2025 CIREBON POWER CONTINUOUS IMPROVEMENT FESTIVAL

Retrofit of Cable Reel Drum (CRD) to IGUS ChainFlex System

Enhanced Reliability in the Coal Handling System

M Taufik J

Innovation and Efficiency to Enhance Company Performance

PROJECT CHARTER SHEET (PCS)

Problem Statement	• Cable reels are subjected to wear over time, especially in harsh environment condition • cable have experience with tension and twisting issues, effecting their lifespan and short circuit during operation • cable experience slack and stuck with support of cable tray, and during travelling make cable damage and short circuit
Project Title	**Retrofit of Cable Reel Drum (CRD) to IGUS ChainFlex System** Enhanced Reliability in the Coal Handling System
Goal Statement	We propose Retrofit of Cable Reel Drum (CRD) to IGUS Chain Flex System. This is a strategic investment to eliminate recurring downtime, reduce maintenance costs, and improve overall equipment effectiveness.
Project Scope	GTSU 1
Breakthrough Ideas	**Cable Reel Drum (CRD) to IGUS ChainFlex System** Most of the Cirebon Power Plant Unit 1 (C1) uses a CRD (Cable Reeling Drum) system for the tripper car gallery at BC08 A and B in GTSU 1-2, as well as in STRE.

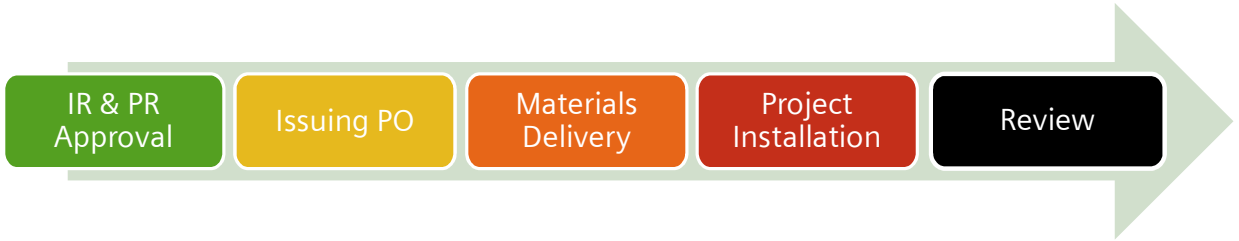
Project Team	**Name**	**Dept.**	**NIK**
Project Leader	M Taufik J	MEL BLR	11158
Project Member	Rudy H Septo C	MEL BLR	

Bottleneck

01

Timeline

Timeline Project



Process	2024					
	January	February	March	April	May	June
IR & PR Approval						
Issuing PO						
Materials Delivery						
Project Installation						

1. **INTERNAL RESOLUTION** Retrofit Cable Reel Drum (CRD) to IGUS Chain flex of CHS CPS-MNT-ELC-SD-IR-I-24-0 issue January 9th 2024
2. **Purchasing Review** Started PR-2024-1248 Retrofit CRD to IGUS Chain Flex at GTSU 1 January 12th 2024
3. **Purchasing Order** sent to vendor PO-2024-1196 Retrofit CRD to IGUS Chain Flex at GTSU 1 January 25th 2024
4. **Material Receiving** on Cirebon power Site June 11th 2024 with GRN :CPS-MNT-WH-FR-SOP-02-08
5. **Installation** schedule June 2024 in GTSU 1

02

PROJECT

1. Problem Identification

Work Order	Problem at GTSU
WK130507.0059	GTSU02: Check and Rectify CRD Fault When Travel to Centre Point
WK140823.0004	Rectify Cable CRD Fault When Pass the Middle Point
WK150818.0005	GTSU02: Rectify CRD Cable Due To Loose And Limit Swtch Not active
WK170408.0018	GTSU 01: Rectify CRD Due Fault Active When Position On Middle
WK190512.0011	GTSU02: Rectify CRD due to can't roll-up
WK190926.0008	Please Check CRD Fault On Middle Position at GTSU02
WK130720.0004	GTSU01: Rectify CRD Over Temperature
WK180514.0315	GTSU 02: Need Rectify CRD Often Fault When Gantry Increasing Speed
WK200415.0013	GTSU 02: Please Install Cover for Power Motor CRD due to loose
WK210419.65992	GTSU 02: CRD Often Slack
WK211221.18351	GTSU 01: CB Motor CRD broken
WK221212.34078	GTSU 02: CRD Often Fault Active

