Back to Front – EPC Project Execution
Strategy – Planning – Execution

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Technip's EPC Project Objectives

EPC Projects – Today's Requirements

- Today, there is increased pressure on projects to reduce cost, to shorten schedules and for EPC Contractors to construct, commission, start-up and operate (particularly the utility systems) to secure the schedule
- Work is performed in various engineering centers; multiple vendors/sub-vendors, fabrication yards, and subcontractors at site
- Suppliers are global, transportation is complex, tariffs and customs requirements can change and unique quarantine requirements may be imposed
- Regulatory oversight and requirements are complex and changing
- Managing these multiple challenges requires concise detailing, tracking, communication and transparency - mandatory for a project to be successful!

Back to Front Planning – What to Look For?

Technip's back to front methodology has identified many critical items that at first glance do not seem critical but soon can be:

- Long lead equipment and material are usually addressed early, but what about the special tools!
- How many boilers are required to complete the steam blows?
- Which large bore piping is required first; steam, cooling water?
- What undergrounds have to be complete to move in the first modules?
- Commissioning in module yards, requirements and capabilities?
- P&ID notes, " Supplied by Others", really??

Back to Front Best Practices Realized

- YEMGAS – Marine flare was utilized 12 months prior to first shipment of LNG
- Etileno XXI – Demineralized water quantities for steam blows were reflected in design, estimates and schedule
- QChem – Chemical cleaning solutions and hydrotest water disposal requirements were addressed, i.e., neutralization tanks and aeration ponds designed (sized)
- CPChem – Energization of utility substation, F&G requirements, required stand alone F&G panel for buildings prior to F&G panel connection to CCR
- SINCOR – Plant main piperack battery limit modules fabricated in Singapore and priority systems defined
- East Area Offshore Project – Molecular sieves loaded onshore rather than offshore, realized 8 week shorter schedule off critical path

“ The Devil is in the Details” – Do the Homework!

Technip's Advanced Work Package Plan - Startup Work Packages – PC&C Systems

Technip's AWP process, developed from start-up packs, ensures always having the right materials and resources at the right place at the right time.

START-UP AND CONSTRUCTION PROJECT REQUIREMENTS DEFINE THE WORK PACKAGES

Start-up Work Package (SUP)
Represents a well-defined scope that can be geographically located by Commissioning Area

Construction Work Package (CWP)
Executable construction deliverables, includes Field Installation Work Package (FIWP) or Work Front Planning

Delivery Work Package (DWP)
Engineering deliverables to Procurement so that right material is there to execute the CWP at the right time

Engineering Work Package (EWP)
Engineering Deliverables (drawings, material take offs, material and equip. specs and vendor documents)

PACKAGE DEFINITIONS HELP MANAGE WORK AND ENSURE DELIVERY

EWP ← DWP ← FIWP ← CWP ← SUP

- Start-up/commissioning equipment and requirements
- Utility equipment and requirements
- Process equipment requirements
- Mitigation requirements and/or temporary equipment
- Construction equipment and requirements interface

Back to Front Integrated Team – Commissionability and Constructability

Lead by PC&CSO Personnel defining the SUPs, with close link to Construction, Module Yard Fabricators, Engineering, Procurement, Subcontractors, Vendors, and Client Personnel.

- Defines the Start-up Sequence and required predecessors and successors by PC&C Systems and Construction Area
- Develops timelines, identifying requirements for each commissioning system/subsystem at the onset of the
- Defines the Path of Construction both for the Site/Module Yards, in relation to the Start-Up Packages to facilitate the transition from one phase to another
- Defines the mitigations that may be necessary to secure the internal turnovers so as to reduce impact to Construction and PC&C activities, i.e., Instrument Air Compressor and Dryer Packages, design for SUP.

