YOKOGAWA

Co-innovating tomorrow™

Bringing Decarbonization to Life™ Solutions for Greenhouse Gas Emissions Management

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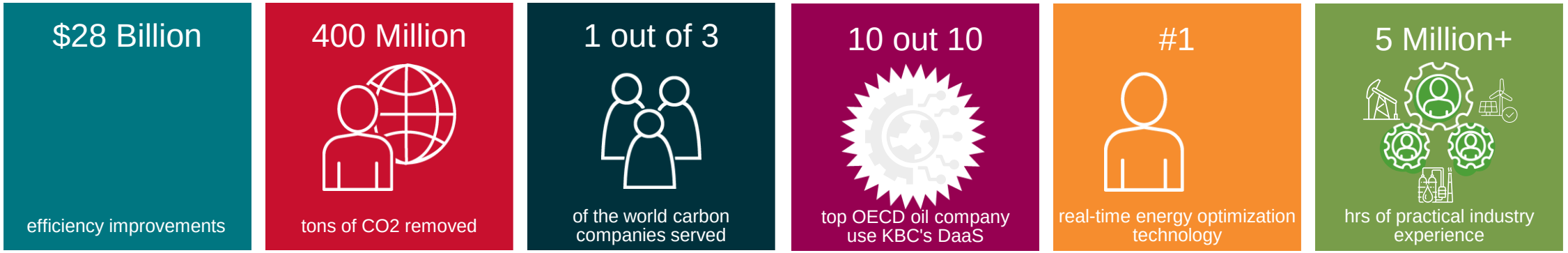
Technical Support Consultant

TNChE 2024 Conference: 20 June 2024

Introduction to KBC

- KBC is an “Energy” and “Process” Technology and Consulting Company.
- KBC has been working with global customer since 1979 and has become a Yokogawa company since 2016.
- We are committed to improving our clients' operations, asset reliability, safety and environmental performance.



GHG Emissions Management: What the Industry Needs

30 years ago	Today
Reduce energy use based only on cost 	Reduce both, energy use based on cost and emissions 
Immature practices and processes towards hydrocarbon losses reporting and reduction	Immature practices and processes towards GHG emissions reporting and reduction

Need for auditable, standard, and compliant processes

GHG Emissions Management: What the Industry Needs

Industry needs

- Frequent and accurate emissions reporting
- Auditing / compliance
- Decision-making (Actionable operational improvement)

Business goals

- GHG emissions reduction
- Better position to get financial aid
- Reduce time to report emissions
- Data reliability

Solution required

- Monitoring, optimization, accounting and reporting capabilities
- To control, reduce and report GHG emissions (Impacts on operations and business)
- Different timespans (real-time, daily, monthly, yearly) for different stakeholders
- All-in-one solution

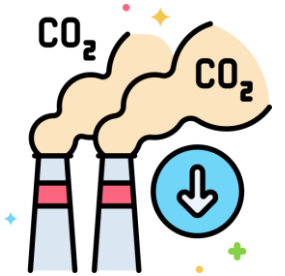
Visual MESA for GHG Emissions Management

Values of Visual MESA for GHG Emission Management

Visual MESA GHG Emissions Managements continuously monitors emissions and energy consumption across the entire plant operation, giving you accurate, real-time data and alert for decision making.