Work Order	Problem at Tripper
WK121218.0004	BC8A : Check and rectify motor tripper 8A due sometimes suddenly off when move backward
WK141010.0042	Tripper B : Please check and cleaning limit switch travelling tripper for silo E due to often can not position
WK150327.0065	Please rectify Tripper car #01A often over travel especially from coal silo E to F till emergency limit swicth active (please adjust the brake gap)
WK150403.0003	BC08A, need cek dan rectify Forward End Stop Limit Switch often active tripper while traveling forward
WK151010.0001	Insertable Dust Collector B (Tripper B), Rectify Motor Turbo fanr overload due to breaker trip out
WK160227.0001	Tripper car -A,Please check and rectify over traveling forward from silo E to silo F limit switc end stop due to not active
WK160505.0003	Tripper A : Please check and rectivy insulator of cable reel drum (CRD) due to torn 25 cm
WK180307.0012	Tripper A : Please rectify due to outer isolator of cable reel drum there is peel off
WK180626.0006	TRIPPER CAR A: NEED TO INSPECTION CABLE POWER (CRD) DU TO SIGNAL RAIL CLAIM OFTEN LOST WHEN REVERSE FROM SILO C T O A
WK180626.0012	TRIPPER CAR A: NEED TO REPAIR RUBBER COVER CABLE POWERE (CRD) DUE TO TORN
WK180817.0016	Tripper A : Please check and rectify due to indication for insertable tripper A always local
WK190421.0010	Tripper B : Please check and rectify roller for cable reel drum (CRD) due to noise
WK200203.0188	Tripper B : Please check and rectify Cable reel drum at position between silo C and Silo Ddue to often slack

1. Problem Identification

Problem : Wear and tear

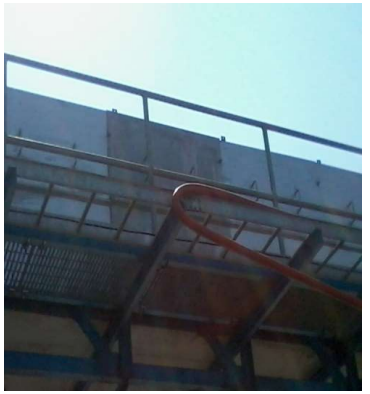
Cause : cable reels are subjected to wear over time, especially in harsh environment condition

Problem : Tension and twisting

Cause : cable have experience with tension and twisting issues, effecting their lifespan and short circuit during operation

Problem : Slack and stuck

Cause : cable experience slack and stuck with support of cable tray, and during travelling make cable damage and short circuit



January 2016 : The cable of GTSU 2 came out of the cable route, causing it to tear and even break. As a result, we had to cut off the damaged section of the cable so it could be reconnected to the CRD system

July 2022: A CRD cable on a Stacker Reclaimer became slack, derailed from the drum, and broke, causing significant damage and downtime

October 2017: A short circuit in the Stacker Reclaimer CRD cable caused 11kV voltage to interfere with control circuits, destroying PLC cards. This resulted in a complete halt of coal delivery and subsequent plant de-rating

2. Defining Baseline &Target

BASELINE:

- From 2013 – 2022 GTSU 1-2 more than 12 major work
- Estimate replacement cable Reel etc. USD 180,000

TARGET:

- After installation IGUS GTSU 1-2 zero major work
- After installation zero/low cost maintenance

CRD of tripper car cable damaged and need the replacement, the price of cable itself is around 100.000 USD, This system still need many spare part such as **electrical motor, gearbox, drum, and contact slip ring.**

Key Performance Indicator installation IGUS
Tripper A **PO-2021-2646 = USD 24,064.54**
Tripper B **PO-2022-2316 = USD 25,495.54.**
Total **USD ~ 50.000**

Since 2022 ***no defect*** *appear again in Tripper Car Gallery*

No	Parameter	IGUS® ECS Estimated Price	CRD (GTSU), Estimated Price	Spare Part Preparation
1	Motor & Drive	0	30,000	Yes
2	Gearbox	0	40,000	Yes
3	Slip Ring Contact	0	25,000	Yes
4	Braking system	0	15,000	Yes
5	Control Switch	0	20,000	Yes
6	Cable (power, control, FO)	29,453	50,000	Yes
7	IGUS e-Chain	35,326	0	No
8	IGUS Stainless steel Guide	30,833	0	No
	Total (USD)	95,612	**180,000**	

Project Budget for GTSU-01 (MOH 2024):

- Materials (IGUS e-Chain, Cable, Guide): $95,612
- Installation Cost: $26,280
- **Total Project Cost: $121,892**
- This is within the allocated CAPEX budget of $150,000.

