- Reverse engineering

WORKSHOP REPAIR GRESIK



- Contruction
- Balancing
- Electrical

WORKSHOP REPAIR PAITON



- Pressure part
- Tube & Pipe

KEMUDAHAN AKSES

WORKSHOP REPAIR GRESIK

JETTY



Jarak : 1 - 1.9 KM

TOL : Romokalisari



WORKSHOP REPAIR MUARA KARANG

JETTY



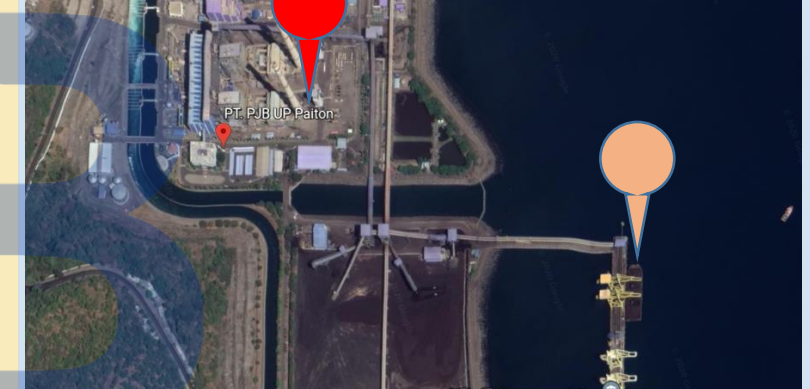
Jarak : ~ 500 M

TOL : Pluit



WORKSHOP REPAIR PAITON

JETTY



Jarak : ~ 850 M

TOL : Probolinggo Timur



Lokasi Workshop



Lokasi Jetty



ISO 9000



ISO 14001



OHSAS

SERTIFICAT TACHNICAL ADVISOR STEAM TURBINE_MHPS



GT MAINTENANCE INFORMATION		Doc. No.	WGFE16-0047	Rev.	2
		Date : 2017 - feb 23			
Customer		Department/Section			
P.T. PEMBANGKITAN JAWA BALI		Power Systems Service Headquarters Takasago Power Systems Service Department Field Service Planning Group			
Project		Prepared		MHPS	
Indonesia O&M Collaboration		S.Teruya		S. Higuchi	
		Checked			
		N.Morinaga		S. Higuchi	
Subject		Approved		MHPS	
Capability Evaluation of Mr.Yulianto Kartono		K.Nitta		F. Kobayashi	



M. NASRUDDIN



WAHYUNIANTO S.



ROHMAD ISKANDAR




ANWAR HAMIDI




RIO PUDJIDARMA
SANTOSO



HASRINUKSMO
NUKIANDI




American Petroleum Institute
Individual Certification Programs: ICP™




API 936

Certification Number: 87224



AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™




API 936

Certification Number: 87225
Original Certification Date: January 31, 2019
Expiration Date: January 31, 2022

This is to verify that **Guntur Budi Santoso**

has successfully met the requirements to be certified under the **API 936 Refractory Personnel Certification Program**.

Signature of Inspector _____

Authorized Signature 



AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™



API 936

Refractory Personnel Certification

This program identifies individuals who have satisfied the minimum qualifications for the API 936 Refractory Personnel Certification. API does not warrant or guarantee the competency of any individual certified under this program.

This is a copy. To verify authenticity please go to <http://myicp.apl.org/inspectorsearch/> and follow instructions to verify the certification status.



API INDIVIDUAL
CERTIFICATION
PROGRAMS



verify that

Andik Santoso

HAS MET THE ESTABLISHED AND PUBLISHED REQUIREMENTS FOR API CERTIFICATION AS AN
API 936 REFRACTORY PERSONNEL.

IN ACCORDANCE WITH THE KNOWLEDGE DEFINED IN THE API Standard 936

CERTIFICATION NUMBER: 87225

ORIGINAL CERTIFICATION DATE: January 31, 2019
CURRENT CERTIFICATION DATE: January 31, 2019
EXPIRATION DATE: January 31, 2022