Real-time Emissions Monitoring

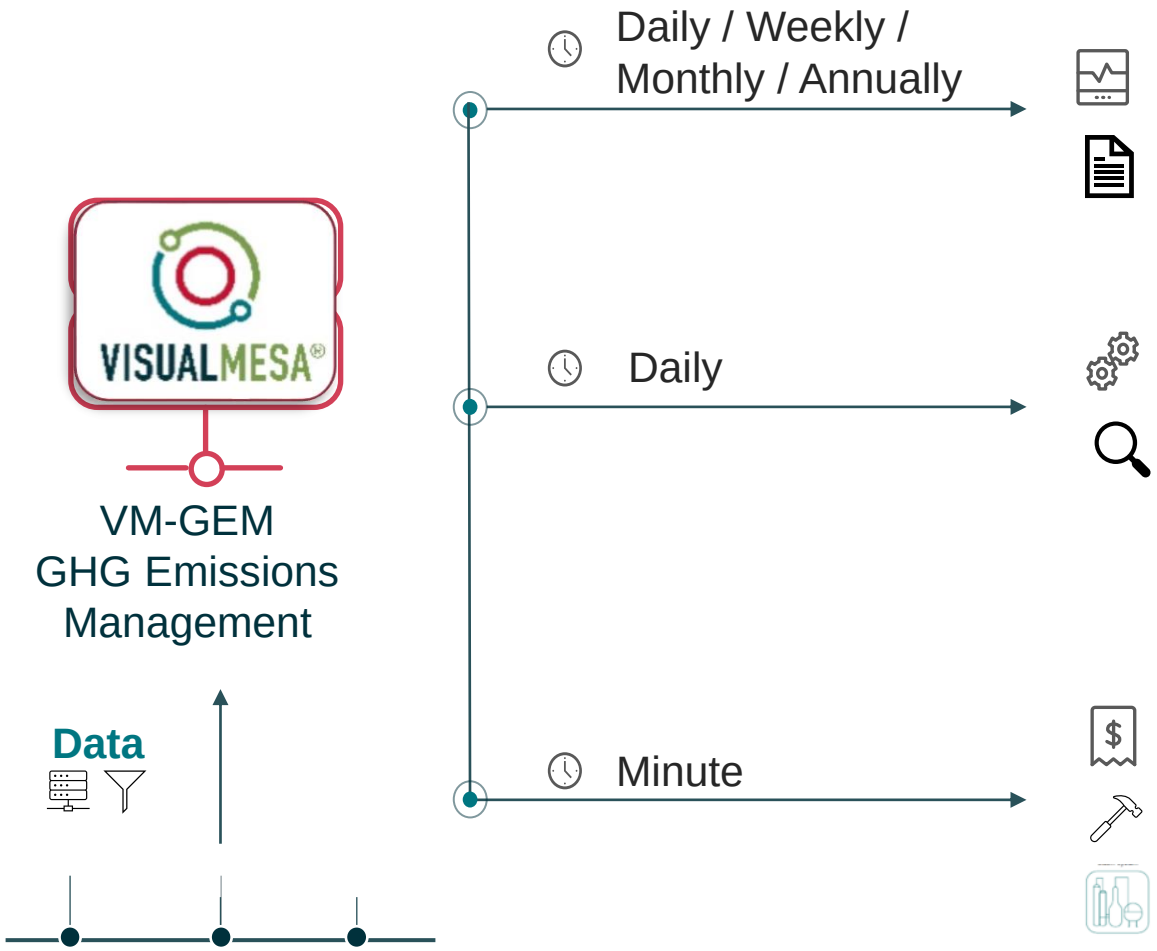
Reduced Emission and Saved Energy



Actionable Recommendation for Operations

Automated Auditable Reporting

How it works?



GHG Emissions Reporting & Tracking

- Total GHG Emissions calculation for Scope 1, 2, and 3.
- Compare GHG Emissions reduction against target
- Auditable Reporting – Standards compliance

GHG Emissions Accounting

- Daily total GHG Emissions calculation for Scope 1 and 2.
- Daily data reconciliation
- Daily Auditing

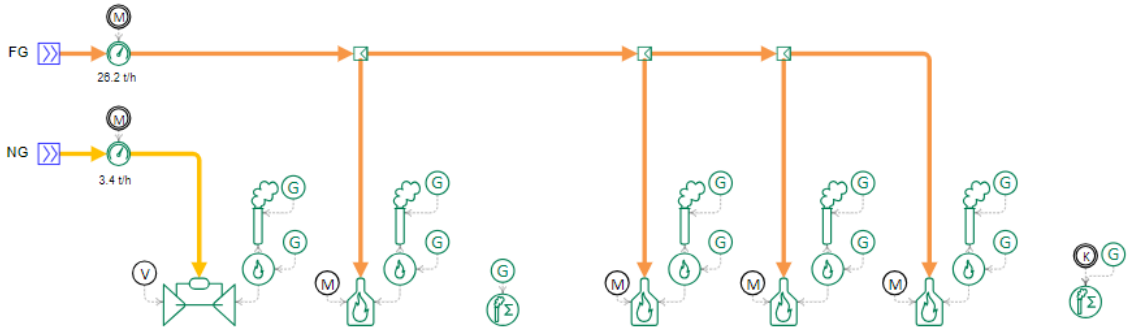
GHG Emissions Calculation, Monitoring, Auditing and Reduction

