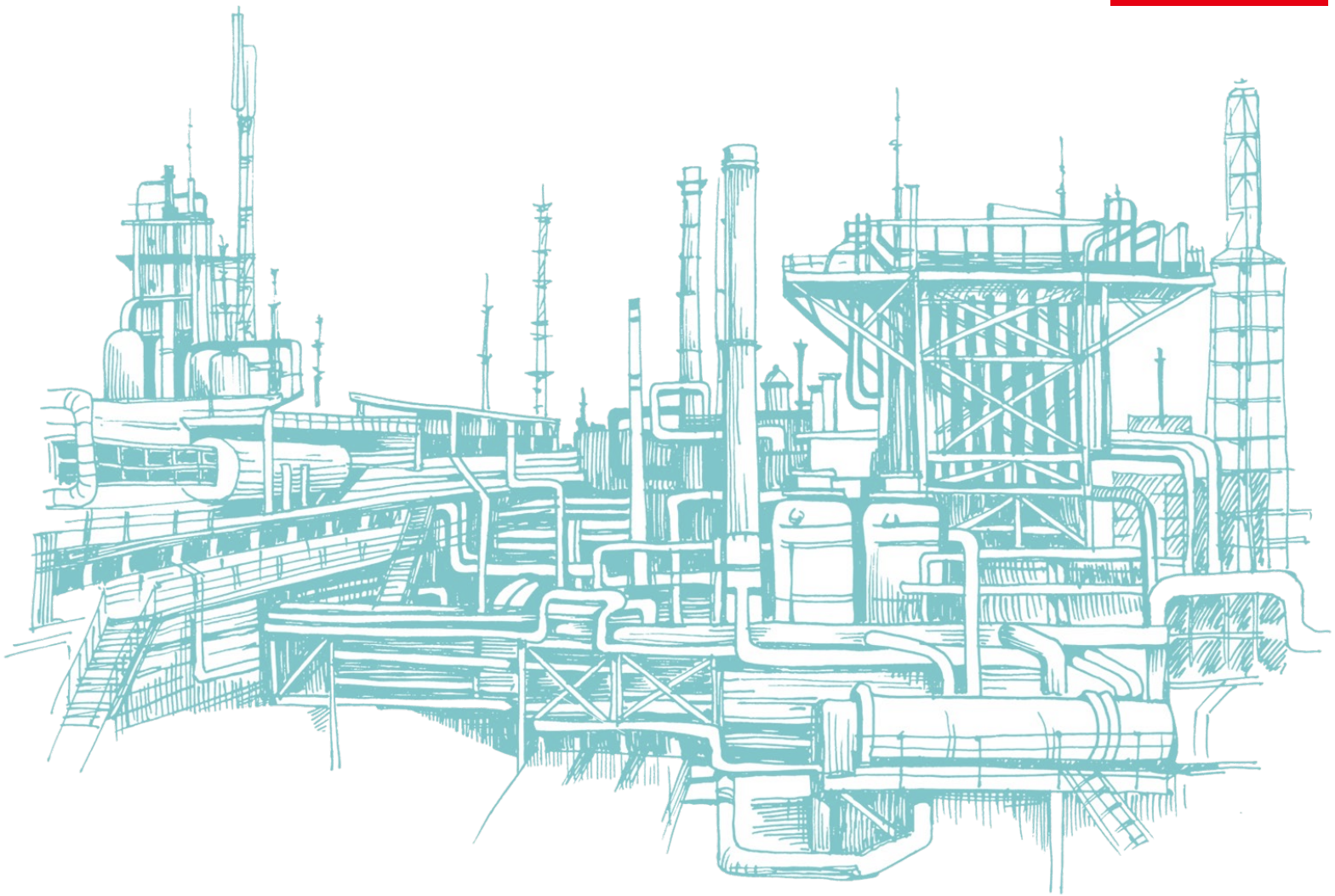
Operational Excellence Services



Services for
Operational Excellence

Long-term Partnering for Our Clients' **Business Success**

Clients' Expectations

For almost 100 years, JGC has provided solutions to meet the various expectations of plant owners.

Clients' Expectations for O&M

Conserve the Environment
Reduction of GHG emissions

Secure Plant Safety
Assessment and management of risks

Manage Turnaround Activities
Minimize downtime and loss of profit

Empower Employees
Training local engineers and technicians

Shift to Smart O&M
Digital Tool application for O&M

Optimize O&M Cost
Improve operations strategy and system reliability

Our Approach

JGC offers the highest quality services for your plant operations optimization to solve difficult problems and technical issues you confront.

Operation

- Maximize Profit
- Optimize OPEX
- Visualize Operations
- Perfect Operations Readiness
- Smooth & Safe Startup

Smart O&M Solutions

- Improve Efficiency through Digital Technology
- Utilize AI Power Combining Engineering Knowledge

Decarbonization

- Energy Saving in Operation
- Manage Life Cycle CO_2
- Quantify & Reduce GHG

HSE

- Manage Operational HSE Risk
- Optimize Fire Protection System
- Ensure Emergency Preparedness

Reliability & Maintenance

- Maximize Plant Availability
- Flawless and Smooth Turnaround
- Extend Plant Life

Our Operational Excellence Services Map

Operation

- Profitability Improvement Program
- Plant Operation Automation Program
- Operations Readiness & Assurance Program
- Predictable Startup Program

Smart O&M Solutions

- Maintenance Digital Twins Program
- Smart Turnaround Management Program
- Plant Smartification Program

Decarbonization

- Decarbonization Program

HSE

- Operational HSE Risk Management Program
- Fire Protection Improvement Program
- HSE Improvement Program
- Application for Risk-Based Process Safety

Reliability & Maintenance

- Mechanical Integrity Program
- Turnaround Assistance Program
- Maintenance Improvement Program

Technical Assistance & Training

- Technical Assistance Service
- Training Service

Decarbonization

Service Menu

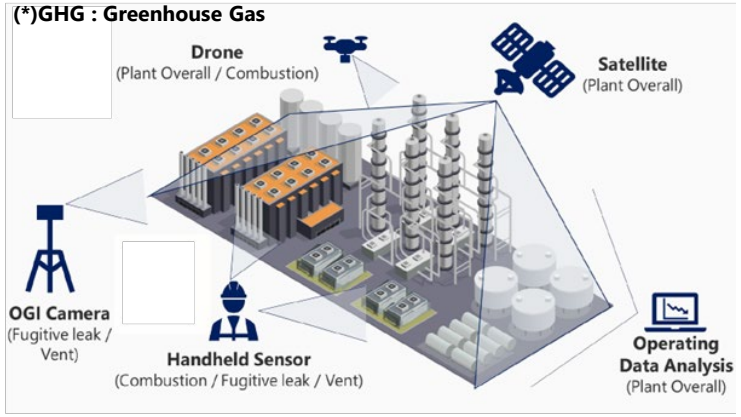
Return to OE Service menu

JGC Group provides a large variety of Decarbonization Programs which are the proprietary GHG(*)s assessment solution and optimized operation service based on our successful experiences in countless EPC & O&M fields.

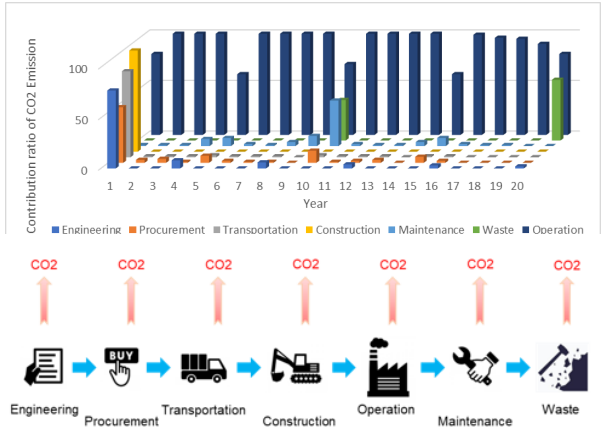
(*)GHG : Greenhouse Gas

Decarbonization Program

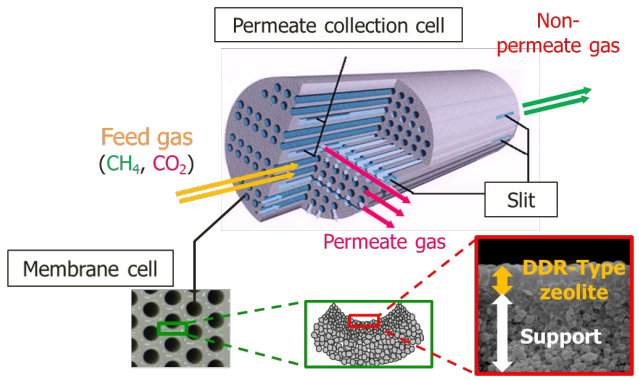
- HiGHGuard™ (GHG Quantification Service)
- Life Cycle Assessment / Management (CO2 Footprint)
- CO2 Removal Solutions
- Energy Optimization
- Fired Heater Improvement



HiGHGuard™(GHG Quantification Service)

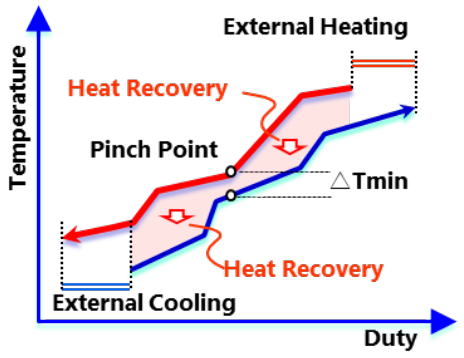


Life Cycle Assessment/Management (CO2 Footprint)

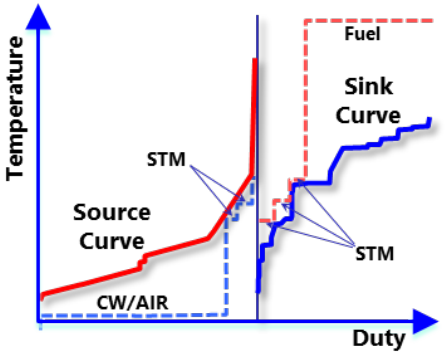


DDR (*) Membrane (CO2 Removal)
High Performance Separation Technology

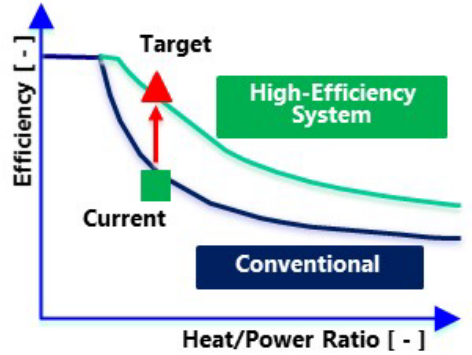
(*)DDR : Deca-Dodecasil 3R, A type of zeolite with a specific crystal structure



Energy Utilization and Optimization of Heat Recovery System



Optimization of Site-Wide Energy Usage



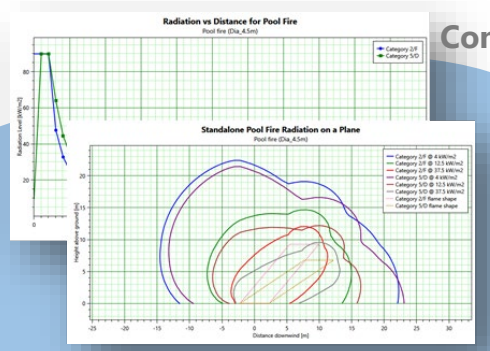
Optimization of Power-Steam Supply System

Energy Optimization-Pinch

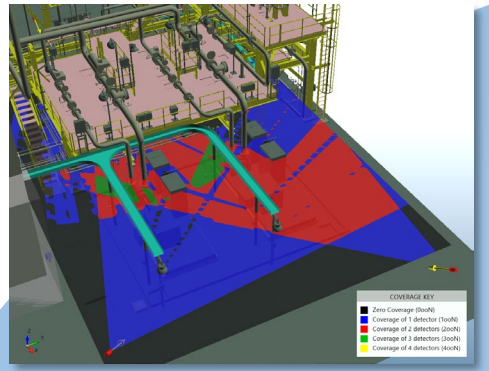
HSE

HSE services focus on systematic identification and evaluation of plant risks based on our long experience in on-site HSE and our own excellent evaluation methods, and on proposing systems that can ensure safe plant operation without major CAPEX.

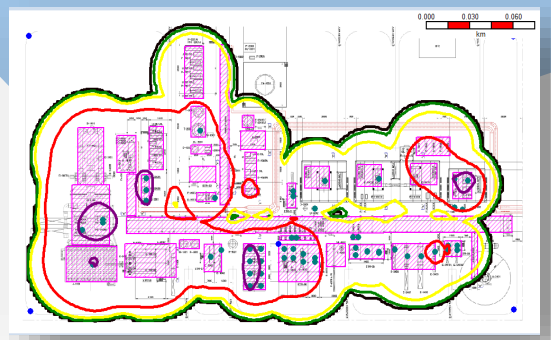
Consulting Service



Fire Hazard Simulation

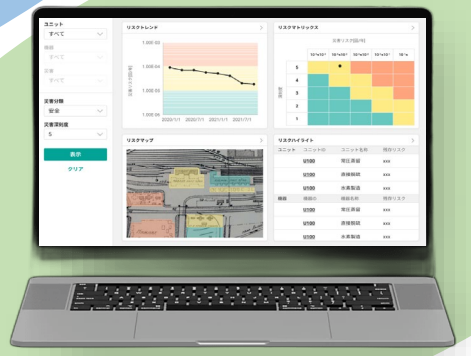


Fire and Gas Mapping Study Technology



Quantitative Risk Analysis (QRA)

Application Product



CoreSafety®

[Return to OE Service menu](#)

Service Menu

◆ Operational HSE Risk Management Program

HSE Risk Management
- Formal Safety Assessment
- Hazard Identification (HAZID)
- HAZOP/SIL/LOPA (*) /Bow-tie Analysis
- Operational Hazard Reduction
- Management System Review
- Process Safety Management

◆ Fire Protection Improvement Program

- Active Fire Protection Assessment
- Fireproofing Assessment
- Fire and Gas Assessment

◆ HSE Improvement Program

- Escape Simulation and Assessment
- Hazardous Area Classification (HAC) Optimization
- Noise Assessment

◆ Application for Risk-Based Process Safety

- CoreSafety®

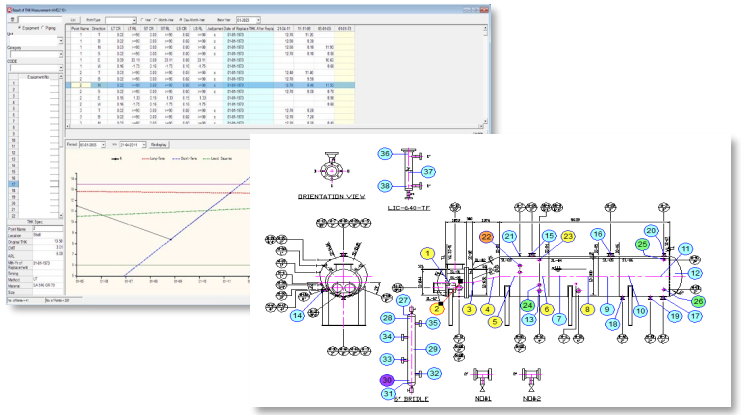
(*)HAZOP : Hazard and Operability Studies / SIL : Safety Integrity Level / LOPA : Layer of Protection Analysis

Reliability & Maintenance

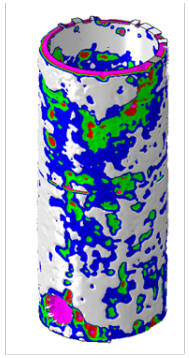
Return to OE Service menu

Service Menu

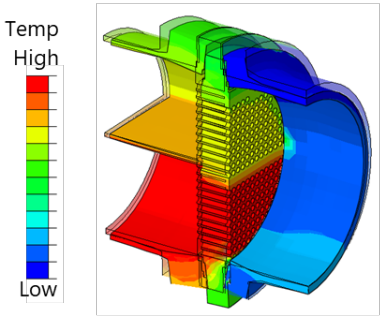
In addition to highly developed engineering technologies and the application of its safety management skills, JGC O&M service improves plant reliability, availability, and quality by collaborating with global affiliate companies and local maintenance companies.



Inspection Data Management System
A-MIS (Asset Integrity Management)

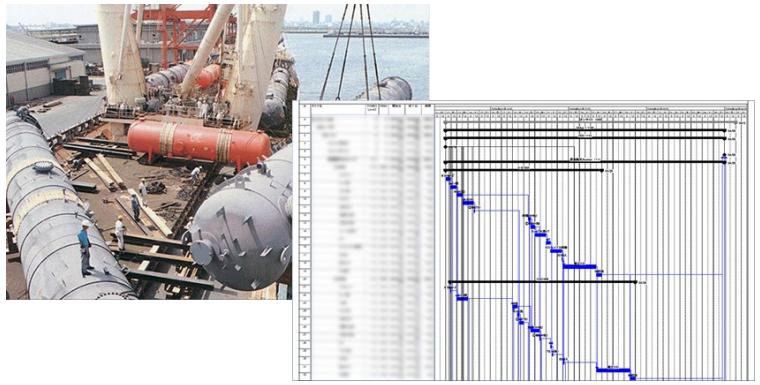


(1) External Corrosion
Analysis Model by Laser Scanning



(2) Flange Deformation
due to Temperature Distribution

Finite Element Analysis (FEA)



Maintenance Planning

JGC Maintenance Team at LNG Plant

◆ Mechanical Integrity Program

- Risk-Based Inspection (RBI)
- A-MIS (Asset Integrity Management)
- Plant Life Extension Program (PLEP)
- Plant Diagnosis and Lifetime Improvement Service

◆ Turnaround Assistance Program

- Turnaround Scope Optimization & Planning
- Turnaround Execution Management
- Inspection & Diagnosis

◆ Maintenance Improvement Program

- Reliability, Availability, Maintainability (RAM)
- Reliability Centered Maintenance (RCM)

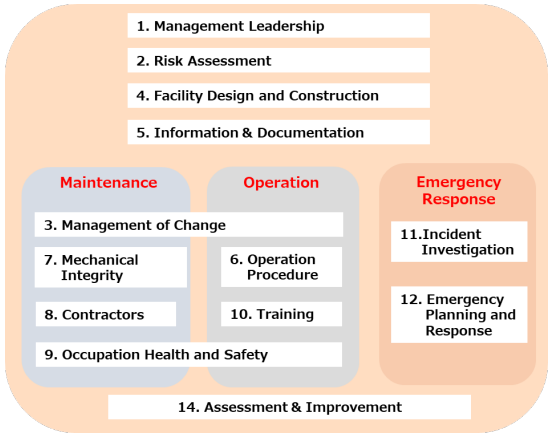
Technical Assistance & Training

Return to OE Service menu

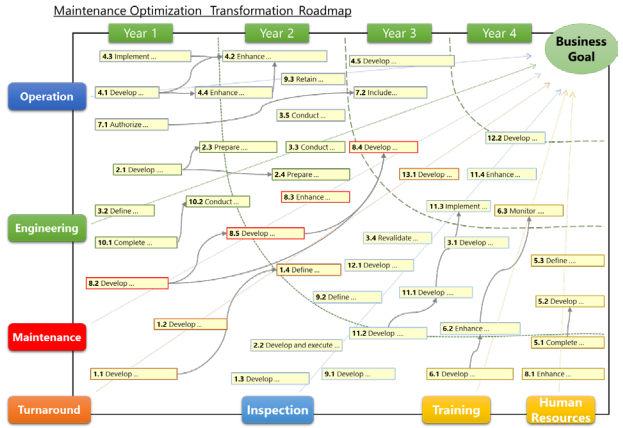
Service Menu

Over the past several decades, JGC Group has conducted various engineer training programs and technical assistance programs at plant sites and remote locations. Many of our clients have achieved considerable improvements in their employee skills and plant operations which significantly contribute to the profitability and efficiency of their business.

- Technical Assistance Service
  - Onsite Assistance (Residential/On-call)
  - Asset & Operation Due Diligence
  - OPEX Assessment
  - Strategic Operational Improvement Assistance
- Training Service
  - Training and Competency Management Services



Asset & Operation Management Framework



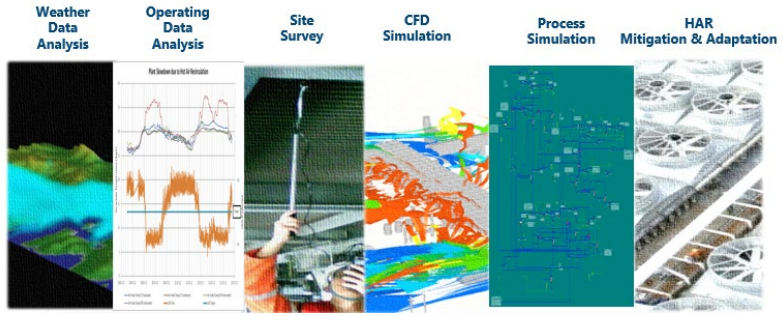
Strategic Maintenance Optimization Road Map

Onsite Assistance

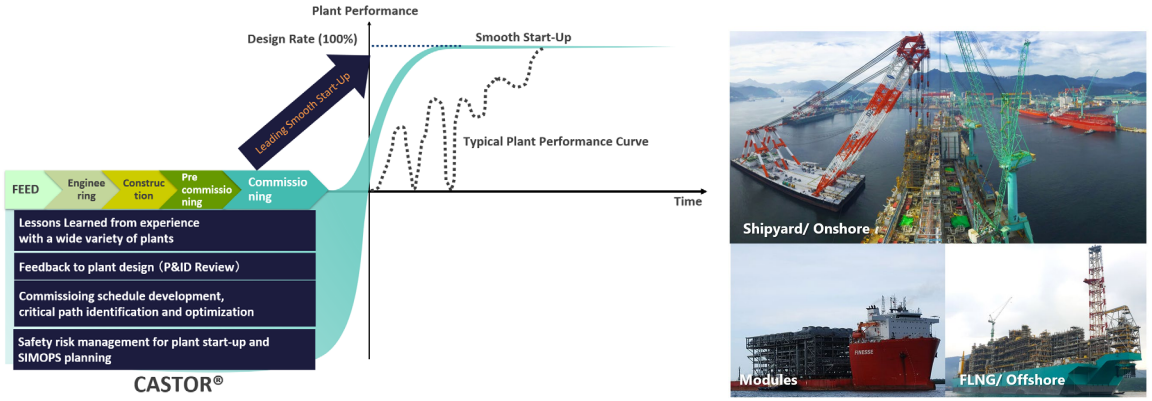
Technical Seminars and Training Class

Operation

Our engineers have a wealth of plant engineering experience and channel their expertise through cutting-edge engineering tools to provide profitability improvement services and plant automation program. Additionally, we provide expert consultations and recommendations for commissioning and startup, utilizing our extensive knowledge and experience from numerous EPC projects.



Key Activities of AIRLIZE LNG®



High-quality Commissioning & Startup Planning Based on a Wealth of Experience

Return to OE Service menu

Service Menu

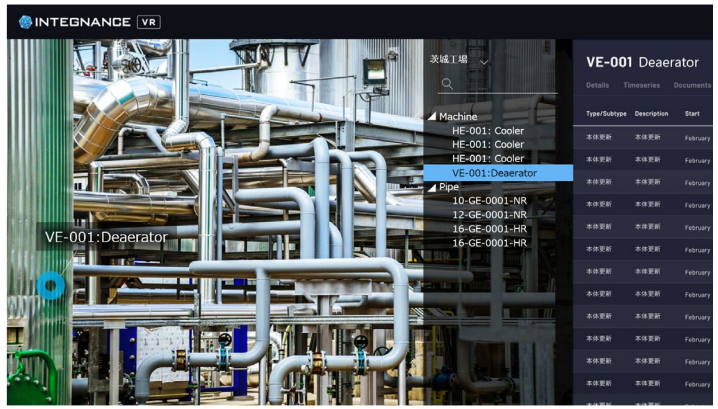
- **Profitability Improvement Program**
  - LNG Cube (Engineering Consultation Service)
  - AIRLIZE LNG®
    (Diagnoses services for HAR(*) optimization)
- **Plant Operation Automation Program**
  - Automatics Operation
- **Operations Readiness & Assurance Program**
  - Operations Readiness & Assurance (OR&A)
- **Predictable Startup Program** See Details
  - CASTOR®
    (Commissioning & Startup Transient Operability Review)
  - Commissioning Safety
  - Commissioning & Startup for FLNG/FPSO/Module

(*)HAR : Hot Air Recirculation

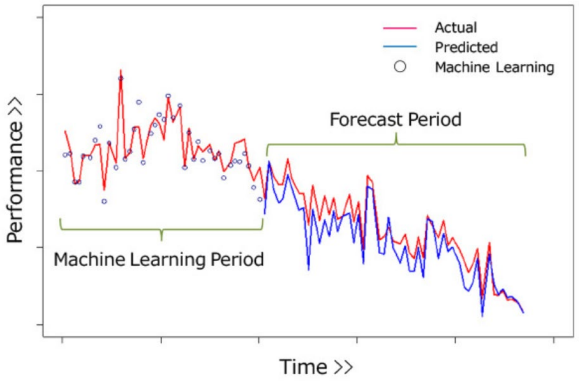
Smart O&M Solutions

Return to
OE Service menu

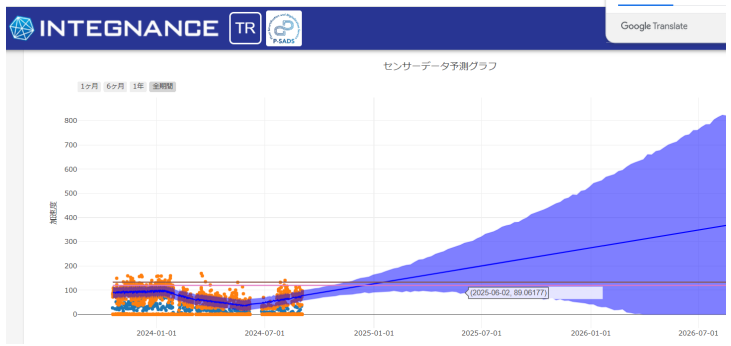
JGC has developed digital solutions utilizing its extensive knowledge and experience from long-term O&M support to achieve work efficiency, sustainable technical transitions, and less manned operations. Additionally, cutting-edge digital twin technologies accelerate the transition of your conventional operation and maintenance to the next stage.



Fast Digital Twin Maintenance Viewer



Plant Smartification
AI Analysis for Catalyst Deterioration



Predicting Failure of Rotating Machinery

MODS Connect

Service Menu

- **Maintenance Digital Twins Program**
  - INTEGNANCE VR (Fast Digital Twin Maintenance Viewer)
- **Smart Turnaround Management Program**
  - MODS - Connect
- **Plant Smartification Program**
  - INTEGNANCE TR (Predicting Failure of Rotating Machinery)
  - Plant Smartification with AI Technology
  - Remote Monitoring and Assistance

JGC Operational Excellence Services

Decarbonization

HiGHGuard®

(GHG Quantification Service)

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

GHG Quantification Service

HiGHGuard

Do you have any of these issues?

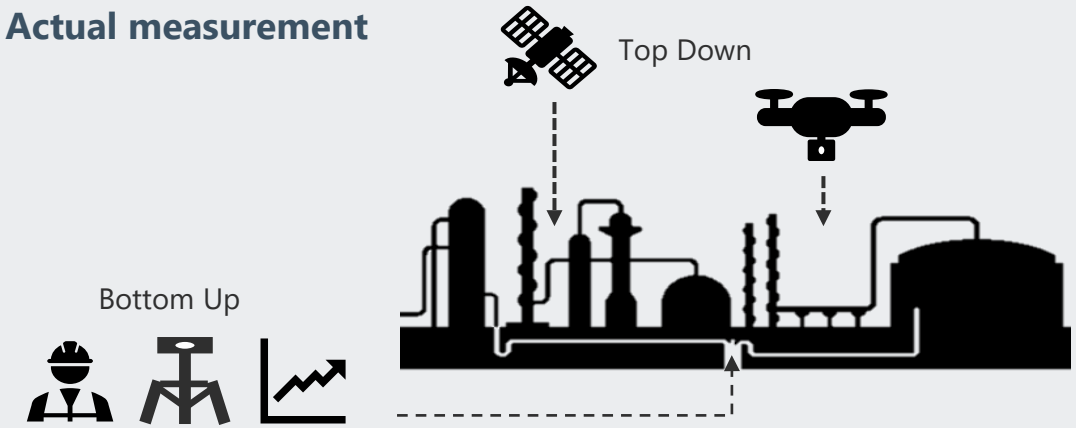
- ☹ **Difficulty in quantifying GHG (including CH_4)**
- ☹ **Need to quantify emissions in actual operation**
- ☹ **Identifying baseline for decarbonization project**

GHG Quantification

- Quantify GHG (CO_2, CH_4, N_2O) by actual measurement and engineering calculation.
- Conduct actual measurement with drone, satellite, handheld sensor, IR camera
- Provide optimized MRV(*) methodology
- Reporting the GHG emission to the authorities.

(*) Measurement, Reporting and Verification

Actual measurement



Emission Calculation

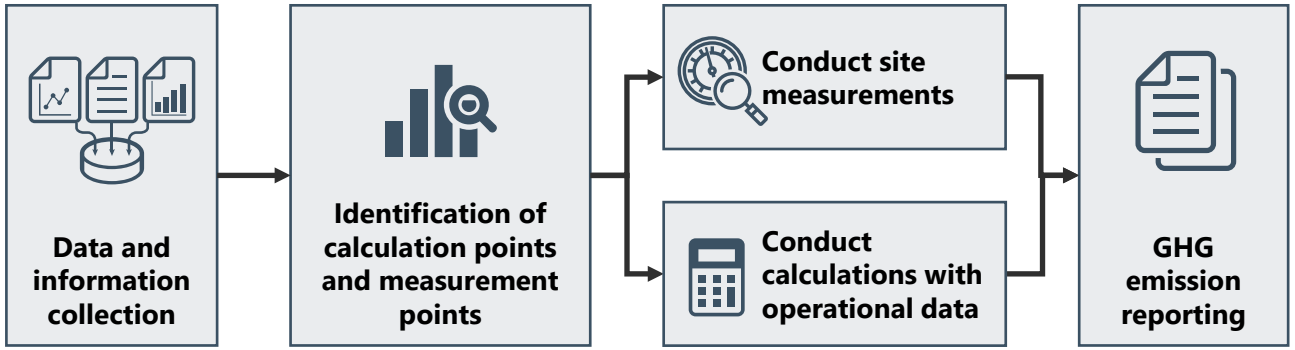
GHG emissions = Emission Factor * Activity Factor

Factors in regulation/guidelines

Operational Data

GHG Quantification Service HiGHGuard

Workflow & Results



Steps

- Identify measuring points and calculation points from design documents.
- Conduct engineering calculations / Actual measurements
- Report to client or government agency with preset format

JGC is

- able to select the most appropriate MRV methodology from those proposed by international organizations and standards/guidelines
- familiar with a variety of plants and can provide the best combination of drones, satellites, and handheld sensors

Our Strengths

- Professional HSE, Process, Mechanical Engineer Teams
- Dispatched technical experts to participate in various international discussions on GHG Measurement, Reporting and Verification (MRV).
- Experience in EPC and O&M of many types of facilities in many locations around the world.
- Collaboration between oversea group companies and local companies.

Our Background

- JGC has been commissioned by Japan Oil, Gas and Metals National Corporation (JOGMEC) to develop their guidelines.
- The Institute of Energy Economics, Japan (IEEJ) has contracted JGC as a technical adviser for GHG MRV

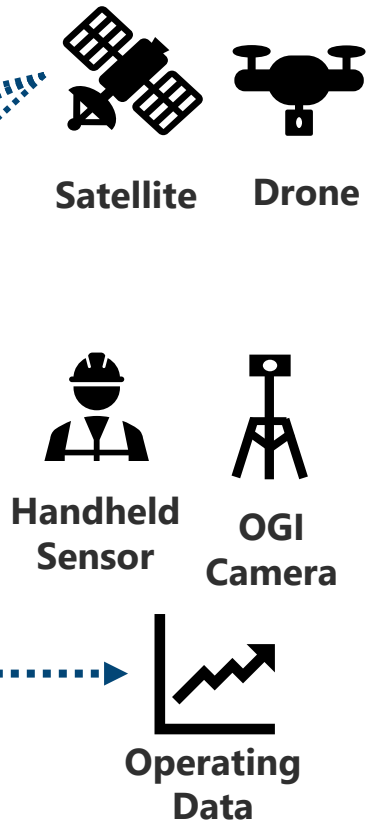
Case Study : Quantification of Methane Emission in Ammonia Plant

HiGHGuard

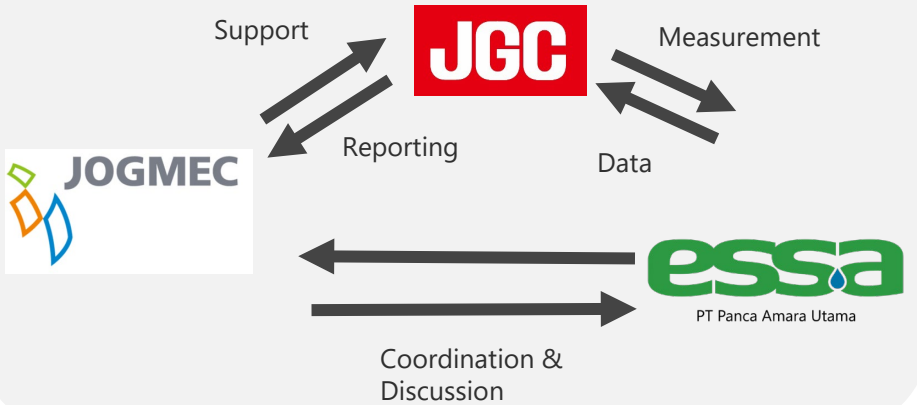
(*) PAU: PT Panca Amara Utama

Project in Actual Plant

- JOGMEC/JGC completed **direct measurement** to quantify Methane emission in PAU(*) Ammonia Plant. (Dec-2022)
- **Satellite / Drone / Handheld Sensor / Camera** were used in the project
- CO2 calculation was conducted using operating data.



Project Formation



Case Study : Quantification of Methane Emission in Ammonia Plant

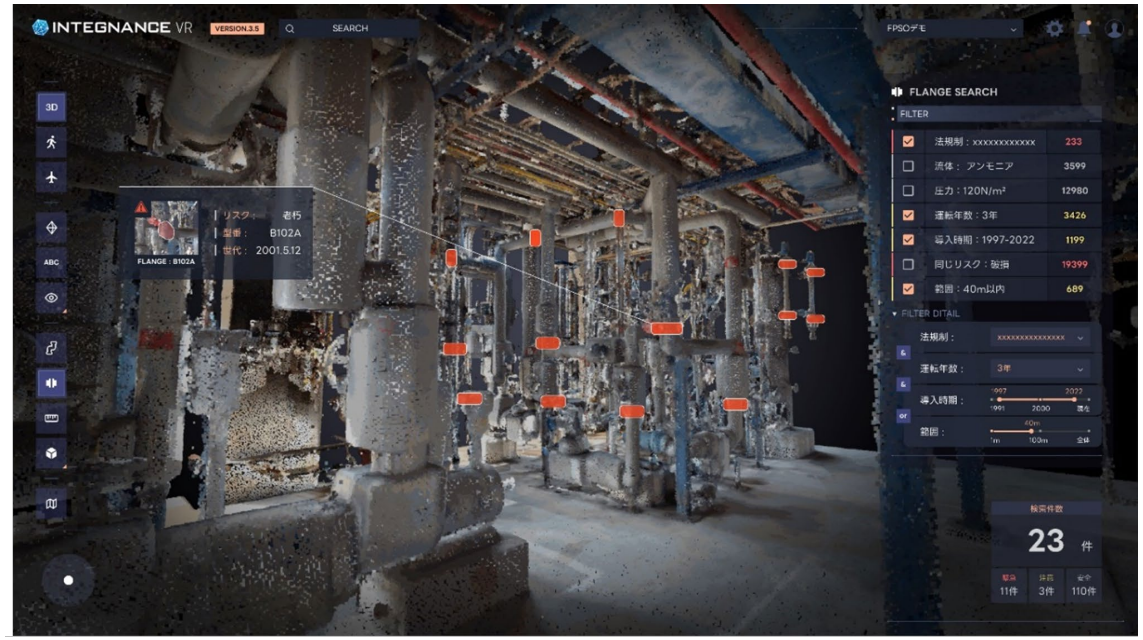
HiGHGuard

Return to Decarbonization menu

Utilizing Digital Twin Technology for Further Achievement

INTEGNANCE VR See Details

- JGC group company Brownreverse Corporation has signed a contact with PAU to begin a joint study. (Sep-2024)
- This joint study digitally replicates the ammonia production plant at PAU to investigate maintenance strategies and operating optimizations that reduce GHG emissions.
- The measured GHG emissions data from each facility will then be mapped onto the 3D viewer "INTEGNANCE VR" to visualize the emissions.



Conceptual drawing of GHG emissions visualization on INTEGNANCE VR

Memorandum of Understanding ceremony held in Indonesia

Operational Excellence Services

Decarbonization

Life Cycle Assessment/ Management (CO2 Footprint)

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Life Cycle Assessment/Management (CO2 Footprint)

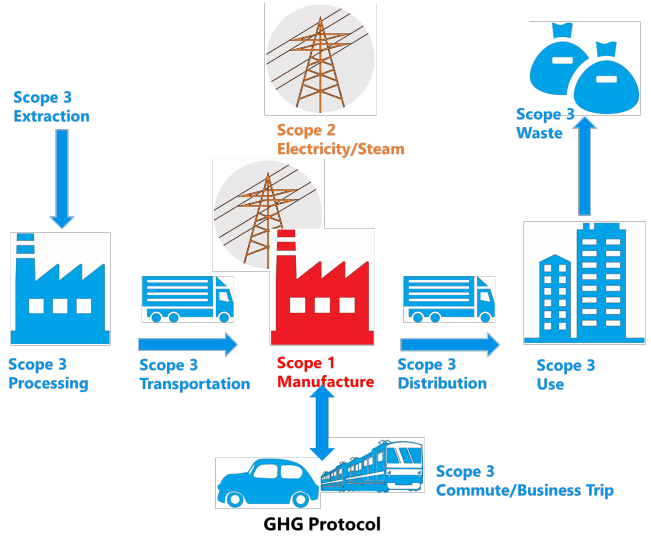
What is the Life Cycle Assessment (LCA)?

- LCA is a method of assessing the environmental impact of your product or service throughout its life cycle (or at a specific stage) :

  Resource extraction, raw materials, product production, distribution, consumption, disposal, recycling
- LCA can objectively and quantitatively evaluate whether a product is "good" or "friendly" for the environment, human body, and society

Concept of LCA

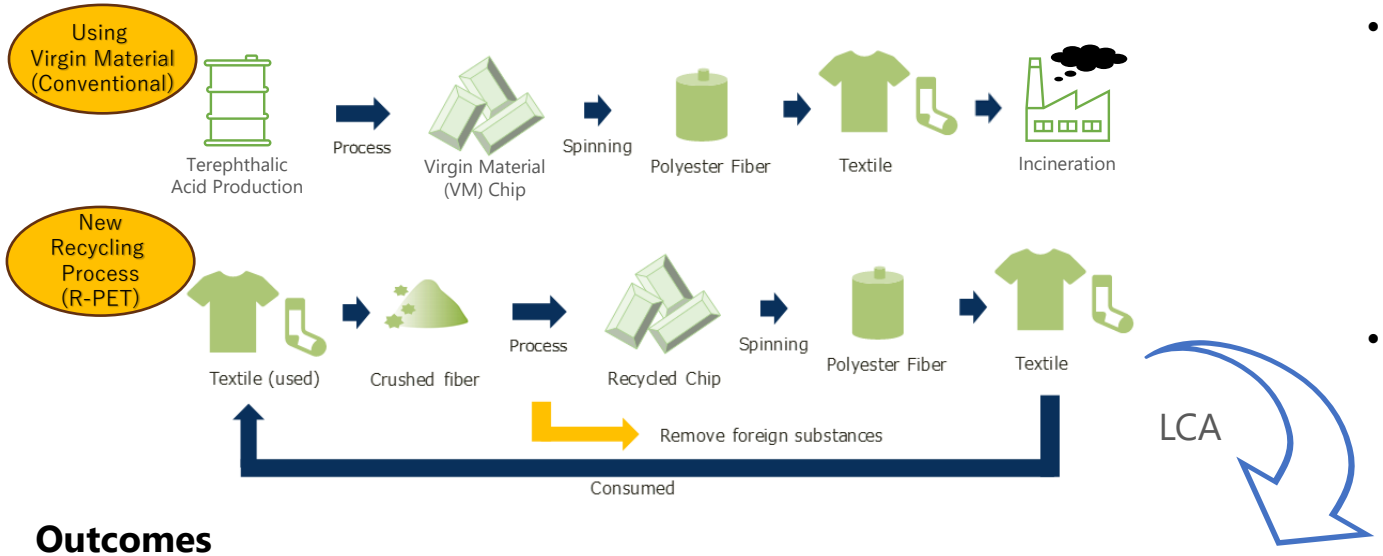
Advanced Application of LCA (LCM) to ....