Back to Front Methodology
- Interface Definitions and Requirements

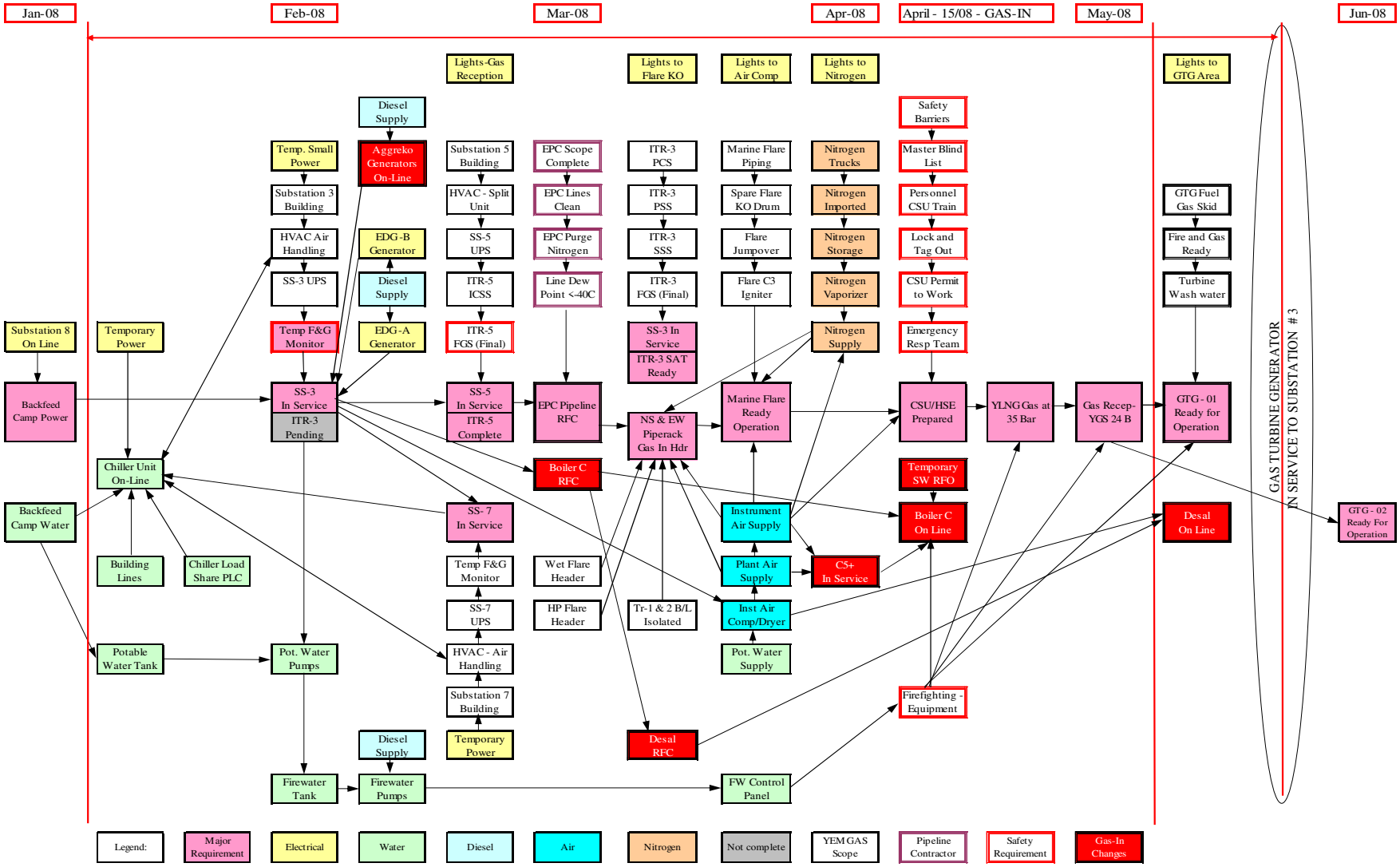
Major Areas and PC&C Systems are defined:

- Start-up requirements for each unit and system (utility and process) defined by utilizing the issued Block Flow Drawings, Process/Utility Flow Diagrams, P&IDs, Electrical Single Line Drawings, Plot Plans and Layout Drawings
- Interrelationship of each unit and system is addressed:
  - Utilities/products direct to downstream units – no tankage
  - Utilities/products to intermediate storage, products to pipelines, etc.
  - Routing of off-specification utilities/products, rerun?
- Review Plot Plans to minimize the SIMultaneous OPerationS (SIMOPS) impact on project completion from the onset of Engineering (FEED and EPC) and procurement
- Ensure that engineering registers are set-up to identify the following: WBS, PC&C Systems, Modules, Packages, for populating and mapping information to EasyPlant™ Quality Control Forms (QCFs)

Note: If the punch list is not categorized then time and effort is being wasted on clearing non-priority work