- Real-time energy and GHG emissions calculation for Scope 1 and 2.
- Most **Profitable** Operation for lowest GHG emission and cost
- **Actionable** Recommendations to Operations
- **Drill-down** to identify and troubleshoot sources of problems

Real-time Emission Monitoring

Inside Visual MESA GHG Emissions Managements, continuously monitors emissions and energy consumption across the entire plant operation, giving you accurate, real-time data and alert for decision making.

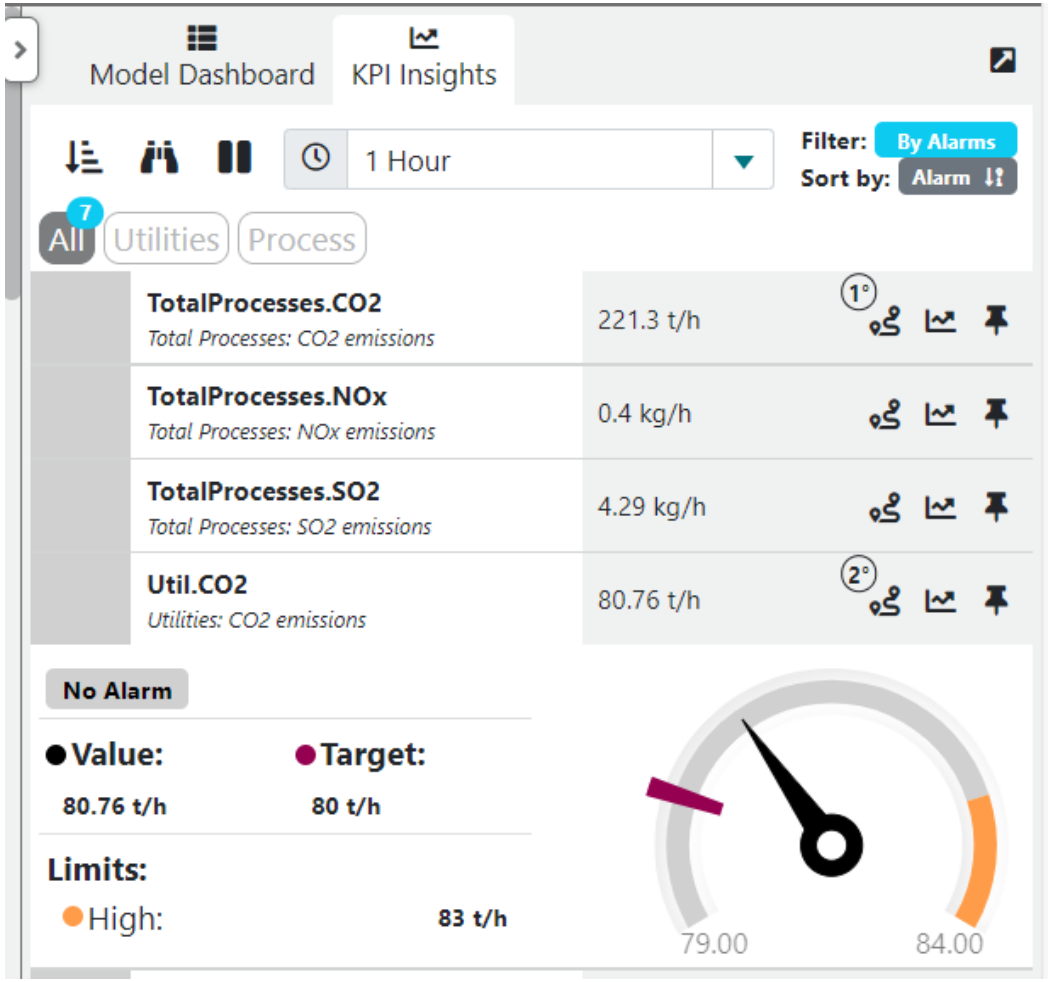
	Utilities	Hydrocracking	Distillation	Cracking	Parafins	Special Processes	Flares 2901 A-B	Processes Emissions	Emissions Scope 2
CO2 (t/h)	81.43	4.89	47.25	21.07	0.00	0.44	66.98	222.06	4.47
CO (kg/h)	49.65	3.17	28.53	4.62	0.00	0.26	4.64	90.87	
SO2 (kg/h)	0.00	0.00	0.00	0.00	0.00	0.00	4.29	4.29	
NOx (kg/h)	0.15	0.01	0.09	0.01	0.00	0.00	0.14	0.40	
MP (kg/h)	4.49	0.29	2.58	0.42	0.00	0.02	4.20	12.00	
COV (kg/h)	3.25	0.21	1.87	0.30	0.00	0.02	3.04	8.69	