Manager, Individual Certification Programs





AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™



API Individual Certification Program

verifies that

Guntur Budi Santoso

has met the requirements for API certification


API-936 Refractory Personnel


Certification Number: 87225

Original Certification Date: January 31, 2019

Current Certification Date: January 31, 2019

Expiration Date: January 31, 2022


Manager, Individual Certification Programs



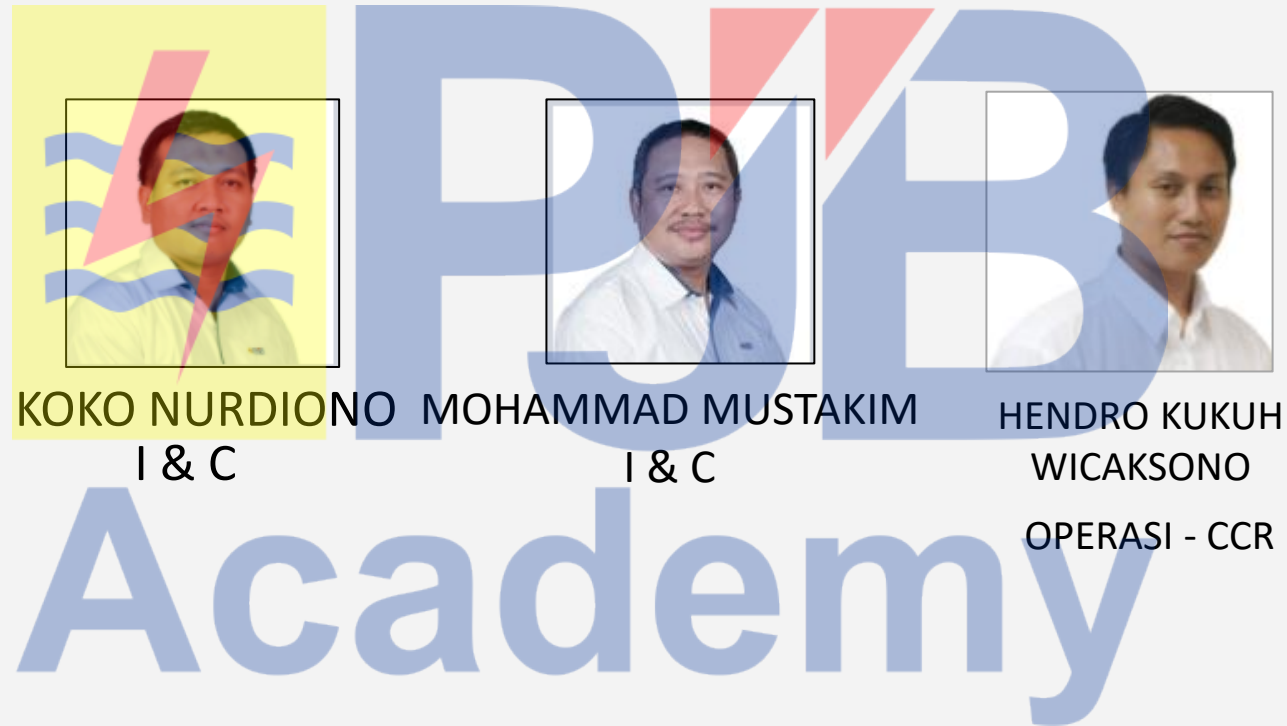


Andik Santoso



Guntur Budi
Santoso

SERTIFICAT INSTRUKTUR O&M-TEPCO



SERTIFICAT MAINTENANCE TRAINING EXPERT (MTE)



**DHIAMA
AKHIRIYANTO**
MAIN GENERATOR



**DEDI
TRICAHYONO**
TRANSFORMATOR

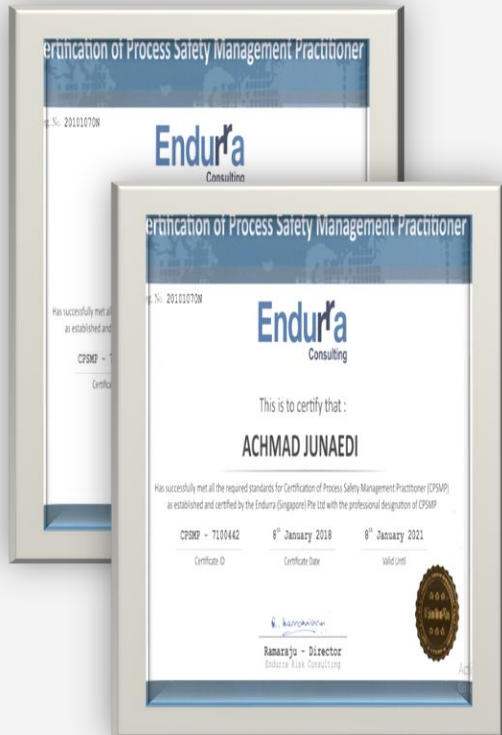


**ROHMAD
ISKANDAR**
BOILER PRESSURE PART
& ACCESSORIES



PRIYO HUTOMO
COAL-ASH HANDLING
SYSTEM

SERTIFICAT PROCESS SAFETY MANAGEMENT (PSM)



**DIMAS HADIANSYAH
HAMKA**



EKO YUNI NUGROHO



**DADANG SELELEPHANT
SUTARTO**



**NURI SETYO
TAUFIQURRAHMAN**



WAHYU ISA ARIFIN



**MUHAMMAD MAHALI
ASNA**



DRAJAT ARIBOWO



DIDIK SUMARSONO

BALANCING



Tranporsible Balance Machine



Low Speed Balancing Machine (LSBM)