High Client Concern on Environmental Impact, Optimized Plant Life Cycle (Engineering, Procurement, Construction, Commissioning, Startup, Maintenance, Manning, Turnaround, Demolition) , GHG Protocol (Scope 1/2/3)

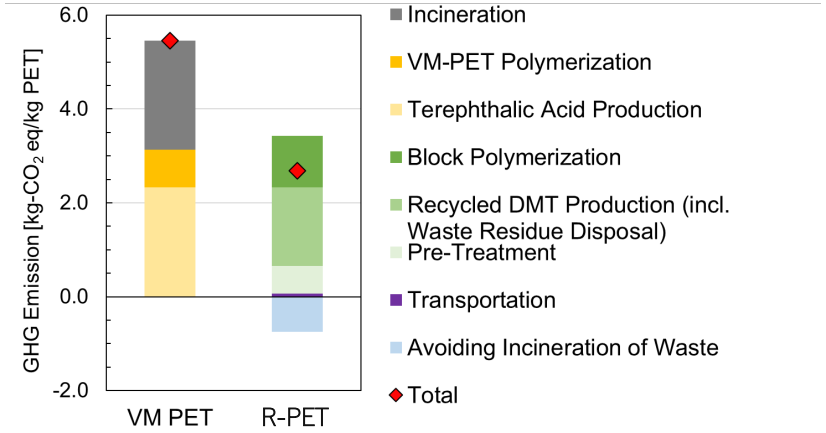
Life Cycle Assessment/Management (CO2 Footprint)

Case Study : LCA for New Recycling Technology



Outcomes

- **Numerical Results(*):** Detailed CO2 emissions data for each process stage
- **Higher CO2 Reductions:** The new recycling process is expected to achieve significantly higher CO2 reductions compared to the conventional process
- **Visualization of Hot Spots:** Identification and visualization of high CO2 emission hot spots



Achievements

- **Conference Participation:**
  - Attended the International Conference (EcoBalance 2022/24, LCM 2023)
  - Attended the 8th S-LCA Conference 2022 – Leave No One Behind –
- **CO2 Footprint Calculation:**
  - Calculated CO2 footprint (Scope 1/2/3) for CDP Report 2021, 2022, and 2023
  - JGC Holdings received a Score B

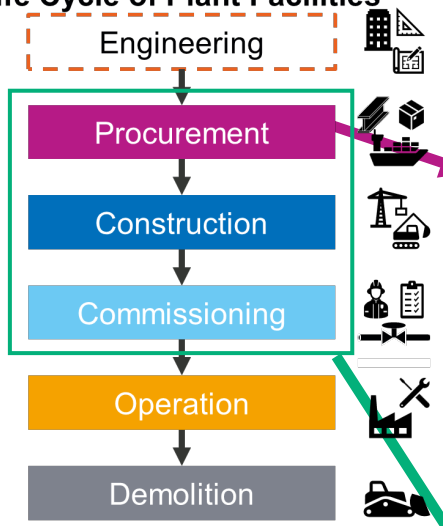
(*)The scope of evaluation, methods, and assumptions that greatly affect the results, it depends on the implementers and companies

Life Cycle Assessment/Management (CO2 Footprint)

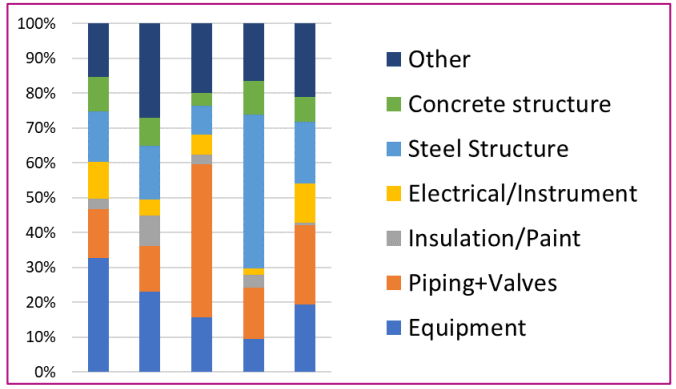
Return to Decarbonization menu

Case Study : LCA for EPC Business

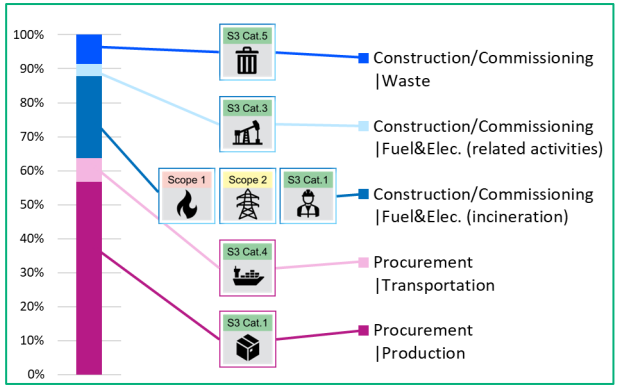
Life Cycle of Plant Facilities



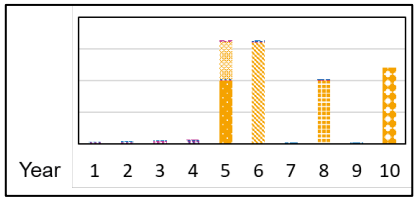
GHG emissions for procured equipment/materials across multiple projects.



GHG emissions from Procurement phase through to Commissioning



Report for annual GHG emissions of a contractor Scope 3



Outcomes

- **Numerical Approach for Plant Life Cycle:** A comprehensive assessment is applied to focus on for GHG Protocol scopes (1/2/3)
- **Real-Time Monitoring:** With a data-centric (DX) approach, both environmental impact and operational data can be monitored in real time, allowing for the identification of hotspots
- **Visualization of CO2 Emission Hot Spots:** High CO2 emission hot spots are visualized throughout the plant life cycle
- **CAPEX/OPEX and CO2 Emissions Relationship:** Understanding the relationship between CAPEX, OPEX and CO2 emissions

Our Strength

- **Broad LCA Expertise:** Conducting Life Cycle Assessment (LCA) not only for the manufacturing business but also for the construction industry
- **Process Engineering Perspective:** Utilizing a process engineering perspective to optimize material flow and reduce GHG emissions
- **Advanced Visualization:** Capability to visualize emissions using the in-house 3D maintenance viewer INTEGNANCE VR See Details

Operational Excellence Services

Decarbonization

CO2 Removal Solutions

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

CO2 Removal Solutions

Challenges for CO2 Capture in Operating Assets

Management of Increased CO_2 in Feed Gas

- ✓ Natural gas/associated gas quality varies over the life of oil/gas fields.
- ✓ Unexpected increases of CO_2 in the feed gas requires additional CO_2 capture units/enhancement of the CO_2 capture performance.

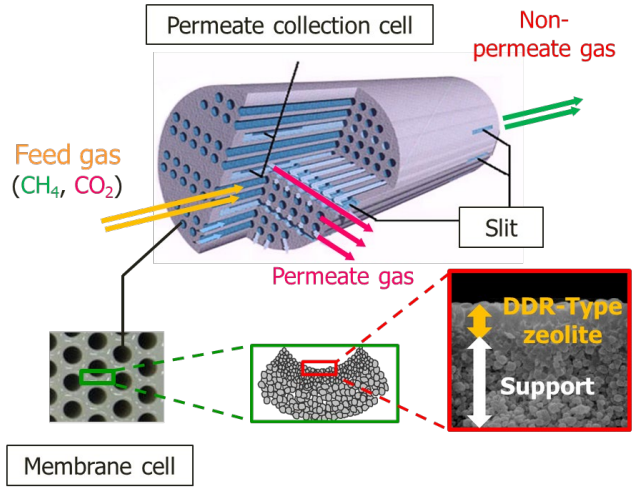
Limited Space and Utilities

- ✓ Limitation in the available space to accommodate the new unit/expansion of the unit.
- ✓ Limitation in the available utilities to operate the CO_2 removal unit

HiPACT® - an Innovative CO_2 Capture Process


Commercial HiPACT™ plant (NIS, Serbia)*1

DDR Membrane - High Performance Separation Technology



CO2 Removal Solutions – DDR Zeolite Membrane

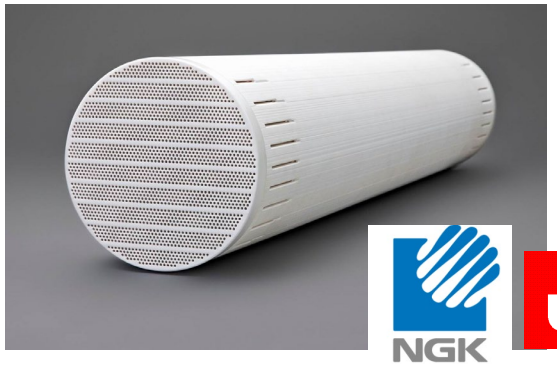
DDR Zeolite Membrane

■ Technology

- Technology jointly developed by JGC and NGK
- World's largest zeolite membrane element

■ Advantages

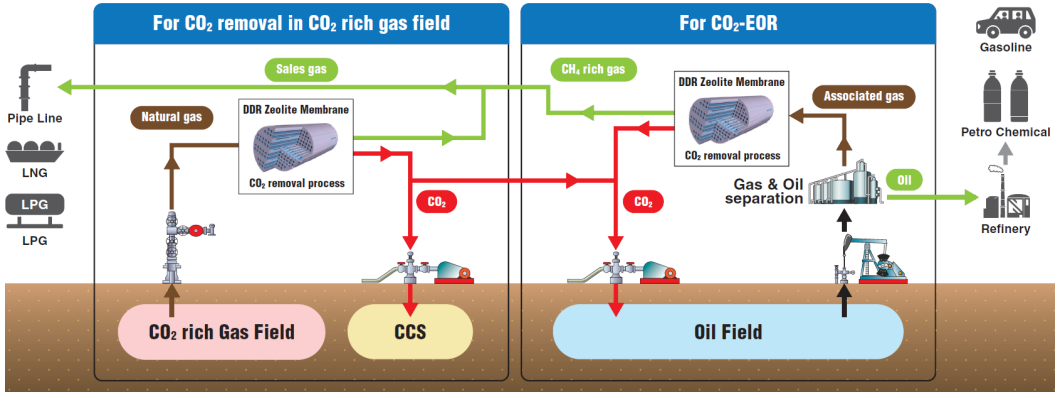
- Enhanced separation performance
  = minimal hydrocarbon loss
- Tough under high pressure, high CO_2 concentration
  = longer membrane life
- Significant lifecycle cost saving (**20-30%**)



■ Application

- Natural Gas Processing (CO_2 removal in CO_2 rich gas fields)
- CO_2 recovery from associated gas for CO_2-EOR(*) projects

(*) EOR: Enhanced Oil Recovery



■ Technology Development Status

- Field tested at U.S. oil field (2017, completed)
- Commercial scale field test at U.S. oil field (from 2020)

Details of the technology can be found at:
https://www.jgc.com/en/business/tech-innovation/environment/ddr-membrane.html

CO2 Removal Solutions - HiPACT®

Return to Decarbonization menu

HiPACT® - CO2 Capture Process

Technology

- Chemical absorption process, using newly developed absorption solvent (jointly developed with BASF)

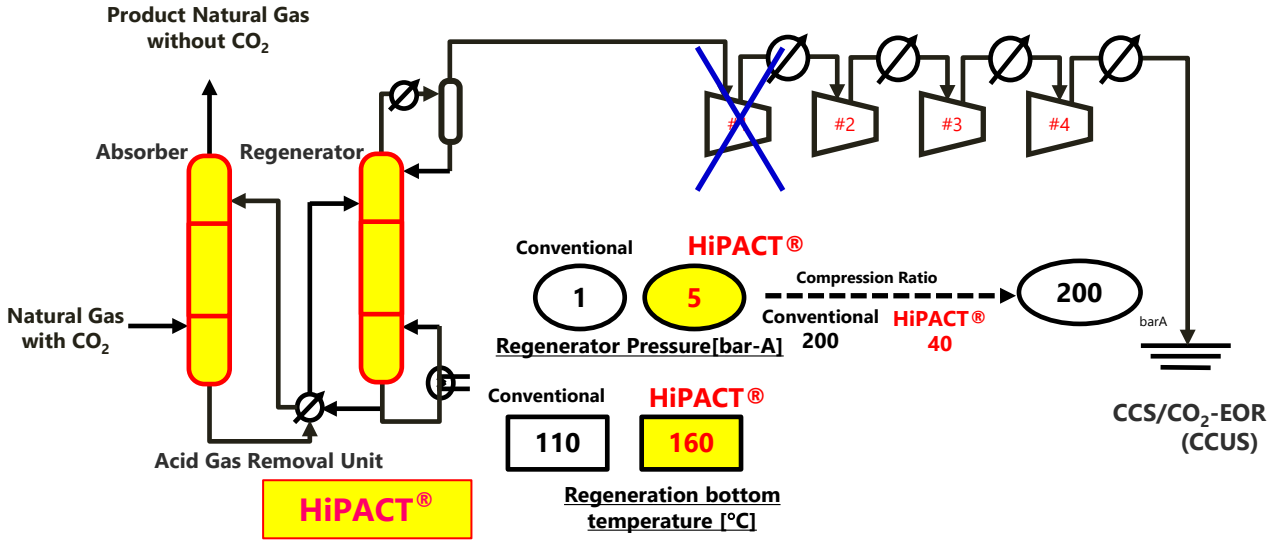
Advantages

- Highly stable against thermal degradation
- Enables high pressure CO_2 stripping, leading to significant energy and cost saving (25 to 35% reduction)
- Reducing the number of compression stages, optimizing the space


Commercial HiPACT™ plant (NIS, Serbia)*1

Reduction of initial investment and reduction of operating costs

by high pressure CO_2 stripping process



Details of the technology can be found at:
https://www.jgc.com/en/business/tech-innovation/environment/hipact.html

Operational Excellence Services

Decarbonization

Energy Optimization

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Energy Optimization

Do you have any of these issues?

☹ **How to reduce energy consumption?**

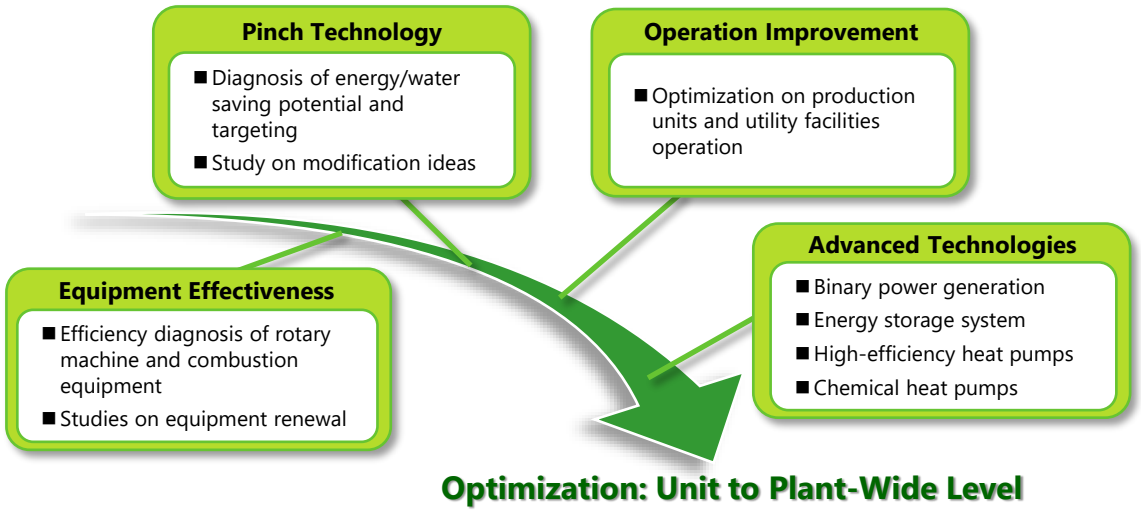
☹ **How to eliminate equipment bottlenecks?**

☹ **What kind of equipment should be updated to improve efficiency?**

What is our service ?

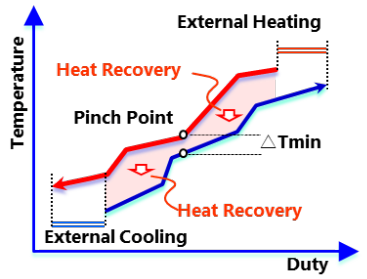
- **Equipment Effectiveness**: Diagnosis to identify the efficiency of existing facilities to be improved and suggestions for types of equipment to be modified.
- **Pinch Analysis:** Identify heat recovery target and create solutions such as heat recovery networks that balance the trade-off between investment costs and energy savings.
- **Operation Improvement:** Studies on unit operation and utility facilities modifications to improve energy efficiency.
- **Advanced Technology:** Studies and proposals on the introduction of high-efficiency equipment and new heat recovery technologies.

Our Approach

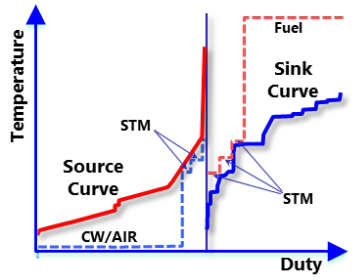


What is Pinch Analysis?

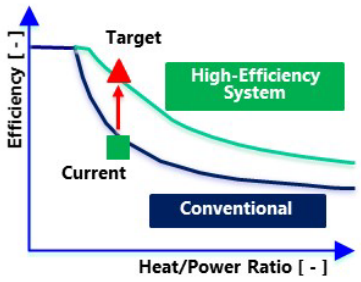
Systematic and Visualization Methods to Identify the Target



Energy Utilization and Optimization of Heat Recovery System



Optimization of Site-Wide Energy Usage

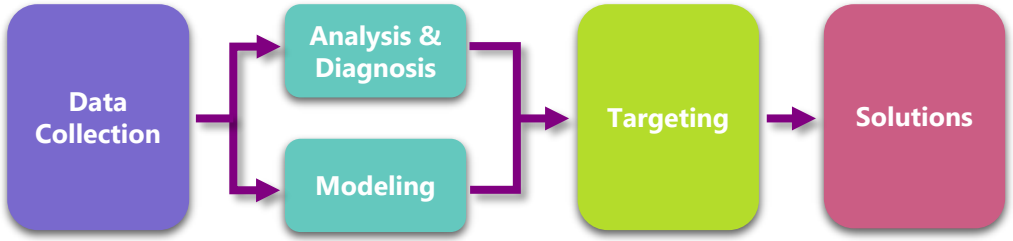


Optimization of Power-Steam Supply System

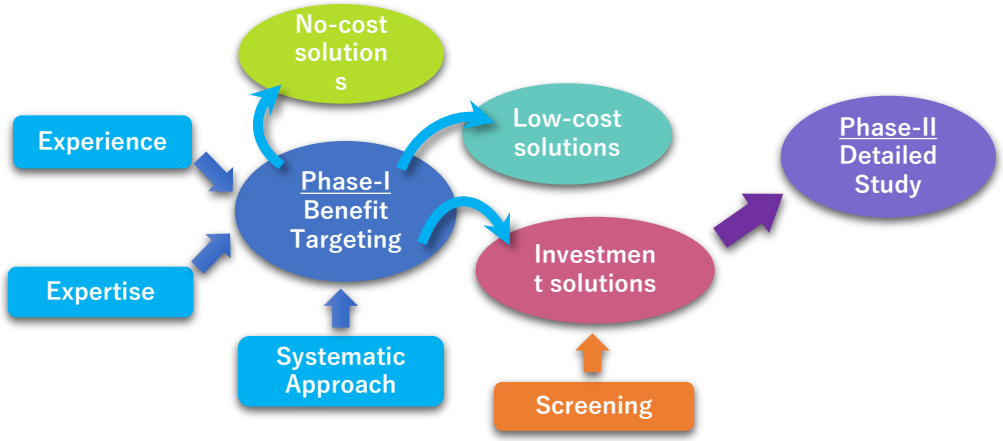
Energy Optimization

Return to Decarbonization menu

Workflow & Result



- Plant Data collection(Operating Data, Climate Data)
- Analysis and diagnosis
- Modeling for Pinch Analysis, and Targeting
- Prioritization of solutions into tree categories as Phase-I
- As Phase-II, detailed study to materialize the investment solutions proposed in Phase-I



Our Strengths

- The proven and successful experiences in executing similar consultancy services.
- Extensive technical knowledge and know-how for energy and water conservation.
- Qualified professionals.
- Collaboration between oversea EPC-capable group companies and out-sourcing for consultancy services.

Our Experiences

50+ Projects

Industry	Japan	Overseas
Petroleum Refinery	26	11
Petrochemical	6	4
Chemical	5	-
Steel	1	-
Total	38	15

- Contributed to over 50 projects in various phases (FS, Pre-FEED, FEED, EPC, Revamps) for Petroleum Refinery, Petrochemical, Chemicals, etc.
- We are certified by a national oil company as an energy consultant.

Operational Excellence Services

Decarbonization

Fired Heater Improvement

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Fired Heater Improvement

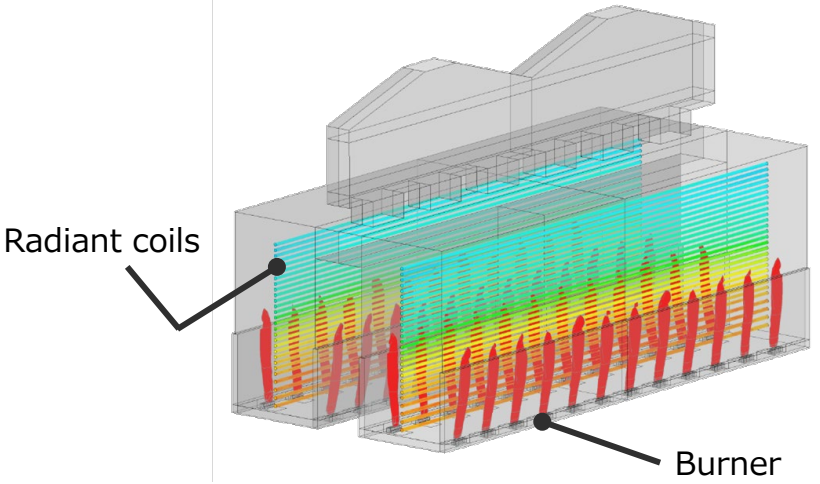
Do you have any of these issues?

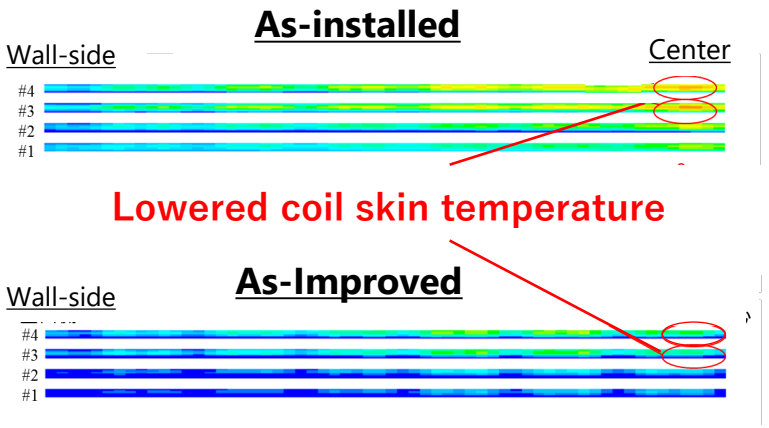
- ☹ **Poor performance and unreliable operation**
- ☹ **Reducing maintenance interval due to severe material degradation**
- ☹ **Need for engineering consulting partner for heater modification**

Fired Heater Improvement Solution

- Utilized **Computational Fluid Dynamics (CFD)** to simulate Combustion and Heat Transfer
- Assessed as-installed Heater Performance based on operation data and CFD Results
- Identified O&M Issues and their Root Causes
- Proposed and Evaluated Performance and Reliability Improvement Plan
  - Burner Layout Optimization for Replacement
  - Windbox Modification for Uniform Air Flow Distribution to each burner
- Provided the Technical Guidance for the Implementation of the proposed solutions

Examples of combustion and heat transfer analysis of Furnace (CFD)



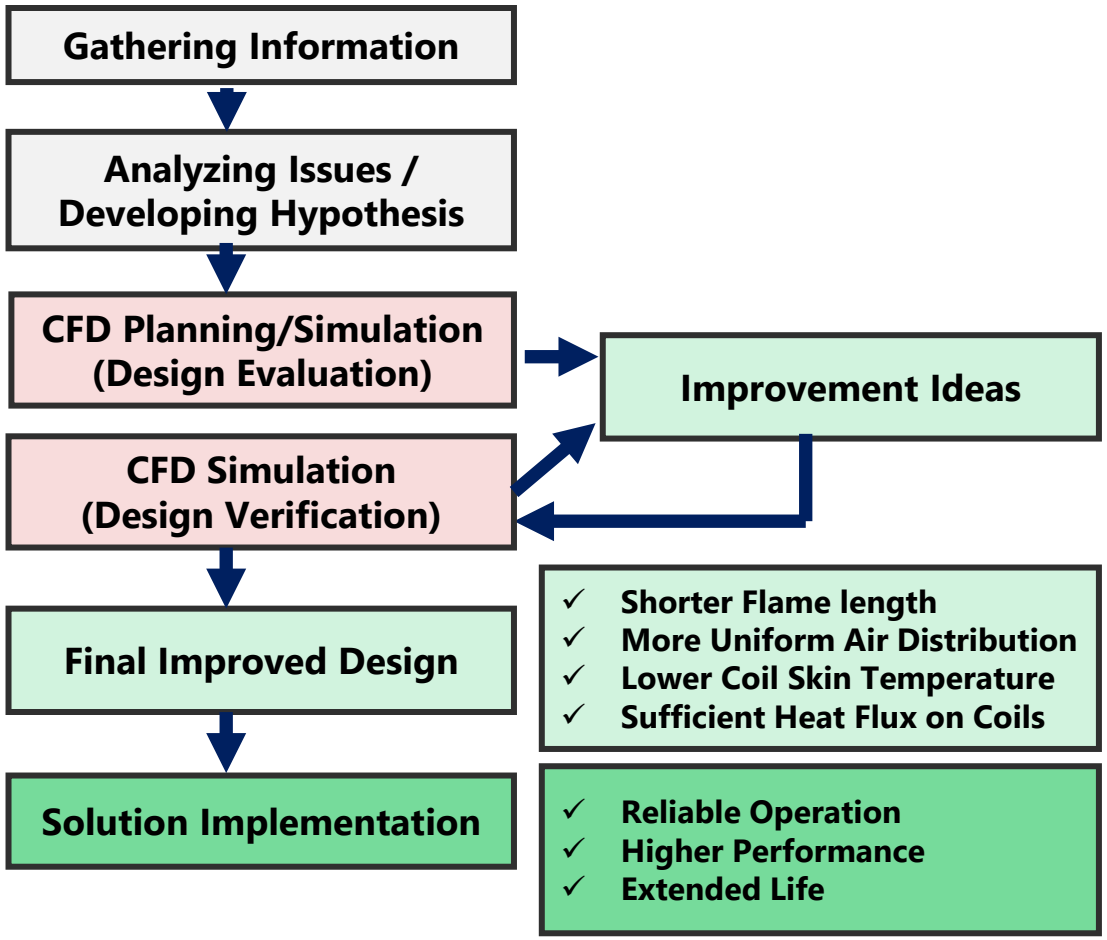


Fired Heater Improvement

PLANT PLUS

Return to Decarbonization menu

Workflow & Result



Our Strengths

- Years of experience in serving domestic customers for performance improvement of fired heaters utilizing the advanced CFD simulation
- Extensive experience in Combustion and Heat Transfer modeling and evaluating heater designs
- Collaboration with Material Engineering experts
- Customer-Focused Global Engineering Service Provider

Our Experiences

50+

Plants

Fired heater design evaluation and improvement studies with the advance CFD simulations

15+

Years

Simulation-based engineering service for plant diagnosis and lifetime improvement

Operational Excellence Services

Health・Safety・Environment (HSE)

HSE Risk Management

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

HSE Risk Management

Do you have any of these issues?

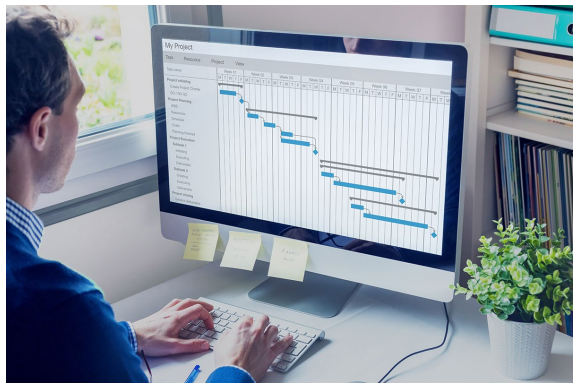
- ☹ **Formalizing facility safety**
- ☹ **Process and operational safety concerns**
- ☹ **High insurance fees**

HSE Risk Management Solutions

- Justify safety using a prescribed process, which includes:
  - Formal Safety Assessment
    - Quantitative Risk Analysis (QRA)
    - Hazard Identification (HAZID)
    - Hazard and Operability Studies (HAZOP)
    - Layer of Protection Analysis (LOPA)
    - Bow-tie Analysis
  - Operational Hazard Assessment/Reduction Study
  - HSE Management System Review

Assessment \ Hazard		Potential Hazards: General	Potential Hazards: Process	Previous Hazards (Incidents/Near Misses)
Hazard Identification		HAZID	HAZOP	OHR *
Risk Assessment	Qualitative	HAZID	HAZOP	OHR *
	Semi-Quantitative	LOPA		
	Quantitative	Consequence Analysis / QRA		

* OHR : Operational Hazard Reduction Study



Combination of Desk-top Study and Workshop

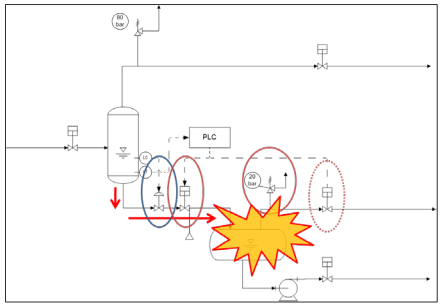
HSE Risk Management

Return to HSE menu

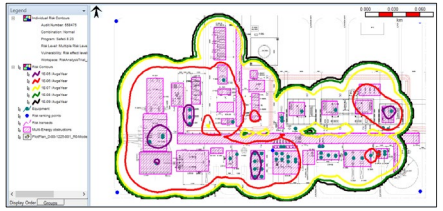
Workflow & Results

Safety Philosophy	Concept of Safety in Design
HAZID HAZOP Hazard Register	Hazard identification
Fire Risk Analysis Explosion Risk Analysis QRA	Risk Analysis
ALARP Study	ALARP Demonstration
Bow-tie Analysis	Visualization of Threat, Consequence and Barriers and Recovery Measures
SCE&PS	Define Safety Critical Element and Performance Standard

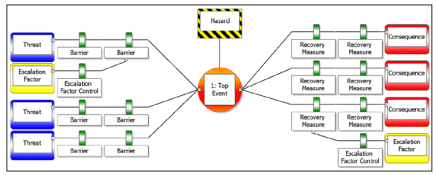
HSE Risk Management System / Safety Case



Hazard Identification in P&ID



QRA



Bow-tie Diagram

Our Strengths

- Professional Safety, Process, Control, Mechanical, Operation and Maintenance Teams
- Top global experience of EPC execution
  Plant types - Refinery, Gas Processing, LNG, Chemical
  Plant locations – Onshore, Offshore
  Clients – IOC, NOC
- Huge record of HAZID/HAZOP and Operational Hazard Reduction

Our Experiences

20+
Cases

20+ HAZOP revalidation, OHR, and HSEMS development

500+
Cases

500+ Process safety plant design

Operational Excellence Services

Health・Safety・Environment (HSE)

Active Fire Protection Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Active Fire Protection Assessment

Do you have any of these issues?

☹ **Fire and explosion incidents**

☹ **High maintenance and inspection cost**

☹ **High insurance fees**

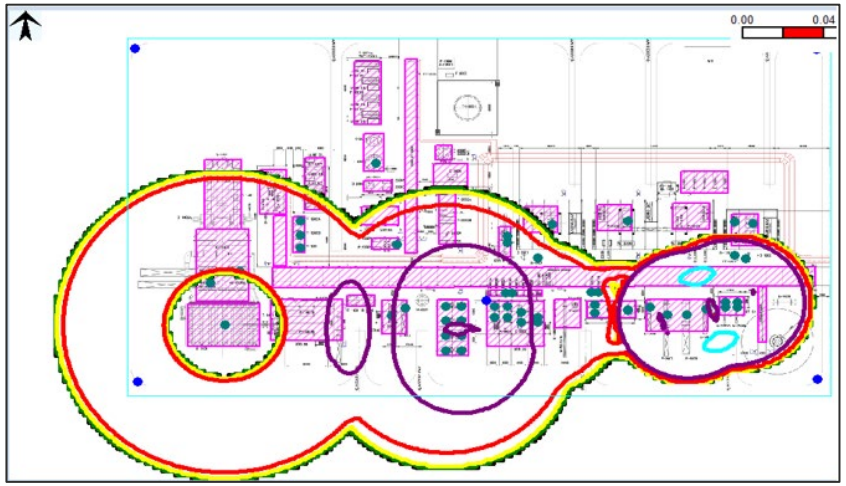
Foam Extinguisher System

Monitor Protection

Water Spray Protection

Active Fire Protection Assessment Solution

- Re-evaluation for facilities based on credible fire scenario and codes & standards
- Fire scenario simulation based on identified fire scenario
- Fire fighting system evaluation by;
  - Hydraulic calculation
  - Fire water monitor coverage assessment
  - Foam system performance evaluation
  - Etc.



Example of Jet Fire Risk Contour

Active Fire Protection Assessment

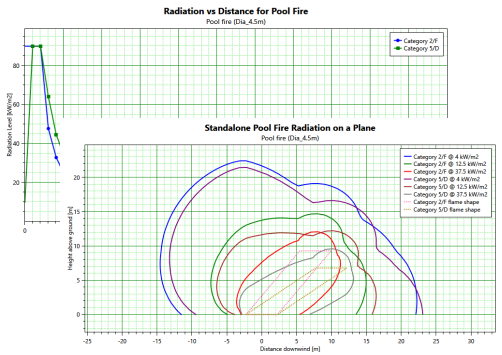
Return to HSE menu

Workflow & Result

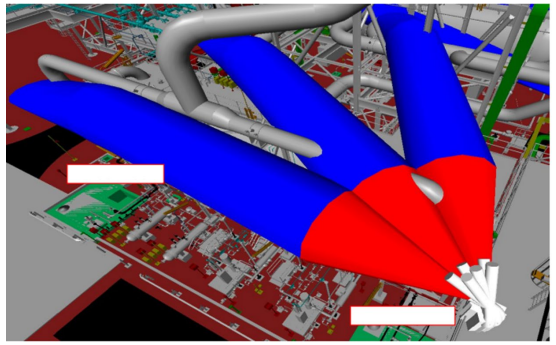
Fire Hazard Scenario Identification → Site Survey + Gap Analysis → Fire Fighting System Assessment
- Fire Water Monitor Coverage
- Hydraulic calculation

→ **Cost-Effective Improvement**

Fire Hazard Scenario + Fire Water Monitor Coverage Assessment



Fire Hazard Simulation



Visualizing Monitor Coverage in 3D model

Our Strengths

- Professional Fire Protection and Analysis Teams
- Top global experiences of active fire protection design and application from EPC execution

  Plant type - Refinery, Gas Processing, LNG, Chemical

  Plant location – Onshore, Offshore

  Client – IOCs, NOCs

  Code and Standards – NFPA, API, BS, etc.
- Strong relationships with global firefighting equipment suppliers
- Analysis software – Phast (DNV), in-house simulation

Our Experiences

20+

Study

Fire water monitor coverage assessment 20+ studies.

500+

Cases

500+ Active Fire Protection Design

Operational Excellence Services

Health・Safety・Environment (HSE)

Fireproofing Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Fireproofing Assessment

Do you have any of these issues?

☹ **Is Our Plant Really Safe from Fire Hazard?**
☹ **High Maintenance Cost for Fireproofing**
☹ **Compliance with Latest Standard?**

Evaluation of existing Fireproofing

Fireproofing Assessment Solution

- Evaluation of existing fireproofing based on identified fire hazard and latest standard.
- Identification of critical fireproofing improvement points.
- Optimization of fireproofing by fire risk assessment and structural redundancy analysis.
- Recommendations of cost-effective improvement solutions.

Deterministic method
>International Code and Standard
>Local regulation
>Fireproofing Application

Conventional Method

Fire Risk Analysis **X** **Redundancy Analysis** **=** **Cost-Effective Improvement**

Latest Method

Fireproofing Assessment

Return to HSE menu

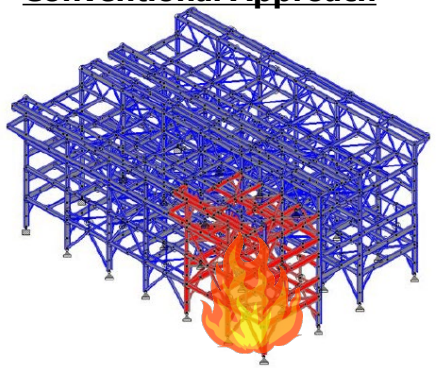
Workflow & Result

Fire Hazard Scenario Identification → Site Survey & Gap Analysis → Structural Redundancy Analysis → Cost-Effective Improvement

Structural Redundancy Analysis

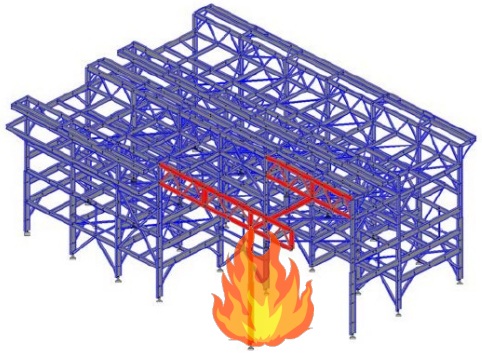
➢ **JGC original method to optimize fireproofing based on API RP 2FB**

Conventional Approach



Fireproofing on Red Structure
(All load bearing structure)

New Approach



Fireproofing on Red Structure Only
(Only critical structure for integrity)

Significant Reduction of Fireproofing / Justify the Available Fireproofing

Our Strengths

- Professional Fire Protection, Structure, Material and Analysis Teams
- Top global experiences of fireproofing design and application from EPC execution
  Plant type - Refinery, Gas Processing, LNG, Chemical
  Plant location – Onshore, Offshore
  Client – IOCs, NOCs
  Code and Standards – NFPA, API, BS, etc.
- Strong relationships with global fireproofing material suppliers
- Analysis software – Phast, FLACS, STAAD.Pro, Abagus, etc.

Our Experiences

3+
Plants

Fireproofing assessment service for 3+ plants.

500+
Cases

500+ Fireproofing Design

Operational Excellence Services

Health・Safety・Environment (HSE)

Fire and Gas Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Fire and Gas Assessment

Do you have any of these issues?

☹ **Insufficient Fire and Gas detector coverage**
☹ **High Maintenance Cost of fire and gas detector**
☹ **High Insurance Fee**

Gas Detector

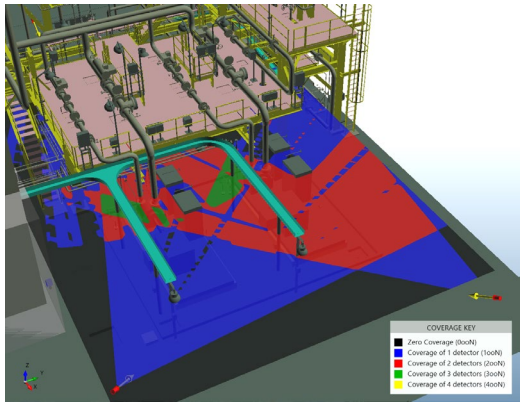
Plant are covered by Fire and Gas Detectors

Flame Detector

Fire and Gas Assessment Solution

- Evaluation of facility and gap analysis
- Identification of credible fire and gas leak hazard
- Conduct fire and gas mapping study to ensure the effectiveness
- Safety improvement by appropriate fire and gas detector placement

Evaluation of facility



Fire and Gas Mapping Study Technology

Fire and Gas Assessment

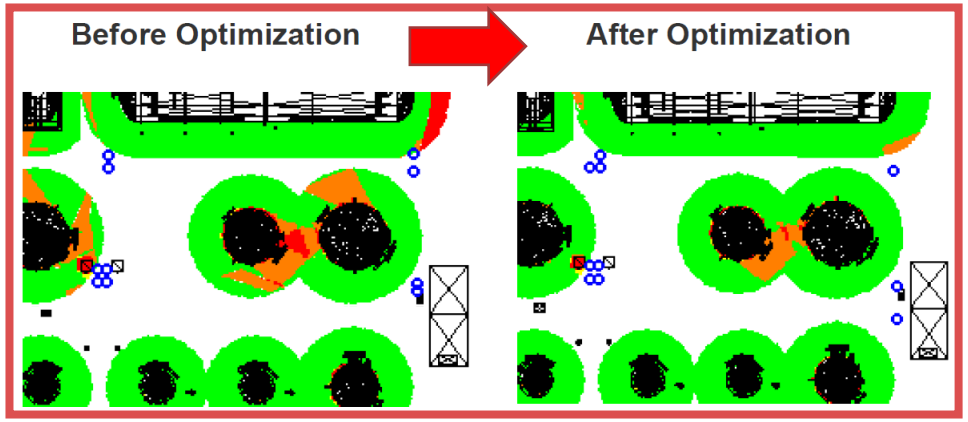
Return to HSE menu

Workflow & Result

Fire and Gas Leak Hazard Scenario Identification → Site Survey + Gap Analysis → Fire and Gas Mapping Study → **Cost-Effective Improvement**

Mapping study

One of the method to analyze the effectiveness of fire and gas detector, and optimize detector location



Same quantity of gas detectors --> Better coverage (wider green area)

Our Strengths

- Professional Safety, Instrument, Process and Analysis Team.
- Top global experiences of fire and gas system design and application from EPC execution
  Plant type - Refinery, Gas Processing, LNG, Chemical
  Plant location – Onshore, Offshore
  Client – IOCs, NOCs
  Code and Standards – NFPA, API, BS, etc.
- Relationship with global fire and gas detector suppliers
- Analysis software – Detect 3D(Insight numerics), Phast (DNV),

Our Experiences

20+

Mapping Study

Fire and Gas Mapping Study Experience 20+ Study

500+

Cases

500+ Fire and Gas Design

Operational Excellence Services

Health・Safety・Environment (HSE)

Escape Simulation and Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Escape Simulation and Assessment

Do you have any of these issues?