	GT101	SG101	GT+SG101	B102	B103	B104	Total Utilities
CO2 (t/h)	9.27	4.09	13.36	25.92	27.03	15.12	81.43
CO (kg/h)	6.08	2.47	8.55	15.65	16.32	9.13	49.65
SO2 (kg/h)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx (kg/h)	0.02	0.01	0.03	0.05	0.05	0.03	0.15
MP (kg/h)	0.55	0.22	0.77	1.42	1.48	0.83	4.49
COV (kg/h)	0.40	0.16	0.56	1.02	1.07	0.60	3.25

Real-time Emission Monitoring

KPI Dashboard & Alarm



Real-Time Report

Factory

Visual MESA GHG Emissions Management
Real Time Report

KBC A Yokogawa Company

VISUALMESA®

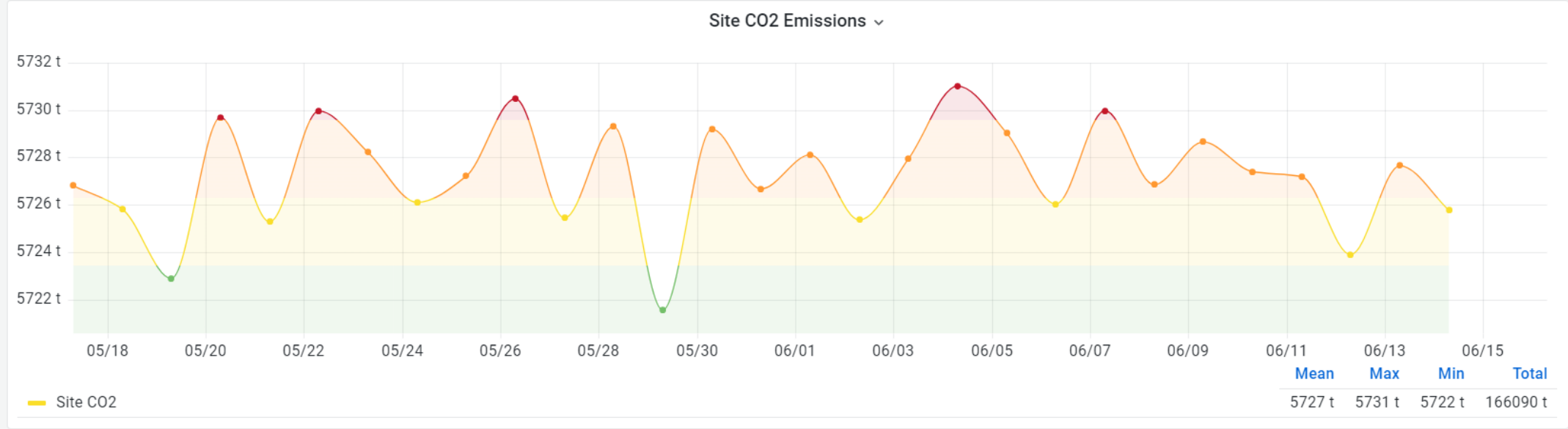
Version 111
Date: 06-13-2024 02:45

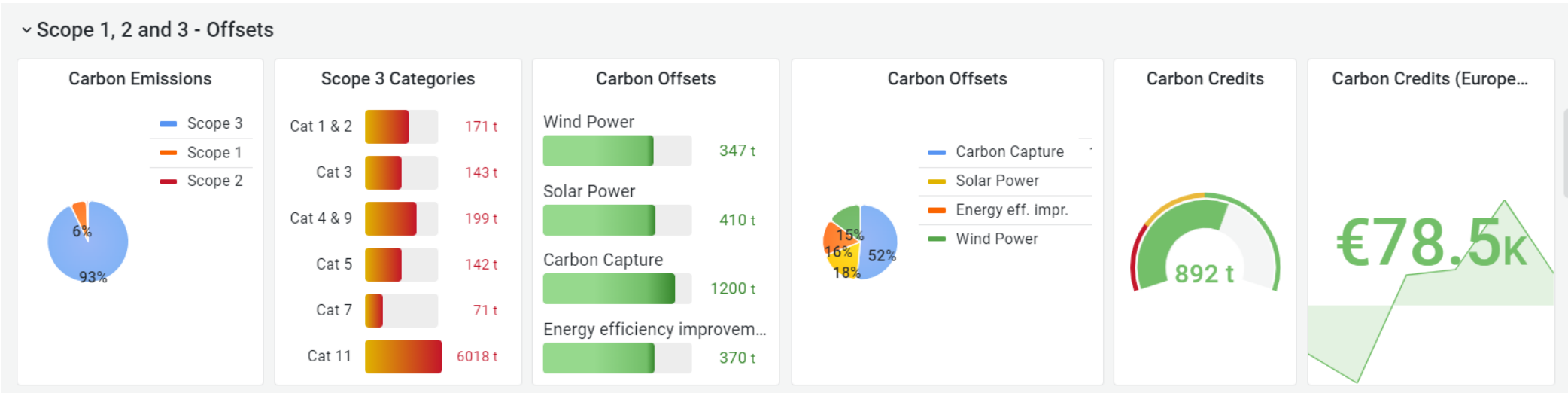