Indu



Induction



Dry Ice Blasting
Cap : 30 kg

MACHINING TOOLS



Mesin Bubut dia 200
x 1500 mm



Lathe Machining
Cap : 600 x 5000 mm



Bend Plate Machine
Cap : 25 x 1220 mm



Cutting Plate
Cap : 1 - 10 mm



Scrap Machine
Cap : 500 - 500 mm



PWHT



Test Bench - Pressure Capacity : max. 250 bar



Tube Expander
Ukuran Nozzle: 25.4 mm



Hydraulic Torque Wrench



Drilling Machine
Cap : 600 x 5000 mm



Hydraulic Press Machine
Cap : 50 T



Drilling Machine
Cap : 1 - 50 mm



Hydraulic Press Machine (Banzai)



Mesin Gergaji Potong (Tsune)



Frais Machine Standard Type : SB-4)



Frais Machine Standard Type : SB-4)



Hydraulic Torque Wrench



Grinding Lapping Valve

MACHINING TOOLS

MESIN BUBUT



PINDAD PL 1000



CNC - PINDAD PL 2000



HONOR SEIKI/VL-46G



Horizontal Lathe Pinacho
SP/165



Horizontal Lathe S90E
260

FRAIS (MILLING)



KNUT
H



MILKO 35 R



Bridgesopt,
Type TVY

DRILLING,BORING & CUTTING



Vertical drilling
machine TNW
13R



Boring
Power Matic



Boring
Ikeda Type Rms
9



Cutting
Power
Matic/143



Cutting
Gergaji Besi Tnw
Waalwijk
Holland



CUTTING
HTC

LIPAT,SENAI



Lipat: Dake



Lipat: Chicago



Lipat: Dake/66-50



Senai : Asada



Scrap: Jochnick &
Normans



Grinding : Okamoto



GRINDING : Surface Grinding PSG-
618

MACHINING TOOLS

MESIN BUBUT



MESIN BUBUT KEMAMPUAN BESAR
(Ø1000MM x L3000MM)



MESIN BUBUT
KEMAMPUAN MENEGAH
(Ø600MM x L1500MM)



MESIN BUBUT PRESISI
(Ø100 MM x L500MM)

MILLING, CUTTING & BORING



MESIN MILLING UNIVERSAL
(L1000 X W300 X H450 MM)



MESIN GERGAJI HORIZONTAL
(W500MM X H500 MM)



MESIN BOR TIANG
(Ø32 MM)



BOR LINGAN RADIAL
(Ø300MM x L475MM)



VERTIKAL
(W300MM W500MM X
H250MM M X
H300MM)



BOR LISTRIK VERTICAL
(Ø5/8")



MESIN GERINDA (BESAR,
MENEGAH)
(3KW, 0.75KW))



MESIN GERGAJI GOROK
(W300MM X H300MM)



MESAIN GERINDA POTONG DAN PERKAKAS UMUM
(Ø300MM x L475MM)



MESIN PEMBUAT ULIR
(Ø100 MM)



MESIN SKRAP
(STROKE 600 MM)



MESIN HIDROLIS KOMBINASI
(THK19MM X L150MM)



MESIN HIDROLIS POWER TEAM
(100 TON)



MESIN ROLL PLAT
(MINIMUM DIAMETER 40 CM)



MESIN PEMANAS TEMPA
(L950 X W950 X H800 (MM)



MESIN POTONGa HIDROLIS GUILLOTINE
(Ø30MM x L2900MM)



MESIN TEKAN HIDROLIS
(15 T)



OVEN
(VOL IM3 1000)