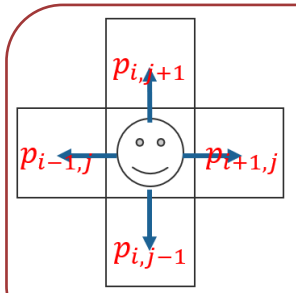
☹ **Insufficient escape and evacuation plans**

☹ **Maintenance plan without safety consideration**

☹ **Many modification in the facility**

Escape Simulation and Assessment Solutions

- Evaluation of current escape route by specialized escape route simulation program.
- Identification of critical point (bottle neck) in escape route plan
- Provide improvement plan of escape route
- Escape simulation in accidental scenario
- Provide safe maintenance plan (location of maintenance, number of maintenance persons, barricade plan in maintenance period)

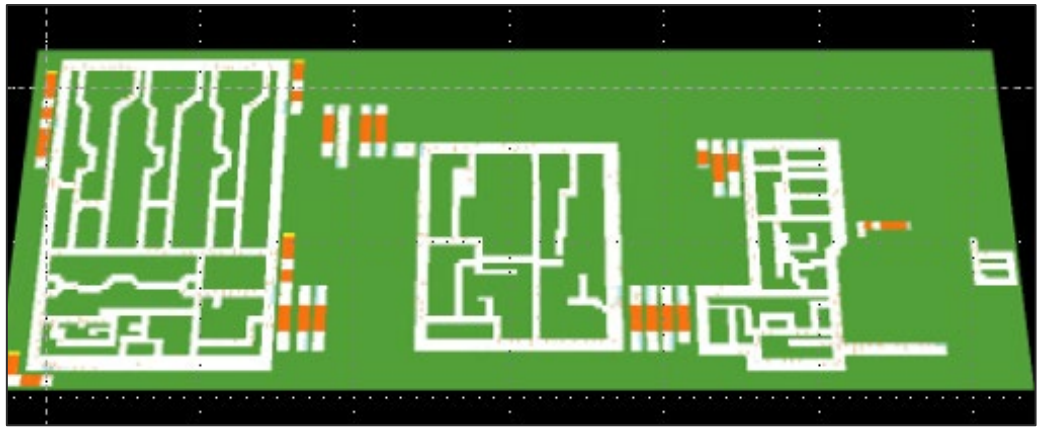


$$p_{ij} = N \exp(k_D D_{ij}) \exp(k_S S_{ij}) p_i(i,j) pw$$

S_{ij} : Static floor field
k_S : Effect of Static floor field
D_{ij} : Dynamic floor field
k_D : Effect of Dynamic floor field
$p_i\ (i,j)$: Effect of direction
p_w : Effect of walls

Human Escape Model

+Characteristics of Plant Facility



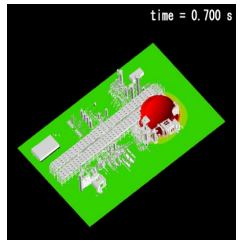
Specialized Plant Escape Route Simulation Program (developed with the University of Tokyo)

Escape Simulation and Assessment

Return to HSE menu

Workflow & Result

Plant Layout → Accident Scenario Definition → Escape Simulation → **1) Improvement Plan 2) Maintenance Plan**



OUTPUTS

1) **Improvement Plan**
   - ✓ Modification plan of escape route to enhance safety for operators in normal situation and accidental situation
2) **Maintenance Plan considering safe operator escape**
   - ✓ Maintenance activities in same location
   - ✓ Number of maintenance person
   - ✓ Barricade plan

Our Strengths

- Professional Safety, Operation and Maintenance Teams
- Top global experiences of escape route design and evacuation planning from EPC execution
  Plant type - Refinery, Gas Processing, LNG, Chemical
  Plant location – Onshore, Offshore
  Client – IOCs, NOCs
- Specialized escape simulation program developed with the University of Tokyo. Research Article is available in "Chemical Engineering Transactions (CET) Journal Vol 90(2022)"

Our Experiences

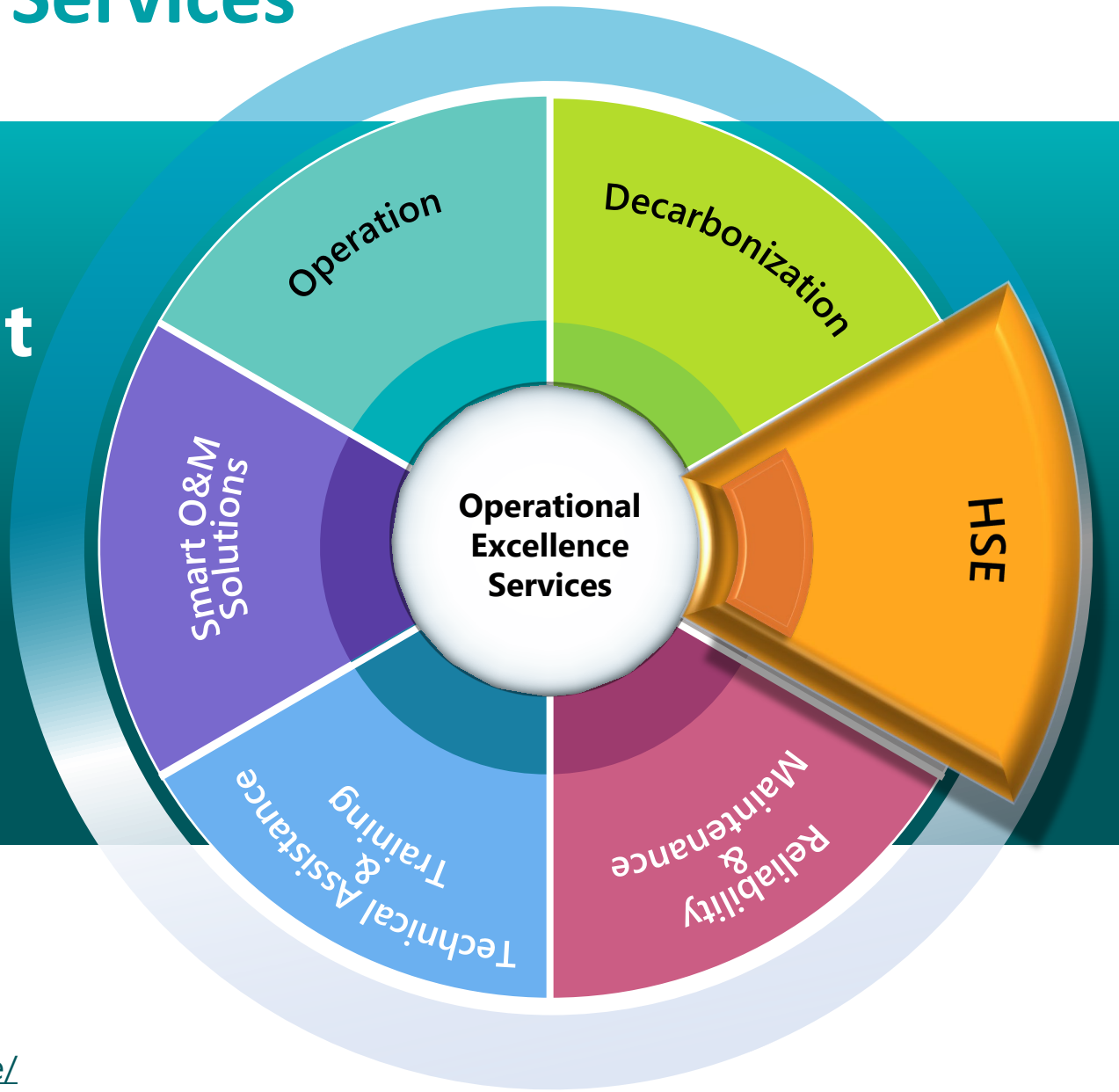
Plant and Escape Route Design Cases

500+ Cases

Operational Excellence Services

Health・Safety・Environment (HSE)

Hazardous Area Classification (HAC) Optimization



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Hazardous Area Classification (HAC) Optimization

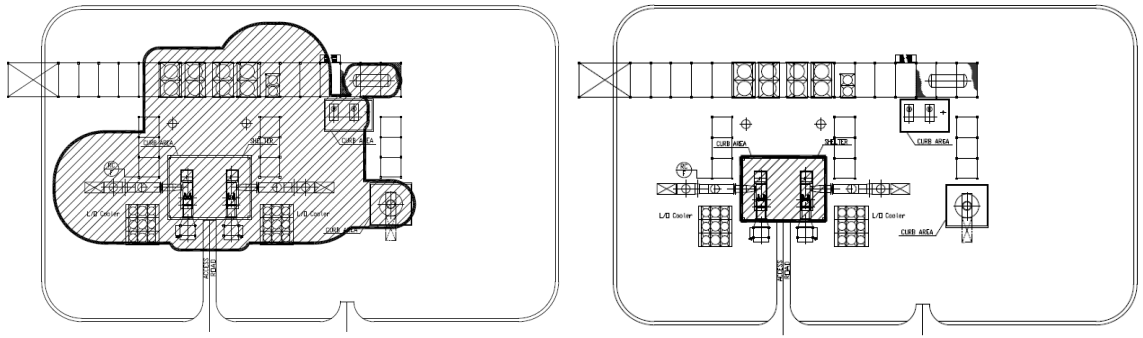
Do you have any of these issues?

☹ **Cannot use unclassified electrical devises at site**
☹ **Many manual works for inspections and recording**
☹ **Increase cost for inspections and recording**

Unclassified electrical devices can not be used in hazardous area

HAC Optimization Solution

- Optimize the hazardous area for unclassified electrical device with International Standards (IEC 60079-10)
- Based on the detail analysis, the classified area can be reduced/optimized
- Propose a plan to use unclassified electrical devices to minimize the accident risk



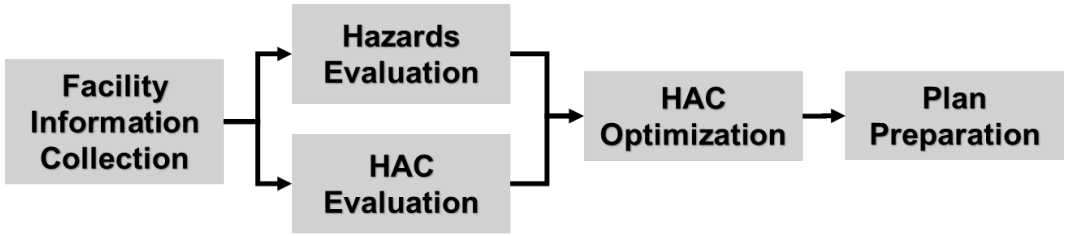
HAC for permanent items **HAC for portable items**

Hazardous Area Optimization for temporary use of unclassified electrical devices

Hazardous Area Classification (HAC) Optimization

Return to HSE menu

Workflow & Result



- Collection of facilities information
- Evaluation of existing hazardous area classification
- Evaluation of potential hazards' magnitude
- Optimization hazardous area classification considering not only hazardous area classification requirements but also potential impact in case of ignition
- Preparation of plan for use of unclassified electrical devices

Our Strengths

- Professional safety and electrical engineers for not only hazardous area classification but also risk assessment
- Top global experience of hazardous area classification design
  Plant type - Refinery, Gas Processing, LNG, Chemical
  Plant location – Onshore, Offshore
  Clients – IOCs, NOCs
- Wide knowledge for international standard such as, IEC, IP, EI, API, NFPA, JIS, etc.

Our Experiences

Hazardous Area Classification Design Experiences

500+ Cases

Operational Excellence Services

Health・Safety・Environment (HSE)

Noise Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Noise Assessment

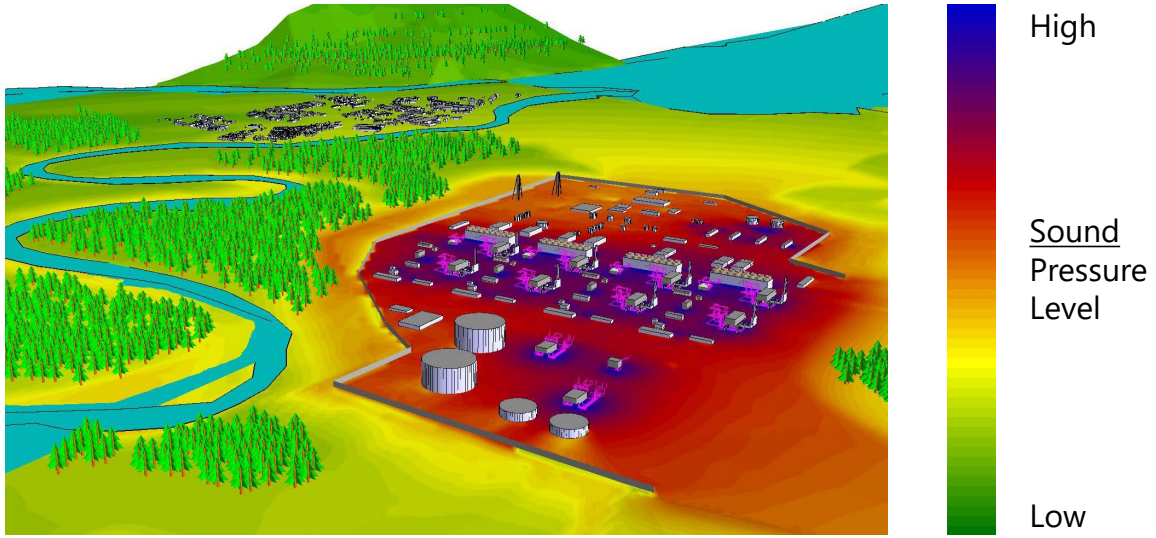
Do you have any of these issue?

- ☹ **Noisy work environment**
- ☹ **High cost noise mitigation for noise emitters**
- ☹ **Need for consulting partner for noise assessment**

Noise Assessment Solution

- Through noise survey;
  - ➢ Identify noise sources
  - ➢ produce noise contour maps before and after noise mitigation plans
- Propose most effective and cost-minimum noise mitigation plans based on result of noise simulation
- Verify the effectiveness of noise mitigation plans

Noise contour map



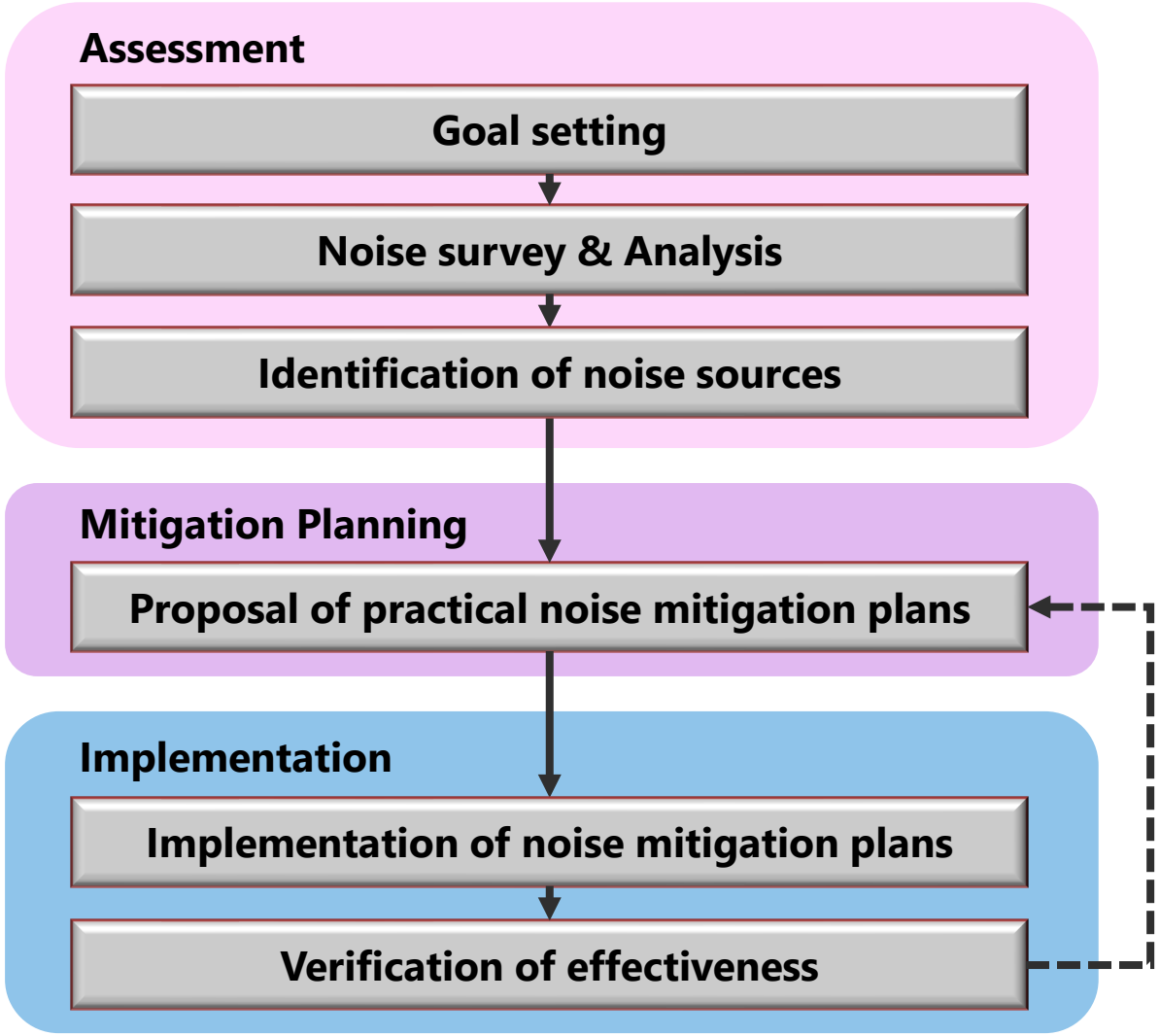
Example of noise mitigation plan (Acoustic insulation)

Before

After

Noise Assessment

Workflow & Result



Our Strengths

- Experienced with noise assessment/control technologies for domestic and overseas customers for many years, and solved various noise problems
- Provided services for noise survey, evaluation, planning of countermeasures, and confirmation of effectiveness after implementation of countermeasures

Our Experiences

600+
Cases

Noise assessment/control technology for 600+ cases.

50+
Years

We have been accumulating noise assessment/control technologies for more than 50 years through EPC businesses and consulting services.

Noise Assessment

PLANT PLUS

Return to HSE menu

Regulatory Inspections

We provide prompt and accurate measurements and analysis of site boundaries and neighborhood measurements for regulatory inspections, as well as equipment, piping, and indoor measurements within the plant site.

- **All Inclusive (Noise maps & Proposal)**

  Measurement results are shown as noise maps, and proposal of variety of noise mitigation measures are included.

- **Latest Measurement Technology**

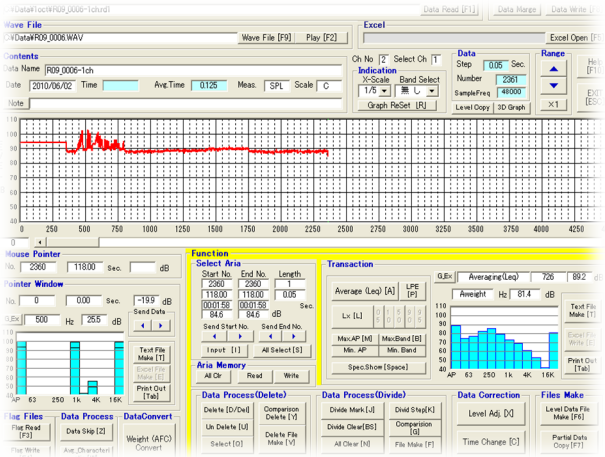
  In addition to the conventional noise level measurement using a sound level meter, we offer the best measurement method such as measurement system using a tablet, cell phone or unmanned noise monitoring measurement with the latest technology. We will propose the most suitable measurement method for each client.

Noise Measurement and analysis

Conventional measurement

Noise monitoring

Tablet measurement system



Noise analysis

JGC Operational Excellence Services

Health・Safety・Environment (HSE)

CoreSafety®

Application for Risk-Based Process Safety

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Access to CoreSafety

https://sales.coresafety.biz/en/

CoreSafety®-Risk-Based Process Safety Application

Do you have any of these issues?

- **Only limited persons know where PHA(*) data such as HAZID, HAZOP, LOPA(**) is stored**
- **PHA data is not actively used for optimization of asset management program**
- **Risk profile of facilities is not shared in organization**

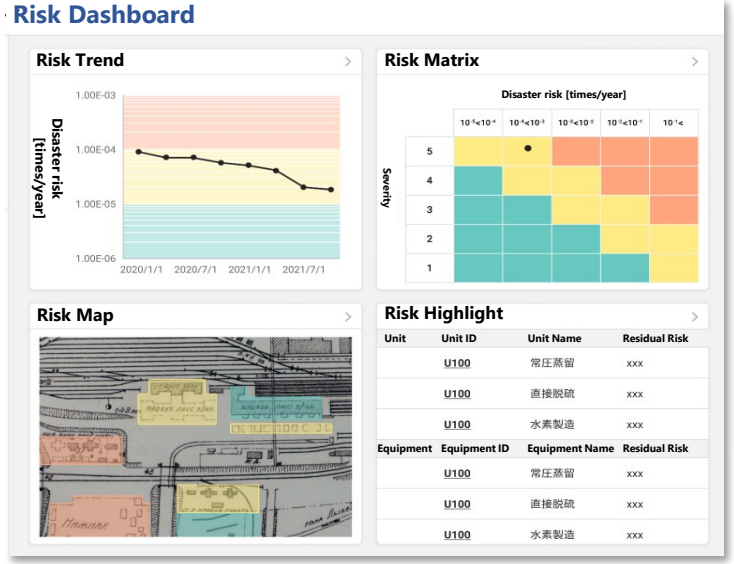
(*)PHA : Process Hazard Analysis

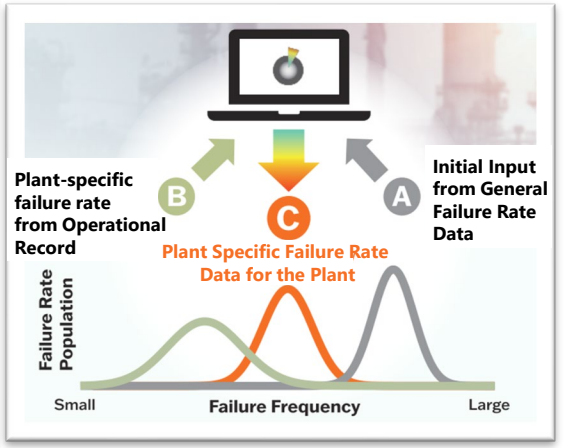
(**) HAZID : Hazard Identification Study
HAZOP : Hazard and Operability Studies
LOPA : Layer of Protection Analysis

Functional Features

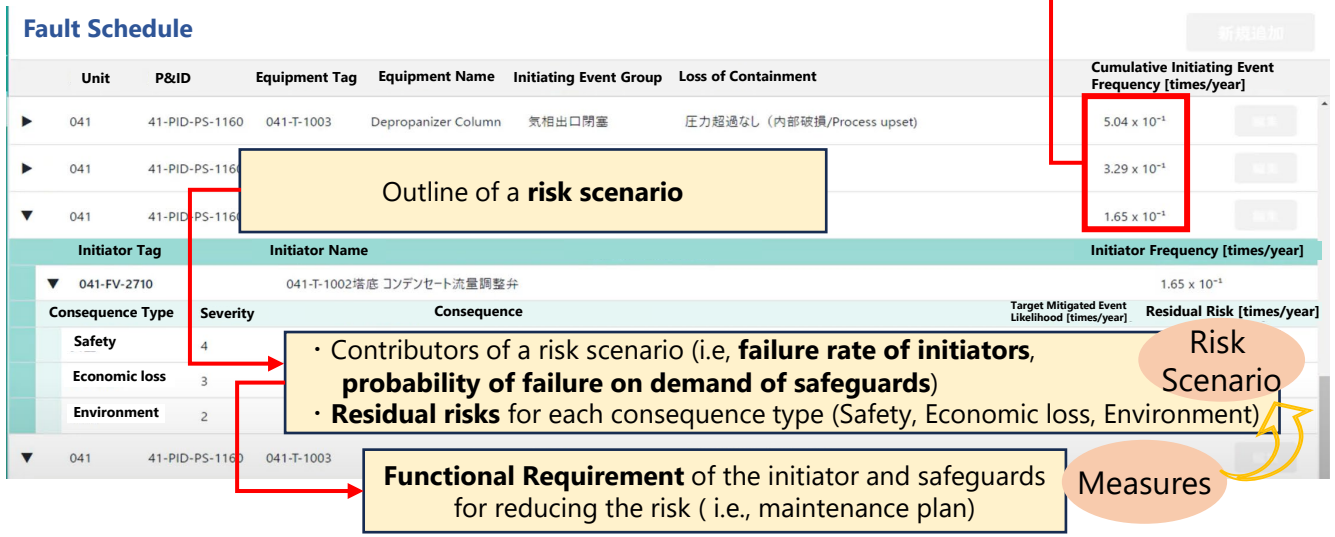
CoreSafety®, one of JGC in-house application, can summarize and register PHA results to visualize Risk Profile, and easily accessed through a web browser

- **Risk Dashboard**
- **Up-to-date risk by Bayesian Update(***)**
- **Fault Schedule (i.e., hazard register)**
- **Functional Requirements' management tied with risk scenario**
- **Safety Performance KPI monitoring**





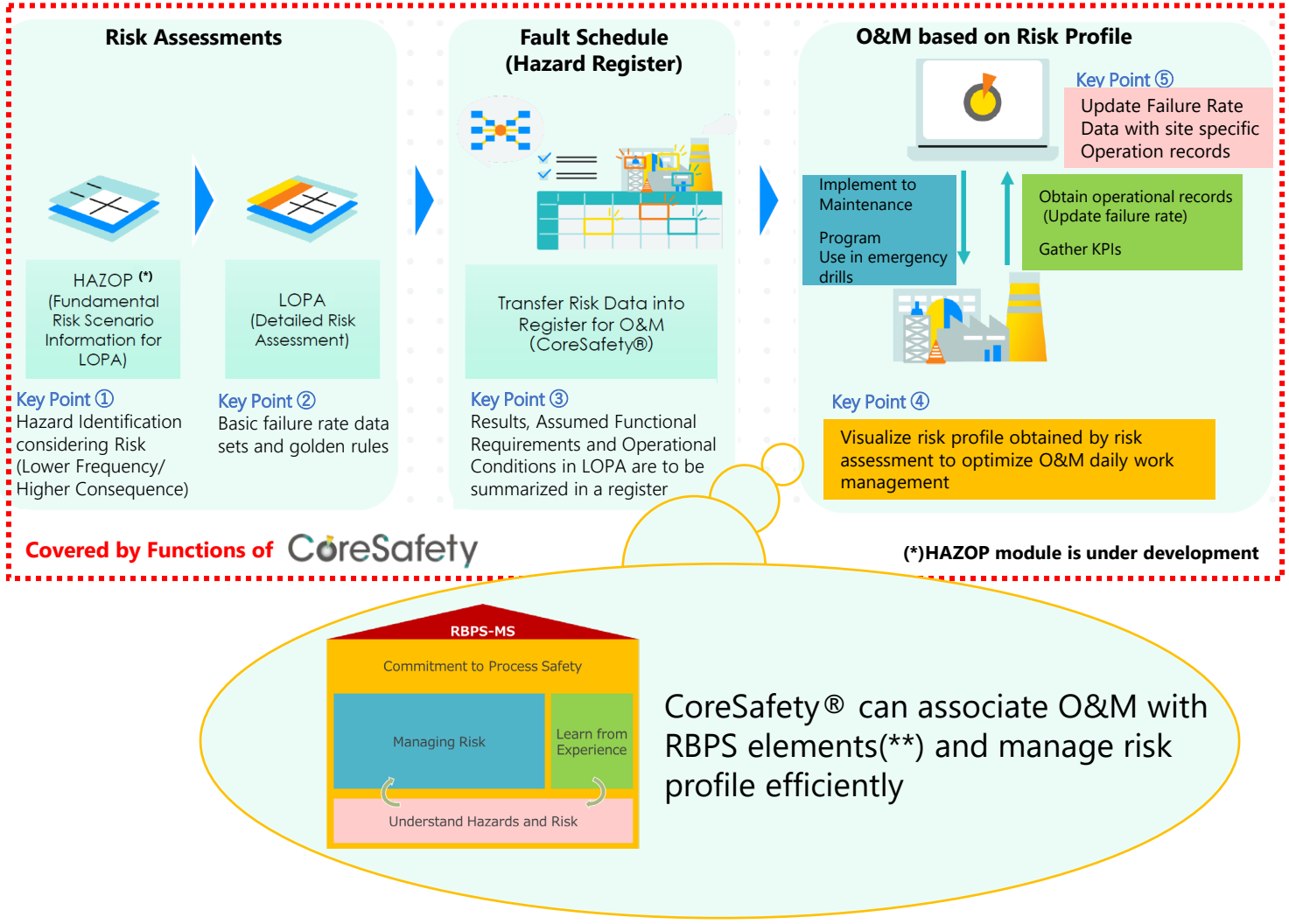
Bayesian Update



(***) A statistical method that updates the probability for a hypothesis as more evidence or information becomes available.

CoreSafety®-Risk-Based Process Safety Application

Implementation of Smart RBPS (Risk Based Process Safety)



(**)RBPS Elements are suggested by AIChE CCPS (American Institute of Chemical Engineers Center for Chemical Process Safety)

Advantages of CoreSafety®

- **Assured by Collaborative Research Projects:**
  Smart RBPS methodology taken in CoreSafety is assured by a collaborative research project involving academia, regulatory bodies, and industry in Japan.
- **Risk Profile Library:**
  1. **Based on our experience**
     Be built on extensive Process Safety Management (PSM) and Process Hazard Analysis (PHA) experience in global Oil & Gas, Chemical, and Nuclear industry projects.
  2. **Standardized Profiles**
     Provides standardized risk profiles for various equipment types (e.g., pumps, fractionation columns, drums).
  3. **Efficient Assessment**
     Enables efficient risk assessments without needing detailed design information.

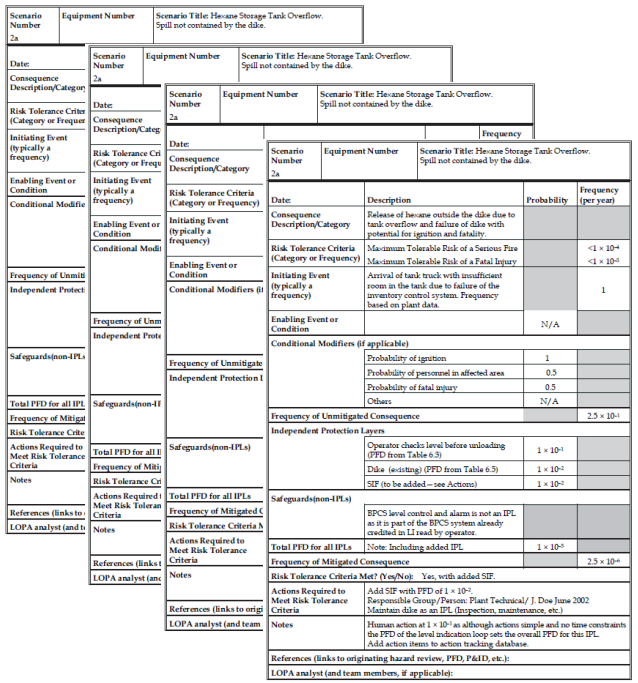
e.g.) Two Phase Separator
Standardized **P&ID** and **Risk Scenario** are available for risk assessments

CoreSafety®-Risk-Based Process Safety Application

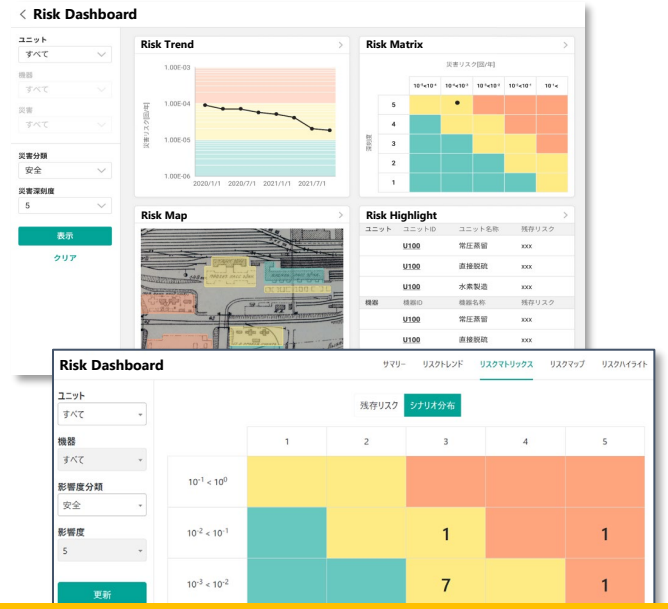
Return to HSE menu

User Benefits

BEFORE PHA by Excel/Paper



Implementation CoreSafety



- Visualizes Risk and Optimizes O&M Tasks
- Brings “Risk Data” to the center of RBPS Management System.

AFTER RBPS’s cycle is improving

Actual Benefits of adopting CoreSafety®

Achievement of ALARP(*) Decision for Higher Risk Items

(*)ALARP : As Low As Reasonably Practicable

Improved Response and Procedure for Safety Critical Alarms by efficient training utilizing CoreSafety®

High Integrity and Reliability of Equipment and Safety Systems

Enhanced Risk Management at MOC and PTW (**)

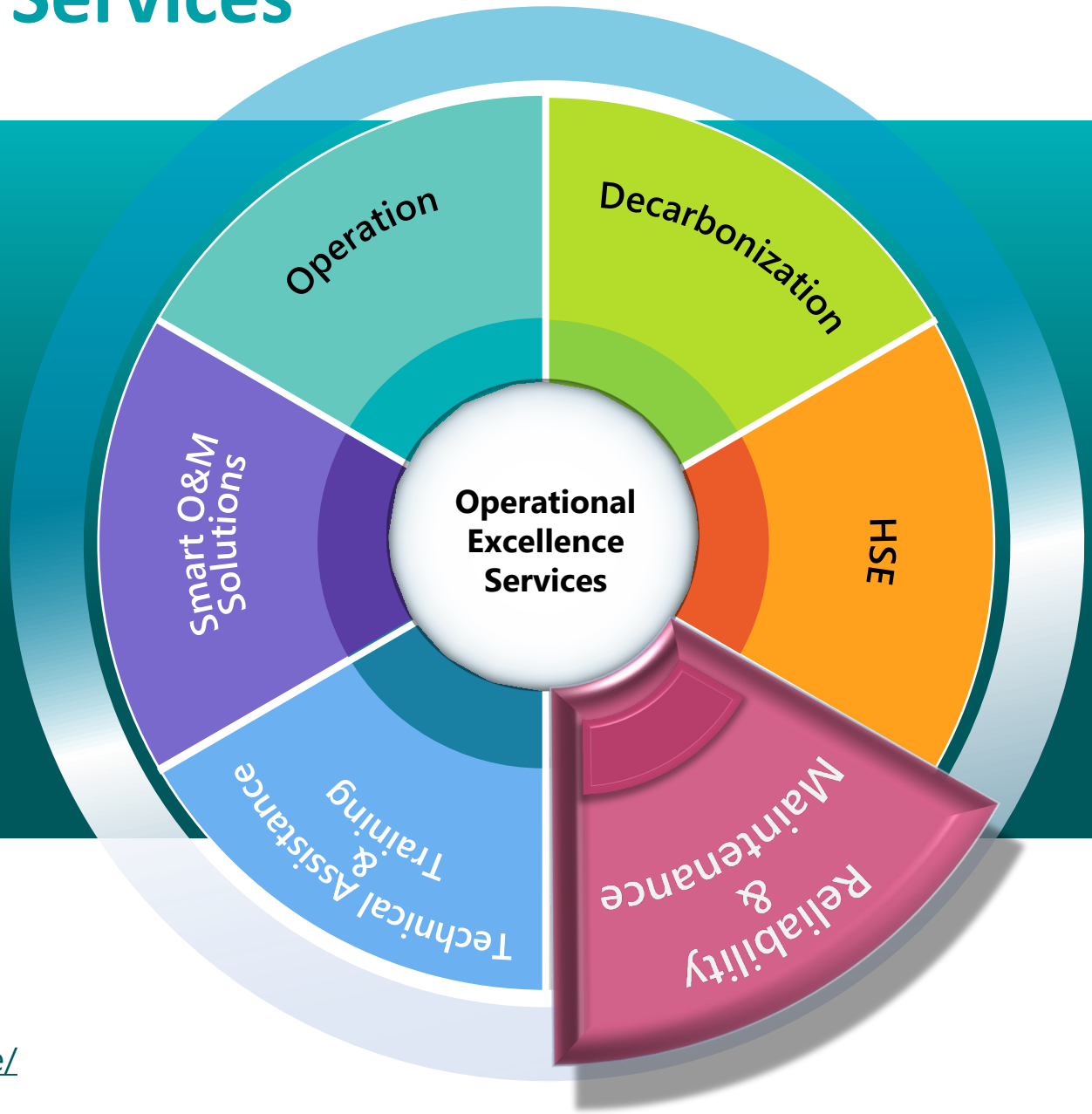
(**)MOC : Management Of Change, PTW : Permit To Work

Sophisticated Emergency Planning for Designated Process Incidents

Operational Excellence Services

Reliability & Maintenance

Risk-Based Inspection (RBI)



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

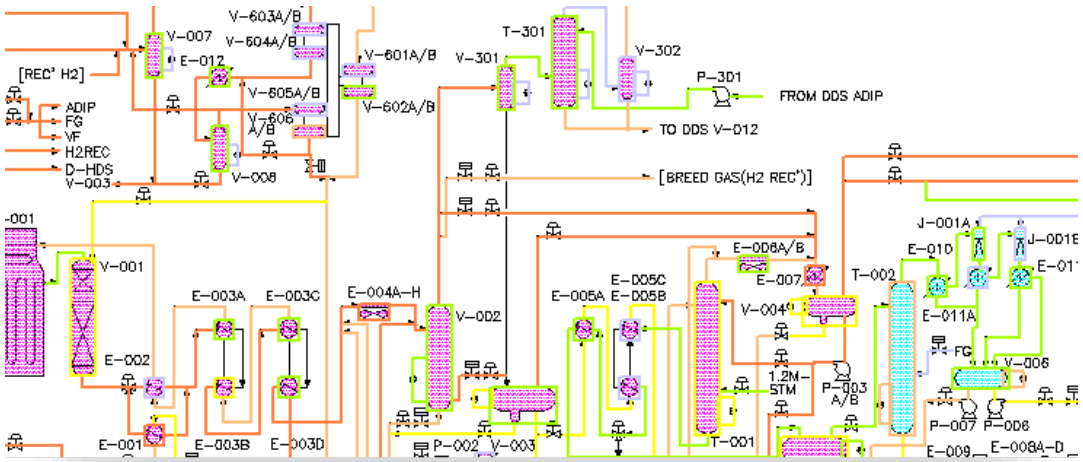
Risk-Based Inspection(RBI)

Do you have any of these issues?