Scope	CO2 (t/h)	CO (kg/h)	SO2 (kg/h)	NOx (kg/h)	COV (kg/h)	MP (kg/h)
Scope 1	221.6	90.6	4.3	0.4	8.7	12.0
Scope 2	4.5					
Total	226.1					

Utilities	CO2 (t/h)	CO (kg/h)	SO2 (kg/h)	NOx (kg/h)	COV (kg/h)	MP (kg/h)
Steam						
GT101	8.8	5.8	0.0	0.0	0.4	0.5
SG101	4.1	2.5	0.0	0.0	0.2	0.2
B102	25.9	15.7	0.0	0.0	1.0	1.4
B103	27.0	16.3	0.0	0.0	1.1	1.5
B104	15.1	9.1	0.0	0.0	0.6	0.8
Total Steam	81.0	49.4	0.0	0.1	3.2	4.5
Total Utilities	81.0	49.4	0.0	0.1	3.2	4.5

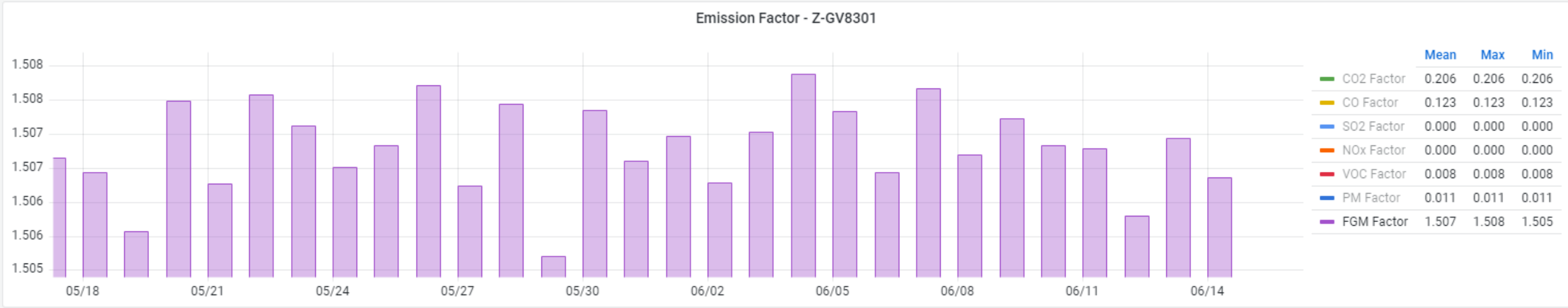
Distillation	CO2 (t/h)	CO (kg/h)	SO2 (kg/h)	NOx (kg/h)	COV (kg/h)	MP (kg/h)
Unit 2						
B201	10.8	6.5	0.0	0.0	0.4	0.6
B202	3.2	2.0	0.0	0.0	0.1	0.2
Total Unit 2	14.1	8.5	0.0	0.0	0.6	0.8