Diverter Gate



Hammer Ring Coal
Crusher



Grab Bucket



Valve



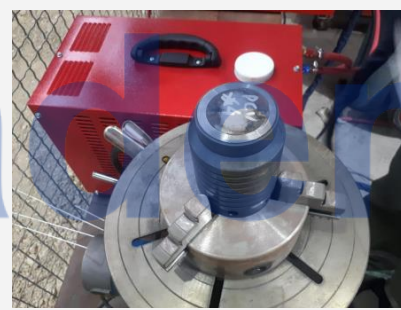
Tooth Plate Coal
Crusher



Impeller



Seal Plate Gas
Turbine PLTGU

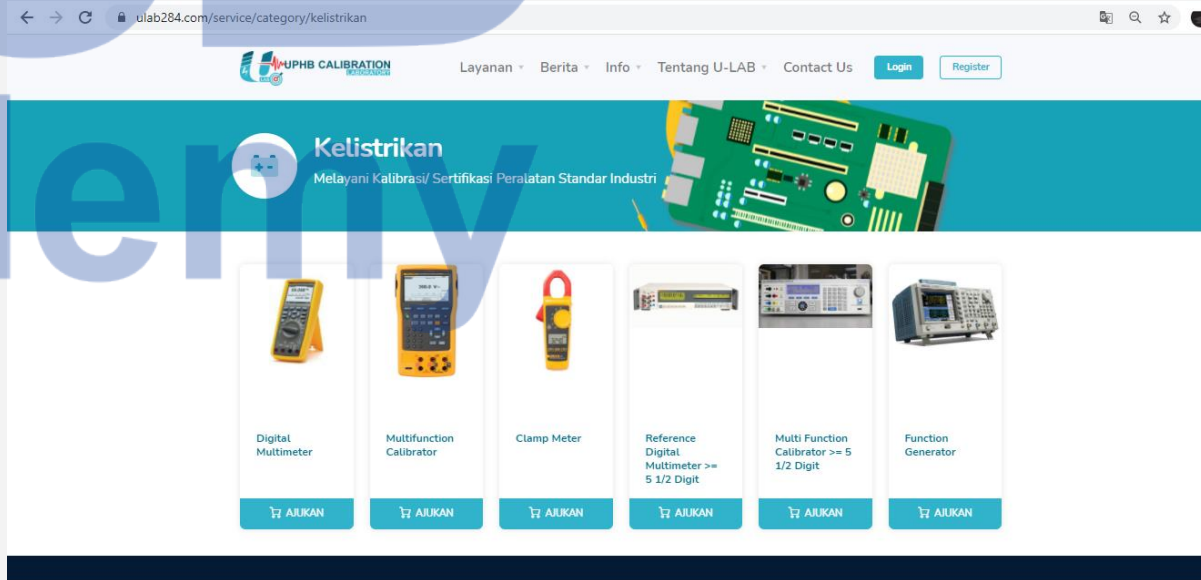
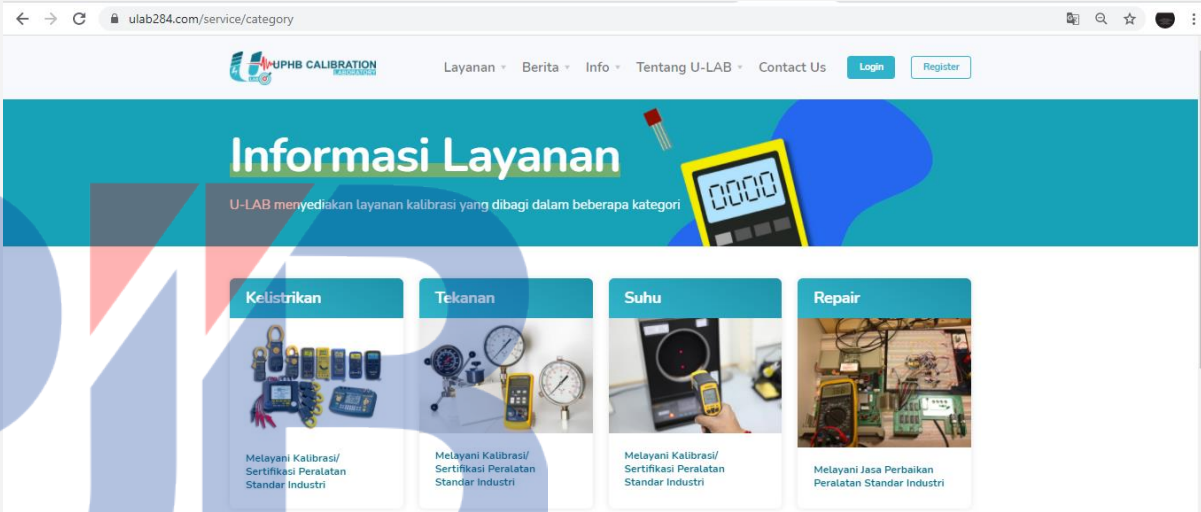
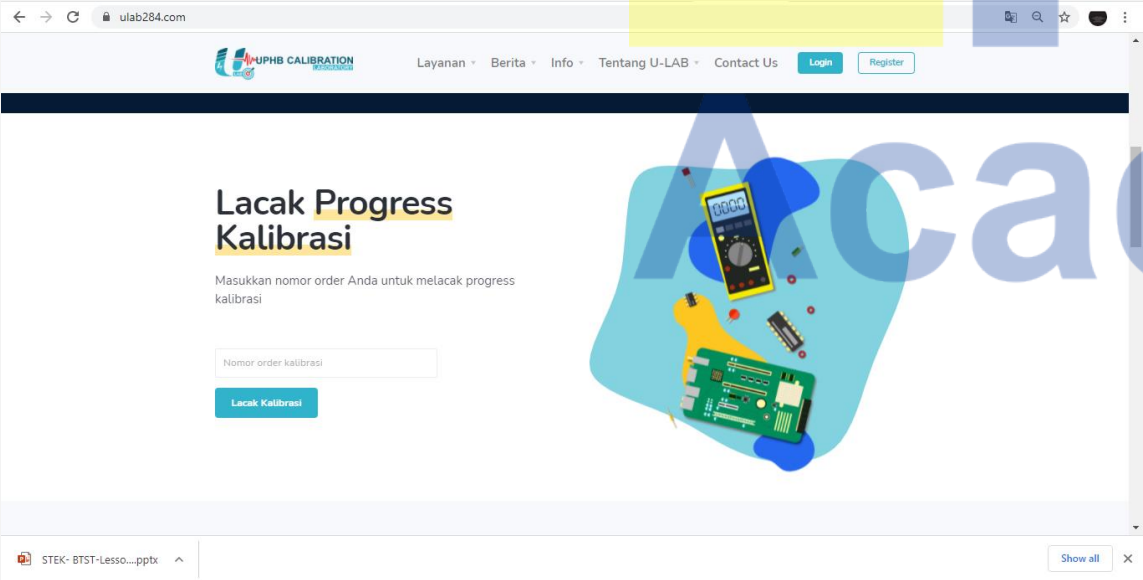