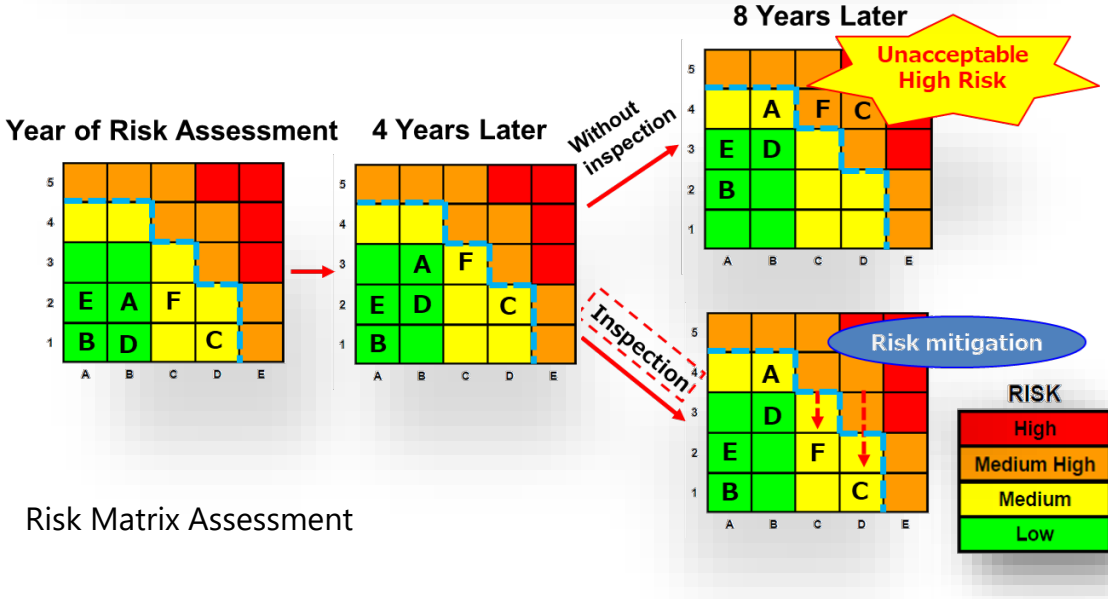
- ☹ **Many Reliability Incidents**
- ☹ **High Maintenance and Inspection Costs**
- ☹ **High Insurance Fees**

RBI Solution

- Determine Risk with probability and consequence of failure
- Prioritize and effective inspection based on risk assessment to static equipment, piping
- Improve reliability while reducing maintenance & inspection costs and insurance fees



Corrosion Loop Marking

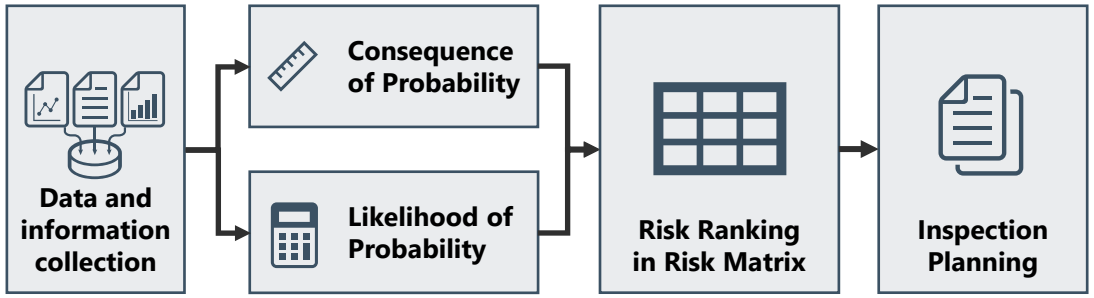


Risk Matrix Assessment

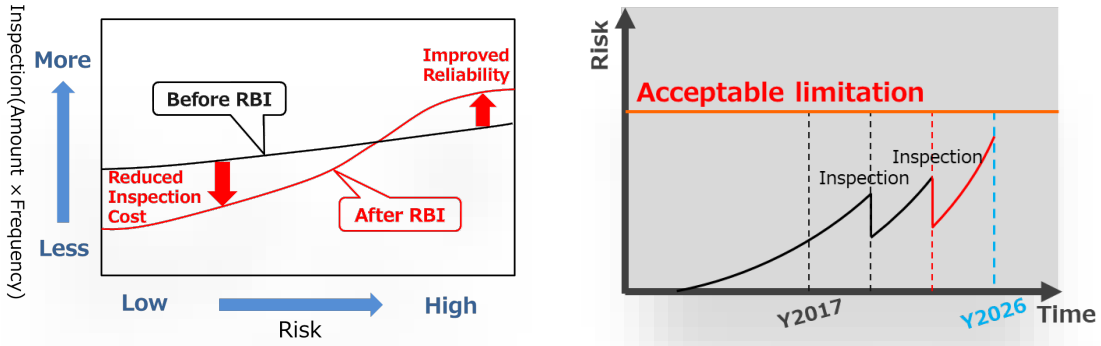
Risk-Based Inspection(RBI)

Return to Reliability & Maintenance menu

Workflow & Result



- Evaluation of the Potential Risks
- Development of Inspection Task Plan
- Development of Computerized Maintenance and Inspection System
- Development of Integrity Operating Window



Reduced inspections and cost cuts with RBI

Our Strengths

- Professional Process and Material Engineer Teams
- Global experiences and performances on risk assessment, inspection planning, on-site Inspection.
- Integrating JGC's many years of inspection and plant design experience to achieve lower inspection costs and longer plant life
- Collaboration between overseas EPC-capable group companies and local maintenance companies.

Our Experiences

Worldwide Achievement

RBI Experience in Far East, Middle East, Southeast Asia, Africa, North America

15+ Projects

Refinery, GTL, Gas Processing, Gas Oil Separation, FLNG, LNG, LNG Terminal

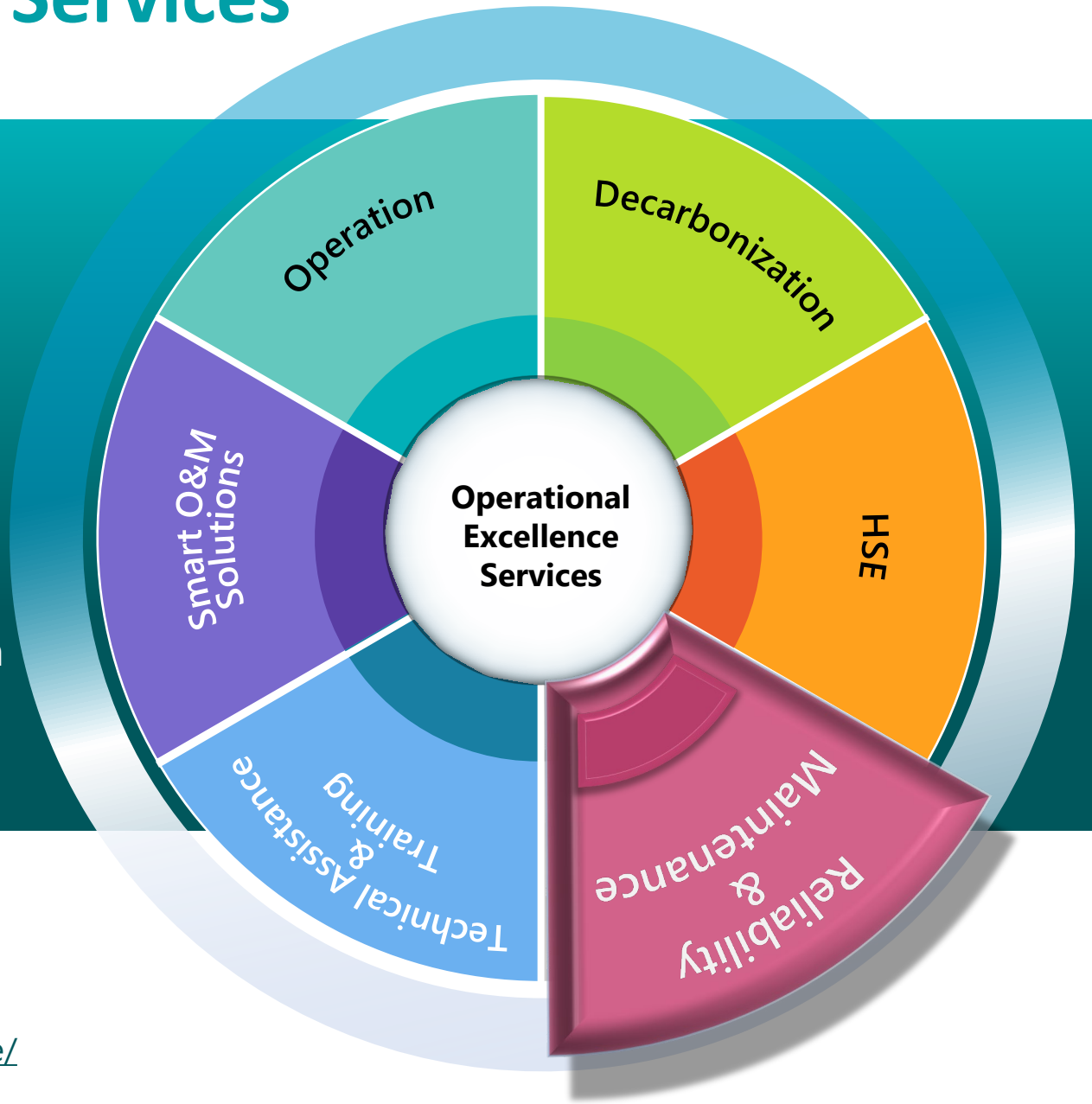
Operational Excellence Services

Reliability & Maintenance

Asset Integrity Management

Introduction of

"Advanced Maintenance Inspection Support System (A-MIS)"



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

A-MIS (Asset Integrity Management)

A-MIS Share

90%

Selected in Japan

12

Countries

128

Plants

A-MIS features and Benefits

Management of Engineering Data for Equipment & Piping

Better asset data management !

Thickness Inspection & Non-Destructive Inspection Planning

Effective work planning !

Visual/Non-Destructive Inspection Recordings

Easy inspection data management and generates report !

Historical Thickness Inspection Data Management

Automatic corrosion rate calculation & remaining life assessment !
Trending graph and effective visualization !

Web Version

Web based and connectable with CMMS (SAP, etc.) !
Site Work Assistance by mobile tool !
Quality data source for further improvement(RBI, etc.) !

A-MIS (Asset Integrity Management)

A-MIS will solve your problem!

Do you have any of these issues?

- ☹ Many asset integrity issues (e.g., leaks)
- ☹ Missing asset information, docs, inspection records
- ☹ Unsure how to utilize inspection data
- ☹ Unsure of asset condition (e.g., remaining life)
- ☹ Leave inspection matters to contractors

Voice of A-MIS Users

- ☺ Able to reduce more than 50% MH and expenses and increased efficiency. I will highly recommend this system.
- ☺ How useful! A-MIS can visualize equipment, piping condition directly on drawing. I wanted to know A-MIS system earlier.
- ☺ A-MIS makes us find suspicious inspection point easily. Reliable data made it possible to plan next inspection more accurately. Now I can cut out excessive cost for maintenance inspection work.

A-MIS developed with our experience and users' feedback!

Implementation Steps and Our Strength

STUDY

＊Maintenance Business Analysis
＊Engineering Data Collection

✓Experts of asset integrity management, unlike an IT vendor.

DEVELOP

＊Cleansing Data
＊Develop initial data plan
＊Insp. plan & procedure

✓ Full range of Asset Integrity Management Risk Assessment, Inspection Planning, Corrosion Management, Shutdown Inspection Support, etc.

SET UP

＊A-MIS Set-up
＊Initial data input
＊Data migration

✓ Digitalized historical data stored in A-MIS for better asset management.

DELIVER

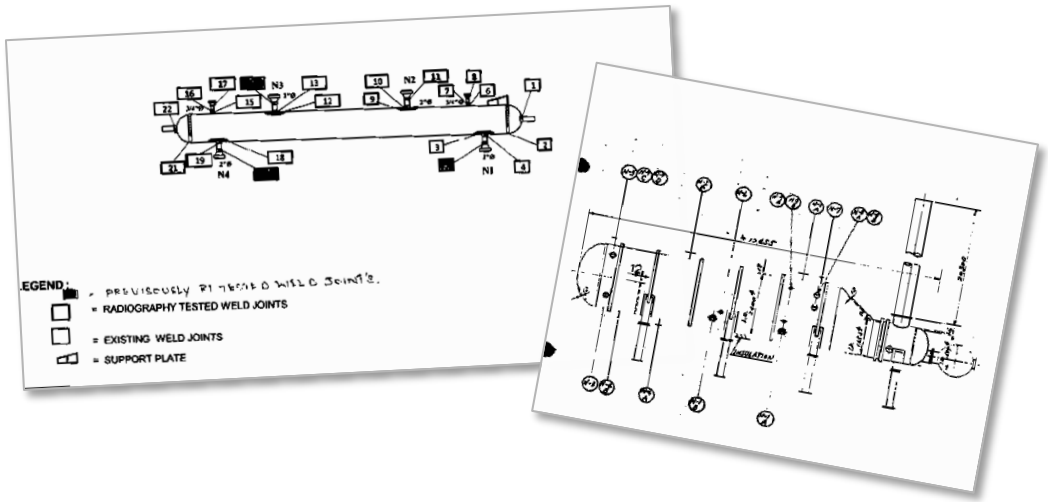
Case Study : A-MIS (Asset Integrity Management)

Return to Reliability & Maintenance menu

Effective Case

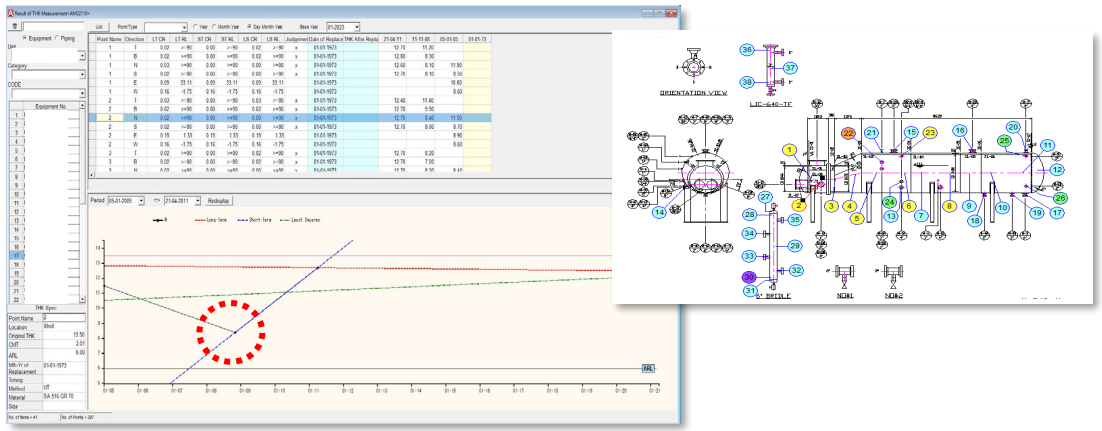
BEFORE

It took time to gather past inspection reports by years from every location which comprised the base documentation for planning maintenance and inspection work.
Handwritten reports were in different formats in different years and the inspection points were not fixed which made it difficult to determine the thickness reduction trends and their causes.
It was unavoidable to expend a lot of man-hours and expenses for planning the maintenance and inspection work.



AFTER

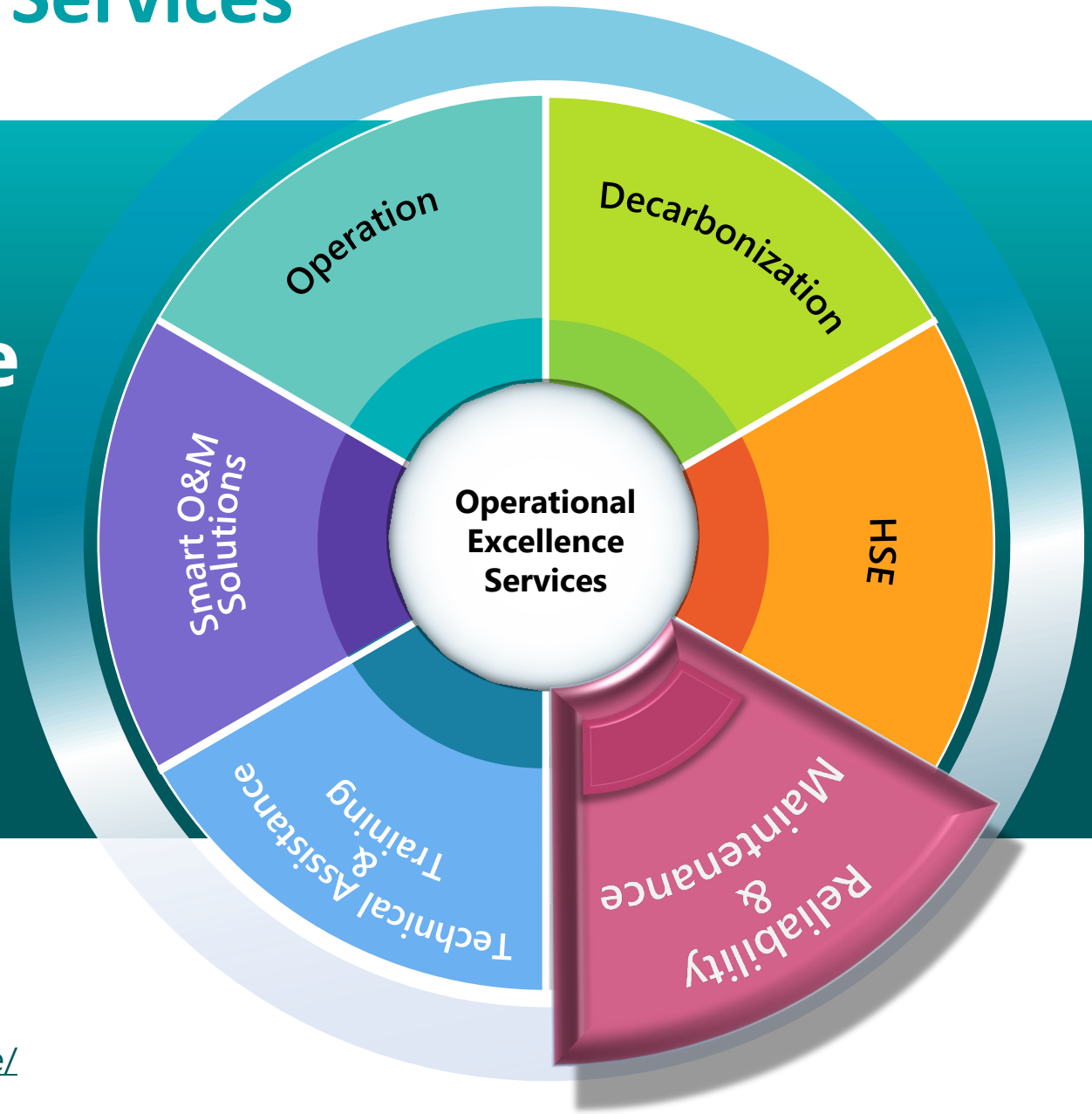
With the introduction of A-MIS, the necessary design data can be accessed instantly, and by inputting measurement results, the thickness reduction trend, corrosion rate, and remaining life could be instantly determined.
In particular, the thickness trend graphs brought up questionable results. Comparing trend graphs, measurement tables, and design data exposed that inspection points had not been fixed and led to setting the fixed annual measurement points after that. This enabled more accurate inspection results to be obtained, leading to more appropriate and efficient work planning.



Operational Excellence Services

Reliability & Maintenance

Plant Life Extension Program (PLEP)



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Plant Life Extension Program (PLEP)

Do you have any issues about plant materials ?

☹ **Plant Aging**

Approaching the lifespan, material degradation is accelerating…

☹ **Operating Condition Changing**

Conditions becoming more severe, deviating from the design range…

☹ **Competitiveness Stagnating**

O&M cost increasing, maintenance intervals shortening…

PLEP Solutions

- Identification of facility and locations having materials and inspection concerns
- Suggestion of practical and economical solutions to solve the concerns
- Projection of revamp work, inspection and maintenance work, etc., to extend plant life

Example of issue:

Furnace tube bowing

- Cause

  Bowing on the specific location

  → Main cause: coking

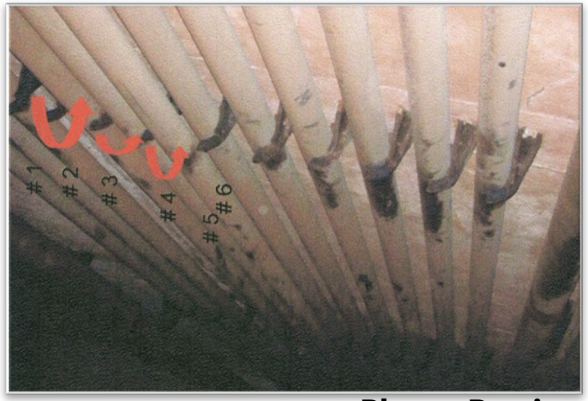
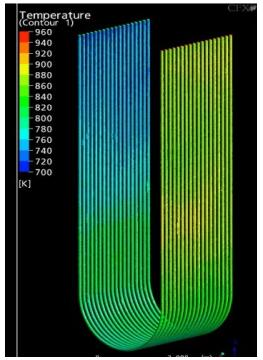


Photo: Bowing

- Countermeasures
  - Periodical IR Monitoring (Hot Spot Monitoring)
  - Periodical Pigging
  - Visual, DPT, UTTM, Creep/Pl.Tape, PMI, Hardness, etc.

- Recommendation for Life Extension
  - To measure circumference length on bowed and sound tube periodically in order to assess the creep in every shutdown.
  - CFD modeling and consultation may be an option for detailed assessment.



CFD Analysis

Plant Life Extension Program (PLEP)

PLEP for preventing troubles in advance…

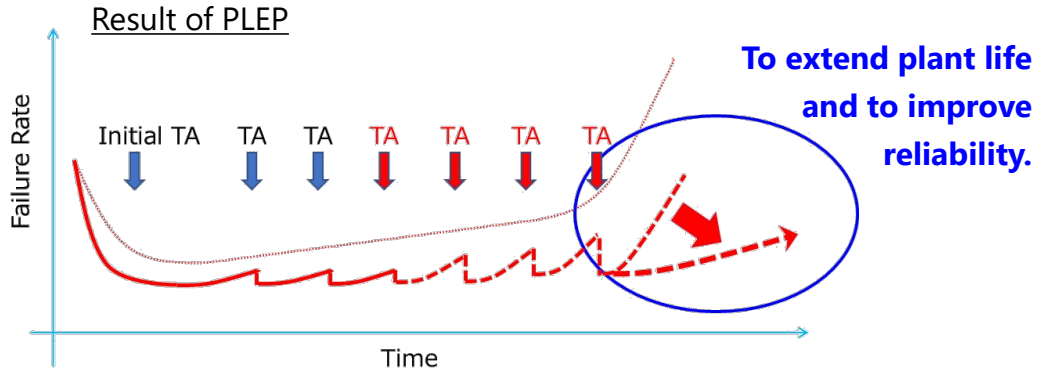
Workflow & Result

1st Step - Plant Integrity Assessment (PIA) : Finding / Screening

- ✓ Assessment of materials selection, inspection program, etc.
- ✓ Site visit and discussion with client.

2nd Step - Integrity Improvement Initiative (III) : Detail Study

3rd Step - Life Extension Project (LEP) : Project Development and Execution



Our Strengths

- ✓ **One-stop** service of engineering, construction and maintenance services to make convenient for client
- ✓ **Practical and efficient** approaches including workshops and site observations will provide best solutions
- ✓ **Easy** methods without special software will avoid client burden
- ✓ **Flexible** program will run along with client's demands to the goal.

Our Experience

- ➢ **CDU/VDU**, Asia

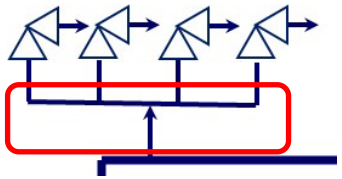
  83 findings / 22 recommendations
- ➢ **Gas Processing Unit**, Middle East

  116 findings / 34 recommendations
- ➢ **GOSP**, Middle East

  88 findings / 7 key recommendations

Plant Life Extension Program (PLEP)

Return to Reliability & Maintenance menu



✓ TML setting at RV manifold

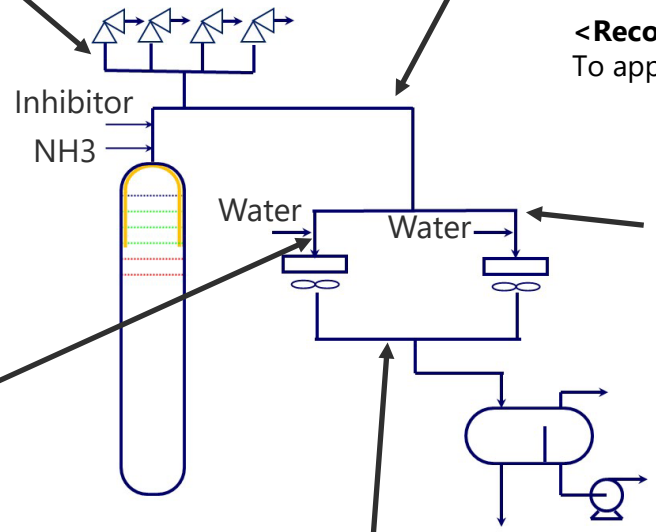
<Finding>
Severe condition is expected because of stagnant condition.

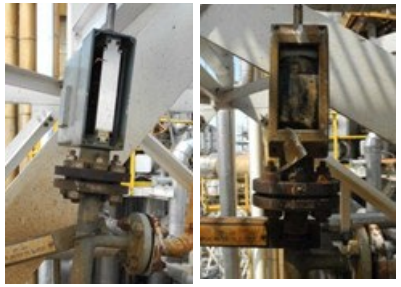
<Recommendation>
To set thickness measurement locations (TMLs) around the manifold.

✓ Hot insulation setting

<Finding>
Due to inadequate length of hot insulation, corrosive water condensed, and it induced severe corrosion.

<Recommendation>
To apply hot insulation.





✓ Flow-meter trouble

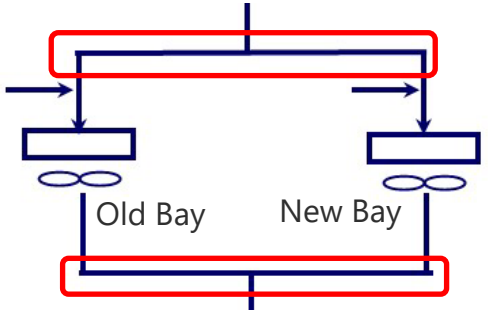
<Finding>
Flow-meter malfunctioned, and flow rate could not be measured

<Recommendation>
To fix the flow-meter and to adjust proper injection rate.

✓ Assessment of flow distribution

<Finding>
The actual corrosion rate is significantly different between old and new bays (condensers), and it suggests uneven flow distribution.

<Recommendation>
To conduct flow distribution analysis.



✓ TML setting at condenser downstream

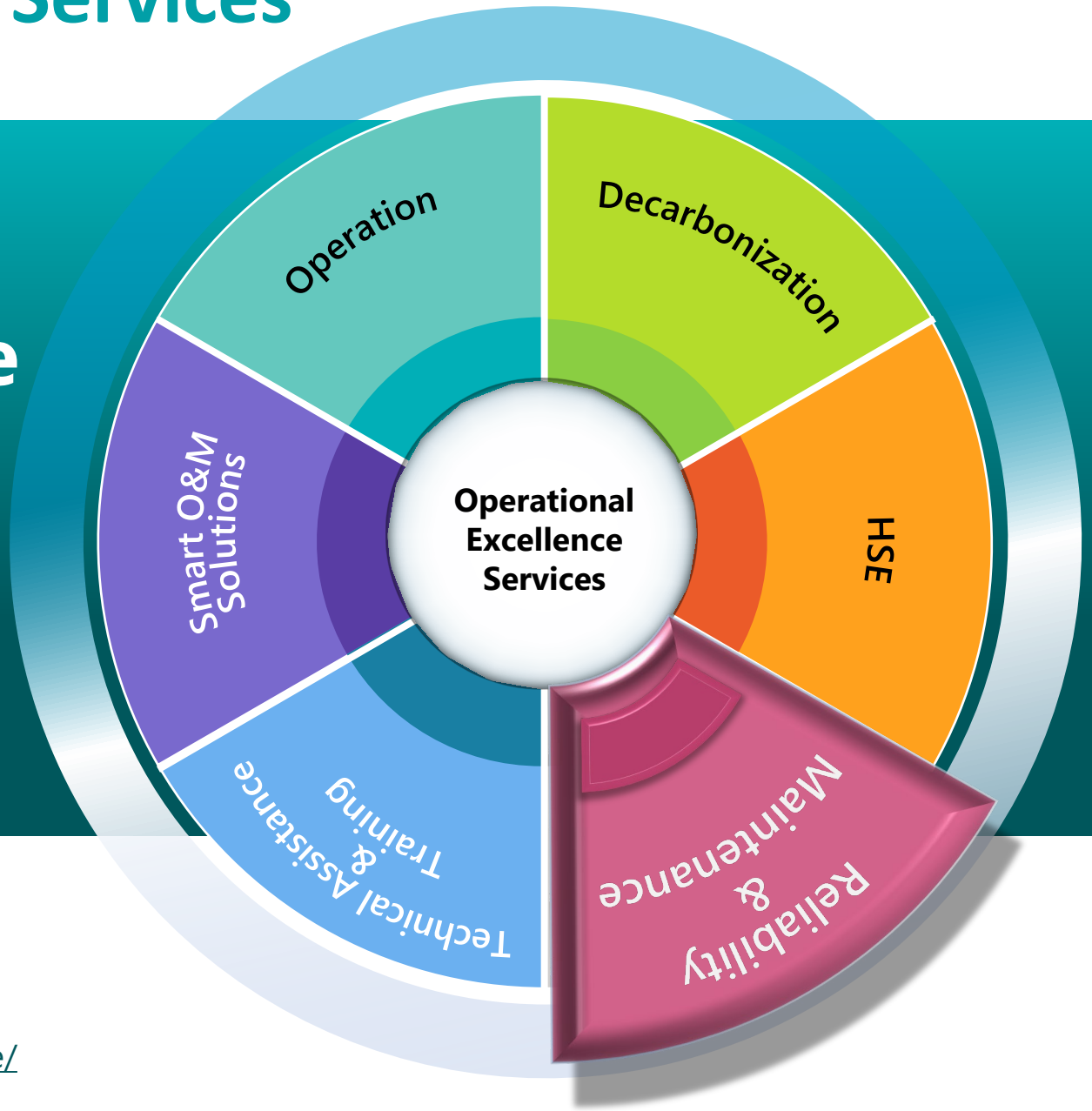
<Finding>
Corrosion monitoring device is installed, but thickness measurement location was not set.

<Recommendation>
To add thickness measurement locations to monitor actual corrosion rate. This can also check the efficiency of corrosion inhibitor and NH3 injection at upstream.

Operational Excellence Services

Reliability & Maintenance

Plant Diagnosis and Lifetime Improvement Service



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Plant Diagnosis and Lifetime Improvement Service

Do you have any of these issues?

☹ **Mechanical damage occurred!**
Can we continue operation? Should we replace?

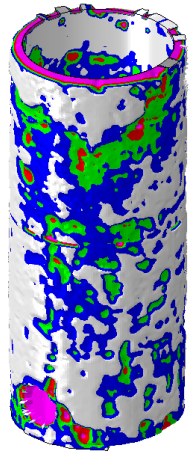
☹ **What is the root cause?**

☹ **Which improvement plan is the most efficient?**

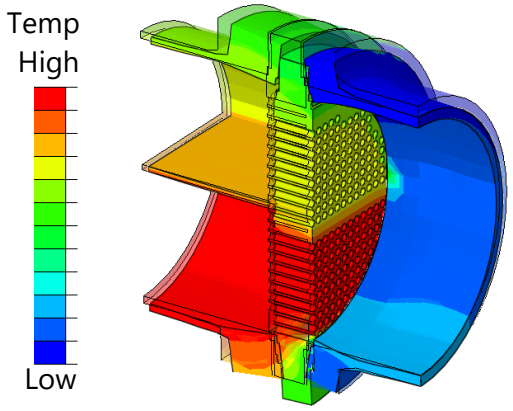
PLANT PLUS℠ Solution

- JGC's simulation-based engineering service
- Investigate the root cause of the mechanical damage
- Diagnose whether a damaged equipment can continue operation or should be reinforced, revamped partially, replaced totally
  - ➢ Leads to reduced cost of repair/revamp
- Propose effective improvement/reinforcement plan

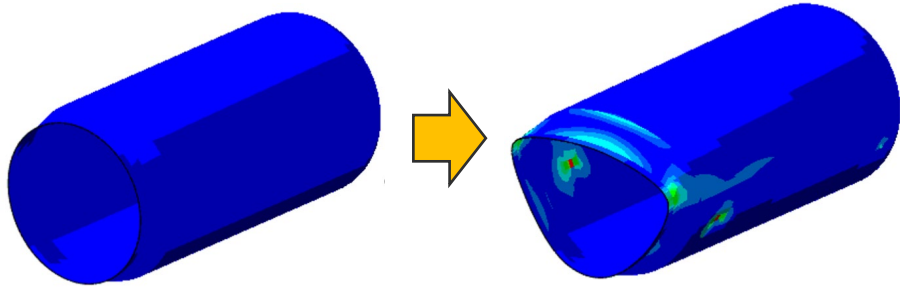
Examples of Finite Element Analysis (FEA)



(1) External Corrosion Analysis Model by Laser Scanning



(2) Flange Deformation due to Temperature Distribution



(3) Creep Deformation of Vessel during PWHT

Plant Diagnosis and Lifetime Improvement Service

PLANT PLUS

Return to Reliability & Maintenance menu

Workflow & Result

Step-1 Data and Information Collection

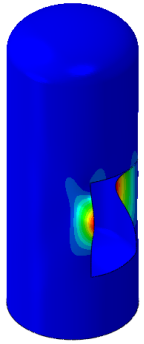
Step-2 Site Survey (if necessary)

Step-3 Scenario Planning:
- Root Cause, Damage Mechanism
- Improvement/Reinforcement Plan

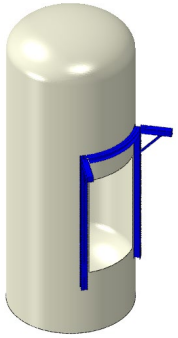
Step-4 Plan Mitigation against Risks

Step-5 Assessment Results
- High Possibility Root Cause
- Effective Solutions

Example: Large opening discovered during Turnaround



Assessed buckling risk for vessel with large hole



Proposed reinforcement plan

Our Strengths

- Diagnosing from various perspectives such as international design codes, fitness-for-service codes, post construction codes, guidelines often used in the plant industry, and JGC's own company standards
- Providing quantitative and easy-to-understand study results and countermeasures using structural analysis techniques such as finite element analysis (FEA)

Our Experiences

1000

Plant Diagnoses

Structural analysis technology, computational fluid dynamics technology and noise assessment/control technology for 1,000+ diagnoses

50+

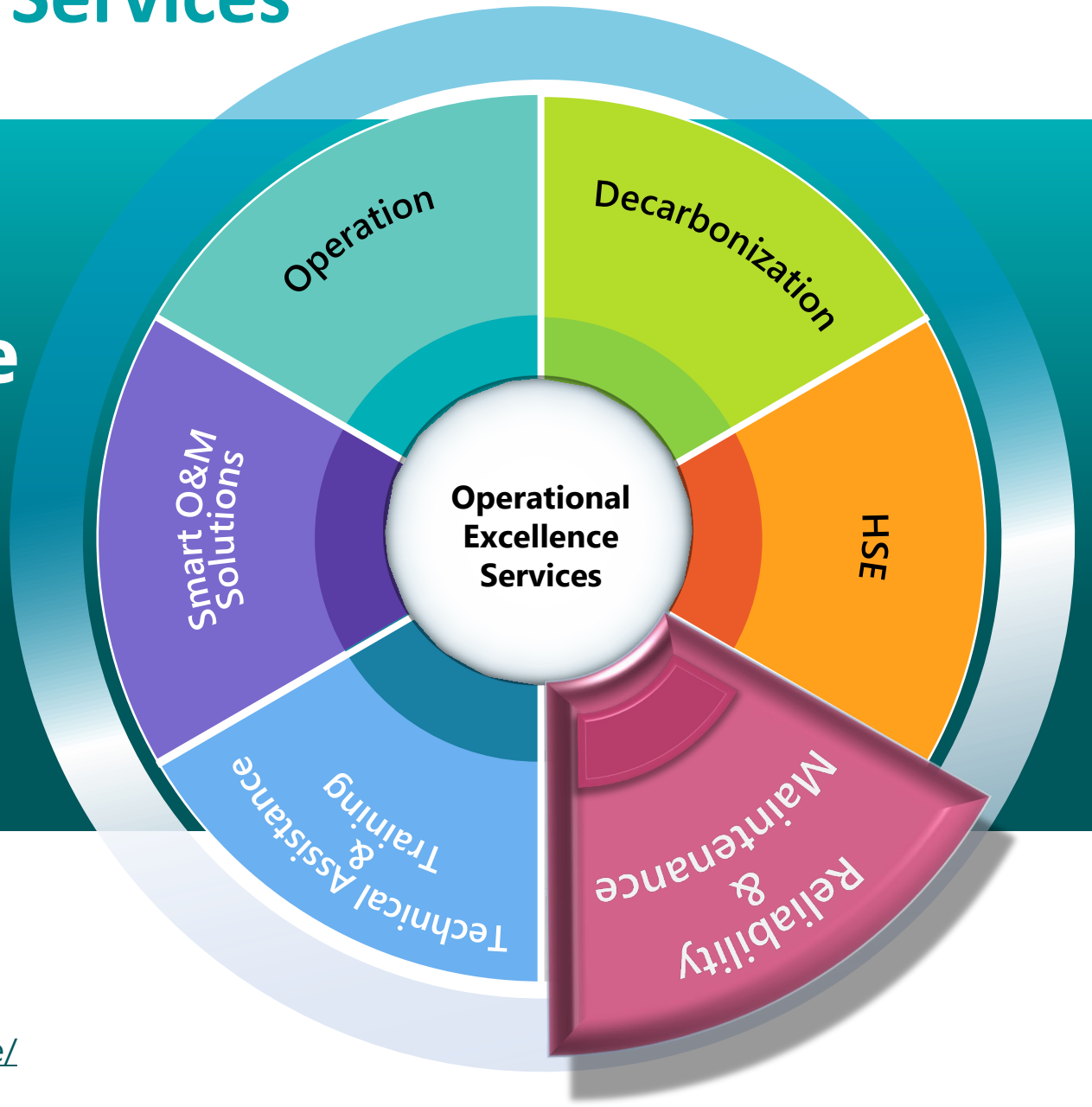
Years

Simulation-based engineering service for plant diagnosis and lifetime improvement

Operational Excellence Services

Reliability & Maintenance

Turnaround Scope Optimization & Planning



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Turnaround Scope Optimization & Planning

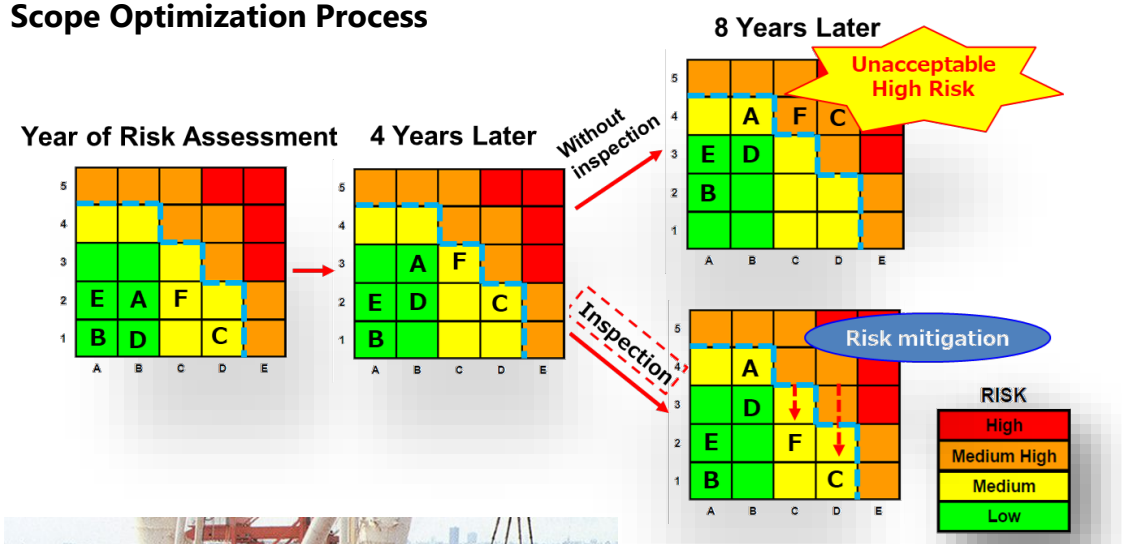
Do you have any of these issues?