Real-time Emission Monitoring

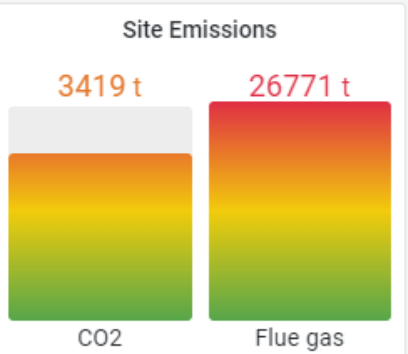


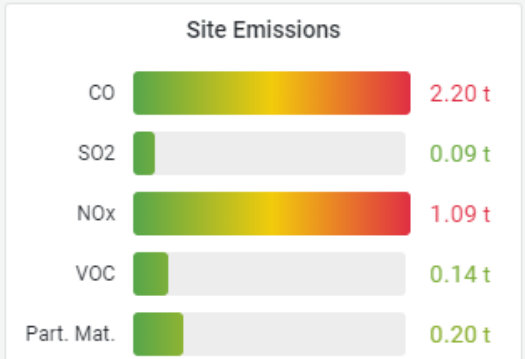


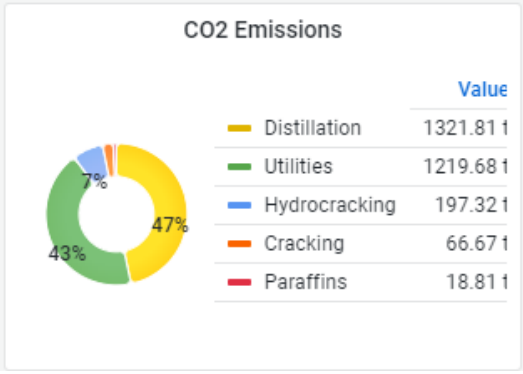
Real-time Emission Monitoring

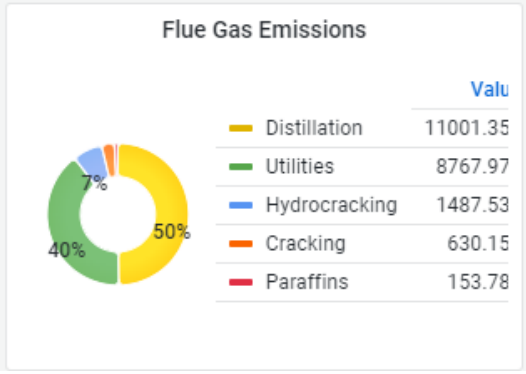


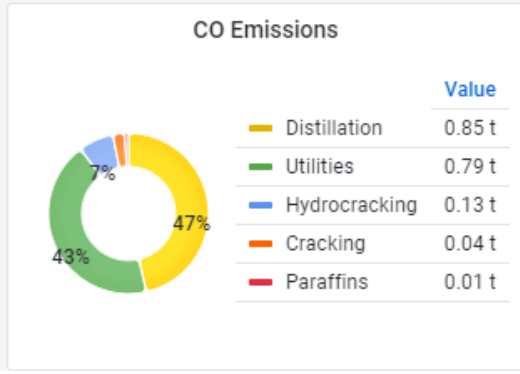
Emissions by type (2024-Jun-16)