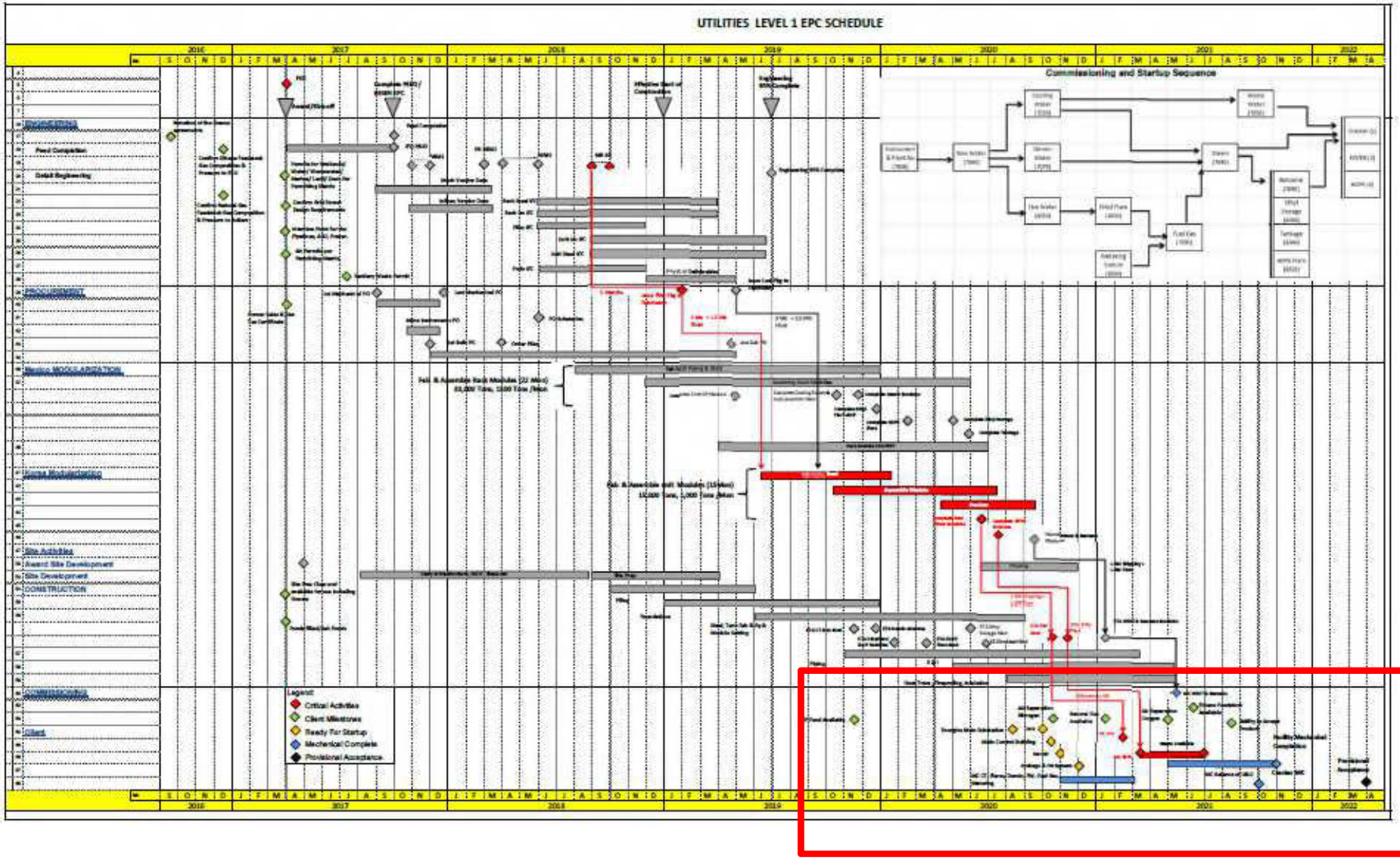
Back to Front – Gas Fired Generator Timeline

YEMGAS - CSU UTILITIES AND OFFSITES TIME LINE (Updated November 21, 2007)

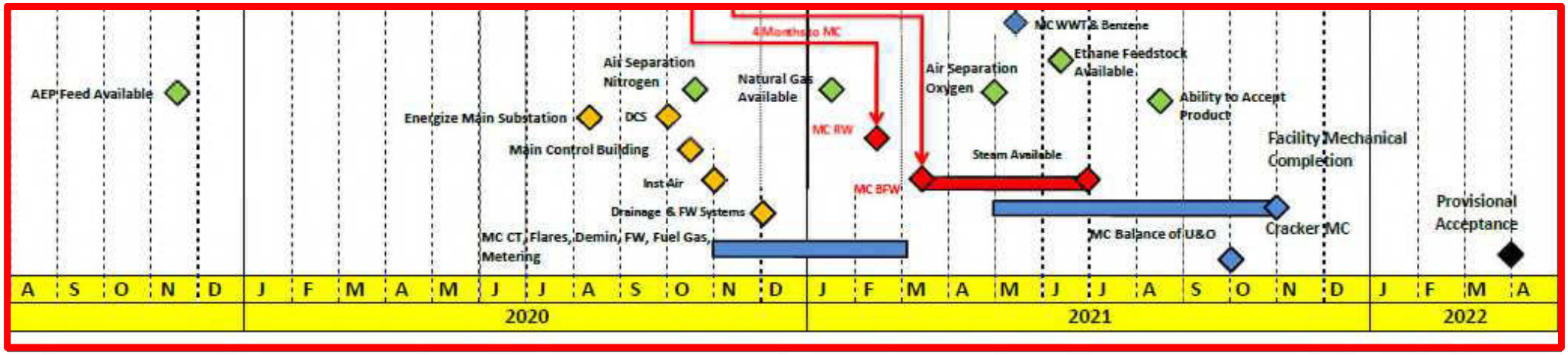


Sequence of activities of PC&C – define temporaries, equipment, fuel, water, etc.

Back to Front Level 1 Schedule



Back to Front Level 1 Schedule – CSO Milestone



Note:

Utilities must be tracked to ensure readiness to support the Process System commissioning and start-up

Back to Front
- Spares and Consumables Required

- The durations of the PC&C, start-up, operations activities must be determined so that consumables and spares can be quantified for each phase and ordered as required:
  - Boiler feedwater, chemicals may be required for one year or more prior to handover.
- Track PC&C, start-up and operating spares to ensure the reliability of the utilities systems for the CSO of the required Utility and Process Units.
- Identify, track and ensure the required special tools are on hand for CSO.
- Review vendors recommended commissioning and operating spares, with concise lists and established project Spare Parts Inventory Register (SPIR) forms.
- Review and approve the vendor and licensor Installation, Operations and Maintenance manuals and guidelines for CSO

SIMultaneous OPerationS (SIMOPS)
- Must Plan For Safety-

- **SIMOPS Plans, requirements, mitigations are critical to the success of a project**
- **SIMOPS requirements are to be defined at the engineering phase, and updated and mitigated throughout the project**
- **Commissioning and Construction Areas need to be aligned**
- **Desktop reviews with construction, commissioning and operations personnel to identify the SIMOPS interfaces and requirements is critical**
- **SIMOPS Areas are tracked in EasyPlant™ Completion Database**
- **Definition of the path of construction and Start-up Packages must align, examples of SIMOPS Activities:**
  - Substation energization for chilled water package operation
  - Steam blows for line cleaning, boiler operation
  - Construction tie-ins and hook-ups of units, modules, packages, etc.