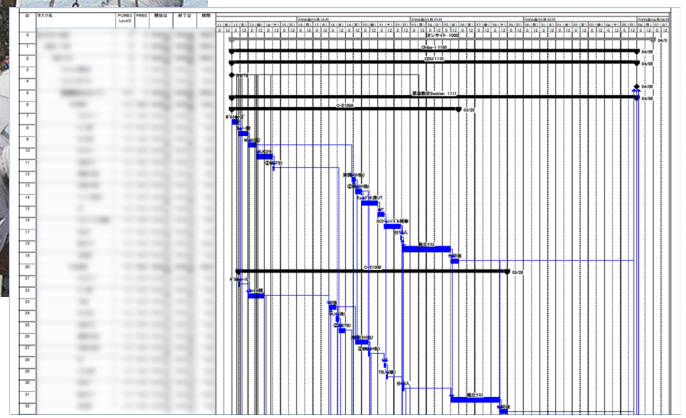
- ☹ **Many reliability incidents during operation**
- ☹ **High turnaround maintenance cost**
- ☹ **Fail to achieve Solomon First Quartile Target**

Turnaround Solution

- Setting of turnaround leadership and steering team
- Risk based process of maintenance and inspection work scope definition by multi-disciplined team
- Comprehensive review process for high cost/long duration items to find lower cost/shorter duration alternatives
- Setting milestone based on turnaround complexity

Scope Optimization Process





Turnaround Scope Optimization & Planning

Turnaround Planning Process

- **Turnaround (TA) planning starts 12 months prior to turnaround (for Medium / High Complexity TA)**

- 12 to - 10 months	*- 9 to - 7 months*	*- 6 to - 2 months*
Basic Maintenance & Inspection Planning	**Procurement and Contract Preparation**	**Detail Implementation Planning**
• **Develop TA execution plan** based on turnaround strategy and finalized work scope • **Develop inspection plan** based on inspection strategy • **Bidding for long lead item** • **Provide cost information** for budget	• **Procurement plan** • **Preparation of job package** for service contract • **Specification preparation** for material procurement • **Contracting for major services** • **Ensuring availability of specialty service** e.g., refractory specialist	• **Develop detail work steps and resource requirement** to finalize timeline chart • **Issue TA Schedule** with Critical Path works • **Detail cost forecast** to be provided

Our Strengths

- Professional Maintenance Engineer Teams
- Global resources
- Practical application of Risk Based Work Selection process such as RCM and RBI
- Rigorous turnround readiness review methodology
- So many experience of turnaround planning

Our Experiences

Executed Project **40+ Cases**

Case Study ~ Turnaround Scope Optimization & Planning

Return to Reliability & Maintenance menu

Background:

A Refinery in Southeast Asia encountered some difficulties in managing hot spots in several sections and some damage at air lift pipe and air rings in regenerators of the RFCC unit after their completion of the second Turnaround & Inspection (T&I).

Objective:

The third turnaround maintenance work is itemized properly for 4 years continuous operation after turnaround.

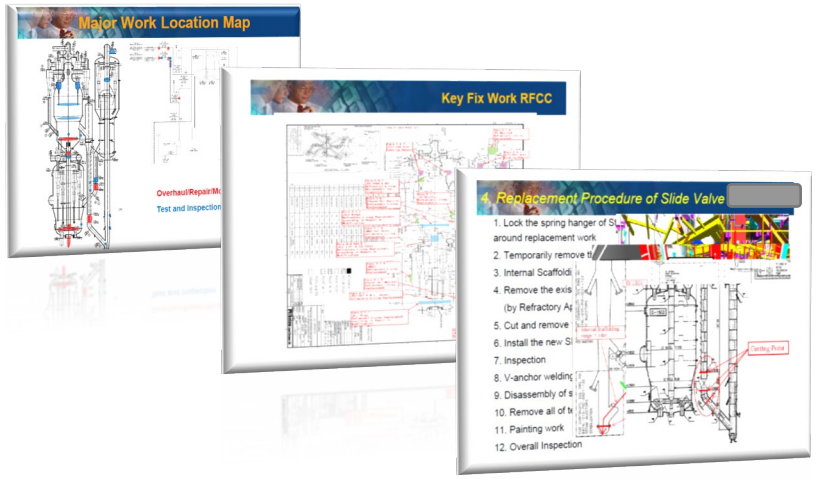
Achievement:

JGC provided the mechanical and refractory assessment for the major maintenance work itemization for the third turnaround, and the engineering for modification of air lift pipe and air rings including root cause analysis.

Key Deliverables :

1. Root Cause Analysis of Hot Spots
2. Maintenance Planning Worksheet (Mechanical/Refractory)
3. Location Map of Major Work (Mechanical/Refractory)
4. List of Major Spare Parts
5. Method Statement of Critical Work
6. Preliminary Scaffolding Assembling Plan

Sample Deliverables



Reference Services

FCC Unit in a Refinery Complex in Middle East

- 2010 - 2011 : T&I Planning and Execution Support at site
- 2015 : T&I Execution Support at site
- 2018 : T&I Planning

RFCC Unit in a Refinery Complex in Southeast Asia

- 2016 - 2017 : T&I Planning

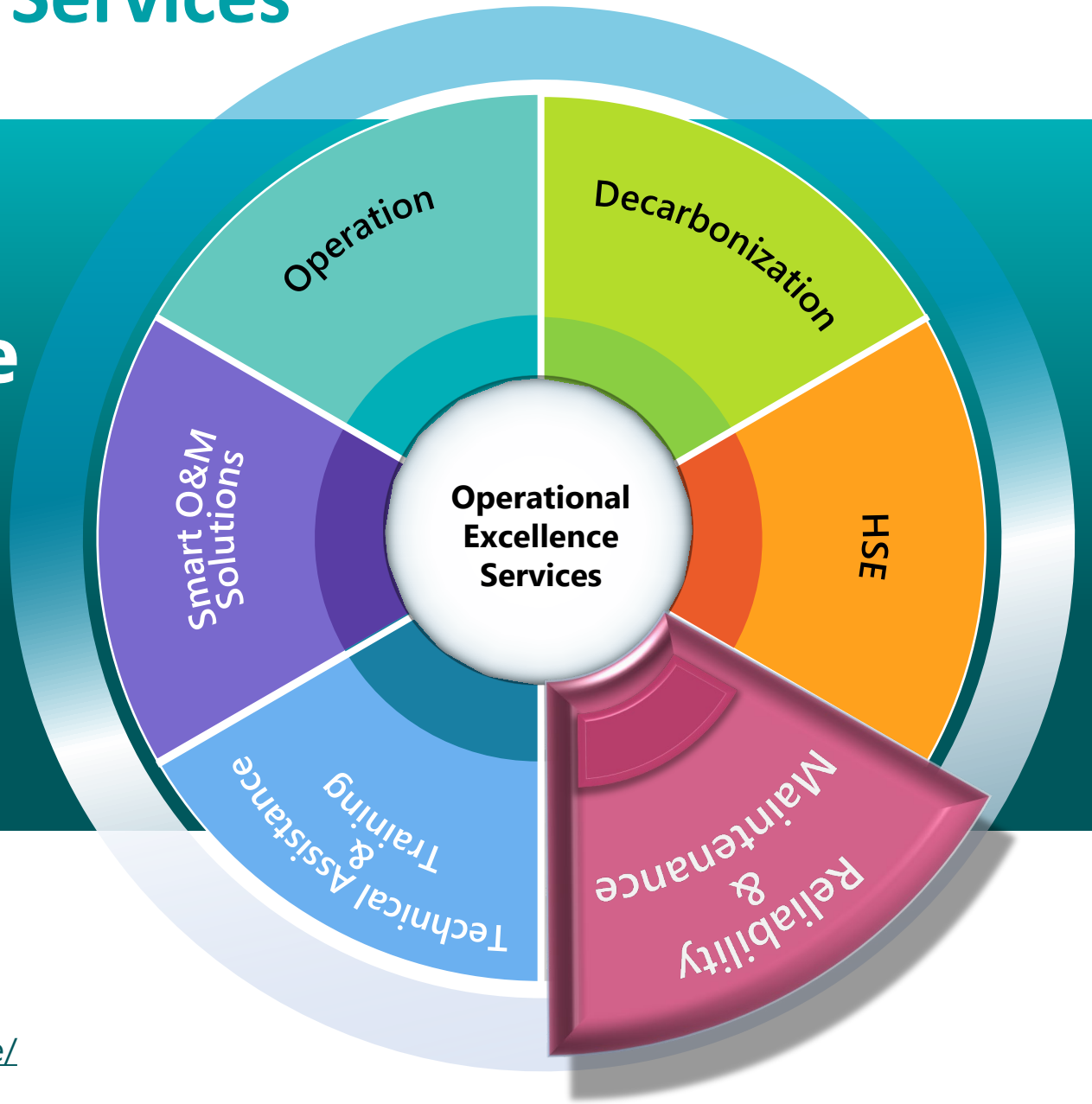
Gas Processing Plant in Middle East

- 2022 – 2024 : T&I Planning and Execution Support at site

Operational Excellence Services

Reliability & Maintenance

Turnaround Execution Management



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Turnaround Execution Management

Do you have any of these issues?

☹ **Fail to achieve turnaround targets**

✓ **Safety, Schedule and Cost**

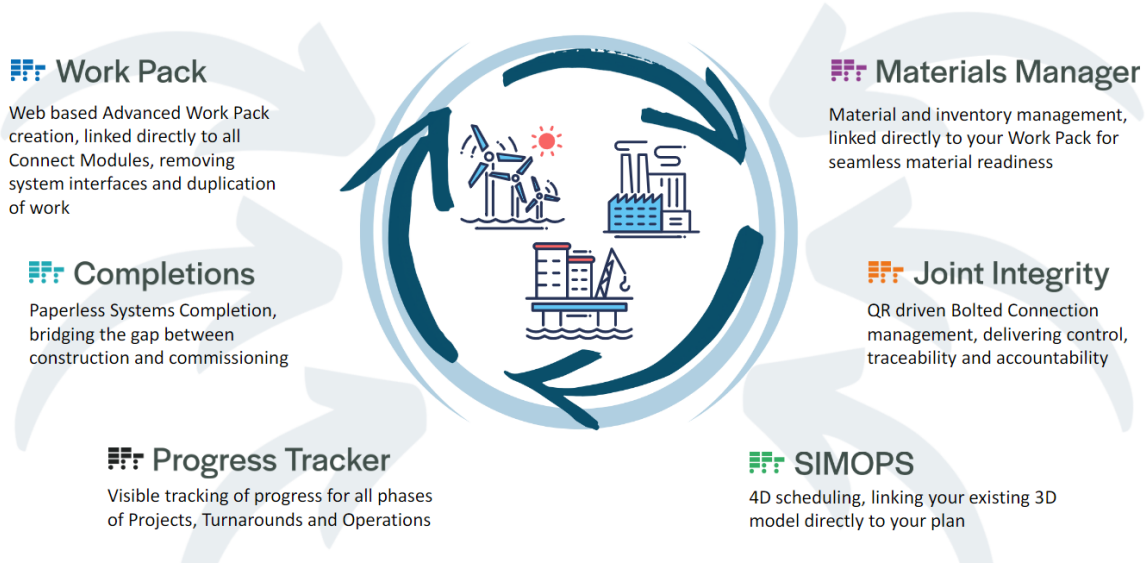
☹ **Lack of experienced execution workforce**

☹ **Shortage of frontend supervisors**

Turnaround Solution

- Management and planning approach using proven methodology
- Detailed work procedures which include description of potential hazard of the work
- Involvement of frontline supervisors in detailed planning of the critical works
- Dedicated coordinators for high-risk works (e.g., inert entry work, critical lifting, etc.)

Turnaround Execution



Turnaround Work Progress Management System

Turnaround Execution Management

Return to Reliability & Maintenance menu

Turnaround Safety Management

Drastic cultural change in behavior-based safety

Adaptive Challenge

- Attitude
- Belief
- Intention
- Culture
- Commitment
- Responsibility
- Behavior
- Clarity
- Understanding

Our Strengths

- Abundant experience in turnaround project execution
- Professional maintenance management teams
- Global resources
- Incident & Injury Free (IIF®) culture (Behavior-based safety)
- Advanced work progress management system

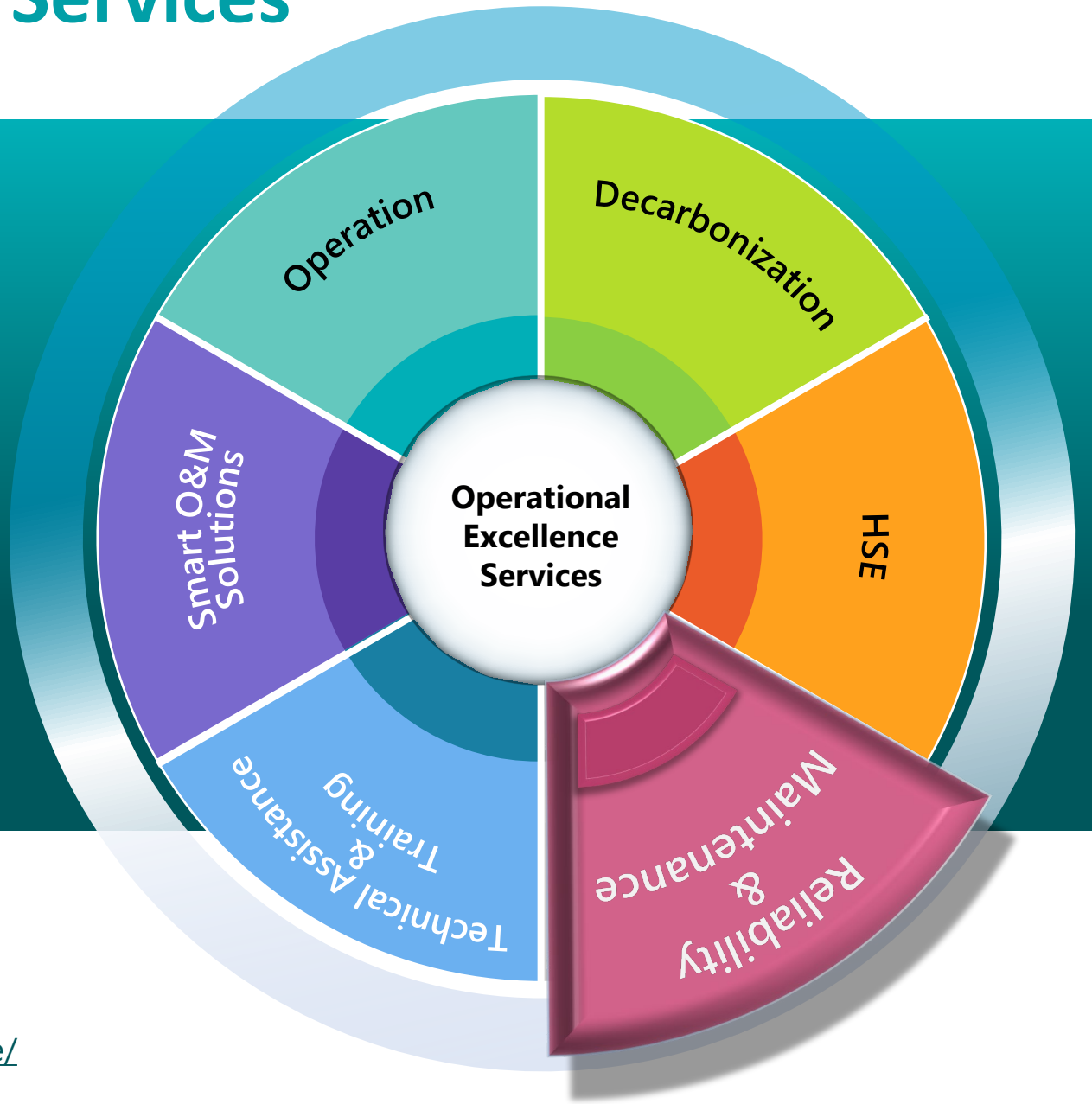
Our Experiences

Executed Project **40+ Cases**

Operational Excellence Services

Reliability & Maintenance

Inspection & Diagnosis



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

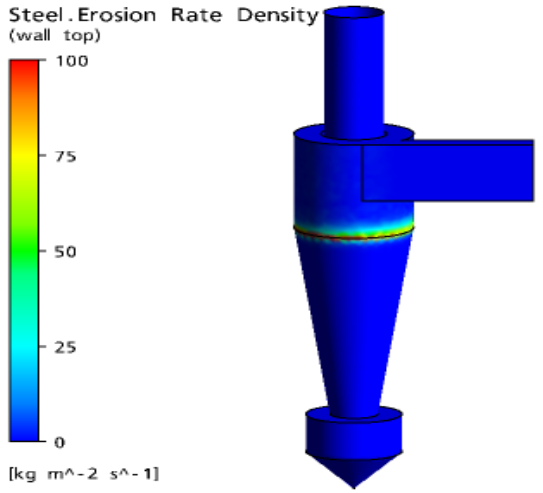
Inspection & Diagnosis

Do you have any of these issues?

☹ **Need to enhance mechanical integrity of process equipment and piping system**

☹ **Lack of experienced inspection and diagnosis engineers**

☹ **Need engineering support during turnaround**



Turnaround Inspection Solutions

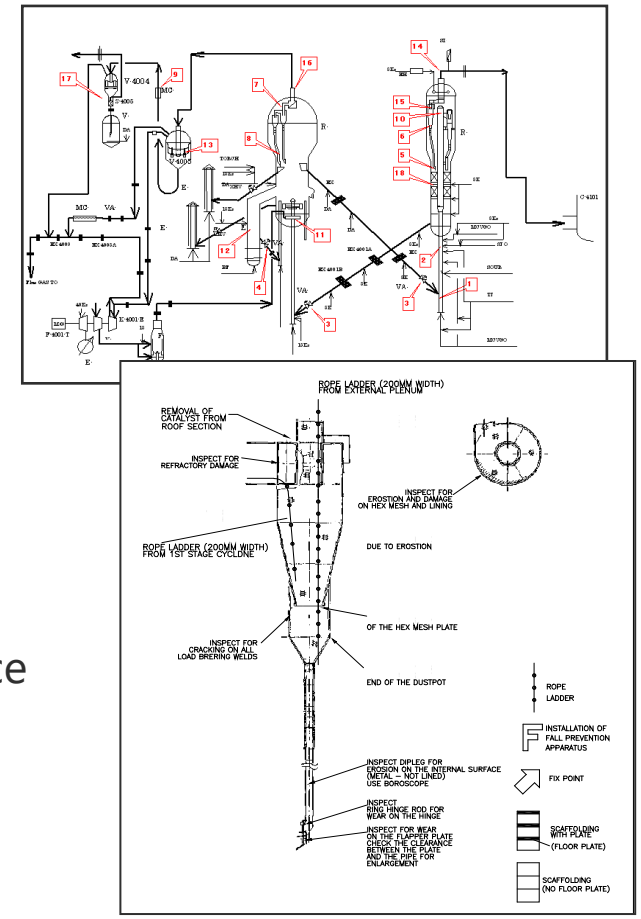
- Prioritized inspection planning, reliable inspection execution and practical repair engineering
- Cutting edge simulation technologies and experienced specialist for complex process degradations evaluation
- Use of advanced NDT technologies to fit for purpose
- “Fitness for Service” assessment by experienced engineers.

Inspection & Diagnosis

Return to Reliability & Maintenance menu

Turnaround Inspection

- Develop inspection plan based on type of degradations before turnaround
- Inspection related preparation work arrangement
  - Scaffolding and ladders
  - Surface preparation for NDT
- Preparation of NDT service package for contract
- Inspection Record Management System



Our Strengths

- Abundant experience in turnaround inspections
- Experienced and qualified inspectors (API 510, API 570, API 936, etc.)
- Simulation with Computational Fluid Dynamic (CFD)
- Fitness for Service assessment by experienced engineers

Our Experiences

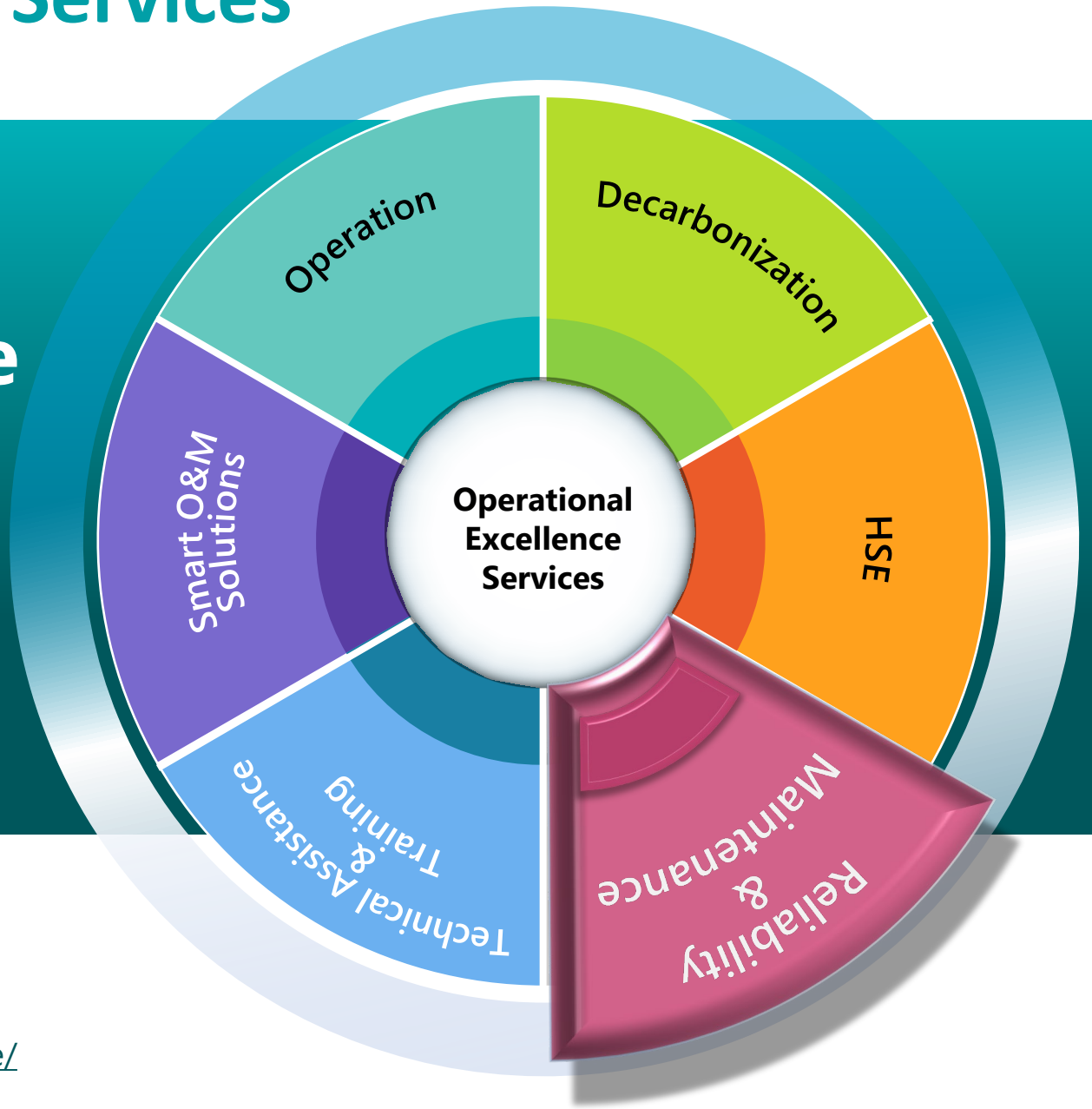
Executed Projects **40+ Cases**

Data Analysis **100+ Facilities**

Operational Excellence Services

Reliability & Maintenance

Reliability, Availability, Maintainability (RAM)



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Reliability, Availability, Maintainability (RAM)

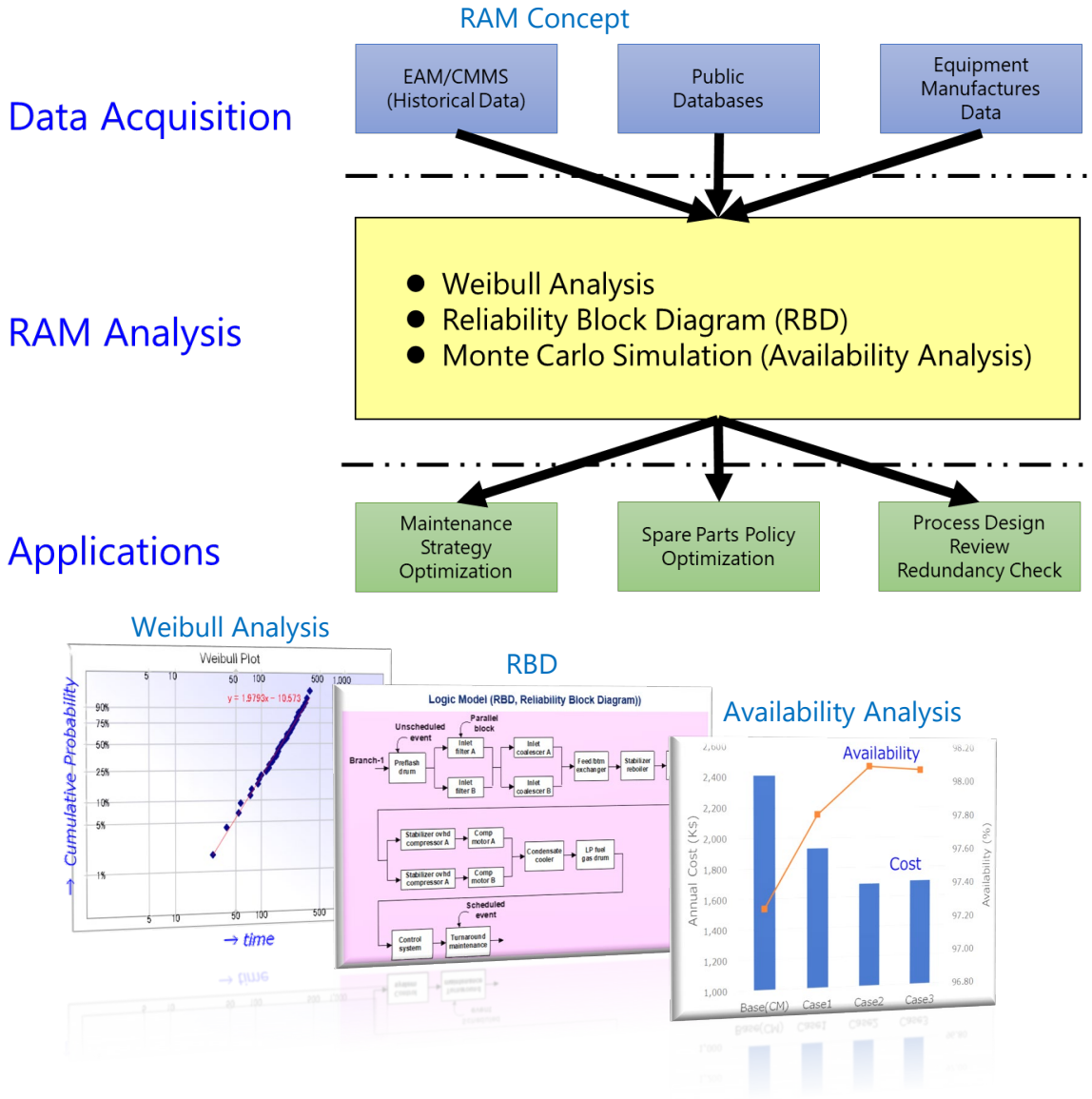
Do you have any of these issues?

☹ **No appropriate answer to the conflicting demands of "maintaining the reliability of equipment" and "reducing maintenance costs"**

☹ **Unable to see opportunities for improvement in reliability from data accumulated in CMMS/EAM**

RAM Solution

- Evaluate the current reliability of facilities based on valuable historical data, which are accumulated at EAM/CMMS.
- Select optimal maintenance measures while balancing the reliability of equipment and maintenance costs.
- Establish a strategic PDCA cycle in the operation and maintenance organization

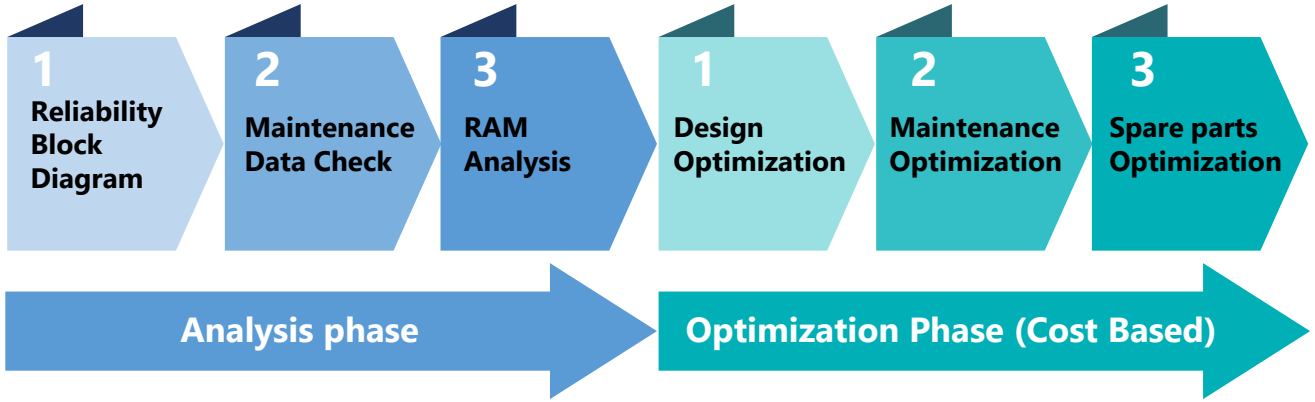


Reliability, Availability, Maintainability (RAM)

Return to Reliability & Maintenance menu

Workflow & Results

JGC's RAM Study Steps



1 Weibull Distribution

2 MTBF Estimation

3 Production Efficiency

1 Optimized Equipment Configurations and Redundancy
2 Optimized Maintenance Method and Frequency
3 Optimized Spare Parts List

2-3 months for Unit (e.g., CDU, FCC)
Critical Equipment : Approx. 70 sets

Our Strengths

- Building an appropriate RAM analysis model based on process engineering knowledge
- Collection of the appropriate reliability data and optimization proposals based on the knowledge of operations and maintenance experts
- Best method approach by combining internal and external resources to meet clients' needs and objectives

Our Experiences

20+
Cases

Not Only O&M phase, but also FEED and EPC phases.

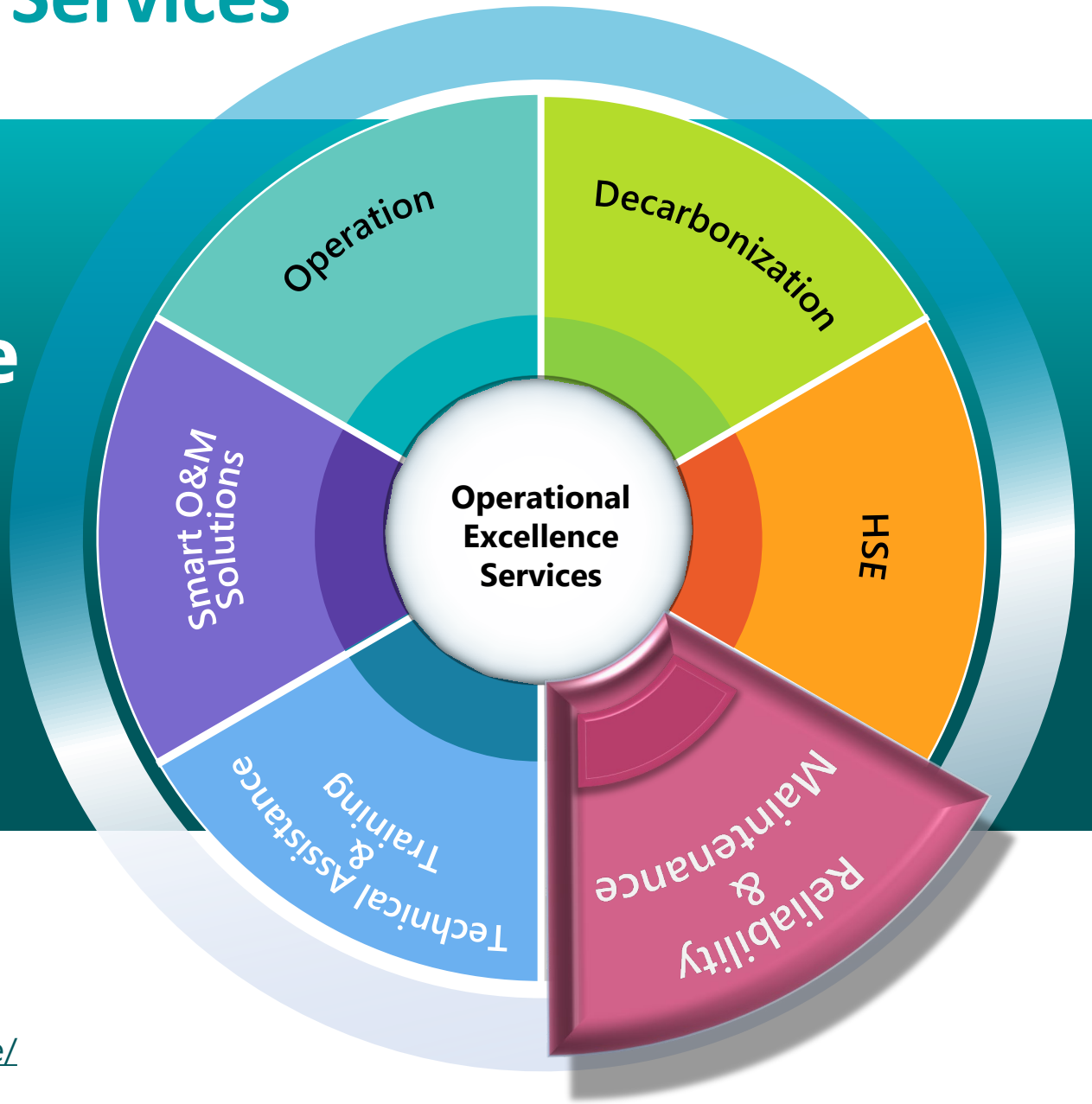
Various Type of Facilities

Refinery
Gas Processing
LNG
FLNG,
LNG Terminal, etc.

Operational Excellence Services

Reliability & Maintenance

Reliability Centered Maintenance (RCM)



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

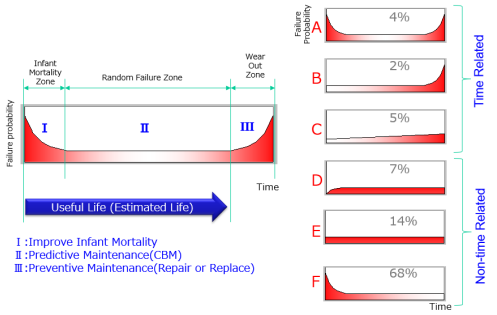
Reliability Centered Maintenance (RCM)

Do you have any of these issues?

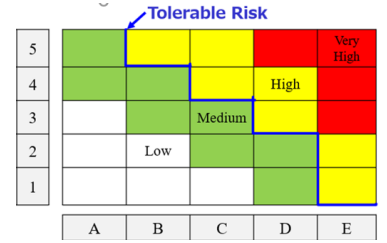
- ☹ **Many unreliability events**
- ☹ **Constant unrequired maintenance work**
- ☹ **High maintenance cost**

RCM Solution

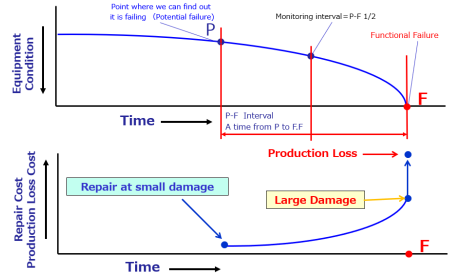
- Determine the optimal failure management strategies for all equipment including risk base approach.
- Provide sustainable Predictive and Preventive Maintenance tasks
- Prevent Functional Failure for Required Function of equipment
- Mitigate Safety, Environment, Production and Asset damage risks



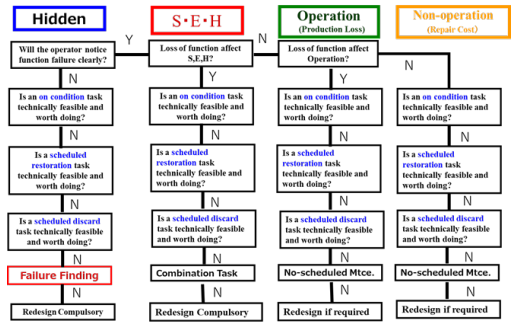
Analyze detailed failure pattern



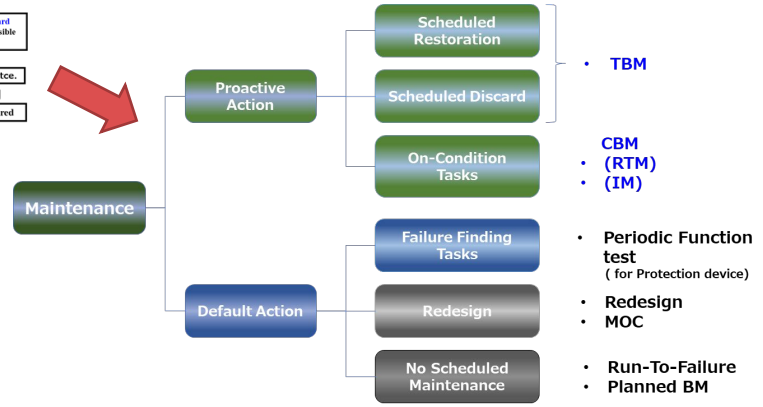
Risk Matrix Assessment



Consider Condition Monitoring



Decision Diagram
Consider Maintenance Tasks

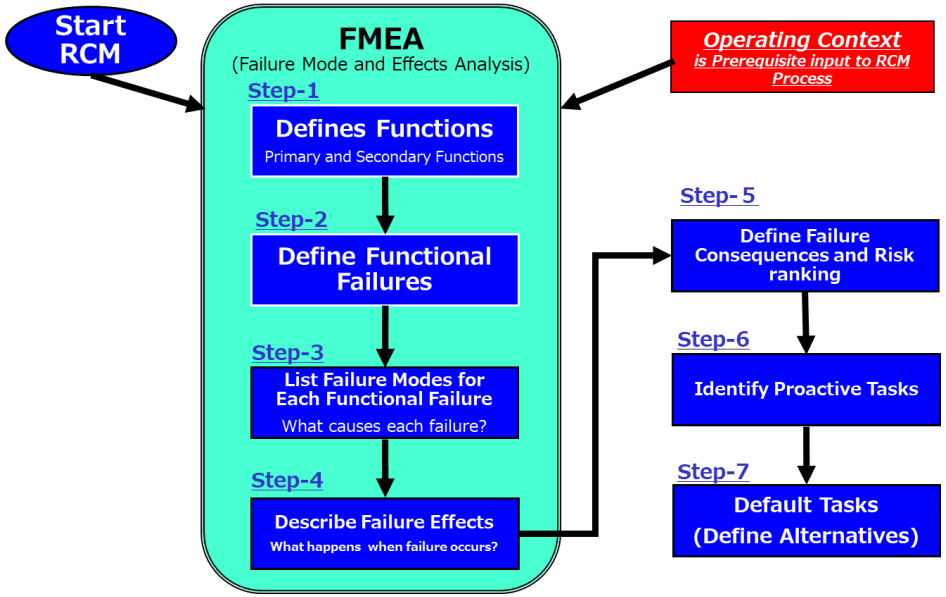


Delivered appropriate Maintenance Tasks

Reliability Centered Maintenance (RCM)

Return to Reliability & Maintenance menu

Workflow & Result



- Analyze Equipment Criticality to prioritize RCM study level
- Organize cross-functional RCM study team
- Define Operating Context including desired performance, legal requirement, integrated operating window, safety hazard, etc.
- Start RCM study depend on RCM work steps
- Identify Function, Functional Failure, Failure Mode, Failure Effect, Consequence and Risk ranking
- Identify Failure Management Tasks to prevent required Functional Failure

Our Strengths

- Professional Process & Material Engineer Teams
- Global experiences and performances on Risk assessment, Inspection planning, On-site Inspection.
- Integrating JGC many years of inspection and plant design experience to achieve lower inspection costs and longer plant life
- Collaboration between oversea EPC-capable group companies and local maintenance companies.

Our Experiences

15+ Projects

RCM Study serviced for over 10 projects

Worldwide Achievement

RCM Experience in Far East, Middle East, Southeast Asia, Africa, North America

Operational Excellence Services

Technical Assistance & Training

Onsite Assistance (Residential/On-call)

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Onsite Assistance (Residential/On-call)

Do you have any of these issues?

☹ **Lack of experienced engineers and technicians**
☹ **Need specific expertise**
☹ **Need technical problem-solving teams when in trouble**

Our Solutions

- Dispatch customized teams, experts, and operation and maintenance staff to the operation site to meet the client's needs.
- Select the most suitable resources from JGC network for client's situation over a long period of time or even within a short period of time.
- The dispatched teams and crew will work as an integrated resource with client's operating organization, or work as an independent task force team.