PCV Boiler



Scapper





SPECIAL CASE 1 : ROTOR TURBIN STRAIGHTENING PLTU PACITAN #1 (315 MW)

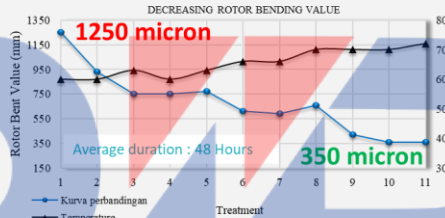


PERMASALAHAN
STANDARD & Code

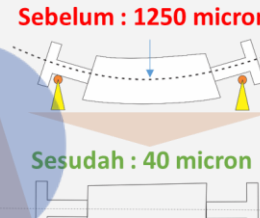
: ROTOR BENDING
: API 687

HASIL IMPLEMENTASI DAN EVALUASI ROBOD 600

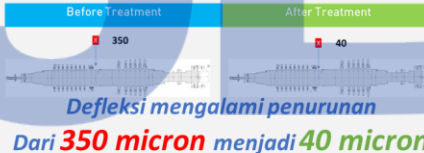
THERMO-MECHANICAL : STEP BY STEP



PENURUNAN BENDING



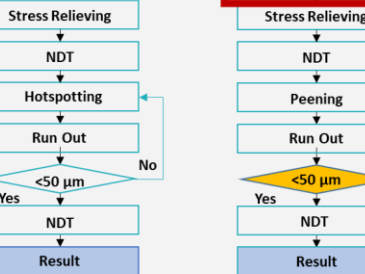
STRESS RELIEVING & PEENING



PENURUNAN GETARAN

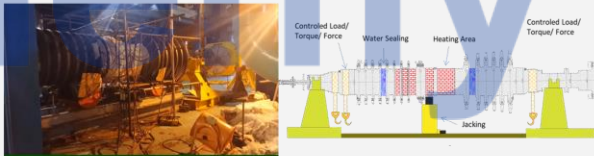


PENCIPTAAN METODOLOGI BARU



IMPLEMENTASI ROBOD 600

THERMO-MECHANICAL STRAIGHTENING



Heating dan jacking sesuai formulasi

PEENING STRAIGHTENING



Peening / hammering sesuai formulasi

STRESS RELIEVING



Stress relieving untuk mengurangi risiko kavitasi akibat shock

MATERIAL INSPECTION



Metallography

Magnetic Particle Test



- Dari hasil pengujian yang sudah dilaksanakan dapat disimpulkan proses pengelasan dengan metode manual GTAW aman untuk dilakukan dari sisi ketahanan isolasi listrik maupun seal lead bus dengan interpass temperature maximal 80°C

- Waktu yang dibutuhkan untuk repair shaft rotor generator adalah 4 hari

- Pengujian MT hasil pengelasan mock up akan

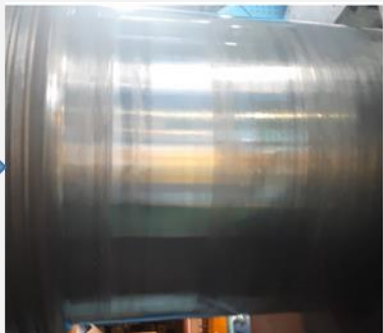
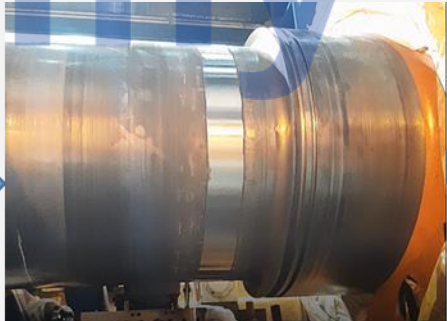
3. Simulasi waktu pengelasan

1. Diameter rotor 450mm, keliling 1415 mm. Masing-masing welder melakukan pengelasan sepanjang 708 mm
2. waktu tiap pengelasan sepanjang 50 mm 2 menit
3. jeda interval tiap pengelasan 10 menit
4. waktu yang dibutuhkan tiap welder untuk melakukan pengelasan per 1 layer adalah 169 menit
5. Lebar pengelasan 60 mm = 8 layer
6. total waktu tiap welder = 23 jam
7. Jam kerja efektif per hari adalah 6 jam
8. Total waktu repair 2 sisi pengelasan (turbine dan exitasi) dengan 4 welder adalah 4 hari