Back to Front – Project Milestones (Example)

- Contract, Subcontractor and Vendor Milestones

- **Milestone can be defined by each tag, system, WBS, module, subcontractor, vendor, etc.:**
  - Milestone – Requirements Substation 7 Energization
  - Milestone – Requirements Instrument Air Available for Loop Checks
  - Milestone – Undergrounds Available for Module Installation
  - Milestone – Module Ready for Sailaway
  - Milestone – Main Piperack Modules on Site
  - Milestone – Utility Systems Battery Limit Modules Hook-up Complete
  - Milestone – Steam Available for Turbine Runs, Condensate, Chemicals
- **Itemized tracking defines the milestone precisely**

Note: Assign main piperack to one subcontractor with milestone for completion

Technip's EasyPlant™ Platform
"IF YOU CAN'T MEASURE IT, YOU CAN'T MANAGE IT"

- Technip has developed a robust tool, EasyPlant™ to measure and compare:
  - Planned Progress vs. Physical Progress vs. Certified Progress
- EasyPlant™ tracks every tag, QCF, punch list, assigned to every subcontractor, vendor, to ensure their Scope of Work is complete as and when it is required
- The subcontractor's, vendor's and fabricator's work processes (steps) are incorporated into EasyPlant™ to facilitate the "Ready to Go" Module, i.e., there are 15 test packs ready for reinstatement, the ready to paint
- EasyPlant™ tracks the work process of the various parties for a seamless transfer of information and status by system/area:
  - Status by system/area
  - Minimizing the impact to Construction, Commissioning and Operation of unknowns, as well as the requirements such as preservation, punch lists, etc.
  - Status by discipline
  - Status by module
  - Status by subcontractor

Note: If the punch list is not categorized then time and effort is being wasted on clearing non-priority work

Progress Measurement
– Planned vs. Physical vs. Certified

- Measurement of the progress achieved from the most detailed level – progress by Item (Tag) – by Discipline, per Project WBS, per PC&C System, etc.
- At all levels, comparison between physical progress vs certified progress
- The gap between the curves is continually monitored so as to avoid negative impact on the plant completion date