Onsite Assistance (Residential/On-call)

Return to Technical Assistance & Training menu

Our Approach

Understand Client Needs or Issues

- Shortage of Engineers and Technicians
- Reinforcement Needs
- Specific Technical issues

Propose Best Teams and Candidates

- Job Description
- Role and Responsibility
- Duration (long-tern/short-term)

Service Agreement

Options:

1. **Combination with Operational Excellence services**
2. **Troubleshooting by Experts in Global Operating Center**

Mobilize Team or Personnel

Our Strengths

- A wide variety of global human resources networks allow flexible use of experienced and knowledgeable experts
- Cooperation with specialized teams at headquarters with expertise from various EPC and Operational Excellence services
- Stand by various experts who can solve problems quickly

Our Experiences

30+

Years in Global Market

Middle East
North Africa
West Africa
Southeast Asia

Various Type of Facilities

Gas Processing
Oil Producing
FPSO
Integrated Water, Steam, Power Plant, etc.

Operational Excellence Services

Technical Assistance & Training

Asset & Operation Due Diligence

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Asset & Operation Due Diligence

Do you have any of these issues?

☹ **Considering investment for operating assets**

☹ **Audit for operation and maintenance of operating assets**

Focus Areas

- ***Facility design and construction*** in accordance with recognized and generally accepted engineering practices
- Implementation of ***Process Hazard Analysis***
- Established ***Operation Manual***
  - ✓ Startup and Shutdown
  - ✓ Normal operations
  - ✓ Emergency Operations
- Deployment of ***safe work practices***
- ***Written procedures*** for maintenance, inspections and testing
- Rigorous ***quality assurance*** systems
- ***Training and competency*** management system

Asset & Operation Management Framework

1. Management Leadership
2. Risk Assessment
4. Facility Design and Construction
5. Information & Documentation

Maintenance

3. Management of Change
7. Mechanical Integrity
8. Contractors
9. Occupation Health and Safety

Operation

6. Operation Procedure
10. Training

Emergency Response

11. Incident Investigation
12. Emergency Planning and Response

14. Assessment & Improvement

Asset & Operation Due Diligence

Return to Technical Assistance & Training menu

Example of JGC's PSM Assessment Checklist

No.	Requirement	Guideline for Compliance	Observation	Opportunities / Comments
5.0	*In accordance with the schedule set forth in [paragraph 3.1] of this section,* the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process and information pertaining to the equipment in the process.	1. A procedure to manage PSI defined in the paragraph 2.1 through 2.3 should be developed. - Information applicable as PSI should be clearly defined in the procedure. - Management process of PSI, including roles & responsibilities of owners should be developed. - PSI should be periodically updated according to Management of Change processes. *(Refer to Element-10)*		
5.1	Information pertaining to the hazards of the highly hazardous chemicals in the process. This information shall consist of at least the following: i. Toxicity data; ii. Permissible exposure limits; iii. Physical data; iv. Reactivity data; v. Corrosivity data; vi. Thermal and chemical stability data; and vii. Hazardous effects of inadvertent mixing of different materials that could foreseeably occur. Note: Safety data sheets meeting the requirements of 29 CFR 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.	1. P... and *TLV : Threshold Limit Value* *TWA : Time Weighted Average* *STEL : Short Term Exposure Limit* *TLV-C : Threshold Limit Value Ceiling* *IDLH : Immediately Dangerous to Life or Health* 2. Material Safety Data Sheet (MSDS) should be used to include the information. - All MSDS should be supplied from manufacturers and compiled. 3. When a contractor brings highly hazardous chemicals to the plant then the contractor shall show MSDS to the employer and obtain approval.		
5.2	Information pertaining to the technology of the process.	1. Most of technology information should be developed during the EPC phase and delivered from the EPC contractor.		

Observations found during the interview will be described in this column.

Guidelines to conform to OSHA requirements as per JGC's knowledge and experiences

Requirements of OSHA 1910.119

Improvement opportunities identified during the interview will be described in this column.

Element 5: Information & Documentation

Our Strengths

- Extensive, worldwide EPC project and maintenance experiences
- Experience in investment for operating assets
- Professional Operation & Maintenance Engineer Teams
- Asset & Operation Management (AOM) system based on OSHA PSM
- Experience in Due Diligence (DD) and audits for operating plants.

Our Experiences

O&M Due Diligence **3+ Cases**

Audits for O&M **5+ Cases**

Operational Excellence Services

Technical Assistance & Training

OPEX Assessment

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

OPEX Assessment

Do you have any of these issues?

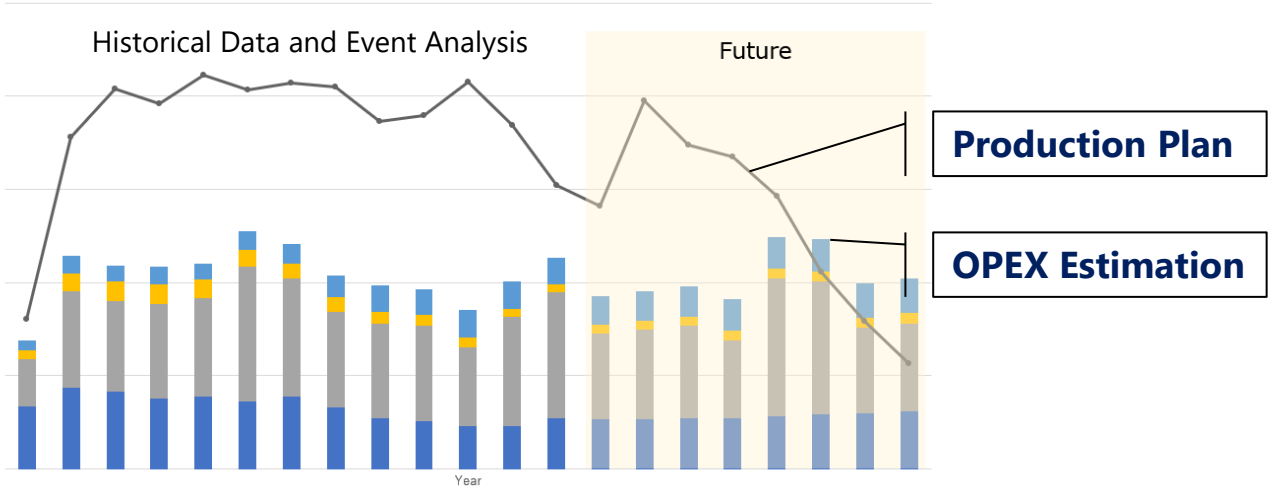
☹ **Estimating OPEX to assess the feasibility at business planning phase**

☹ **Verifying future OPEX in operation phase**

☹ **Identifying improvement opportunities on operation and maintenance costs**

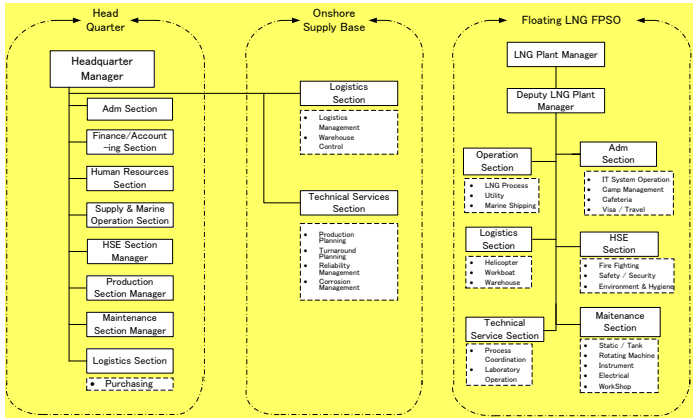
Our Solution

- Estimate or Assess OPEX by experts who understand the processes and regions at business planning phase
- Analyze historical OPEX data from the operation phase
- Conduct a case study to identify the optimized OPEX in either of the above cases



OPEX Estimation based on Production Plan

O&M Strategy Development as the basis of OPEX (e.g., Organization Chart)



OPEX Assessment

Return to Technical Assistance & Training menu

Workflow & Results

Business Planning Phase

Business Case and Plant Concept Check	OPEX Item Definition	O&M Strategy Definition	OPEX Item Estimation	Case Study for Optimization
• County • Plant Type • Production Plan • Schedule • Local Conditions • etc.	• Personnel • Maintenance • Chemical • Fuels • Insurance • Training • etc.	• Organization and Working System • Operation Strategy • Maintenance Strategy • Logistics Strategy • Training Strategy • etc.	• Estimation by O&M Experts and Cost Engineers	• Case Studies with optional O&M Strategy

Operation Phase

Business Case and Plant Concept Check	Historical Data Check	OPEX Item Estimation	GAP Analysis	Case Study for Optimization
• County • Plant Type • Production Plan • Schedule • Local Conditions • etc.	• Past OPEX Review • Past Operation Result Review • Past Maintenance Event review • Future OPEX plan review (if available)	• Estimation by O&M Experts and Cost Engineers	• Identification of GAP between JGC estimated OPEX and Client given future OPEX	• Case Studies with optional O&M Strategy

Our Strengths

- Assess using the latest cost information accumulated through plant EPC projects worldwide
- Estimate by experts with plant process, operation and maintenance knowledge
- Provide output tailored to client needs and business phases
- Advise improvement opportunities by experts

Our Experiences

10+

Projects in 10 years

Various Type of Facilities

Gas Processing
LNG Terminal
Onshore LNG
FLNG
FPSO, etc.

Operational Excellence Services

Technical Assistance & Training

Strategic Operational Improvement Assistance

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

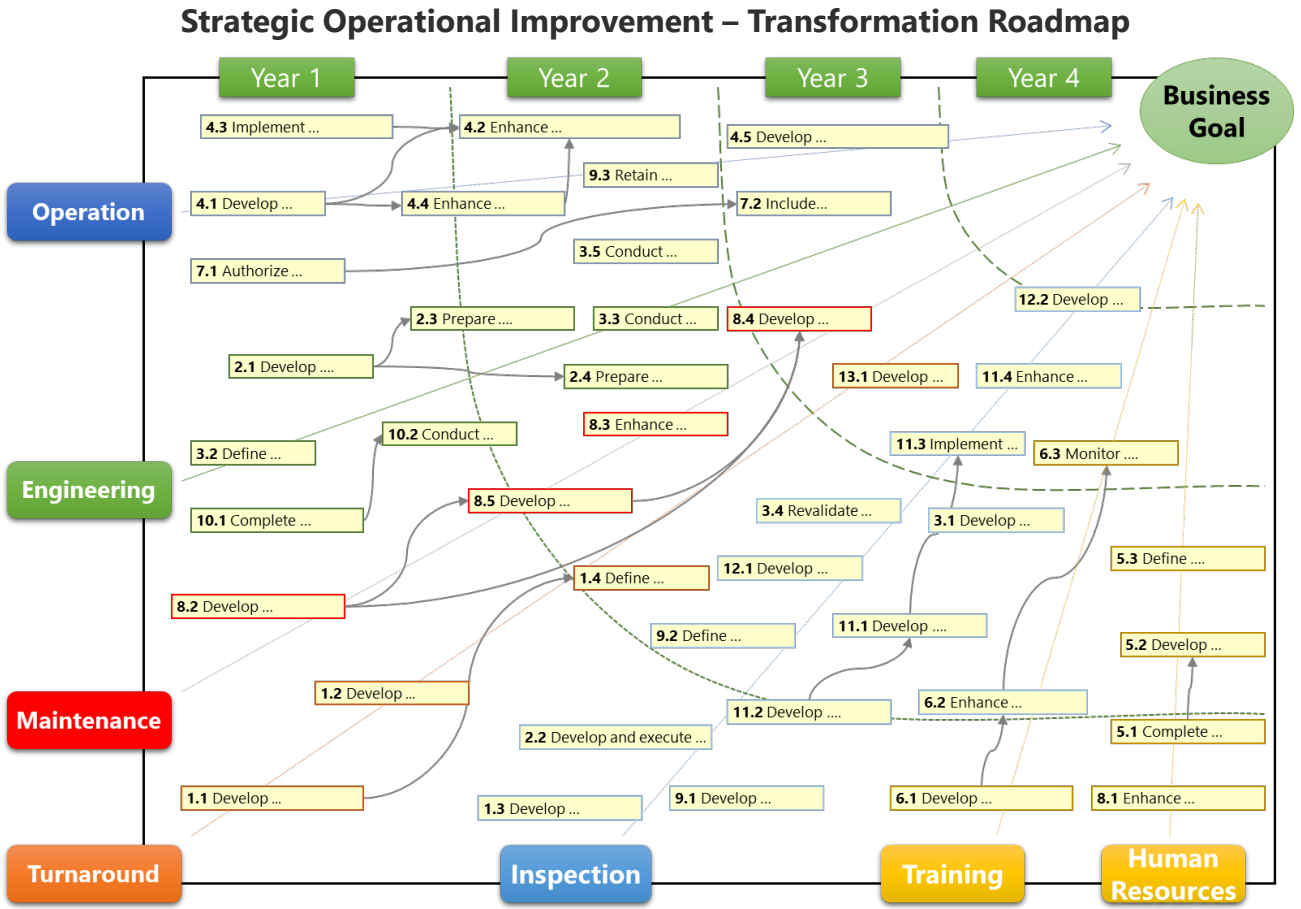
Strategic Operational Improvement Assistance

Do you have any of these issues?

☹ **Increasing Unplanned Plant Outages**
☹ **Increasing Maintenance Costs along with Age**
☹ **Lack of Experienced Maintenance Staff**
☹ **Representing Improvements Visually**

Solution

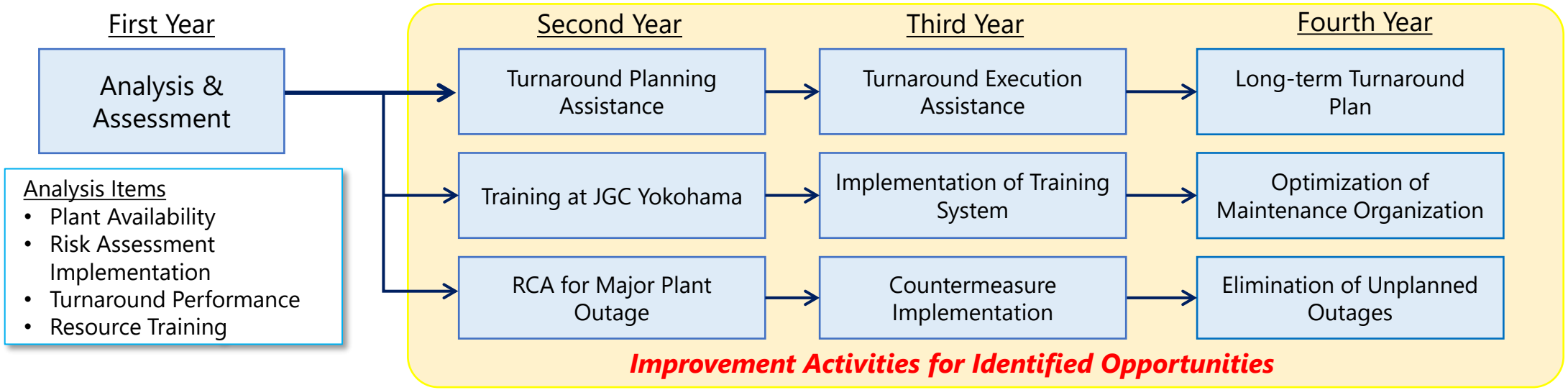
- SWOT Analysis of operation and maintenance organization
- Middle and long-term operation and maintenance plan including turnaround plan
- Setting Key Performance Indicators (KPI)
- Root Cause Analysis (RCA) for equipment failure and countermeasure development
- Training focusing on younger staff and skill/knowledge transfer from experienced staff



Strategic Operational Improvement Assistance

Return to Technical Assistance & Training menu

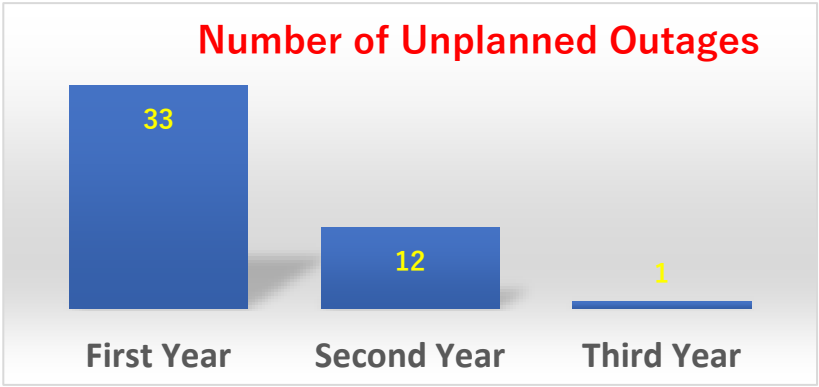
Long-Term Strategic Operational Improvement Assistance Program



Our Strengths

- Professional Operation and Maintenance Engineer Teams
- Global resources
- Practical application of Risk Based Work Selection process such as RCM and RBI
- Rigorous turnround readiness review methodology
- Many experiences in turnaround planning
- Engineering tools and experienced analytical staff for RCA

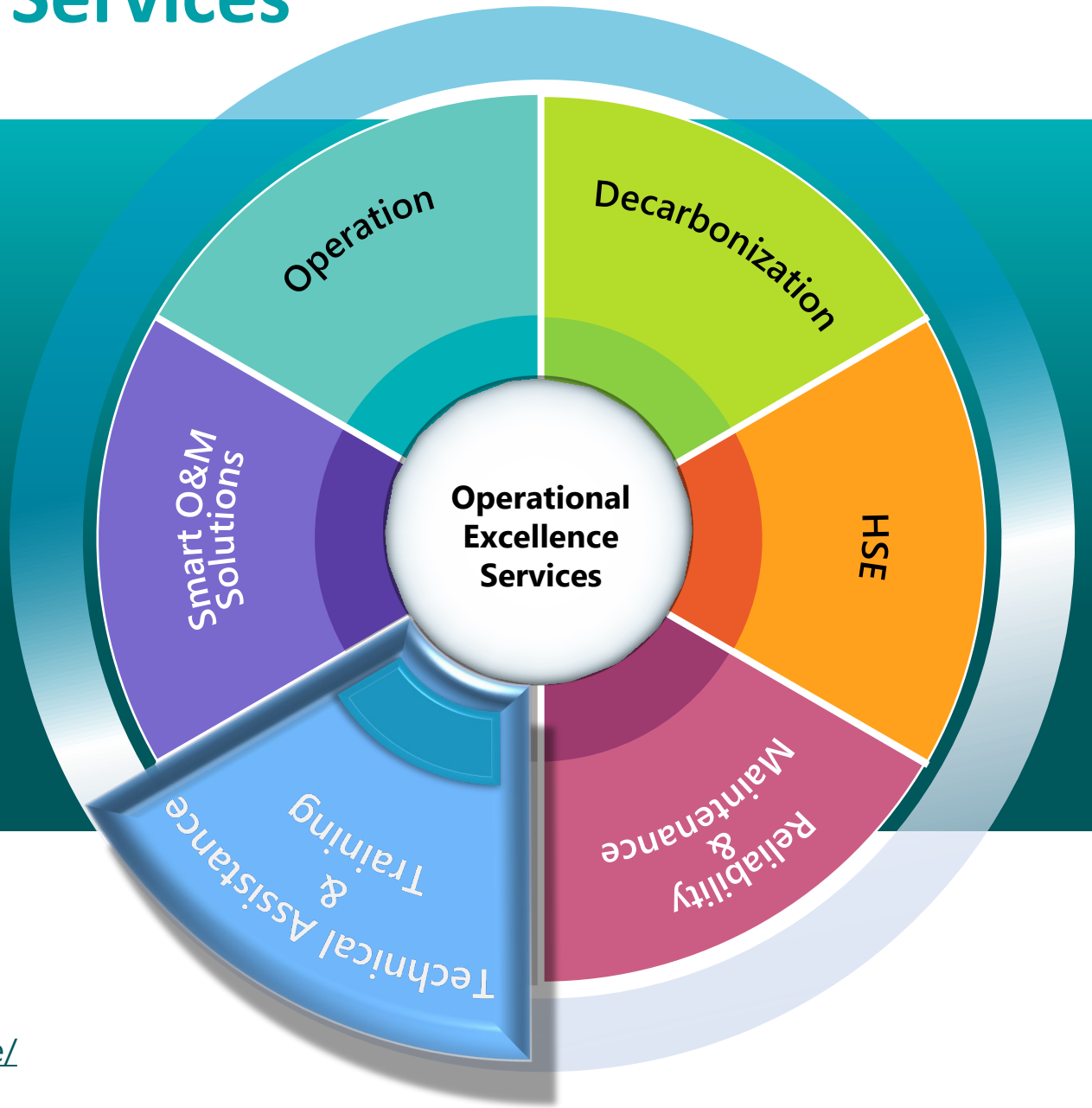
Our Experiences Chemical Plant Case in Indonesia



Operational Excellence Services

Technical Assistance & Training

Training and Competency Management Services



Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Training and Competency Management Services

Do you have any of these issues?

☹ **Catching up to the latest technical trends**
☹ **Refreshing knowledge on essential technical matters**
☹ **Specific training linked to technical issues**
(e.g., troubleshooting, performance improvement)
☹ **Struggling to fill gap between actual and required skill set**

Training Services

- Organize a tailor-made training program
  (e.g., Asset Management, Process Safety Management, TA Management, Plant Life Extension, etc.)
- Deliver training courses and seminars (at site or on-line)
- Implement competency management program
- Dispatch experts to site;
  - ➢ for hands-on training
  - ➢ for troubleshooting and performance evaluation with follow-up technical sessions

Training and Competency Management Services

Key Categories / Themes for Technical Training

Engineering & Project	Operation & Maintenance
P&ID	Process Safety Management
Hydraulic Design	Reliability, Availability, Maintainability (RAM)
Process Engineering	Reliability-Centered Maintenance
Dynamic Simulation Technology	Risk-Based Inspection
Plant Safety Design and Risk Management	Plant Life Extension Program
HAZOP	Fitness for Service
Material Selection	Simulation Technology for Plant Troubleshooting (CFD)
Piping Engineering	Turnaround Management
Pressure Vessel, Exchangers and Tanks	Computerized Maintenance Management System
Energy Efficiency Improvement	Computerized Inspection Management System
Pump and Compressor	
Instrument Engineering	
Safety Instrumented Systems	
Electrical Engineering	
Civil Engineering	
Welding Technology	
Paint Technology	
Corrosion under Insulation	
Latest Non-Destructive Testing Technology	
Vibration Control	
Mechanical Handling	
Commissioning	
Operations Readiness & Assurance	

Our Strengths

- Professional Engineering Experts run our Training Services.
- Training programs are updated in line with latest technical trends and are applicable to actual implementation.
- In association with and funded by Japanese governmental support, such as JCCP (Japan Cooperation Center, Petroleum).
- Continuous follow-up and support are provided by our overseas affiliates and local partners.

Our Experiences

Technical seminars — **20+ in past 5 years**

Trainees — **500+ in past 5 years**

Case Study : Customized Training for FCC Unit Reliability Improvement

Return to Technical Assistance & Training menu

Background:

A refinery in Southeast Asia was struggling with stable operation of RFCC unit from the start after EPC project

Attendees:

Maintenance and inspection departments and technical service departments at the plant site and headquarters

Objective:

To share information on various problems that occur in RFCC, analysis methods to solve them, and technical advice from refractory vendors.

Workshops are also held to share examples of problems encountered in their RFCC and to discuss how to plan the next turnaround maintenance.

Reference Services

Process Safety Management Seminar - JGC Headquarter 2016 for E&P Company in Japan

Plant Life Cycle Management Seminar - JGC Headquarter 2017 for E&P Company in Japan

Process Safety Management Seminar - Online 2021 for E&P Company in Japan

FCC Unit Integrity & Reliability Improvement Seminar– Online 2022 for Refinery in Middle East

FCC Unit Integrity & Reliability Improvement Seminar– Online 2023 for a Refinery in Southeast Asia

O&M Engineering Training – JGC Headquarter 2023 for a Petrochemical Plant in Middle East

FCC Unit Integrity & Reliability Improvement Seminar– Online 2024 for Refinery in South America

Examples of customized training programs

Material Degradation and Remaining Life Assessment (Day 1)

1. FCC Unit Process Overview
2. Material Selection and Degradation
3. Remaining Life Assessment Methodologies
4. Experience of Material Degradation and Current Issue (by Client)

Corrosion Management and Inspection Data Management (Day 2)

1. Corrosion Management Program
2. Corrosion Under Insulation
3. Inspection Data Management System
4. Corrosion Management Program and Improvement Plan (by Client)
5. Workshop - Corrosion Management Program (All members)

Fitness for Service and Major Replacement Work (Day 3)

1. Fitness for Service Technology
2. Major Replacement Work
3. Advanced Repair Technology
4. Past Experiences and Future Plans (by Client)
5. Workshop – Major Replacement and Repair Planning and Execution (All members)

Reliability of Critical Mechanical Components (Day 4)

1. Refractory (Vendor)
2. Expansion Joint (Vendor)
3. GRP Piping
4. Future Actions and Wrap Up (All members)

Operational Excellence Services

Operation

LNG Cube

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

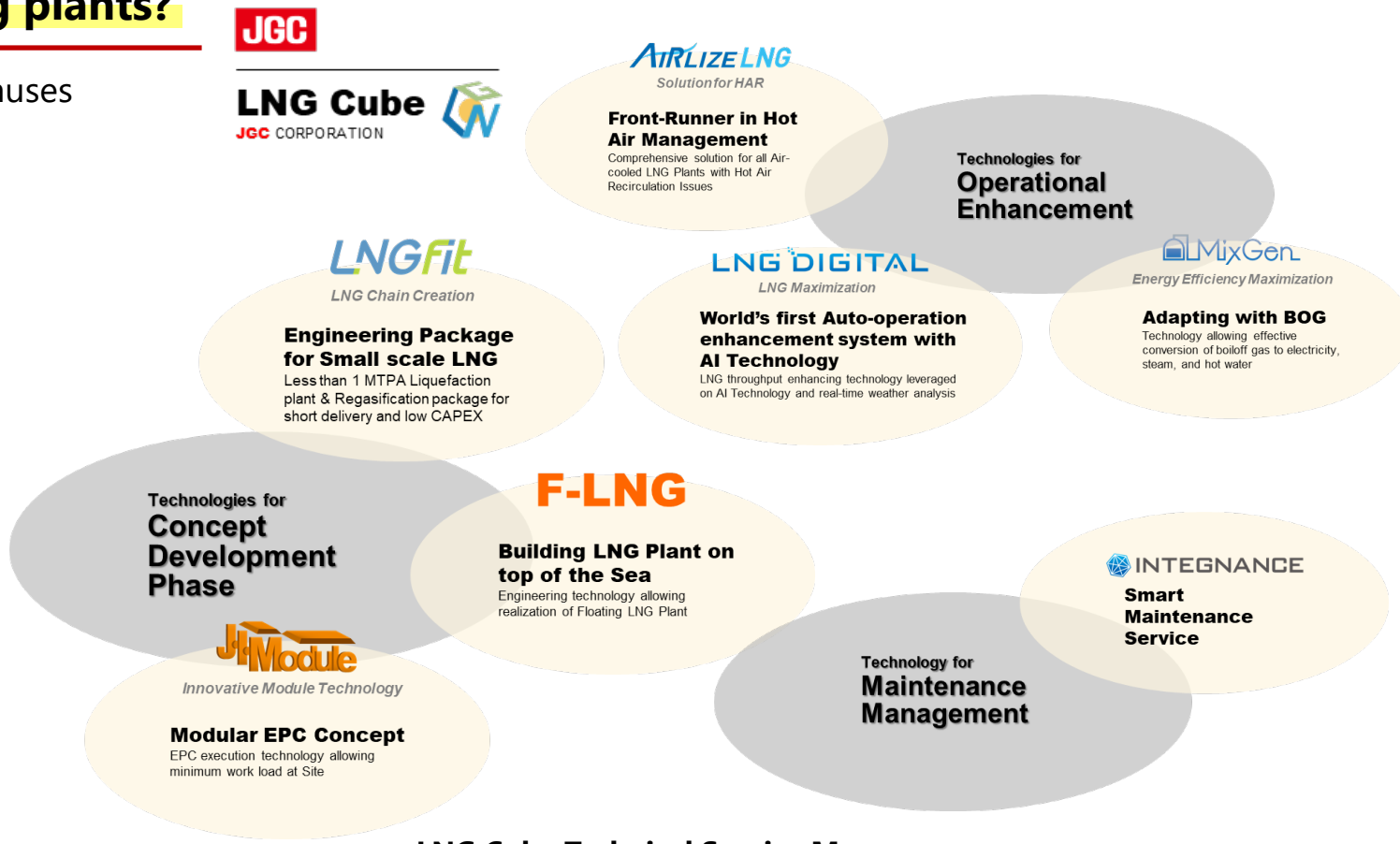
LNG³ (Engineering Consultation Service)

Do you have any needs in your operating plants?

- Sudden shutdown of the plant with unknown root-causes
- Frequent malfunction of equipment
- Unachieved production corrective planning
- Flare minimizing
- Smooth startup operation and flawless maintenance

What is LNG³ ?

- LNG Cube is a comprehensive technical service package related to LNG plants
- LNG Cube starts from Workshop and Consulting by the world's leading LNG specialists
- Analysis and Consulting leveraged on lessons learnt and operational database from past engineering, construction and operational experiences
- LNG Cube technical services are not limited to existing plants but can be applicable to grassroots plants



LNG Cube Technical Service Menu

LNG³ (Engineering Consultation Service)

Return to Operation menu

Workflow & Results

1. Send Survey Form
2. Send Operational Data and Register for LNG Cube Analysis

Client

3. LNG Cube Analysis
4. Develop Improvement Plan or General Concept (2~3 weeks)
5. LNG Cube Workshop with Client
6. Share Improvement Ideas, Execute Consultation
7. Implementation of the Plan, Seamless Execution of EPC

JGC

Our Strengths

- Abundant experience in commissioning and startup
- Speedy solutions leveraged on numerous of Lessons Learned from past commissioning and startup experience
- Consulting by Project Manager and Study Manager with extensive site experience and EPC execution experience

Our Experiences

Client	Year	Region	Activity
A Company	2017 - 2019	**South East Asia**	- LNG Cube Workshop (Development of New Digital Solutions) - Feasibility Study for the implementation of the Digital Solution - Implementation of the Digital Solution
B Company	2018 - 2019	**South East Asia**	- LNG Cube Workshop (Development of Efficiency Improvement Ideas) - Proposal for Advanced Control System Installation - Feasibility Study of the Advanced Control System Installation (Planned)
C Company	2018 - 2019	**South East Asia**	- LNG Cube Workshop (Development of Production Enhancement Ideas) - Business Case Study for LNG Production Enhancement
D Company	2018 - 2019	**Europe**	- LNG Cube Pre-Workshop (Development of New LNG Technology) - LNG Cube Workshop

Operational Excellence Services

Operation

AIRLIZE LNG®

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

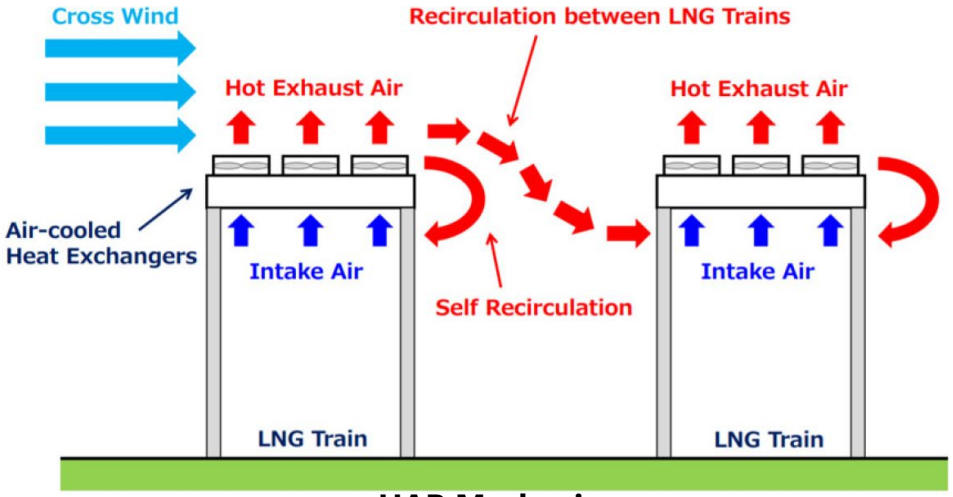
https://www.jgc.com/en/business/epc/operation-maintanance/service/

HAR(*) causes loss of LNG production

(*)Hot Air Recirculation

- ☹ **Process performance degradation due to HAR**
- ☹ **Increased ACHE(**) inlet air temperature due to HAR**
- ☹ **It is difficult to identify HAR mitigation plan or adaptation plan**

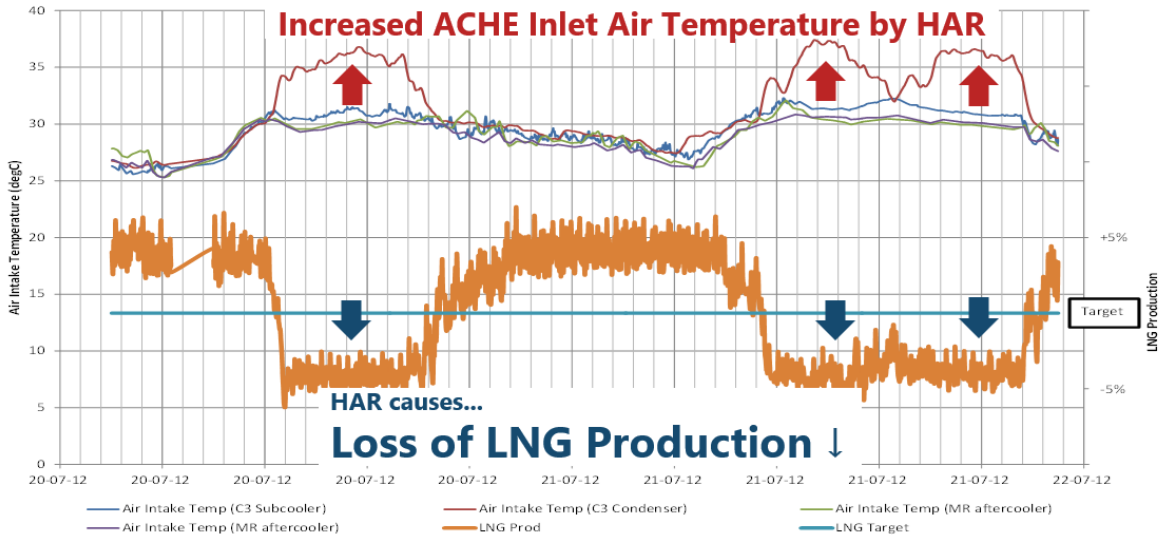
(**)Air Cooled Heat Exchanger



HAR Mechanism

What is AIRLIZE® ?

- AIRLIZE LNG® is JGC's Comprehensive Life Cycle Support Services for Air-Cooled LNG Plants
- Diagnoses and Analysis services for HAR optimization

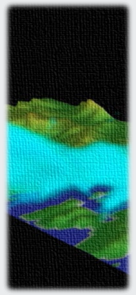


AIRLIZE LNG

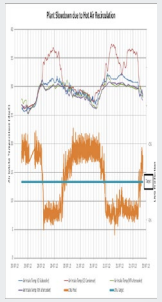
Workflow & Result

Data and information collection & site survey

Analysis

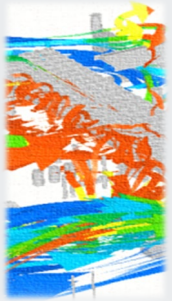


Weather Data

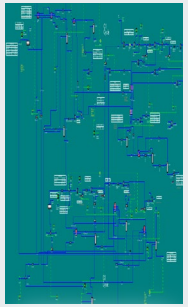


Operating Data

Simulation



CFD



Process

Solutions

Dry Fogging

HAR Digital

Our Strengths

- **Real-time Weather Monitoring System:** Introduction of advanced systems for real-time weather monitoring.
- **Advanced Analytical Capabilities:** Expertise in process big data analysis, CFD (Computational Fluid Dynamics) simulation, and rigorous process simulation.
- **Extensive Experience:** JGC's extensive experience in LNG processes and Hot Air Recirculation (HAR) analysis.
- **Comprehensive HAR Management Solutions:** JGC offers two types of solutions for HAR management:
  - Dry Fogging
  - HAR Digital

Our Experiences

20+

Projects

Contributed to over 20 projects in various phases of Project/Plant Life Cycle (FS, Pre-FEED, FEED, EPC, Revamps)

TANGGUH LNG · PETRONAS LNG 9 · Ichthys PROJECT INPEX · MOZAMBIQUE LNG · DONGGI SENORO Liquefied Natural Gas · YAMAL LNG · GORGON AUSTRALIAN LNG · Kitimat LNG · Jordan Cove LNG VERESEN · Golden Pass LNG · Cameron LNG · Lake Charles LNG

AIRLIZE LNG

Return to Operation menu

What is Dry Fogging?

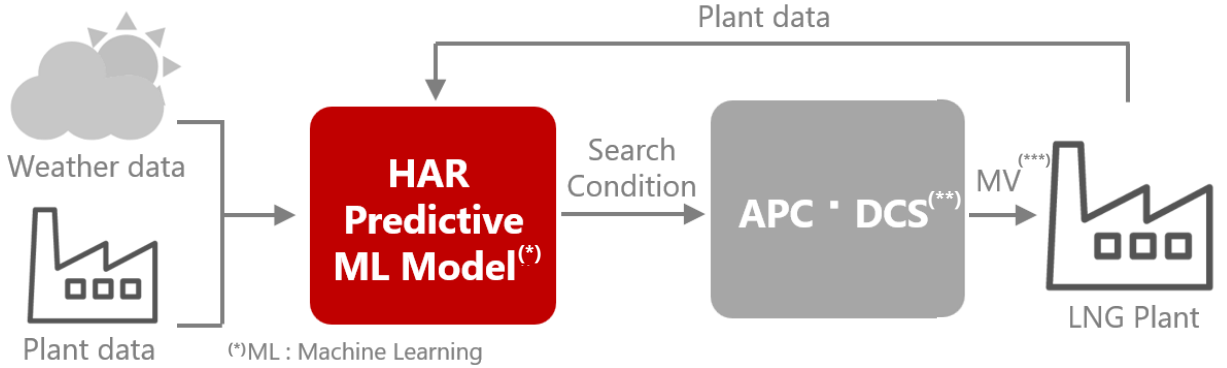
Dry Fogging enhance the performance of ACHE by implementing simple water mist system.

The water mist helps lower the air inlet temperature of the ACHE.

Improves the overall performance of the ACHE.

What is HAR Digital?

HAR Digital is an automated control system powered by Artificial Intelligence (AI).



(*)ML : Machine Learning
JGC jointly developed HAR Digital software with LNG operator in Southeast Asia through PoC.
(**)APC : Advanced Process Control, DCS : Distributed Control System
(***)MV : Manipulated Variable

Advantage of Dry Fogging

- **Increased LNG Production:** By enhancing cooling performance with minimal capital investment, LNG production can be increased by up to 2%.
- **Quick Delivery Time:** From design to installation, the system can be delivered within a year.
- **No Equipment Damage:** The fine water mist ensures no damage or scale formation on the equipment.
- **Simple System and Easy Operation:** The system consists of only pumps, piping, and fogging nozzles, making it easy to operate.