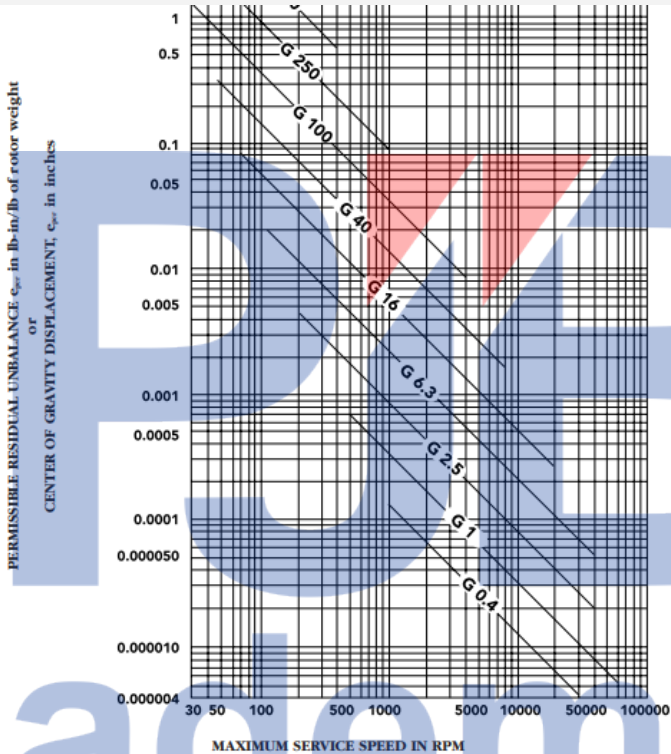
HASIL PENGUJIAN ROUGHNESS

Bagian	Titik ambil	Ra (µm)	Rz (µm)	Rz max (µm)
Turbin	Diluar machining	1.1	7.2	8.2
	Air Side	0.5	3.3	4.4
	Middle Side	0.3	2.9	5.4
	H2 Side	0.3	2.3	-
Exiter	Diluar machining	1.2	8.2	13.8
	Air Side	0.5	4.3	6.5
	Middle Side	0.5	3.1	3.7
	H2 Side	0.5	3.7	4.6

HASIL MACHINING



SPECIAL CASE 4 : LOW BALANCING ROTOR LP TURBIN 330 MW



COMPARING API, ISO & MIL-STD-167-1 BALANCE TOLERANCES

U_{per} = Permissible residual unbalance FOR EACH CORRECTION PLANE in ounce inches. (oz-in)
 W = Rotor Weight In Pounds. $W = 1000$ lbs. for all examples shown.
 N = Maximum Continuous Operating RPM.
 G = ISO Balance Quality Grade Number, i.e. 6.3, 2.5, 1.0 etc.

$F_c < 10\%$ Journal Static Load $U_{per} = \frac{56.347 \times (\text{Journal Static Load } W/2)}{N^2}$

ISO $U_{per} = \frac{G \times 6.015 \times W/2}{N}$

MIL-STD-167-1 $U_{per} = 0.177 W$ (0 to 150 RPM)
 $= 4000 W / N^2$ (150 to 1000 RPM)
 $= 4 W / N$ (Above 1000 RPM)

API $U_{per} = 4 W / N$ (W = Journal static Load)

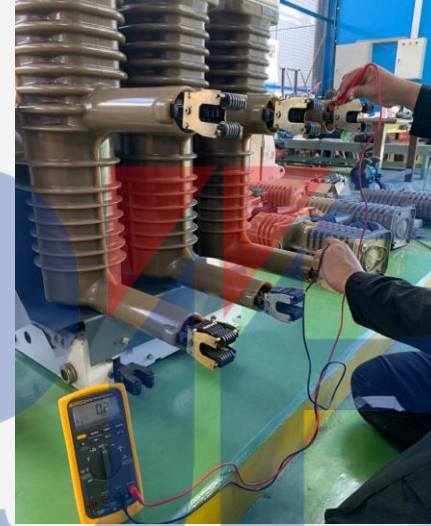
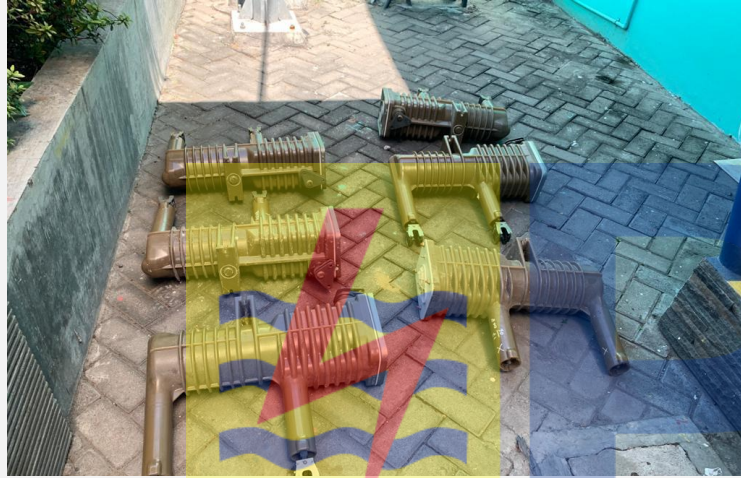
$F_c = 1.77 (\text{RPM}/1000)^2$ (oz-in) [Centrifugal Force]