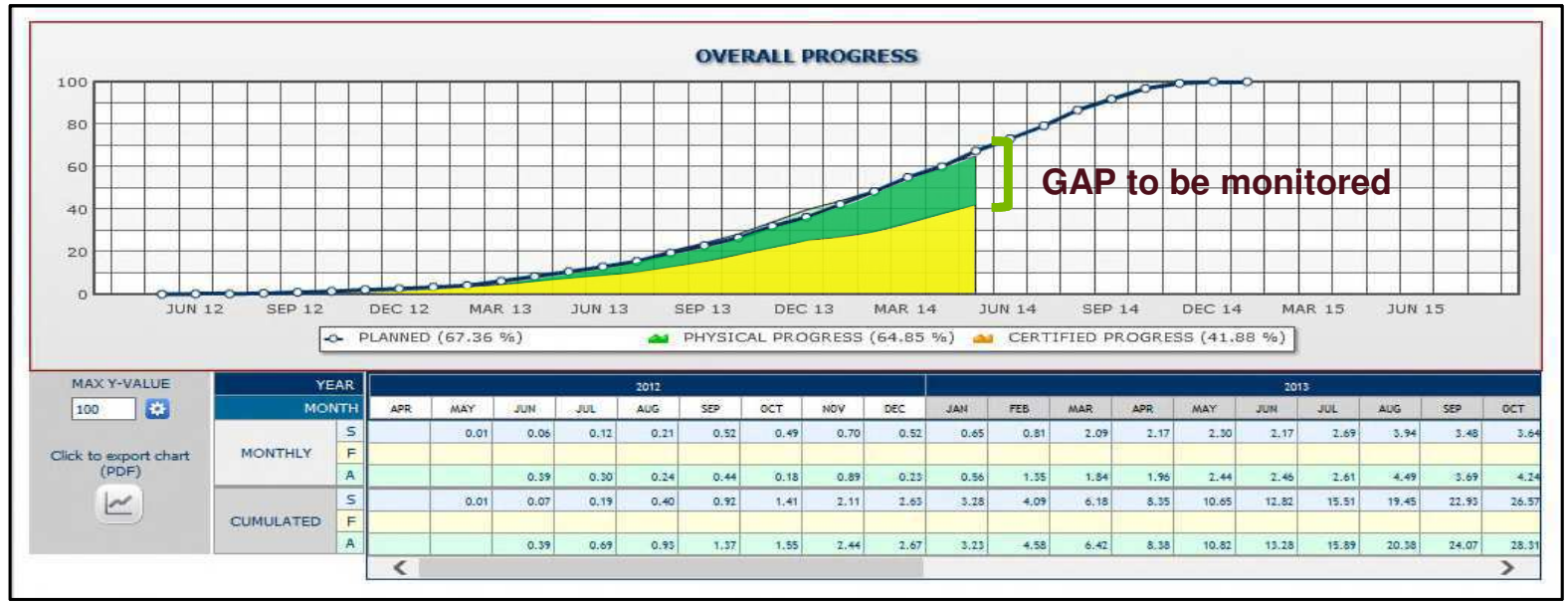
Planned

vs.

Physical

vs.

Certified

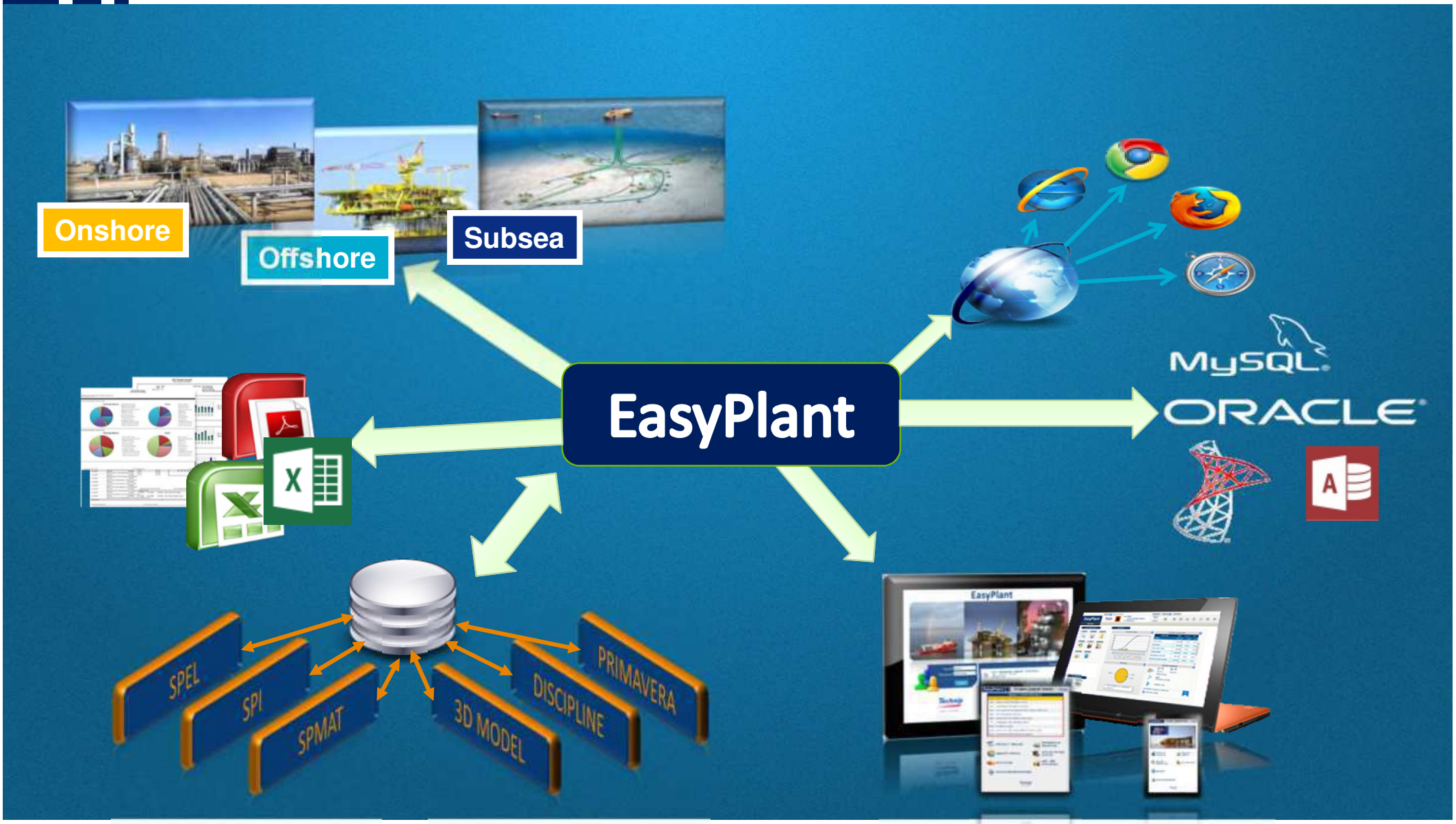


Technip's EasyPlant™ - Project Management and Execution

- Technip's in-house tool, **EasyPlant™**, has been developed to facilitate the management (Tracking and Reporting) of equipment prioritization, material, procurement, prefabrication, construction, pre-commissioning, commissioning, start-up and Handover Requirements and Activities.
- **The EasyPlant™ Platform** is composed of integrated functional and discipline modules which share the same database.
- Built in line with Technip's standards, methods and procedures.
- **EasyPlant™**, is a unique platform that gathers integrated functionalities of the required activities.
- **EasyPlant™** is extensively used on Technip projects
- It is deployed, supported and upgraded by a dedicated Technip Internal Organization, the Construction Method Center (CMC) and dedicated IT support