3. Factor & Cause Analysis

Factor

Longer Corrective Downtime

High Maintenance Cost

Increasing Safety Risks

Analysis

The repetition current cable reels on the STRE,GTSU-01 and GTSU 02 are a frequent and unpredictable point of failure, causing an average of many hours of production downtime.

The downtime of corrective takes too long time while there barge unloading (GTSU 1-2) then we have to pay demurrage, if problem in STRE while Full Load 698 MW feeding the bunker then we are facing to force decrease load.

Cable failures can lead to electrical shock, data errors, process interruptions, and potential safety hazards from damaged cables

4. Improvement Planning

Cavotec cable reel system

1. Motor (with drive) Standard squirrel cage or torque motors, according to IEC Norms.
2. Gearbox or Torque Unit Sever gearboxes and eight torque unites are available with variable output torque
3. Collector Standard sizes of collectors are available for power and signals.
4. The drums are composed of standard elements and can easily be adjusted to required widths. Standard drum diameters range from 300mm to 8700mm.

igus plastics for longer life®

They call it an "**Energy Chain System**" because it creates a protected "chain" or "conduct" for energy, data, and media to flow reliably to moving parts.

5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

1. Actual Condition Survey Plant condition and material preparation on GTSU 1 this also GTSU 1 have been parking in Left Side

5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

2. Dismantling the cable Tray ,Dismantling existing Cable CRD an

5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

3. Installing Guide trough and Assembly E Chain

5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

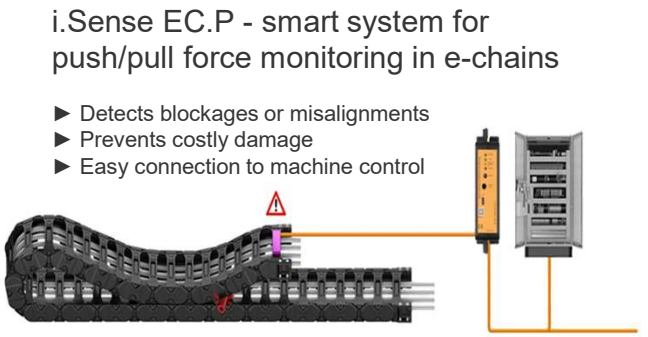
4. Applying cable E Chain and Install other accessories



5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

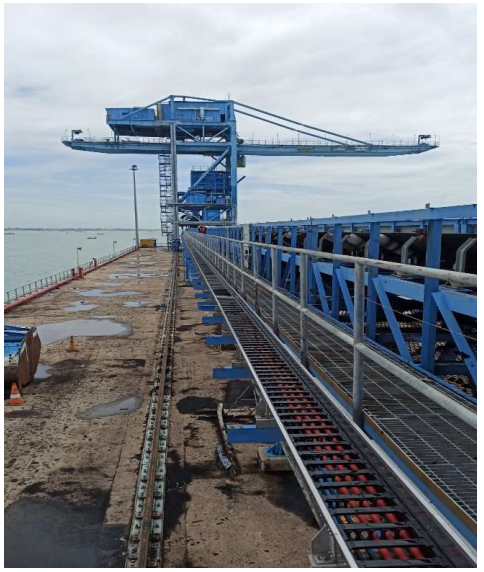
5. 11 KV Cable termination and control cable termination



5. Improvement Execution

MOH 2024 from MEL BLR schedule the IGUS installation on June 8th – July 5th 2024

6. Test and Commissioning on 7th July 2024



6. Improvement Evaluation

Maintenance Record

Maintenance carried out in accordance with Tables 1 and 2

Item	Hours/Weeks	Performed DATE	Operating Hr. /cycles	Free for operation	by: SIGNATURE	Checked by Works Manager: SIGNATURE
1	200h / 2W					
2	600h / 6W					
3	2400h / 24W					
4	4800h / 48W					
5	7200h / 72W					
6	9600h / 96W					
7	12000h / 120W					
8	14400h / 144W					
9	16800h / 168W					
10	19200h / 192W					
11	21600h / 216W					
12	24000h / 240W					
13	26400h / 264W					
14	28800h / 288W					