MIL-STD-167		ISO G 6.3		ISO G 2.5		ISO G 1.0		API		FC = 10%W/2		
N	U_{per} oz-in	Centr. Force	U_{per} oz-in	Centr. Force	U_{per} oz-in	Centr. Force	U_{per} oz-in	Centr. Force	U_{per} oz-in	Centr. Force	U_{per} oz-in	Centr. Force
150	177	7	126.0	5	50.0	2.0	20.0	0.8	13.3	0.5	1252.0	50
500	16	7	38.0	17	15.0	6.6	6.0	2.7	4.0	1.8	113.0	50
1000	4	7	19.0	34	7.5	13.3	3.0	5.3	2.0	3.5	28.0	50
2000	2	14	9.5	67	3.8	26.6	1.5	10.6	1.0	7.1	7.0	50
3000	1.33	21	6.3	100	2.5	39.8	1.0	15.9	0.6	9.6	3.1	50
4000	1.0	28	4.7	133	1.9	53.8	.8	21.2	0.5	14.2	1.8	50
5000	.8	35	3.8	168	1.5	66.4	.6	26.6	0.4	17.7	1.1	50
6000	.7	43	3.2	201	1.3	79.7	.5	31.9	0.3	19.1	0.8	50
7000	.57	49	2.7	234	1.1	92.8	.4	37.3	0.3	26.0	0.6	50

Copyright 1999 IRD Balancing

*PLTU # 2.0 Tj. Awar-Awar LP
Turbine Low-Speed Balancing
Resulting on ISO Standards ISO
1940 Grade 0.4*

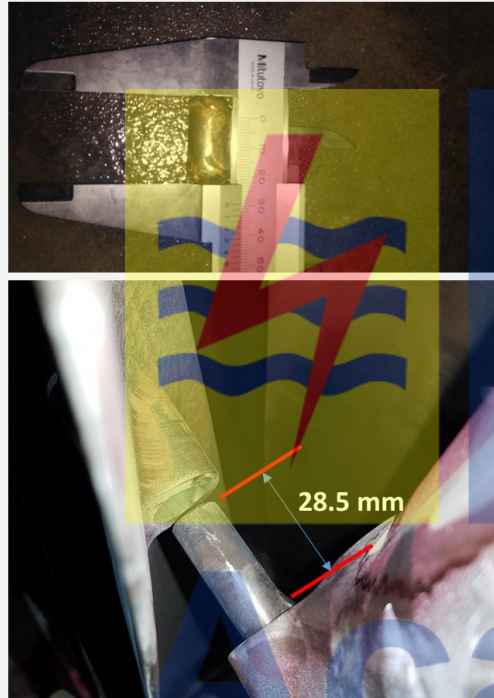
Special case 5 : Repair Electrical 20 Kv