Advantage of HAR digital

- **Increased LNG Throughput:** The feed-forward process control system, powered by a HAR predictive machine learning (ML) model, can increase LNG throughput by up to 2% without any major modifications.
- **Stable Operation:** Achieves stable operation by adjusting in advance.
- **High Performance**: High performance operation can be achieved by maintaining proximity to the operating limit while HAR does not occur

Operational Excellence Services

Operation

Automatics Operation

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

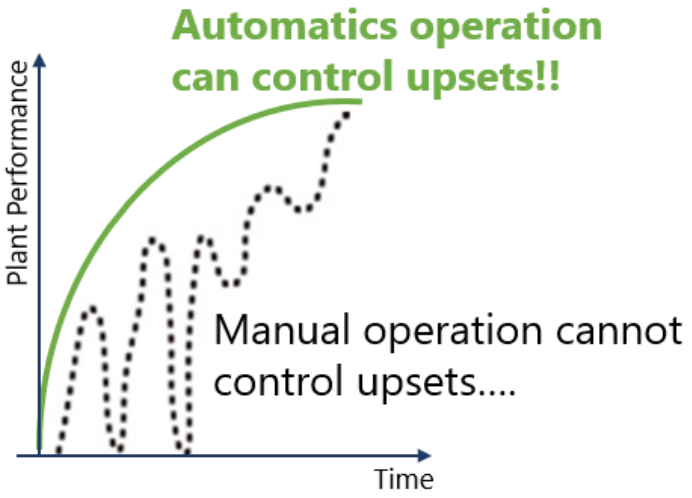
Access to Our Homepage

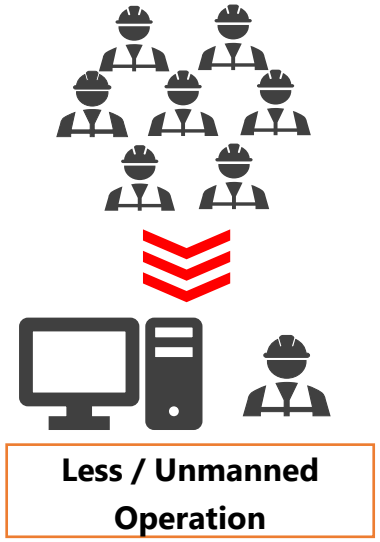
https://www.jgc.com/en/business/epc/operation-maintanance/service/

Automatics Operation

Advantages of Automatics Operation

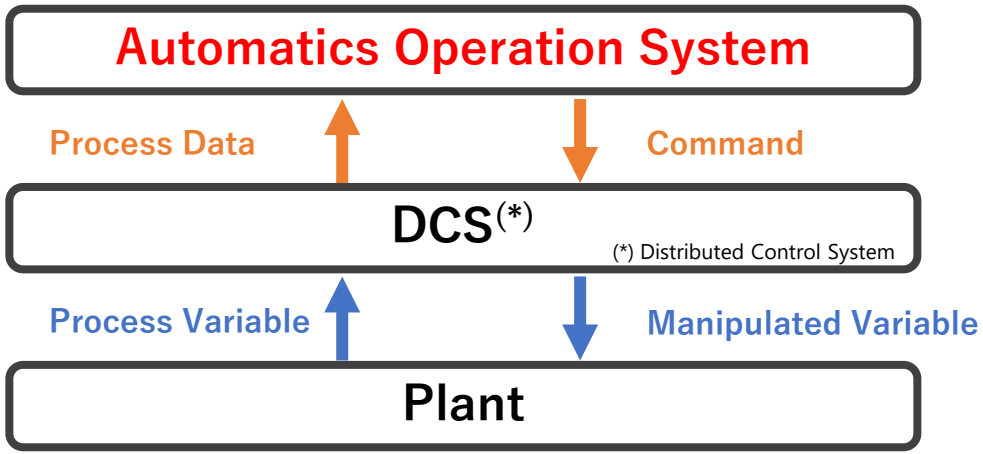
- **Stabilizing facility performance by reducing process upsets during process operation**
- **Prevention of equipment damage due to mistakes**
- **Minimizing transient operation time**
- **Standardization of transient operation sequence**
- **Assistance for operators with limited experience.**





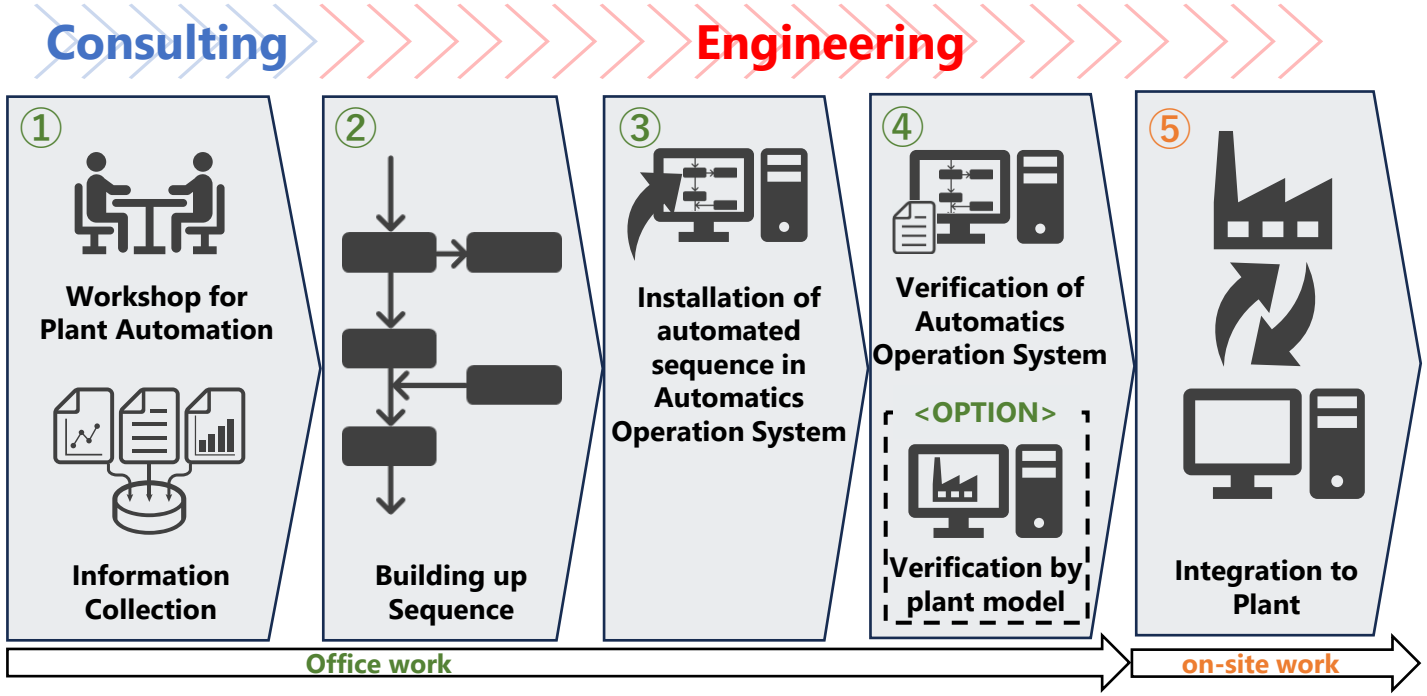
What is Automatics Operation ?

- Automatics Operation achieves an automated operation for numerous types of plant and equipment (upstream, midstream, downstream).
  - Plant Startup and Shutdown
  - Transient Operation (ramp-up/down, etc.)
  - Process Upset (adjusted for stable operation)
  - Package System Startup and Shutdown (Compressor, Expander, etc.)
- JGC provides consulting and engineering services to implement Automatics Operation for existing plants.



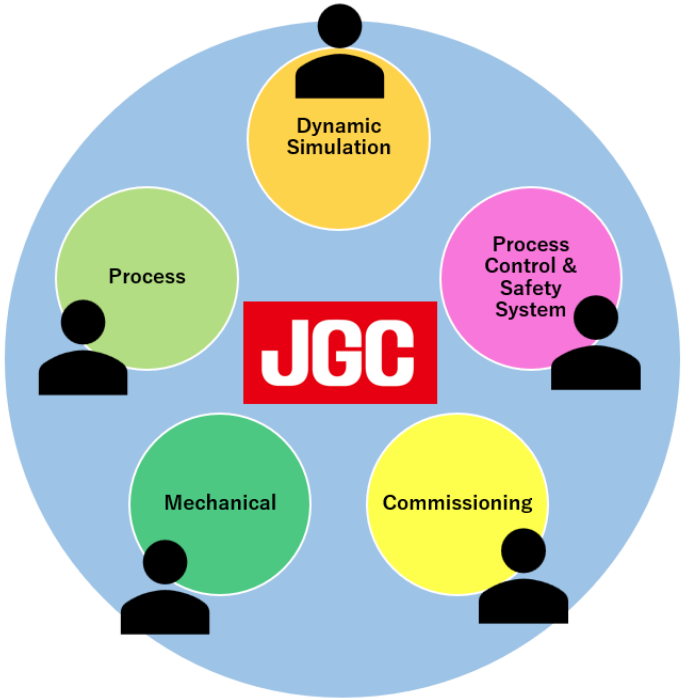
Automatics Operation

Workflow for Implementation



Our Strengths

- Experience in EPC and O&M of many types of facilities in many locations around the world
- Specialist Engineering Team consisting of various experts in JGC to deliver Automatics Operation



Our Experience

- LNG, Ammonia, Power Plant, etc.
  Automation for plant startup and shutdown in various types of plants.
- MCHE(*) Cooldown, Compressor change-over, etc.
  Automatic sequences for startup and shutdown of many types of package system

(*) Main Cryogenic Heat Exchanger

Automatics Operation

Return to Operation menu

Case Study : Success of Automated Startup/Shutdown in IGFC(*)

- Plant owner: Osaki Coolgen Corporation <https://www.osaki-coolgen.jp/en/>
- Process: CO2 Capture and Recovery Facility in the IGFC
- Requirement: Fully automated plant startup/shutdown operation

(*) Integrated Coal Gasification Fuel Cell Combined Cycle

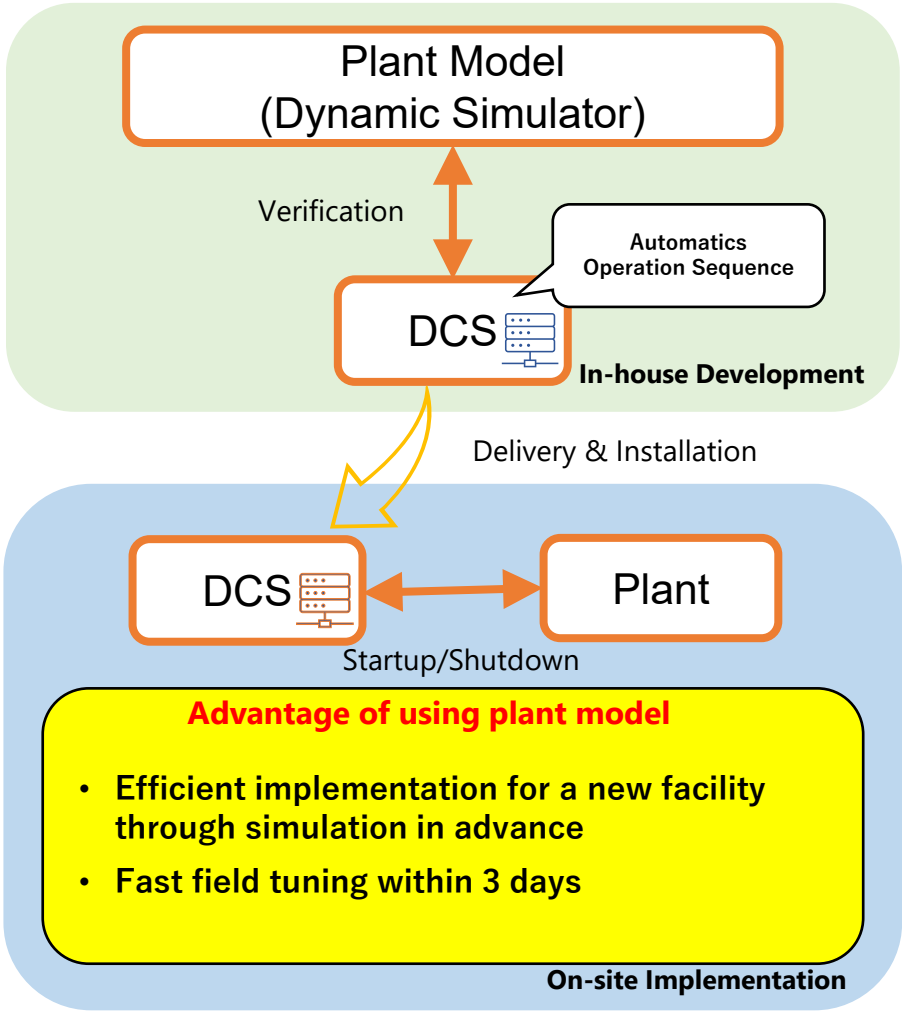
Approach

- Developed Plant Model to validate Automatics Operation Sequence for minimizing tuning work during on-site implementation
- Implemented Automatics Operation sequence into DCS according to system configuration at existing unit

Achievement

- Quick startup/shutdown operation by automating over 1000 steps in the procedure
- Safe startup/shutdown operation without any human error and any failure of an equipment

Provided by Osaki Coolgen Corporation



Implementation by using plant model

Operational Excellence Services

Operation

Operations Readiness & Assurance (OR&A)

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Operations Readiness & Assurance (OR&A)

Do you have any of these issues?

☹ **Concern of safe and smooth startup of O&M**

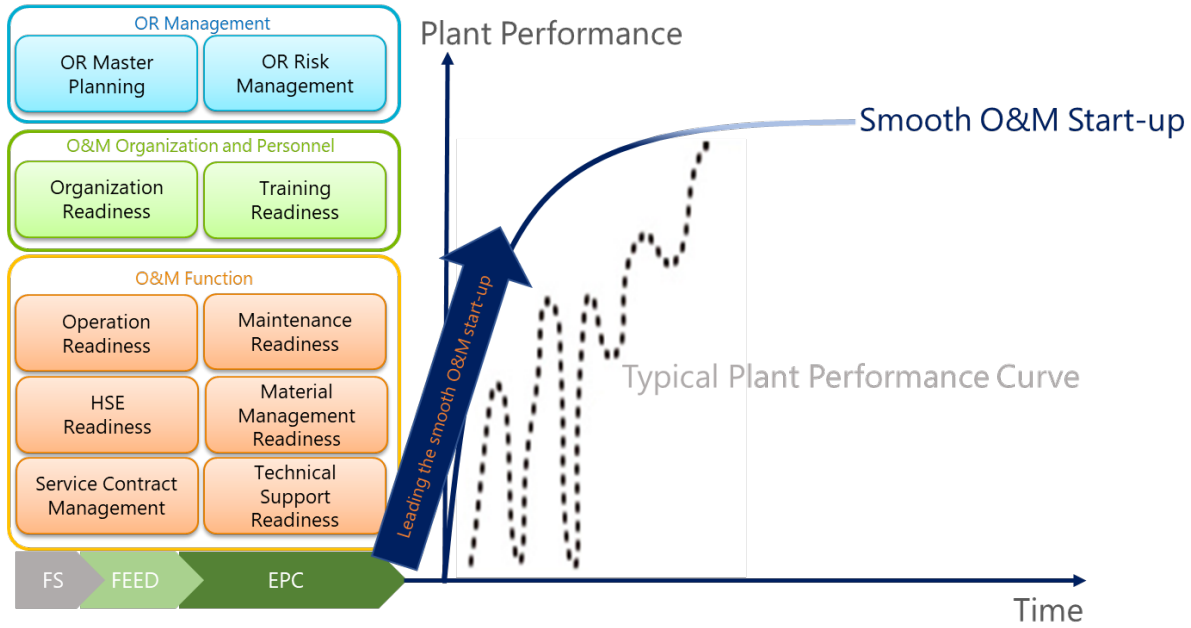
☹ **High total cost of ownership**

☹ **Potential areas of concerns and its mitigations in OR(*)**

OR&A Solution

- Execute OR&A program for all OR key components of facilities(**) by expert team
- Assess OR plan and progress and reporting with findings and mitigations
- Follow up prioritized mitigation actions to reduce OR risk and to minimize the facility total cost of ownership

(*)OR : Operations Readiness
(**)facilities : Onshore and offshore O&G plant, chemical plant etc.



Operations Readiness & Assurance (OR&A)

Operations Readiness & Assurance (OR&A)

Return to Operation menu

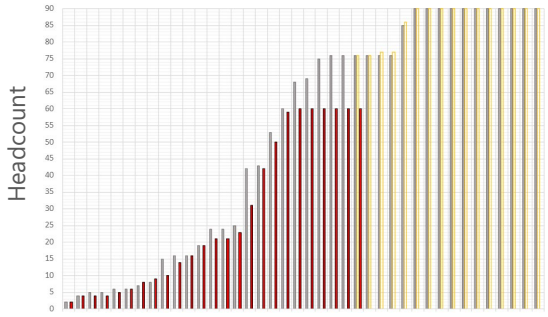
Workflow & Result

A) OR&A Planning Phase

1. Verification of overall OR schedule
2. Define OR elements
3. Establish OR progress and KPI tracking system

B) Assurance Phase

1. Monitor OR activities
2. Assess the progress and risk for OR activities (Health Check)
3. Report and follow up mitigation actions



Recruiting Progress Tracking

OR Components	Business Processes	Status	Plan	Forecast	Actual
Organization Readiness	Recruting for O&M personnel	Completed	☺	☺	☺
Training Readiness	Competency Assessment	Completed	😐	☺	☺
HSE Readiness	PTW	Completed	☺	☺	😐
HSE Readiness	LOTO	In progress	☺	😐	
HSE Readiness	Emergency Response	In progress	☺	😐	
HSE Readiness	Spill Prevention	In progress	😐	☺	
HSE Readiness	Waste Management Plan	Not Started	☹	☺	
Operation Readiness	Production Reporting	Not Started	☹	😐	
Operation Readiness	Laboratry Analysis	In progress	☺	☺	
Operation Readiness	Crew Change	Completed	😐	☺	☺
Maintenance Readiness	Maintenance Management (Work Process)	Not Started	😐	😐	

Business Process Progress Tracking

Sample Progress and KPI tracking system

Our Strengths

- Standardized OR&A program based on FLNG project
- Expert O&M engineers with experiences in operating companies
- Utilization of global project management experiences from over 20,000 FEED and EPC projects

Our Experiences

- OR&A program execution for FLNG O&M
- Operations audit for FPSO in West Africa
- O&M and Training readiness planning and execution for various EPC projects

Operational Excellence Services

Operation

Predictable Startup Program

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Predictable Startup Program

Do you have any of these issues?

- ☹ **Reliability of current Commissioning Plan**
- ☹ **Lack of experience in planning**
- ☹ **Unfamiliar equipment/unit**
- ☹ **Resource for unfamiliar countries**

Our Solution

Provide consultation, recommendations and/or improvements for the following items on the following plans/topics:

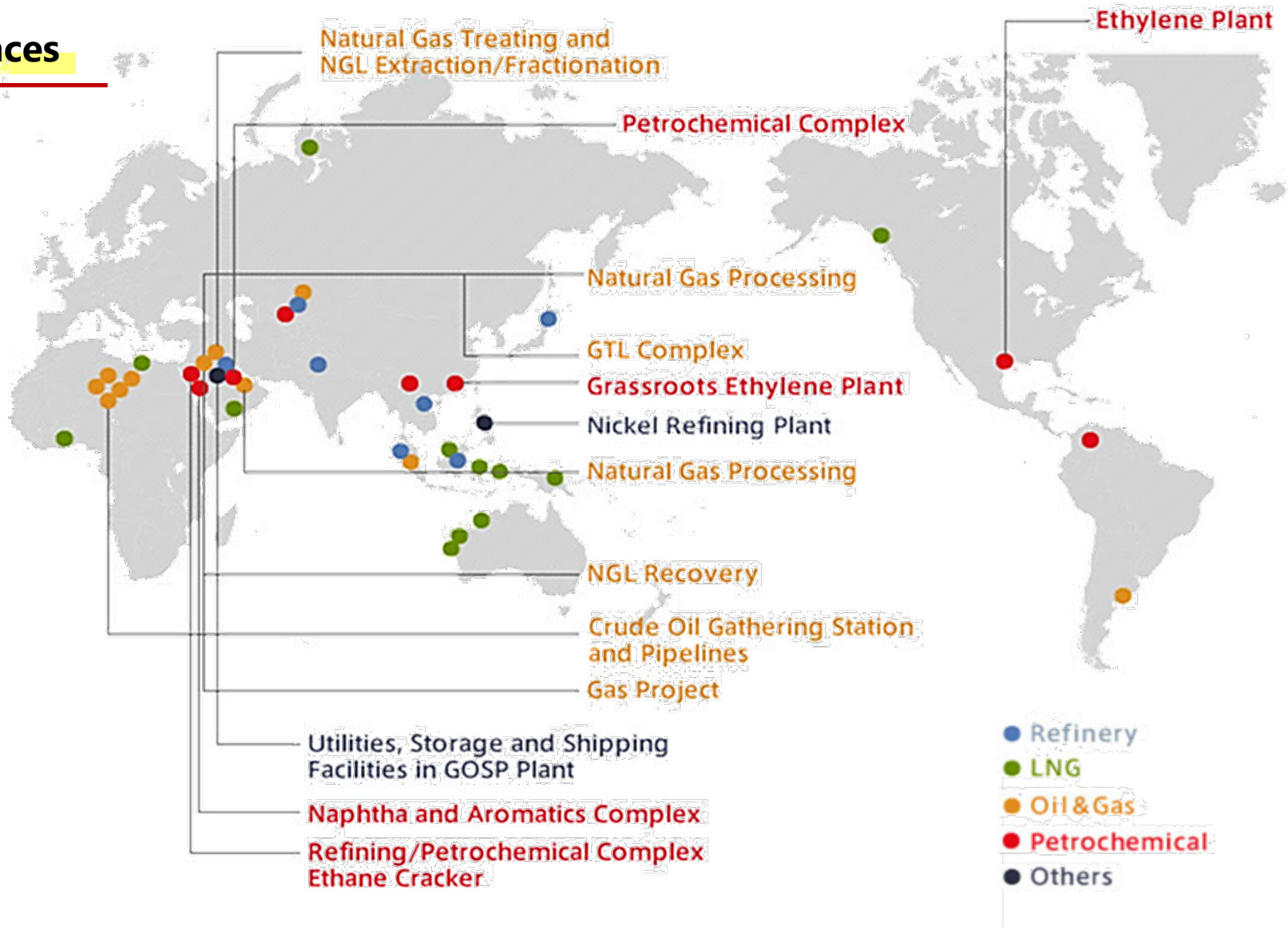
- **Commissioning HSE Plan**
- Commissioning Execution Plan
- **Plan and/or procedure with CASTOR®**
- Completion Plan includes Systemization and/or RFSU Blocks
- **Commissioning & Startup for FLNG/FPSO/Module**
- Design/Engineering Considerations
- Benchmark Schedule and/or manning against projects completed
- Contractor Strategy (SOW, Technical evaluation, Selection)
- Identifying Commissioning Risks and Mitigation

Predictable Startup Program

Return to Operation menu

Our Strengths and Experiences

Extensive experience
in commissioning
of refinery, LNG, Gas
and petrochemical plants
for a variety of clients
around the world.



Operational Excellence Services

Operation

CASTOR®

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

CASTOR® (Commissioning and Startup Transient Operability Review)

Do you have any of these issues?

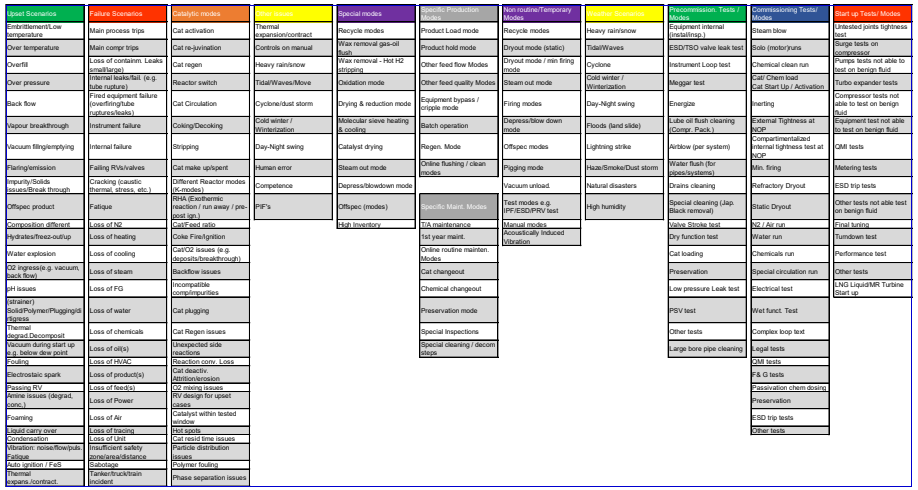
☹ **Concerns on Commissioning and Startup Plan**

☹ **Lack of (or No) Experience in Plant Startup**

☹ **Introduction of Unfamiliar Equipment/Unit**

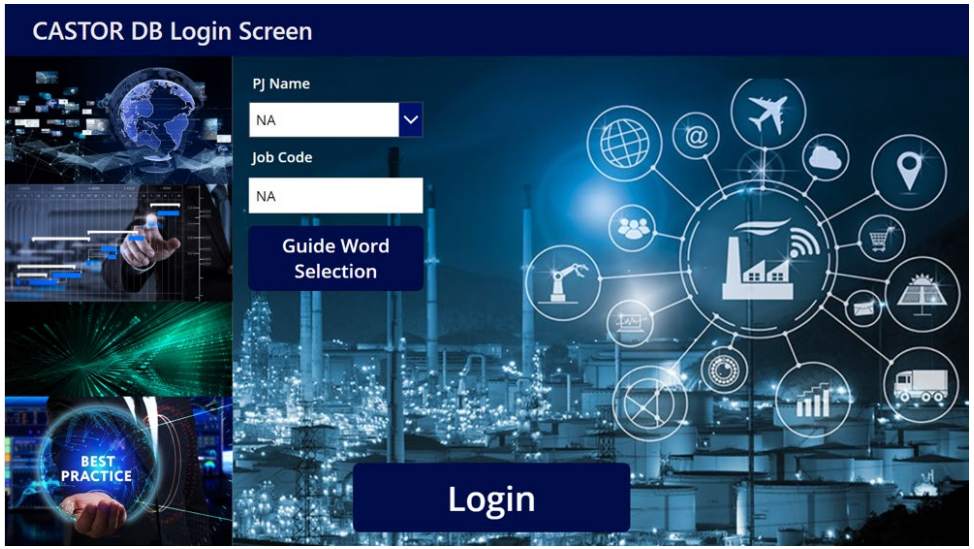
CASTOR® Solution

- Reveal risks during transient state operation at commissioning and initial startup phase
- Plan mitigation actions against risks
- Increase likelihood of successful commissioning and plant startup
- Minimize downtime due to trouble
- Eliminate risks of schedule delay



Upset Scenarios	Failure Scenarios	Catalytic modes	Slow modes	Special modes	Specific Production Modes	Non routine/Temporary Modes	Weather Scenarios	Precommission. Tests / Modes	Commissioning Tests/ Modes	Start up Tests/ Modes
Embrittlement/Low temperature	Main process trips	Cat activation	Thermal expansion/contract	Recycle modes	Product Load mode	Recycle modes	Heavy rain/snow	Equipment internal (install/insp.)	Steam blow	Untested joints tightness test
Over temperature	Main compr trips	Cat re-juvination	Controls on manual	Wax removal gas-oil flush	Product hold mode	Dryout mode (static)	Tidal/Waves	ESD/TSO valve leak test	Solo (motor)runs	Surge tests on compressor
Overfill	Loss of containm. Leaks small/large)	Cat regen	Heavy rain/snow	Wax removal - Hot H2 stripping	Other feed flow Modes	Dryout mode / min firing mode	Cyclone	Instrument Loop test	Chemical clean run	Pumps tests not able to test on benign fluid
Over pressure	Internal leaks/fail. (e.g. tube rupture)	Reactor switch	Tidal/Waves/Move	Oxidation mode	Other feed quality Modes	Steam out mode	Cold winter / Winterization	Meggar test	Cat/ Chem load	Turbo expander tests
Back flow	Fired equipment failure (overfiring/tube ruptures/leaks)	Cat Circulation	Cyclone/dust storm	Drying & reduction mode	Equipment bypass / cripple mode	Firing modes	Day-Night swing	Energize	Cat Start Up / Activation	Compressor tests not able to test on benign fluid
Vapour breakthrough	Instrument failure	Coking/Decoking	Cold winter / Winterization	Molecular sieve heating & cooling	Batch operation	Depress/blow down mode	Floods (land slide)	Lube oil flush cleaning (compr.,Pack.)	Inerting	Equipment test not able to test on benign fluid
Vacuum filling/emptying	Internal failure	Stripping	Day-Night swing	Catalyst drying	Regen. Mode	Offspec modes	Lightning strike	Airblow (per system)	External Tightness at NOP	
Flaring/emission	Failing RVs/valves	Cat make up/spent	Human error	Steam out mode	Online flushing / clean modes	Pigging mode	Haze/Smoke/Dust storm	Water flush (for pipes/systems)	Compartimentalized internal tightness test at NOP	OMI tests
Impurity/Solids issues/Break through	Cracking (caustic, thermal, stress, etc.)	Different Reactor modes (IK-modes)	Competence	Depress/blowdown mode		Vacuum unload.	Natural disasters	Drains cleaning	Min. firing	Metering tests
Offspec product	Fatigue	RHA (Exothermic reaction / run away / pre-/post ign.)	PIF's	Offspec (modes)	Specific Maint. Modes	Test modes e.g. IPF/ESD/PRV test	High humidity	Special cleaning (Jap. Black removal)	Refractory Dryout	ESD trip tests
Composition different	Loss of N2	Cat/Feed ratio		High Inventory	T/A maintenance	Manual modes		Valve Stroke test	Static Dryout	Other tests not able test on benign fluid
Hydrates/freez-outtup	Loss of heating	Coke Fire/Ignition			1st year maint.	Acoustically Induced Vibration		Dry function test	N2 / Air run	Final tunins
Water explosion	Loss of cooling	Cat/O2 issues (e.g. deposits/breakthrough)			Online routine mainten. Modes			Cat loading	Water run	Turndown test
O2 ingress(e.g. vacuum, back flow)	Loss of steam	Backflow issues			Cat changeout			Preservation	Chemicals run	Performance test
pH issues	Loss of FG	Incompatible comp/impurities			Chemical changeout			Low pressure Leak test	Special circulation run	Other tests
Catalyst(r) Solid/Polymer/Plugging/dp/press	Loss of water	Cat plugging			Preservation mode			PSV test	Electrical test	LNG Liquid/MR Turbine Start up
Thermal degrad.Decomposit	Loss of chemicals	Cat Regen issues			Special Inspections			Other tests	Wet funct. Test	
Vacuum during start up e.g. below dew point	Loss of oil(s)	Unexpected side reactions			Special cleaning / decom steps			Large bore pipe cleaning	Complex loop test	
Fouling	Loss of HVAC	Reaction conv. Loss							Legal tests	
Electrostaic spark	Loss of product(s)	Cat deactiv. Attrition/erosion							QMI tests	
Passing RV	Loss of feed(s)	O2 mixing issues							F& G tests	
Amine issues (degrad, conc.)	Loss of Power	RV design for upset cases							Passivation chem dosing	
Foaming	Loss of Air	Catalyst within tested window							Preservation	
Liquid carry over	Loss of tracing	Hot spots							ESD trip tests	
Condensation	Loss of Unit	Cat resid time issues							Other tests	
Vibration: noise/flow/puls Fatigue	Insufficient safety zone/area/distance	Particle distribution issues								
Auto ignition / FeS	Sabotage	Polymer fouling								
Thermal expans./contract.	Tanker/truck/train incident	Phase separation issues								

CASTOR Guideword Template (General)



CASTOR Database

CASTOR® (Commissioning and Startup Transient Operability Review)

Return to Operation menu

Workflow & Results

Workflow of CASTOR®

- **Step-1** Develop CSU Plan and Diagram
- **Step-2** Review Plan with Experienced Engineers
- **Step-3** Reveal Risks using Guidewords
- **Step-4** Plan Mitigation against Risks

- Develop Commissioning and Startup (CSU) Plan and Diagram
- Review CSU Plan and Diagram with highly experienced engineers
- Reveal risks related to transient operation during Commissioning and Startup using Guidewords and experiences of engineers
- Plan mitigation actions against revealed risks
- Improvement of Operation Manuals, Procedures (SOP), Training Programs and updating of procedures for existing plants

Our Strengths

- Professional Process & Commissioning Engineer Teams
- World-class experiences and expertise in Plant Commissioning and Startup as an EPC Contractor
- A wealth of Lessons Learned about Commissioning and Startup
- Experiences in various types of plant like LNG, Refinery, NGL, GOSP, Floating LNG, Chemical, etc.

Our Experiences

- CASTOR® for LNG, NGL, GOSP, Floating LNG, Ethylene, etc.
- Not only for EPC but also for FEED projects
- Long history of startup review as the predecessors of CASTOR®

  == > **CASTOR Database**

CASTOR®
Since 2015
7 Cases

Operational Excellence Services

Operation

Commissioning Safety

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Commissioning Safety

Do you have any of these issues?

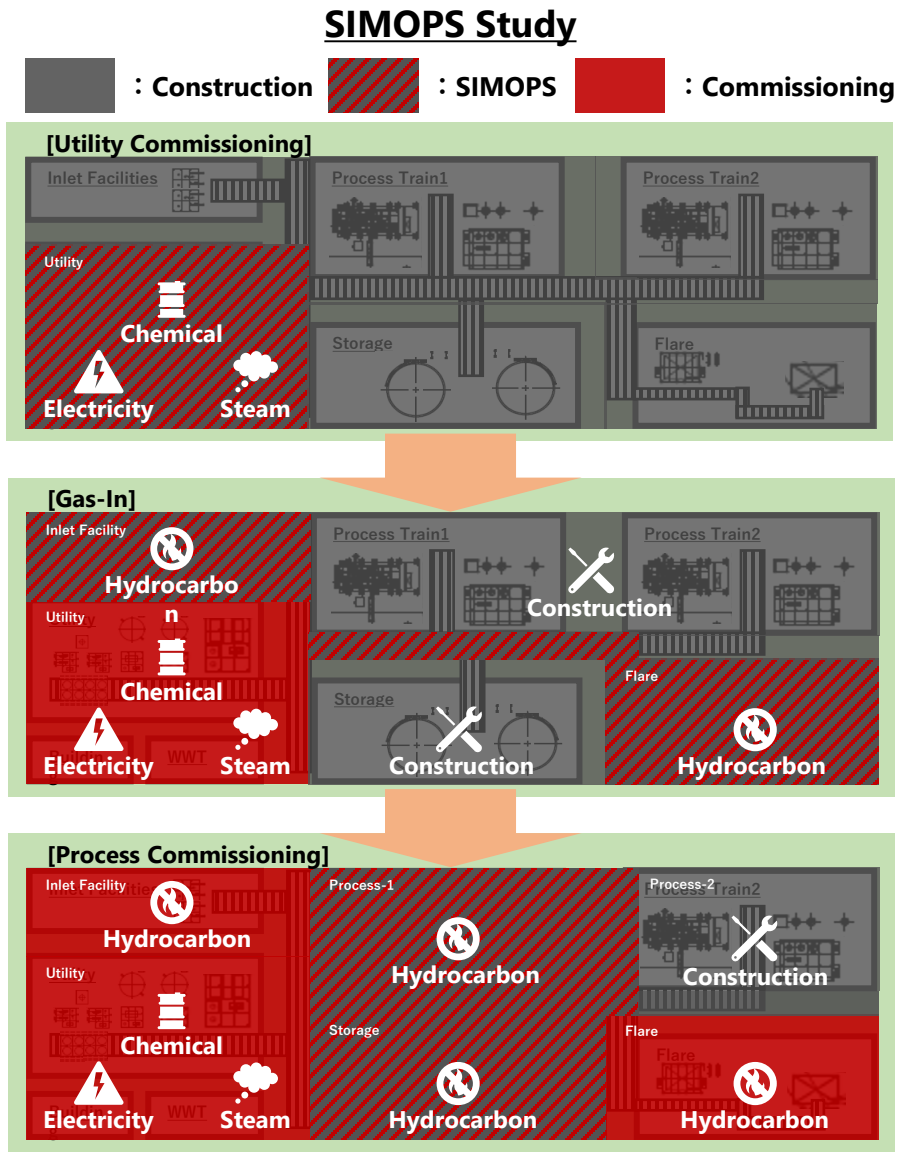
☹ **Introduction of hazardous material in areas where construction is still in progress**

- ✓ **Electricity**
- ✓ **Chemicals**
- ✓ **Steam**
- ✓ **Hydrocarbon**

Our Solution

Provide consultation on the following plans/topics:

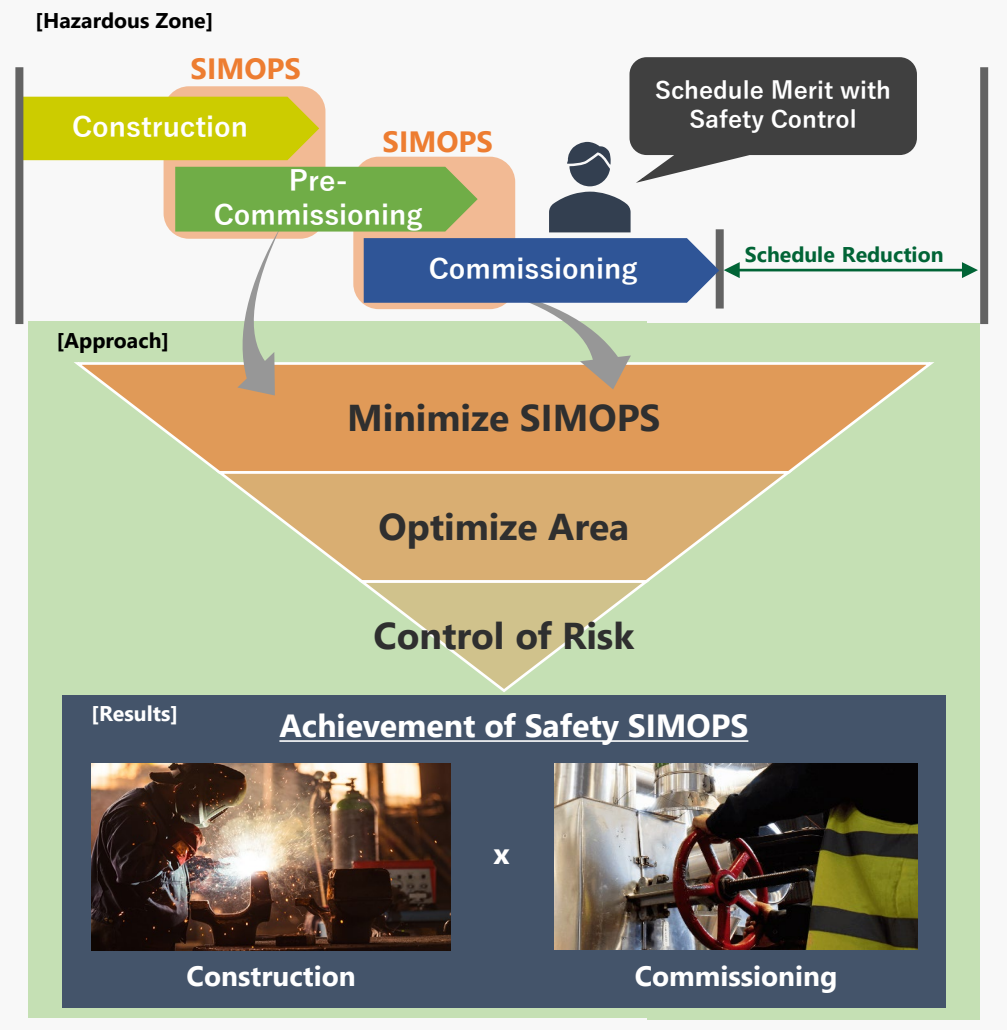
- Completion Plan
- Systemization
- Identify Safety Risks and Prepare Risk Mitigation (SIMOPS Study)
- Design/Engineering Considerations (Additional Isolations)
- QRA Study with Technical HSE Engineering



Commissioning Safety

Return to Operation menu

Workflow & Result



Our Strengths

- Professional Process & Material Engineer Teams
- Top global results and performances on Degradation Assessment, Inspection Planning, On-site Inspection.
- Use of big data that integrates customer plant operating data and JGC design data to forecast future plants' needs
- Collaboration between oversea EPC-capable group companies and local maintenance companies.

Our Experiences

- CSU planning using system definitions since early 1990s
- SIMOPS study since early 2000s
- Continued to ensure commissioning safety in recent larger and more complex projects.

Operational Excellence Services

Operation

Commissioning & Startup for FLNG/FPSO/Module

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Commissioning & Startup for FLNG/FPSO/Module

Do you have any of these issues?

☹ **What shall be conducted at each location??**

- ✓ At Module Fabrication Yard
- ✓ At Shipyard / Onshore
- ✓ At Offshore (both Pre-RFSU and Post-RFSU)

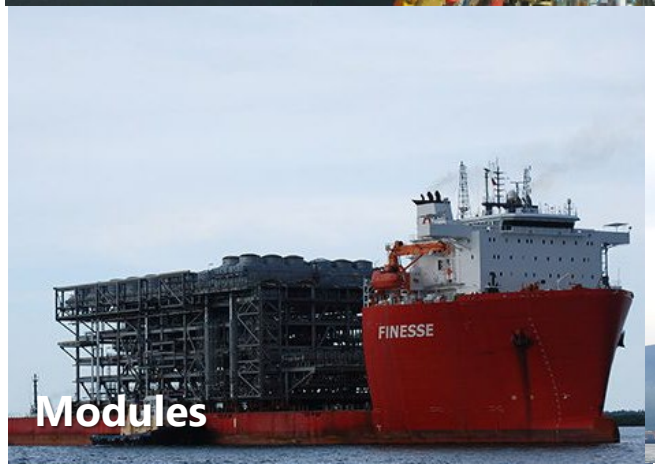
☹ **What shall be prepared at each phase??**

- ✓ Manning (POB Plan/ Flotel)
- ✓ Spare Parts/Special Tools/ Temporaries/Consumables
- ✓ Logistics/Onshore Base/Storage Area
- ✓ Startup Procedure/Training, etc.

Solution based on actual FLNG EPCIC experiences

☺ **Provide consultation on the following topics:**

- ✓ Project Completion Plan
- ✓ Design/Engineering Considerations
- ✓ Commissioning Execution Plan
- ✓ Startup Plan, Procedure and Operator Training
- ✓ Manning including Offshore Training
- ✓ Logistics Strategy and/or Material Arrangement etc.