Date of commissioning		break in phase	Operating phase			
Test interval, weeks / operating hours		2	6	24	48	Comment
Point	Inspection point	200 h	600 h	2400 h	4800 h	
1.	Check chain wear	X**		X	X	
2.	Check for obstructions	X**		X	X	
3.	Check roller links.	X**		X	X	
4.	Check chain endpoints	X**	X		X	
5.	Check strain reliefs	X**	X		X	
6.	Check cables & hoses	X**		X	X	
7.	Check troughs	X**		X	X	
8.	Check moving arm	X**		X	X	
9.	Measure chain elongation			X	X	

6. Improvement Evaluation

igus®

Maintenance Schedule
e-chainsystems®

igus GmbH
e-chainsystems®
Spicher Straße 1 a,
51147 Cologne (Porz-Lind)
Germany

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Maintenance Record

Maintenance carried out in accordance with Tables 1 and 2

Item	Hours/Weeks	Performed DATE	Operating Hr. /cycles	Free for operation	by: SIGNATURE	Checked by Works Manager: SIGNATURE
1	200h / 2W					
2	600h / 6W					
3	2400h / 24W					
4	4800h / 48W	16/06/25			Wihan	
5	7200h / 72W					
6	9600h / 96W					
7	12000h / 120W					
8	14400h / 144W					
9	16800h / 168W					
10	19200h / 192W					
11	21600h / 216W					
12	24000h / 240W					
13	26400h / 264W					
14	28800h / 288W					

6. Improvement Evaluation

Measuring benefit from installation until Nov 2025

Tripper Car A from installation June 2020 until Nov 2025 (42 month)

Motor Rating (CRD Drive)
- Rated HP: 5 HP (3.7 kW)
- Voltage: 220/380 V
- Current: 15.2 / 8.8 A
- Frequency: 50 Hz
- Speed: 965 rpm

approximate tariff for industrial electricity in Indonesia under PLN. According to recent PLN-tariff data (2025), industrial customers (group I-3 with load > 200 kVA) are charged around Rp 1,114.74 per kWh.

calculate again using assuming 12 hours/day operation

12 hours/day × 30 days = 360 hours/month
3.7 kW × 360 h = 1,332 kWh/month
1,332 × 42 = 55,944 kWh
55,944 kWh × Rp 1,114.74/kWh ≈ Rp 62,360,000

Cost Component	Assumed Price year/month
Oil SPIRAX HD 8OW/90	5 million / ~ 420k month
Slip ring regular parts	10 million / ~830k month

After run hour for 42 month average cost spend for maintenance the CRD :
((420k + 830k) x 42 = 52,500,000
Total energy consumption with cost components
62,360,000+52,500,000 = 114,860,000

6. Improvement Evaluation

Measuring benefit from installation until Nov 2025

Tripper Car B from installation Jan 2023 until Nov 2025 (35 month)

approximate tariff for industrial electricity in Indonesia under PLN. According to recent PLN-tariff data (2025), industrial customers (group I-3 with load > 200 kVA) are charged around Rp 1,114.74 per kWh.

calculate again using assuming 12 hours/day operation

12 hours/day × 30 days = 360 hours/month
3.7 kW × 360 h = 1,332 kWh/month
1,332 × 35 = 55,944 kWh
55,944 kWh × Rp 1,114.74/kWh ≈ Rp 51,967,314 ~ 51,960,000

Cost Component	Assumed Price year/month
Oil SPIRAX HD 8OW/90	5 million / ~ 420k month
Slip ring regular parts	10 million / ~830k month

After run hour for 42 month average cost spend for maintenance the CRD :
((420k + 830k) x 35 = 43,750,000
Total energy consumption with cost components
51,960,000+43,750,000 = 95,710,000

6. Improvement Evaluation

Measuring benefit from installation until Nov 2025

GTSU 1 from installation June 2024 until Nov 2025 (18 month)

Description
Isolator GE Dilos 25 A 3P, 690V
Auxiliary contact for GE Dilos isolator
Terminal cover for 3P isolator GE Dilos
Fuse holder Wimex 3P type PS10-3, 690V, 32A
Fuse Wimex 38x10 16A type CF10 gG, 500V
Circuit-breaker 1P Telemecanique 8 A