Secure Web Based Tool – Internet access Worldwide
http://easyplant.apps.technip.com/login.asp

EasyPlant™ - Interfaces and Communication



The EasyPlant™ architecture is web-based, modularized, scalable and integrated with Technip tools

http://easyplant.apps.technip.com/login.asp

EasyPlant™ Platform - Modules Overview

General Configuration and Collection such as: set-up information to prepare all functionalities, project title, which EasyPlant™ modules will be utilized

Execution recording and status reporting of all assigned QCFs (Quality Control Forms), i.e., piping hydro test, instrument loop checks and functional test, PSV calibration

EasySubcontract, dedicated signatory features for subcontractor, Technip and client supervisors/inspectors, utilizing digital, bar code and wet signatures as required.

Collection of item tags information from Engineering Registers: from Engineering, SCs, Vendors, Licensors, etc.

Execution recording and status reporting from fabrication yards, sites, vendors, subcontractors, i.e., equipment, spares, motors, all preservation activities prior to handover

System Subdivision linked to Construction Area – Quality Progress Monitoring by System, Reports and Charts

Quality Control Forms (Certificates) follow-up, collection and status reporting for Construction, PC&C and Start-up

Management of the entire life cycle of piping construction activities, including fabrication and QC activity in sequence

Selected Site Activities Readiness status – to match the SC/Vendor Work process

Progress recording and status reporting for Construction and PC&C, by Area and System

Structural database, Laydown Areas, Material Follow-Up and Tracking, Status Reports and Charts

Punch list management, project reporting, formal Turnover certificates – digital verification

Collection and reporting of information and data relevant to HSE/BBS (Behavior Based Safety Program) on site

Work Packages and Job Cards creation, validation and follow-up. To facilitate, module hook-up, vendor punch lists, completion of carryover work, etc.

Centralization of information and reporting available in other modules for the plant handover to Client

Ready-To-Go Module
(To Energize or not to Energize?)

The Ready-To-Go is a fully flexible module developed in EasyPlant capturing and reporting specific information available in other EasyPlant modules, relevant to:

- ❖ **Work step process as related to sequence**
- ❖ **Punch list status and category**

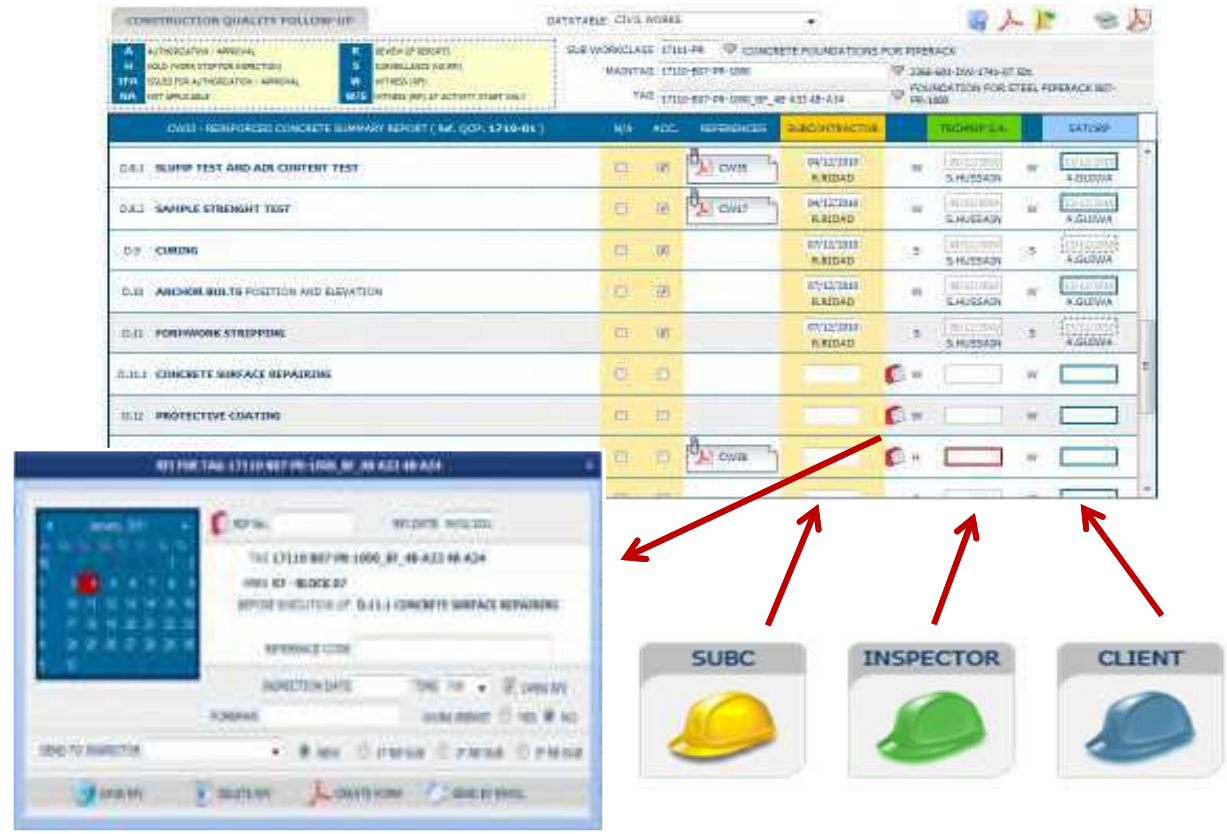
- **Foundations - steel structure**
- **Structure - piping erection**
- **Piping installation - instruments**
- **RIE - Instrument loop checks**
- **Inst Opp checks - functional tests**
- **Breaker - Motor solo runs**
- **Loading of equipment – Equip box-up**