demy

Special case 5: Pengelasan Latching Wire UJTA

Failure komponen last Blade Awar-awar



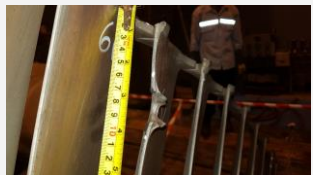
Corrective action Lst Blade Awar-awar



Latching Wire

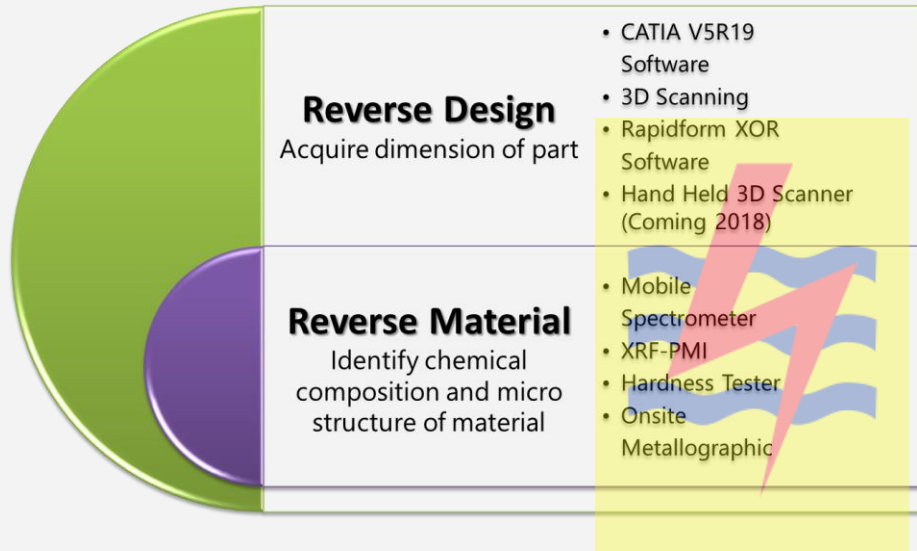


Root dan groove



Special case 6: Reverse Engineering

Overview



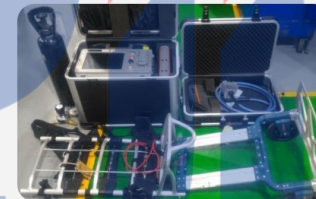
Metode & Teknologi



XRF - Chemical Composition Testing
Specification:
- Brand : HITACHI
- Type : X-MET 8000



3D SCANNER
Specification:
- Brand : CREAFORM
- Type : Handy Scan 3D



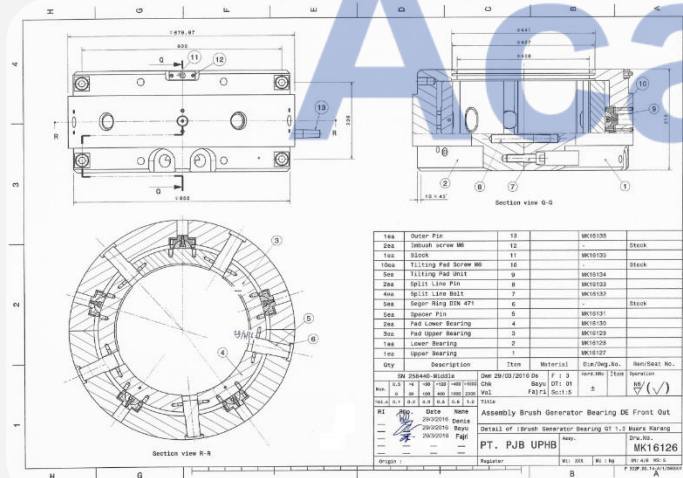
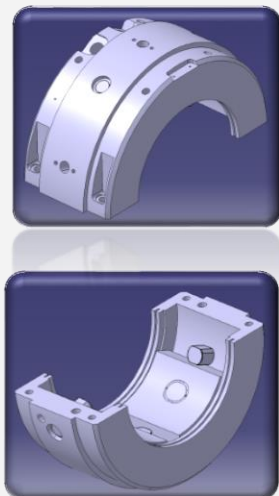
PMI - Chemical Composition Testing
Specification:
- Brand : HITACHI
- Type : PMI-Master SMART



Micro Hardness Testing
Specification:
- Brand : FUTURETECH
- Type : ARV 900

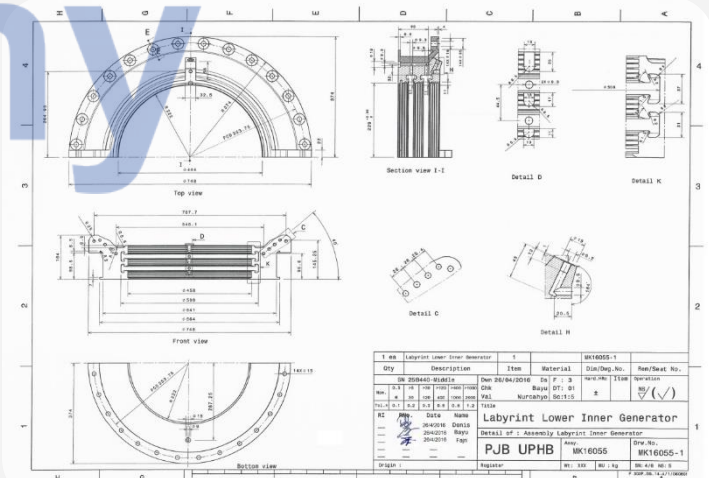
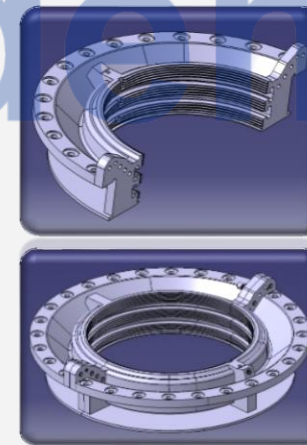
REVERSE ENGINEERING – IMPLEMENTASI

ASSY BRUSH GENERATOR BEARING DE – GT 1.3 MUARA KARANG



REVERSE ENGINEERING – IMPLEMENTASI

LABYRINTH LOWER INNER GENERATOR – GT 1.1 MUARA KARANG







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