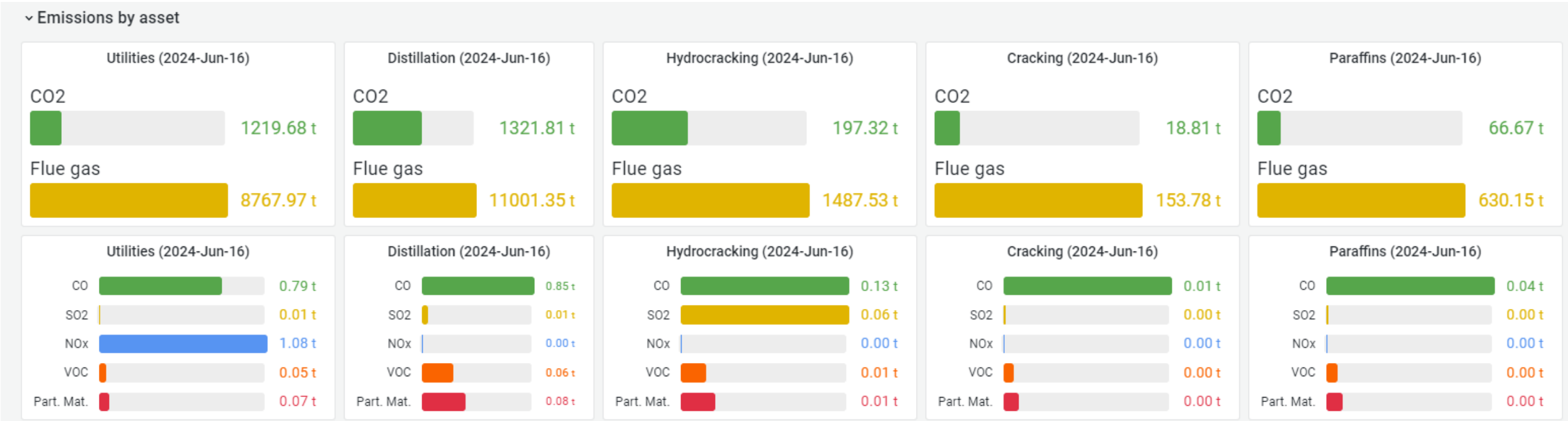








Real-time Emission Monitoring



Automated Auditable Reporting

Emissions data lookup

Area: M-00 - Utilities | Node: [All nodes] | Type: Inventory measurement | From: 01/06/2024 02:00:00 | To: 14/06/2024 01:59:59

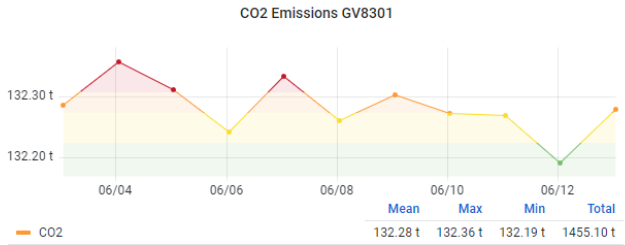
Lookup

Results

Date time	Node	Material	User	Entry date time
14/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Emissions Operator	14/06/2024 08:13:33
14/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	14/06/2024 05:10:02
13/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	13/06/2024 05:10:01
13/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	13/06/2024 05:10:02
12/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	12/06/2024 05:10:01
12/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	12/06/2024 05:10:02
11/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	11/06/2024 05:10:01
11/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	11/06/2024 05:10:02
10/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	10/06/2024 05:10:01
10/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	10/06/2024 05:10:02
09/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	09/06/2024 05:10:02
09/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	09/06/2024 05:10:02
08/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	08/06/2024 05:10:02
08/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	08/06/2024 05:10:03
07/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	07/06/2024 05:10:04
07/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	07/06/2024 05:10:05
06/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	06/06/2024 05:10:01
06/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	06/06/2024 05:10:02
05/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	05/06/2024 05:10:01
05/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	05/06/2024 05:10:02
04/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	04/06/2024 05:10:01
04/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	04/06/2024 05:10:02
03/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	03/06/2024 05:10:01
03/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	03/06/2024 05:10:02
02/06/2024 01:59:59	GV8301 - Boiler 101	FG - Fuel Gas	Default user	02/06/2024 05:10:01
02/06/2024 01:59:59	TG8301 - Gas Turbine 101	NG - Natural Gas	Default user	02/06/2024 05:10:02