Used by Construction and PC&C to track the readiness of a task, item, area and/or system for the next phase

Quality Module – Quality Control Plans

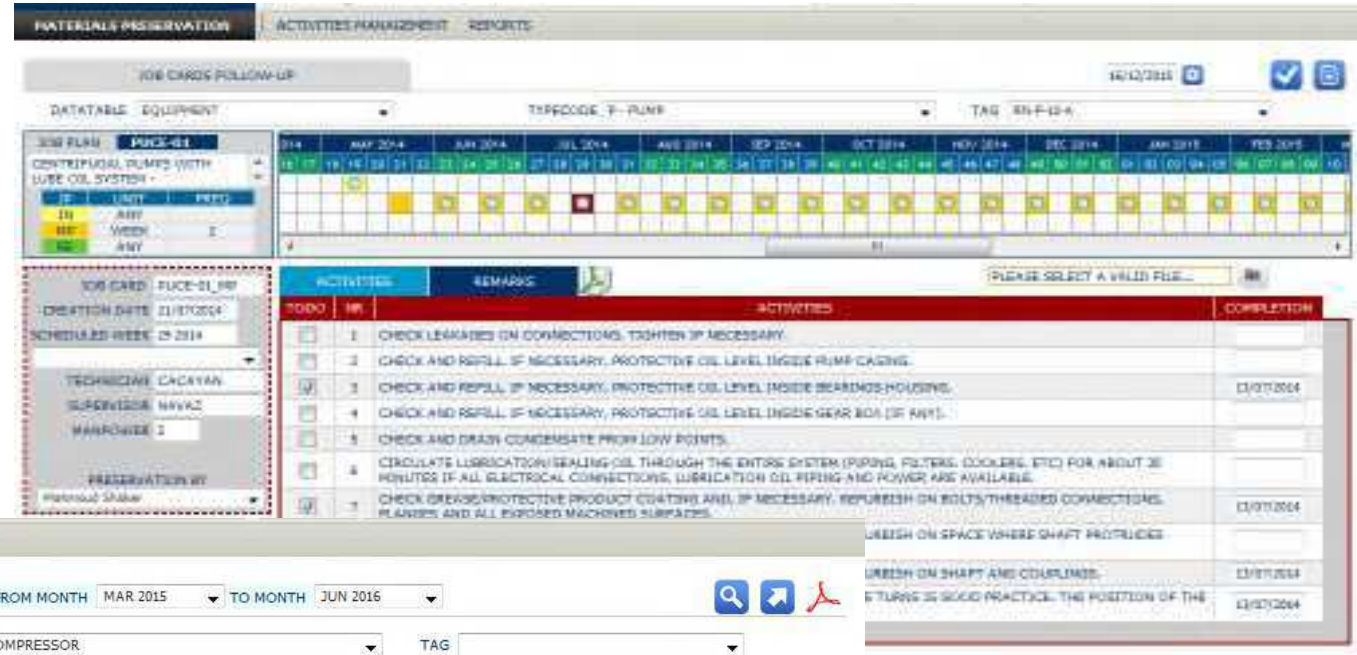
All QCFs reside in EasyPlant™ with all work steps defined

- Each step is can be signed off by either digital, bar code and/or wet signature, of course once the inspection has been complete by authorized Inspectors from each organization
- RFIs (Request for Inspection) are tracked and managed by system as per the Quality Control Plan
- Quality Control Dossier are scanned and uploaded only at the end



Preservation Module – Tracking and Scheduling
– By Date, by Action, by Tag, Location, Area and System

Material Preservation Module is designed to track, schedule and notify the required preservation activities required/when