We can assume the CRD GTSU 1 using power 400VAC and 32Amp

calculate again using assuming 18 hours/day operation
P=1.732×400×27.2÷1000 =18.83 kW 18.83 kW×18 h/day=338.94 kWh/day
338.94×30=10,168.2 kWh/month 10,168.2×18=183,027.6 kWh
Cost=183,028×1,114.72 =204,008,652

Maintenance/Repair Type	Frequency / Assumption	Estimated Cost per Event	Total for 18 months
Routine gearbox/motor lubrication & check	every 6 months	Rp 1,000,000	~Rp 3,000,000
Gearbox seal/bearing/gear repair (1 event)	once or twice	Rp 3,000,000	~Rp 3,000,000 – Rp 6,000,000
Motor maintenance / partial rewind or bearing replacement (1 event)	once	Rp 5,000,000 – Rp 15,000,000 (depending severity)	~Rp 5 – 15 million
Slip ring / brush replacement & housing maintenance (maybe 1)	once	Rp 1,000,000 – Rp 2,000,000	~Rp 1 – 2 million
Unexpected failure / downtime repairs (structural, drum, cable guide)	possible 1–2 events	Rp 2,000,000 – Rp 8,000,000 per event	~Rp 2 – 16 million
Labor, inspections, small parts, consumables (oil, grease, etc.)	ongoing	Rp 500,000–1,000,000 per 6 mo period	~Rp 1.5 – 3 million

After run hour for 18 month average cost spend for maintenance the CRD :
(3+6+15+2+16+3)M = 45,000,000
Total energy consumption with cost components
204,000,000+45,000,000 = 249,000,000

6. Improvement Evaluation

Measuring benefit from installation until Nov 2025

If CRD still usage until Nov 2025 then

GTSU 1 from installation June 2024 until Nov 2025 (18 month)
After run hour for 18 month average cost spend for maintenance
249,000,000 IDR
Tripper Car B from installation Jan 2023 until Nov 2025 (35 month)
After run hour for 18 month average cost spend for maintenance
95,710,000 IDR
Tripper Car A from installation June 2020 until Nov 2025 (42 month)
After run hour for 42 month average cost spend for maintenance the
114,860,000 IDR

COST off 3 item = 459,570,000 in IDR
Average defect work order ~ 10 WK / 6 month

Using IGUS chain flex until Nov 2025 then

GTSU 1 from installation June 2024 until Nov 2025 (18 month)
After run hour for 18 month average cost spend for maintenance
0 IDR
Tripper Car B from installation Jan 2023 until Nov 2025 (35 month)
After run hour for 18 month average cost spend for maintenance
0 IDR
Tripper Car A from installation June 2020 until Nov 2025 (42 month)
After run hour for 42 month average cost spend for maintenance the
0 IDR

COST off 3 item = 0 in IDR
Average defect work order ~ 0 WK / 6 month

7. Standardization

Item	Description	Details:	Condition	Problem *Corrective Action*	
1	Check chain wear: ❑checked ❑not checked	Check contacting surfaces of chain on inside of radius. Measure depth of wear. _____ mm _____ %	Is each chain band evenly worn? ❑yes ❑no	One side more worn than the other. A Step is worn into the links. ***Adjust trough width – see section 3.6***	Work completed ❑yes ❑no (explain)
			Crossbars in good condition? ❑yes ❑no	Crossbars are worn. ***Replace chain(wear limit has been reached)***	Work completed ❑yes ❑no (explain)
			Other faults? ❑yes (explain) ❑no		Work completed ❑yes
2	Check for obstructions ❑checked ❑not checked	Visual inspection of trough system for obstructions or blockages.	Ist the trough free f snow, dirt, tools or foreign material? ❑yes ❑no		
			Other faults? ❑yes (explain) ❑no		