Commissioning & Startup for FLNG/FPSO/Module

Return to Operation menu

Workflow & Result

Engineering
- Establish Project Completion Plan
- Establish Commissioning Execution Plan

Module Yard
- Pre-commissioning (Clean & Tight)
- Preservation

Shipyard
- Maximize Commissioning (Minimize Offshore Works)
- Preparation for Offshore (Materials/Manning etc.)

Towing
- Hull & Marine Operation
- Preservation

Pre-RFSU Offshore
- Offshore Installation
- Reverification of Onshore Works & PSSR

Post-RFSU Offshore
- Smooth Startup as per SOP
- Ramp up & Performance Test

🙂 **Successful Project Completion**

Our Strengths

We are one of leading companies for Modularized Project & FLNG and have several experiences of actual project execution.

- Executed several Modularized Projects for both Onshore and Offshore
- Accumulated know-how to work with Module Fab Yard and Shipyard
- Executed two (2) FLNG EPCIC Project (see below photos)
- Executed Construction Management and Completion Support Service for Prelude FLNG Project

Our Experiences


Petronas FLNG-2 EPCIC


ENI Coral FLNG-2 EPCIC

Operational Excellence Services

Smart O&M Solutions

INTEGNANCE VR

Fast Digital Twin Maintenance Viewer

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

INTEGNANCE VR-Fast Digital Twin Maintenance Viewer

Do you have any of these issues?

- ☹ **Struggling with promoting DX to aging plant which doesn't have 3D model**
- ☹ **Wasting time on Site Visit for repair work planning, inspection planning, and daily maintenance work planning**
- ☹ **Outdated or missing blueprints**

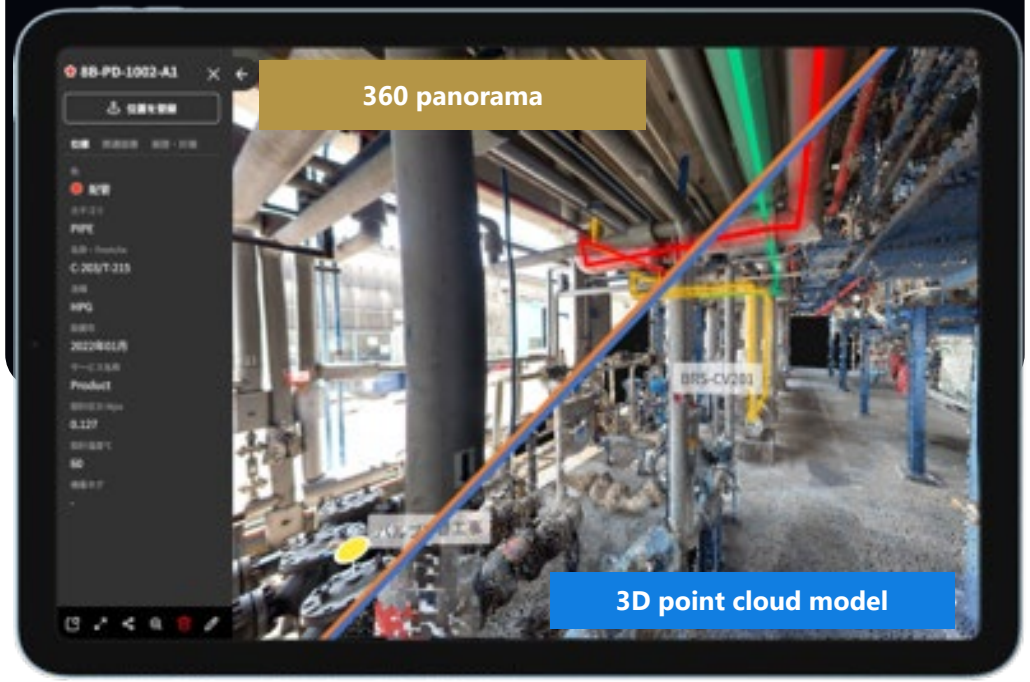
Our Solutions

- **Our "Fast Digital Twin" replicates your plant as 3D model within 3 days at the earliest**
- **Without going to the site, maintenance planning can be developed via web**
- **Direct recording into a 3D model with tablets on-site is an efficient way to share site data without the need for blueprints**

Brownreverse

3D Viewer development/provision (INTEGNANCE VR)(*)

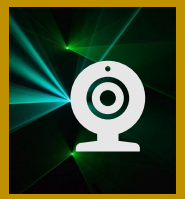
INTEGNANCE VR



3D scanning

Wearable 3D Imaging Scanner

Drone

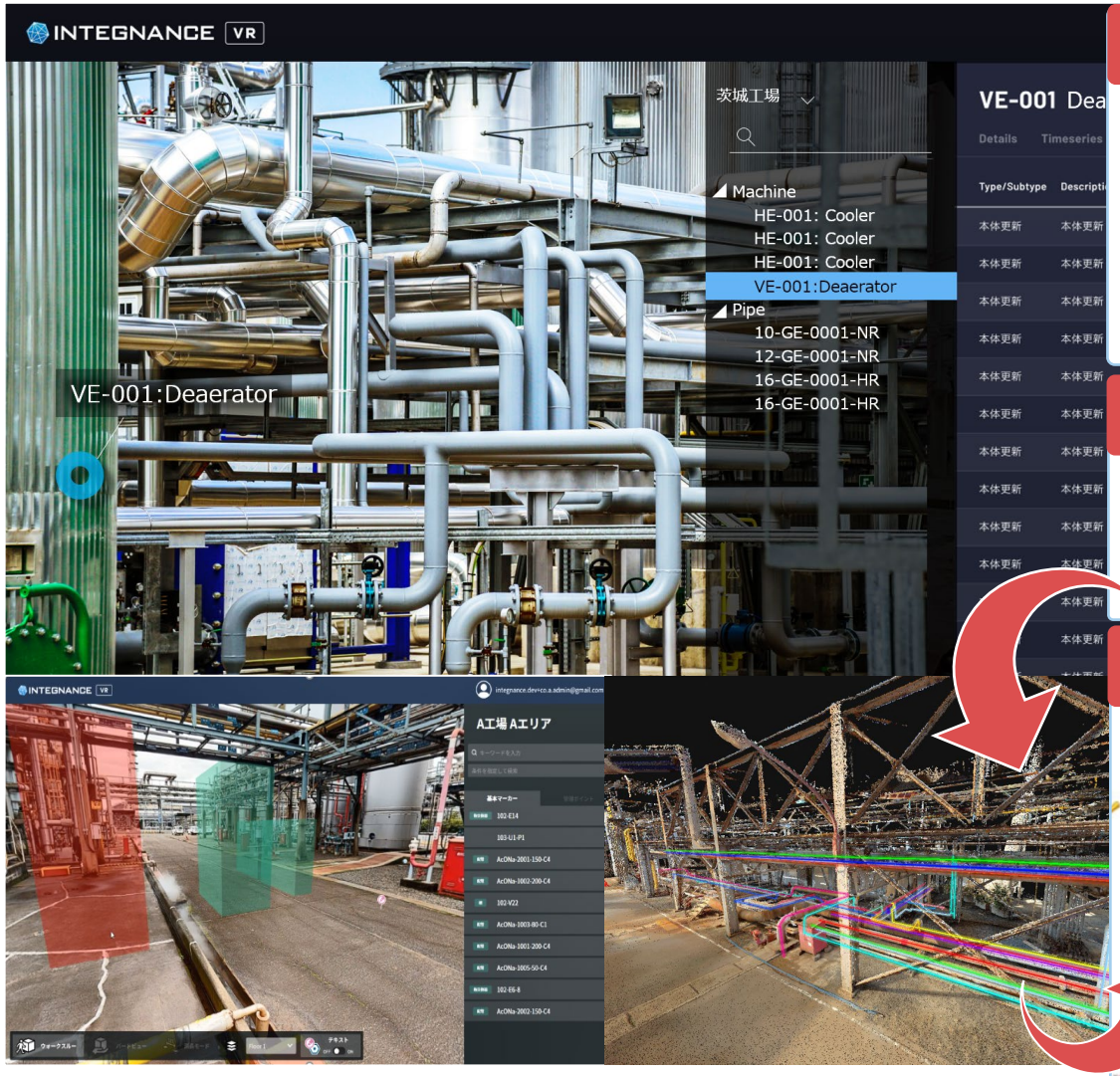


Imaging Laser Scanner

(*)INTEGNANCE VR is developed by Brownreverse which is one of JGC group companies.

INTEGNANCE VR-Fast Digital Twin Maintenance Viewer

Key Features



3D Simulation

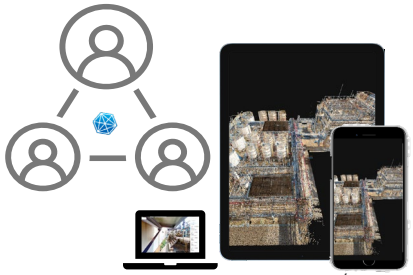
Planning of scaffolding area, Checking of material delivery routes, complicated construction, etc.

Desktop Survey

Measure the length between two points on the display without reading the drawing or measuring the actual length in the site.

Anytime Anywhere Access

No special hardware required.
Easy sharing thru URL. collaborative editing by multiple users.



Apps for Windows/iOS

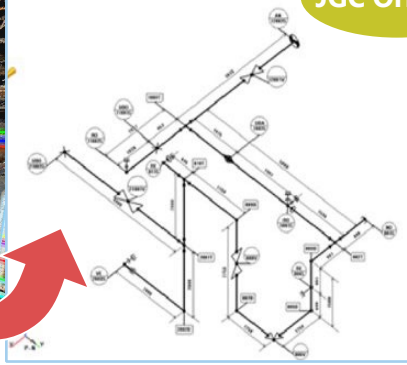
Automatic Piping Recognition

JGC Original

Mapping of corrosive loops and corrosion /damage focus areas on 360 panorama image

Automatic Isometric Output

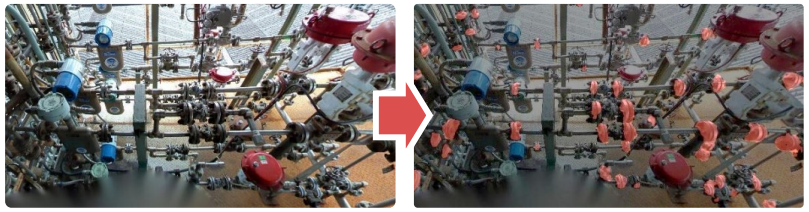
JGC Original



Automatic Flange/Valve Detection

JGC Original

Auto detection of flanges/valves positions form 360 panorama image by utilizing AI machine learning technology



INTEGNANCE VR-Fast Digital Twin Maintenance Viewer

Return to Smart O&M Solutions menu

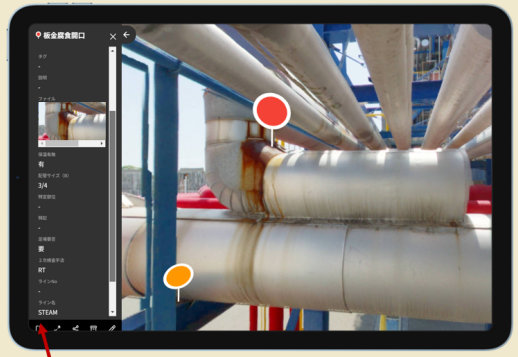
Use Case

Direct recording of 3D model into tablets on-site saves 22,500hr from 50,000hr annually. (45% reduction*)

BEFORE

- Outdated drawings
- With sketching
- Complicated to manage
- Difficult to identify managing location
- Field survey is essential for planning

AFTER



Photographs/details/incidental work, etc.
Record all related information together

Direct on-site recording
⇒Reduction of time and work for preparation and reporting

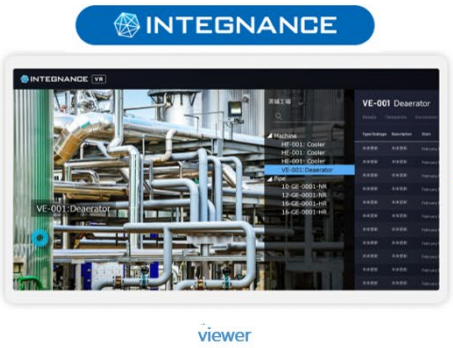
Check information all at once
⇒Optimized planning

Record location information
⇒ Efficient information sharing

*5,000 cases annually

System Integration

Integrating data infrastructures* with WEB API makes it easier to reference and update related information on INTEGNANCE VR.



API Linkage

Providers under consideration

- DataOps: COGNITE【CDF】, AVEVA【AIM】, HEXAGON【SDx】
- Facility/operation management: FUJITSU【PLANTIA】, YOKOGAWA【PI-System】, IBM【Meridium】
- construction／inspection management: JGC【A-MIS】, VALQUA【SPM】, CoreSafety

*PoC with various providers is being implemented and discussed based on requests from clients.

Our Experiences

Over 50 Sites

INTEGNANCE VR has been adopted to over 50 sites.

Recent news:
INTEGNANCE VR was adopted for an ammonia production base in Indonesia for a joint study on reducing GHG emissions.(Sep 2024)

JGC Operational Excellence Services

Smart O&M Solutions

MODS Connect

Smart Turnaround Management

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Access to MODS Connect

Industrial Construction Management Software | MODS Connect | MODS

MODS Connect-Smart Turnaround Management

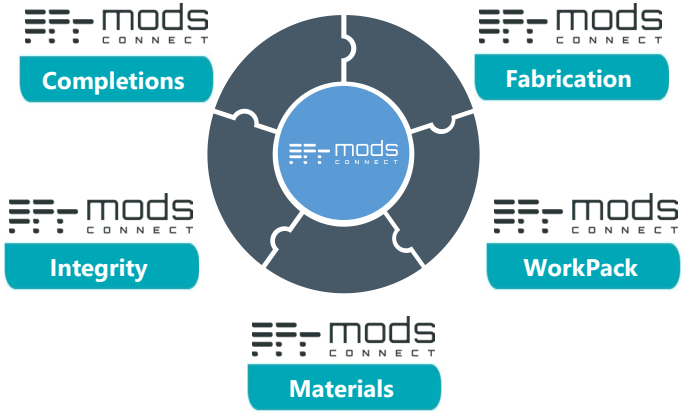
Do you have any of these issues?

- **Desire efficient information sharing and status update with digital tools during turnaround**
- **Struggling with transitioning to paperless work management**
- **Need to optimize the turnaround plan effectively**

Concept of MODS Connect for Turnaround

- A cloud-based solution that digitalizes, visualizes and automates Turnaround Project workflows, MODS Connect simplifies processes, improves safety, optimizes cost and time efficiencies.
- It enables remote collaboration and information sharing to help users make best decisions every day from turnaround planning to execution.

As flexible as comprehensive MODS Connect ecosystem includes 5 intelligent modules that connect in any combination.



> Completions

Facilitate a controlled, staged transfer of responsibility under each discipline via an intelligent centralized database.

> Fabrication

Intelligently track components throughout the upstream fabrication process to provide transparency, traceability and reliable supply-chain control.

> Integrity

Provide the digital intelligence to ensure leak-free startup, process safety and major hazard avoidance.

> WorkPack

Go paperless with digital work packs for more intelligent, transparent and accountable project execution

> Materials

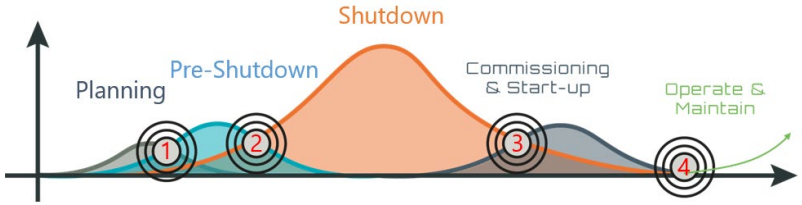
Intelligent inventory control of materials, equipment and components to ensure delivery on time, in sequence and to the correct location.

MODS Connect-Smart Turnaround Management

Return to Smart O&M Solutions menu

Seamless Turnaround Management

MODS Connect achieves seamless interface management during turnaround activities



> 1.Planning to Pre-Shutdown

Manage the pre-shutdown work by assessing risks, scheduling tasks, and preparing resources based on the accumulate past experiences and knowledge in the database.

> 2.Pre-Shutdown to Shutdown

Assign successors and predecessors to define the path of shutdown work, identify execution requirements to allow constraint management

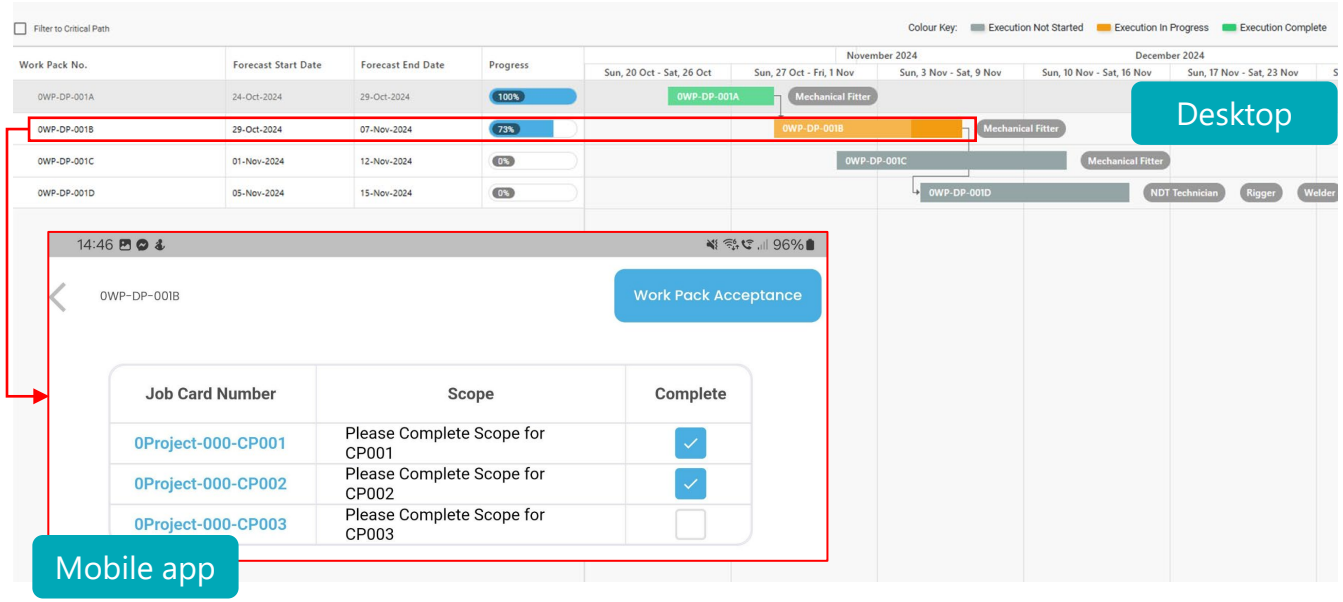
> 3.Shutdown to Start-up

Monitor shutdown work progress utilizing mobile devices, complete installation and quality records on mobile technology to provide real time tracking.

Visualize shutdown to commissioning handover.

> 4.Handover

Provide Realtime handover acceptance for operational hand over and stable operations



Gant chart monitoring and managing of activities on desktop and mobile app

Client's Benefits

- Reduces costs, for example, by reducing time spent searching for data by ~50%.
- Improves safety through transparent, streamlined workflows to minimize risk and increase the awareness of teams.
- Streamlines complex processes and maximizes resource utilization and efficiency.

Operational Excellence Services

Smart O&M Solutions

INTEGNANCE TR

Predicting Failure of Rotating Machinery

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

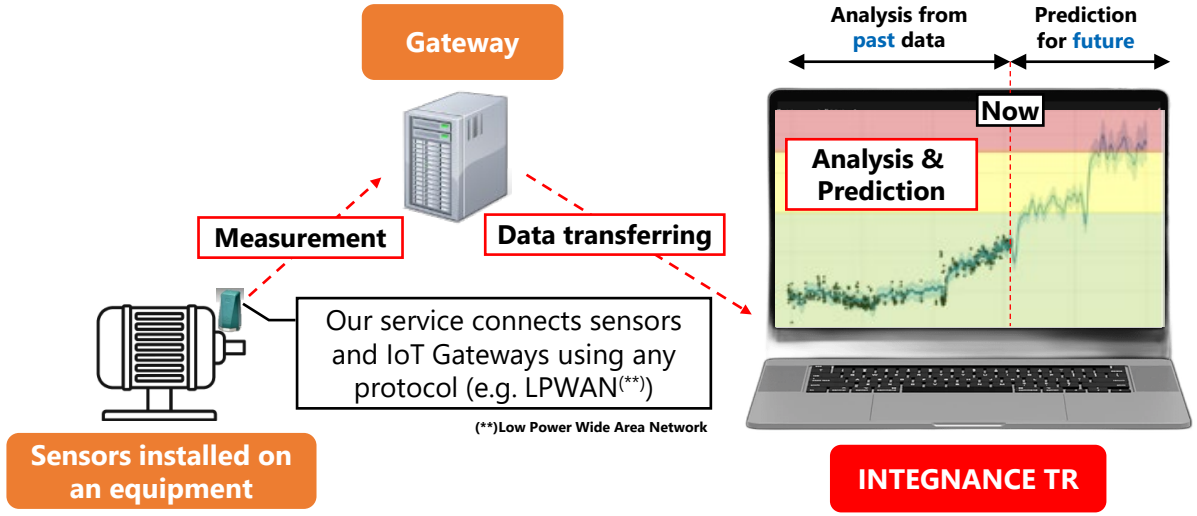
Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

INTEGNANCE TR-Predicting Failure of Rotating Machinery

Do you have any of these issues?

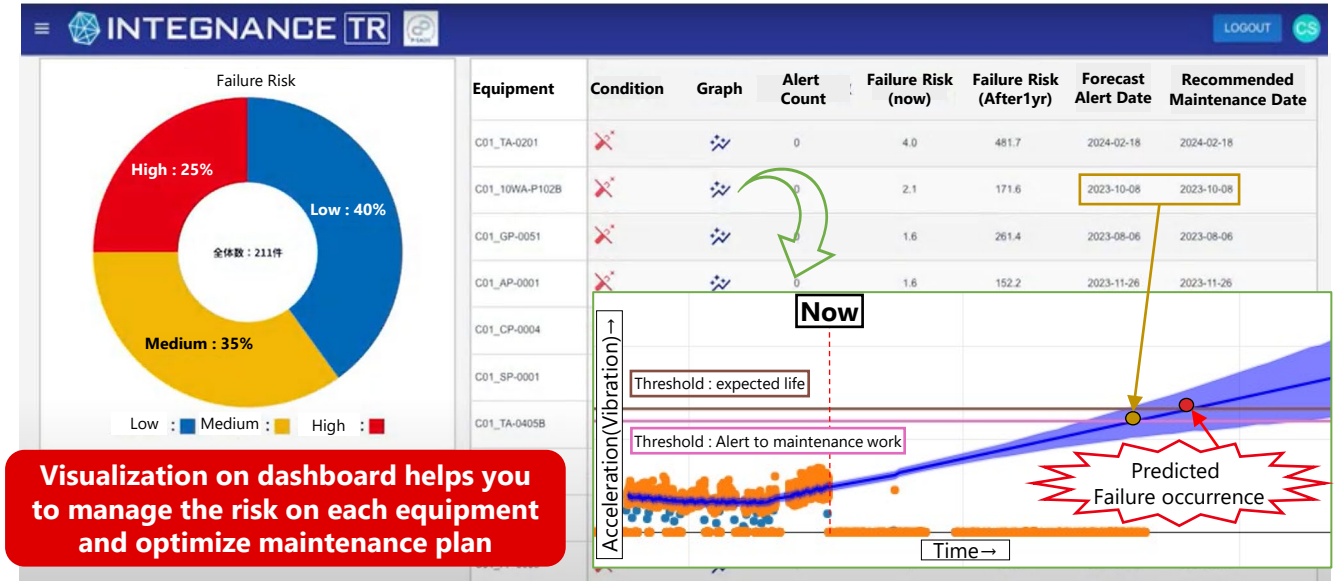
- **Need to predict failure event to minimize production loss**
- **Need to optimize maintenance plan and cost for rotating machinery with/without existing sensors**
- **Struggling to accumulate maintenance knowledge**



What is INTEGNANCE TR(*)

- **Web-Based Analysis Tool:**
  INTEGNANCE TR, one of JGC in-house software, analyzes and visualizes the predicted condition of rotating machines by modeling time series data from sensors (e.g., vibration, temperature).
- **One-Stop Service:**
  Provides comprehensive services, including the installation of sensors and gateway devices to connect equipment to the cloud, AI modeling, and cloud-based visualization, all with secure data transfer protocols.

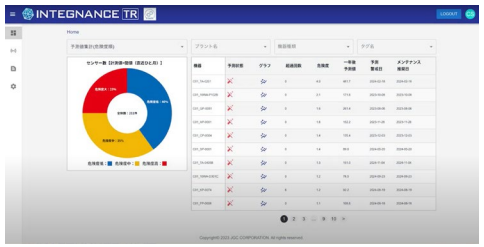
(*)Time series regression forecast for Rotating machinery



INTEGNANCE TR-Predicting Failure of Rotating Machinery

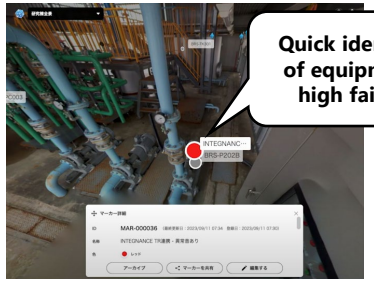
Linkage to Virtual Reality

- **VR-Linked Monitoring**
  Track equipment failure risks with INTEGNANCE VR.
- **Quick Anomaly Response**
  Technical staff can quickly act on alarms and share equipment status and location.



INTEGNANCE TR

INTEGNANCE VR See Details



INTEGNANCE VR
(Fast Digital Twin Maintenance Viewer)

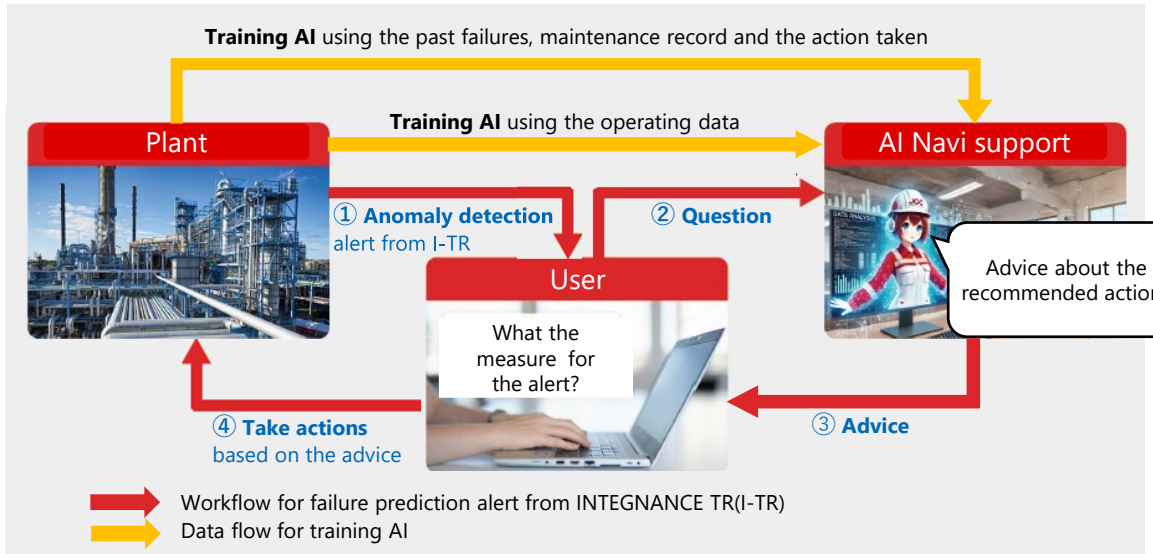
Our Strengths

- **Customized AI Algorithms:**
  Leveraging extensive plant engineering expertise, we develop tailored AI algorithms for specific equipment and situations.
- **Flexible Integration:**
  Our system seamlessly connects with sensors from any vendor.
- **Cost-Effective:**
  We offer low implementation and licensing costs.

Future Features of INTEGNANCE TR

- **AI Navi (*) Integration:**
  Get advice based on past failures, actions taken, and operating data.
- **Prescriptive Maintenance:**
  Combining INTEGNANCE TR and AI Navi for proactive solutions.
- **Knowledge Standardization:**
  AI Navi captures and standardizes expert knowledge for sustainable transitions.

(*)AI Navi is under development by JGC



INTEGNANCE TR-Predicting Failure of Rotating Machinery

Return to Smart O&M Solutions menu

Use Case : Failure Prediction in Oil Refineries

Client: Japanese oil refinery

- Predictive maintenance for the rotating machinery in offsite area
- Approximately 300 rotating machinery (e.g., pump, mixer) without sensors monitoring its condition

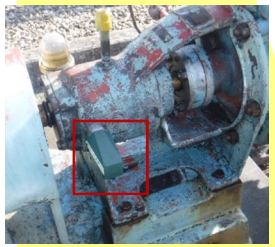
Client benefit

- **Prevent Unexpected Shutdowns:**
  Timely maintenance prevents unexpected equipment failures.
- **Remote Monitoring:**
  Expanded from 300 to 800 rotating machines monitored remotely.
- **Reduced Maintenance Costs:**
  Optimize maintenance schedules to reduce costs.

Pilot Implementation → Full-scale Operation

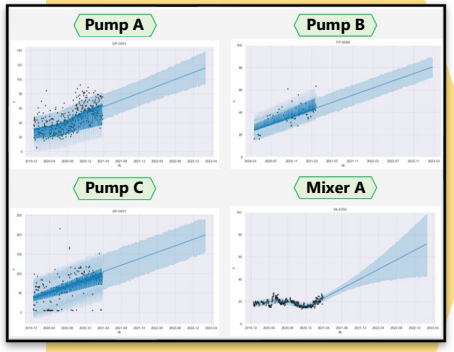
Initial Setup

- **Vibration Monitoring:**
  Connected sensors to monitor vibration acceleration.
- **AI Model Development:**
  Developed and trained an AI model using past operating data.



Validation of AI model

- **Trend Detection:**
  Identified increasing vibration acceleration trends in various types of rotating machineries
- **Condition Check:**
  Client inspections confirmed failure symptoms actually in these rotating machineries which trended to increase vibration



Go Live and Roll Over

- **Go Live:**
  Full-scale operation of INTEGNANCE TR has been commenced.
- **Roll Over:**
  Expansion of INTEGNANCE TR in the Client's other 2 plant as well and monitored approximately 800 rotating machinery totally.

Operational Excellence Services

Smart O&M Solutions

Plant Smartification with AI Technology

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Plant Smartification with AI Technology

Do you have any of these issues?

- ☹ Lack of specific expertise for O&M improvement
- ☹ Decline in productivity due to plant aging
- ☹ Accumulated large amount of data but not being used
- ☹ Knowledge gained through the experience of senior O&M personnel is not shared well with other members of the team.

Why choose an AI Solution with JGC

Know your Process Design	Extensive achievement in process engineering for various types of EPC project
Longstanding O&M Service	Our team has wide knowledge and experience in O&M service
Multi-field Engineers	Our engineers can propose AI solution with multiple fields including process, pressure vessels, rotating equipment, static equipment, electrical, instrumentation, HSE, etc.
Excellent AI experts	Extensive successful experience in providing AI solutions and well-developed implementation methodology.
30+ Cases	Prediction of catalyst degradation, Digital systemization of O&M, Equipment Failure Prediction System…etc.
Various Types of Facilities	Oil Producing, Power Plant, LNG Plant, Chemical plant, Space station, Waste treatment plant…etc.

Plant Smartification with AI Technology

Our Solution

Operation Visualization

Visualize plant operation data to intuitively determine operating conditions

Anomaly Detection

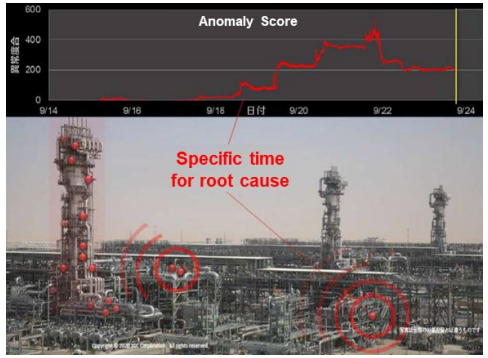
Quickly detect abnormalities and analyze causes to prevent any unforeseen events and trouble

Prediction of age-related deterioration.

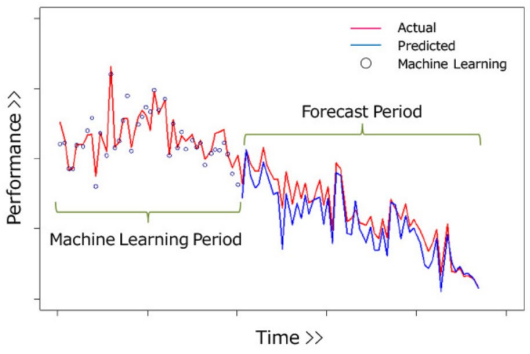
Predicts age-related deterioration of catalysts, solvents, etc., and suggests optimal replacement times.

Productivity Improvement

Incorporating external factor such as climate data into operational data analysis to improve productivity



Trace the process determine the cause



Time-dependent catalyst deterioration

Our Approach

Workshop

Discussions between client and JGC data analysis engineers (1.5-2 hours/workshop x 1 or more times as required).

- Identification of customer recognized and potential issues
- Planning of problem-solving measures
- Confirmation of quantity and quality of data required for data analysis

Proposal

Contract

Mobilize Team and Engineer

Offer the best methods such as:

- Report on cause investigation, etc.
- AI software (GUI of customer's choice)
- Automation system
- Image identification equipment
- Consultant for customer's AI construction and use

AI Digital Solution

Case Study: Analysis equipment clogging factors in Chemical plant

Return to Smart O&M Solutions menu

(1) Issue

☹ **Equipment clogging occurs frequently**

☹ To clean the clogging, the plant had to be shutdown and resulting in a **significant loss of production.**

☹ Difficult to analyze **the large number of operating conditions** under which clogging occurs.

(2) Our Solution

Step-1 To develop AI model based on algorithms for LightGBM Classifier model to investigate operating conditions during clogging for the past 10 years

Step-2 The model calculates clogging in real time during operation and extracts operational factors (e.g., sensor values) related to blockages sequentially.

Step-3 Approximately 20 factors representing operating conditions that contribute to blockage were found. The top three factors were visualized as a three-dimensional plot. **(Fig. 1)**

Step-4 The result allows engineers to properly analyze the elements causing the clogging and develop an efficient solution.

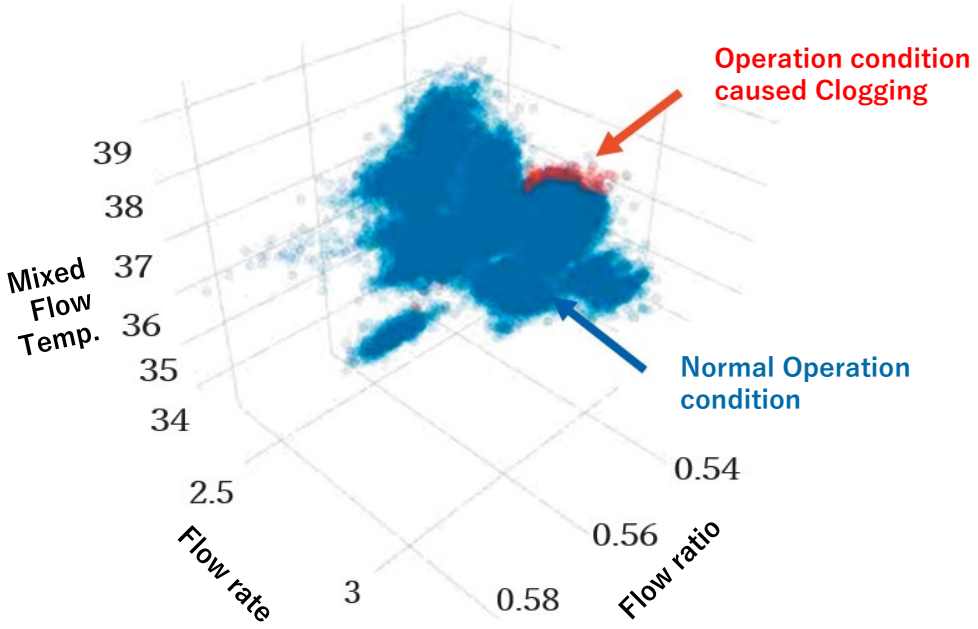


Fig.1 3D visualization of elements causing clogging

(3) Client's Benefit

Improved productivity was achieved by operating to prevent clogging

Operational Excellence Services

Smart O&M Solutions

Remote Monitoring and Assistance

Contact Us

Technology Inquiries | Contact Us | JGC HOLDINGS CORPORATION

Access to Our Homepage

https://www.jgc.com/en/business/epc/operation-maintanance/service/

Remote Monitoring and Assistance

Do you have any of these issues?

- ☹ **Restricted number of persons for site access**
- ☹ **Understanding operational status of remotely located plants**
- ☹ **Identify improvement opportunities in operations**
- ☹ **Problem-solving teams on technical troubles**
- ☹ **Lack of experienced engineers & technicians**

Our Solutions

- Remotely visualize the operations data or share the operations information with the remotely located plant site and our Global Operating Center and solve the problem with clients as “one team”.

- Without dispatching experts to the site, our expert team at Global Operating Center will support clients with troubleshooting.

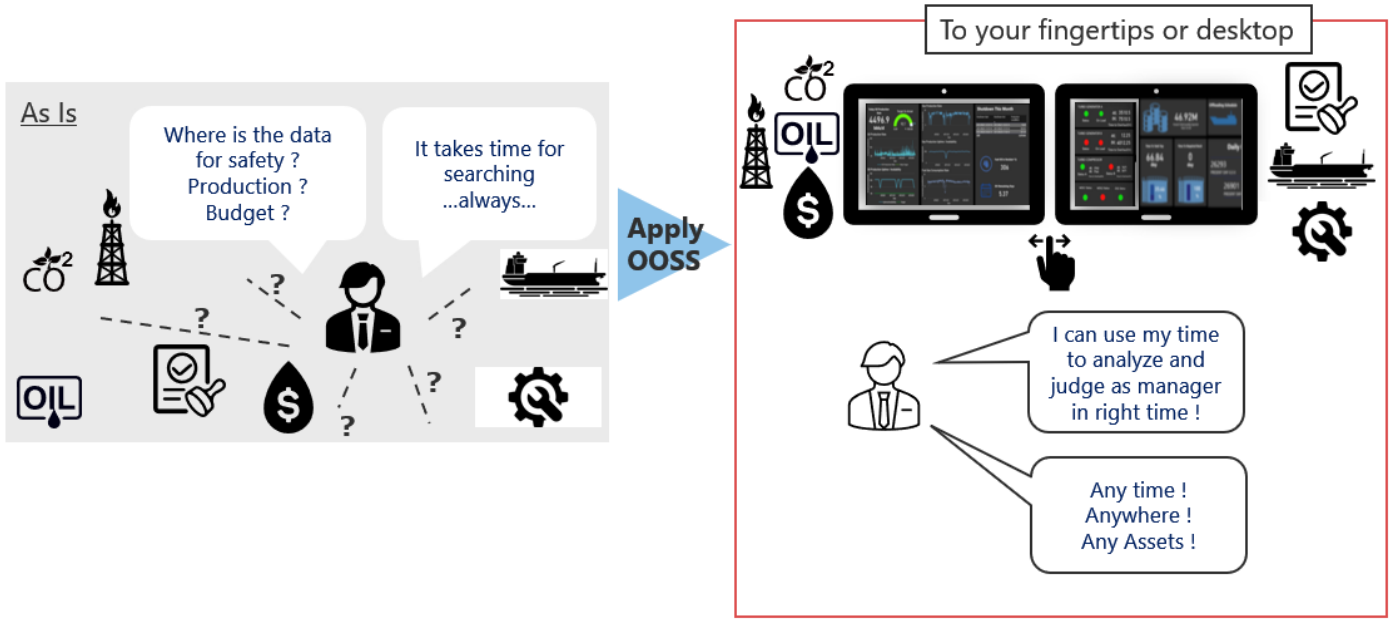
Example of KPI Dashboards for remote operations monitoring

Remote Monitoring and Assistance

Return to Smart O&M Solution menu

Use Case Bringing scattered information to your fingertips

Significantly reduced time to spend for searching necessary information for managers for the right decision at the right time



Our Strengths

- Data Visualization System to enable monitoring and analyzing the trouble with clients
- Specialized teams at Global Operating Center with expertise from various EPC and Operational Excellence services
- Availability of various experts who can solve problems quickly

Our Experiences

30+

Years in Global Market

Middle East, North Africa
Southeast Asia...etc

Various Type of Facilities

Gas Processing
Oil Producing
FPSO
Integrated Water, Steam, Power Plant, etc.