MATERIALS PRESERVATION | ACTIVITIES MANAGEMENT | REPORTS

PRESERVATION OVERALL SCHEDULE

FROM MONTH MAR 2015 TO MONTH JUN 2016

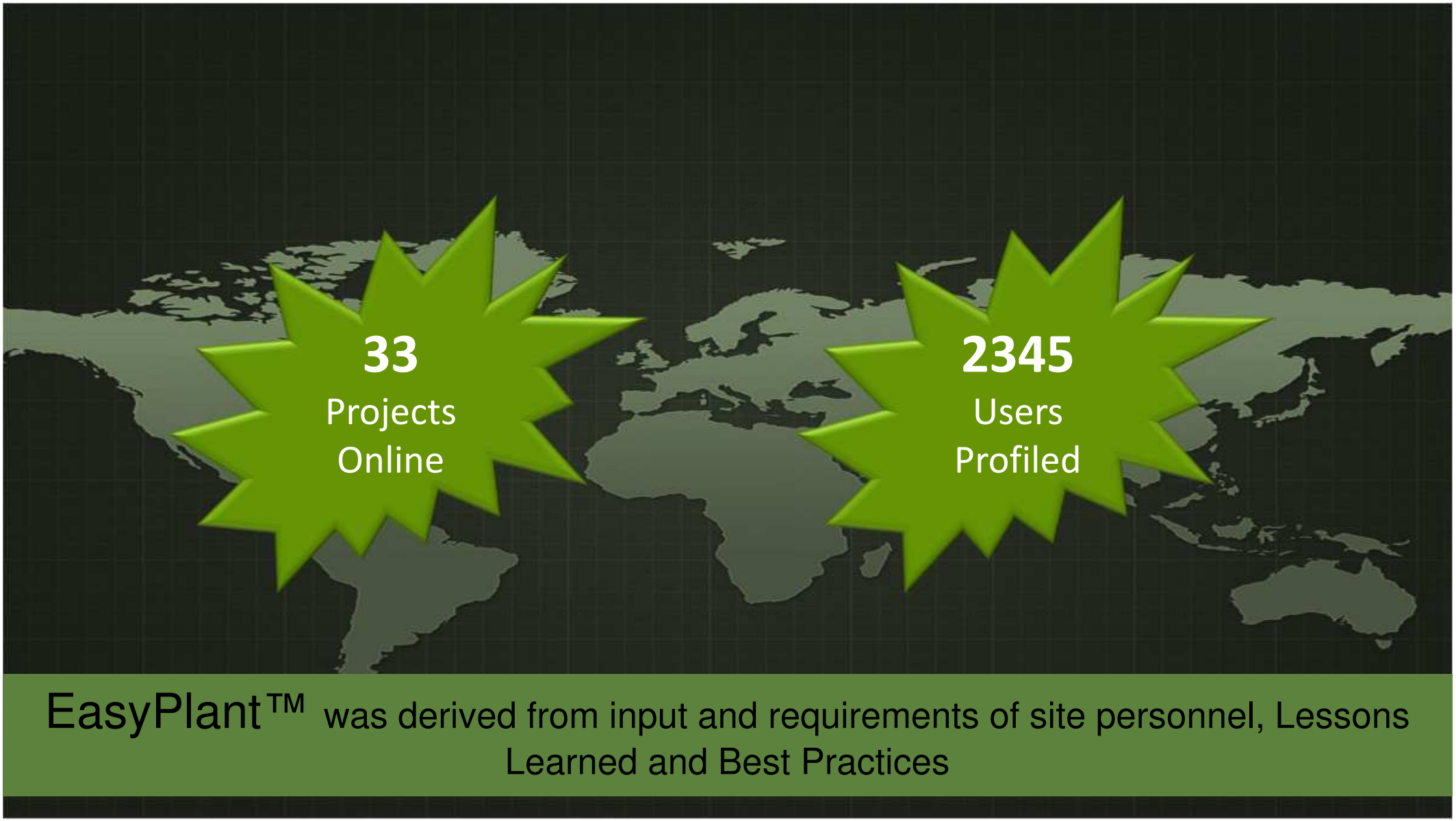
DATATABLE EQUIPMENT TYPECODE C - COMPRESSOR TAG

SYSTEM

TAG	DESCRIPTION	SUPPLIER	MR	SUBCONTRACTOR	C3 %	PRESERVATION			REM
						JOB PLAN	WEEK	DONE	
RG-C-200	PROPYLENE REFRIGERATION COMPRESSOR	ELLIOTT EBARA TURBOMACHINERY CORP.	9409C-000-MR-1011-001	TP	75.00	COCG-01 MP	11 2015	10/03/2015	
						COCG-01 MP	13 2015	22/03/2015	
						COCG-01 MP	15 2015	06/04/2015	
						COCG-01 MP	17 2015	20/04/2015	
						COCG-01 MP	19 2015	04/05/2015	
						COCG-01 MP	21 2015	18/05/2015	
						COCG-01 MP	23 2015	03/06/2015	
						COCG-01 MP	25 2015	15/06/2015	
						COCG-01 MP	27 2015	30/06/2015	
						COCG-01 MP	29 2015	12/07/2015	
						COCG-01 MP	31 2015	28/07/2015	
						COCG-01 MP	33 2015	11/08/2015	
						COCG-01 MP	35 2015	26/08/2015	
						COCG-01 MP	37 2015	09/09/2015	
						COCG-01 MP	39 2015	23/09/2015	
						COCG-01 MP	41 2015	07/10/2015	

Preservation follow-up is realized by tag, system, area, location and handover

EasyPlant™ Projects and Users Worldwide



EasyPlant™ was derived from input and requirements of site personnel, Lessons Learned and Best Practices

Thank you – Questions, Comments?

Polyethylene Plant, SECCO
Shanghai, China