Item	Description	Details:	Condition	Problem *Corrective Action*	Item
3	Check Chain Rollers ❑checked ❑not checked ❑does not apply	Check function of chain rollers. **List of defective rollers starting at tow arm:** _____	Rollers turn freely. ❑yes ❑no	Rollers do not turn freely. ***Replace rollers or roller link as necessary.***	Work completed ❑yes ❑no (explain)
			Extension links only: Are roller covers in place? ❑yes ❑no	Cover is missing. ***Replace cover, rollers or entire roller link as necessary.***	Work completed ❑yes ❑no (explain)
			Other faults? ❑ yes(explain) ❑no		
4	Check end connections ❑checked ❑not checked	Check for loose or missing screws at both ends of chain, also the support plate and tow arm.	Are both ends of the chain attached properly? ❑yes ❑no	Loose or missing screws. **Replace missing screws, and tighten loose screws according to specification.**	Work completed ❑yes ❑no (explain)
			Other faults? ❑yes(explain) ❑no		
5	Check strain reliefs ❑checked ❑not checked	Check strain reliefs at moving end to make sure they are all in place, installed correctly and tight.	All in place and tight? ❑yes ❑no	Cables or hoses are loose. ***Replace missing strain reliefs and tighten loose strain reliefs***	Work completed ❑yes ❑no (explain)
			Other faults? ❑yes(explain) ❑no		

7. Standardization

Item	Description	Details:	Condition	Problem Corrective Action	Item
6	Check cables and hoses ❑checked ❑not checked	Check condition of cables and hoses over entire length of e-chain®.	Cables & hoses in good condition? ❑yes ❑no	Cables and hoses are damaged or worn severely. ***Replace as necessary.***	Work completed ❑yes ❑no (explain)
		Pull chain out to end position. The cables and hoses must be able to move freely within the e-chain® without scraping on the crossbars at the chain bend.	Are cables and hoses free to move within the e-chain? ❑yes ❑no	A Cable is tight and pulls against crossbars at the chain radius. **Adjust cable length within**	Work completed ❑yes ❑no (explain)
			Other faults? ❑yes(explain) ❑no		

Item	Description	Details:	Condition	Problem Corrective Action	Item
7	Check Troughs ❑checked ❑not checked	Check trough sections for damage. **List damaged trough** **Support number:** _____	All troughs in good condition? ❑yes ❑no	Trough segments damaged. ***Replace or repair.***	Work completed ❑yes ❑no (explain)
		Check vertical trough brackets for damage. **List damaged bracket** **Support number:** _____	Are all screws in place and tight? ❑yes ❑no	Missing or loose screws ***Replace screws as necessary and torque to specification.***	Work completed ❑yes ❑no (explain)
			All brackets in good condition? ❑yes ❑no	Brackets damaged ***Replace or repair.***	Work completed ❑yes ❑no (explain)
		Check trough width according to Specification (see system drawing). **adjustment needed at** **Support number:** _____	The width is according to specification. ❑yes ❑no	The width is not according to specification. ***Adjust inner width and torque screws according to specification.***	Work completed ❑yes ❑no (explain)
		Check hinge point where applicable. ❑no hinge point	Are trough and coupling aligned? ❑yes ❑no Are parts in good condition and all screws tight? ❑yes ❑no	Trough and/or pins misaligned ***Adjust trough and/or pins so that they are aligned.*** Parts are damaged. ***Replace or repair parts and tighten all screws according to spec.***	Work completed ❑yes ❑no (explain) Work completed ❑yes ❑no (explain)
			Other faults? ❑yes(explain) ❑no		

8. Further improvements

A. Historical of replacement of CRD to IGUS Chain Flex.

- Tripper Car-08A, Retrofit CRD to IGUS Chain Flex **(MOH2022)** ✓
- Tripper Car-08B, Retrofit CRD to IGUS Chain Flex **(MOH2023)** ✓

B. Further Propose Retrofit of CRD to IGUS Chain Flex on :

- GTSU-01 **(MOH 2024)** ✓
- GTSU-02 **(MOH 2026)** ○
- Stacker Reclaimer **(MOH 2028)** ○

9. Conclusion

1.	Innovation	From CRD system to IGUS Chain Flex
2.	Efficiency	Eliminate CRD problem, Reduce power usage , No more cost for Spare for CRD system (motor, cable, slip ring etc.)
3.	Enhance Company Performance	Operating more , Less for cost operation, Reducing cost maintenance, Higher reliability system

Retrofit from CRD to IGUS Chain System in GTSU 1

1. is a proactive investment in reliability, safety, and operational cost savings
2. Directly reduce downtime maintenance and safety risks
3. The positive return of investment and long-term benefits

Thanks

CIREBON POWER

M Taufik J