TG8301 14/06/2024 01:59:59

Dashboard



Inputs

Property	Source	Value
CO2 daily emission	Cal	268.874 t
CO daily emission	Cal	176.339 kg
SO2 daily emission	Cal	0.000 kg
NOx daily emission	Cal	0.524 kg
VOC daily emission	Cal	11.549 kg
PM daily emission	Cal	15.953 kg
Flue Gas daily emission	Man	0.000 t

Results

Property	Source	Current	13/06/2024 01:5	Difference	
CO2 daily emission	Cal	268.874	270.188	-1.314	t
CO daily emission	Cal	176.339	177.201	-0.862	kg
SO2 daily emission	Cal	0.000	0.000	0.000	kg
NOx daily emission	Cal	0.524	0.527	-0.003	kg
VOC daily emission	Cal	11.549	11.605	-0.056	kg
PM daily emission	Cal	15.953	16.031	-0.078	kg
CO2eq daily emission	Man	0.000	0.000	0.000	t
Flue Gas daily emission	Man	0.000	0.000	0.000	t

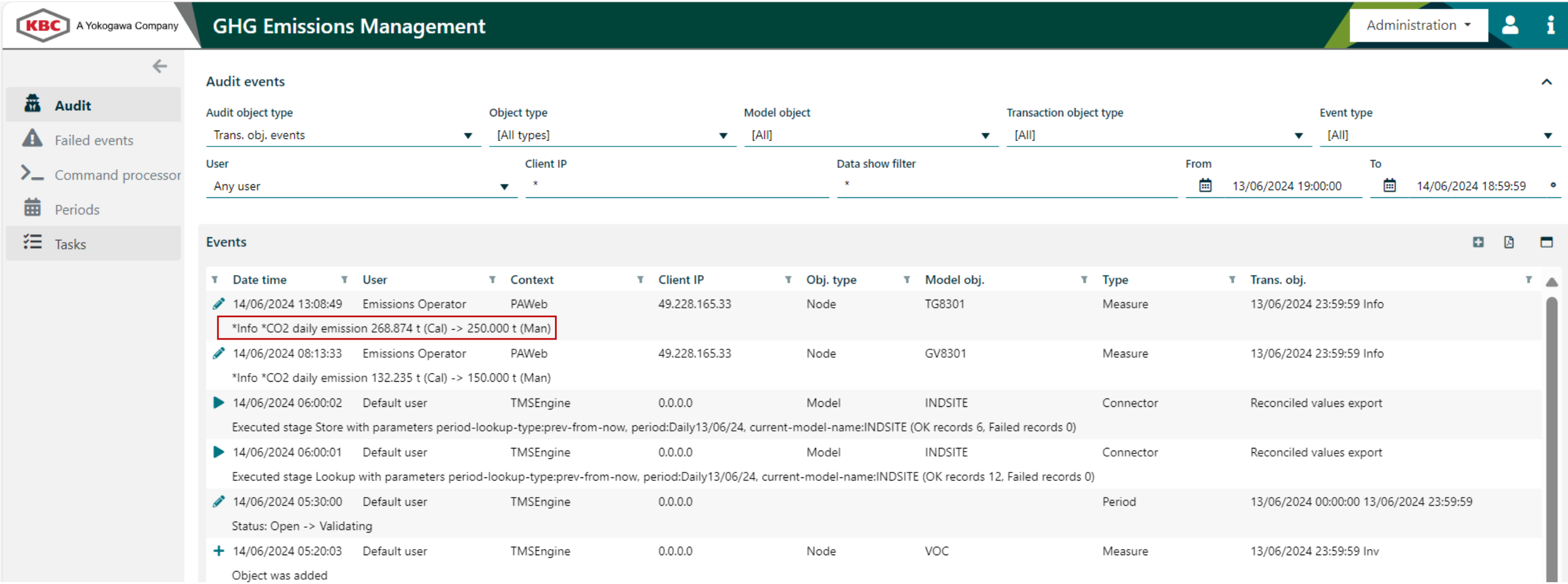
Inputs

Property	Source	Value
CO2 daily emission	Man	250.000 t
CO daily emission	Cal	176.339 kg
SO2 daily emission	Cal	0.000 kg
NOx daily emission	Cal	0.524 kg
VOC daily emission	Cal	11.549 kg
PM daily emission	Cal	15.953 kg
Flue Gas daily emission	Man	0.000 t

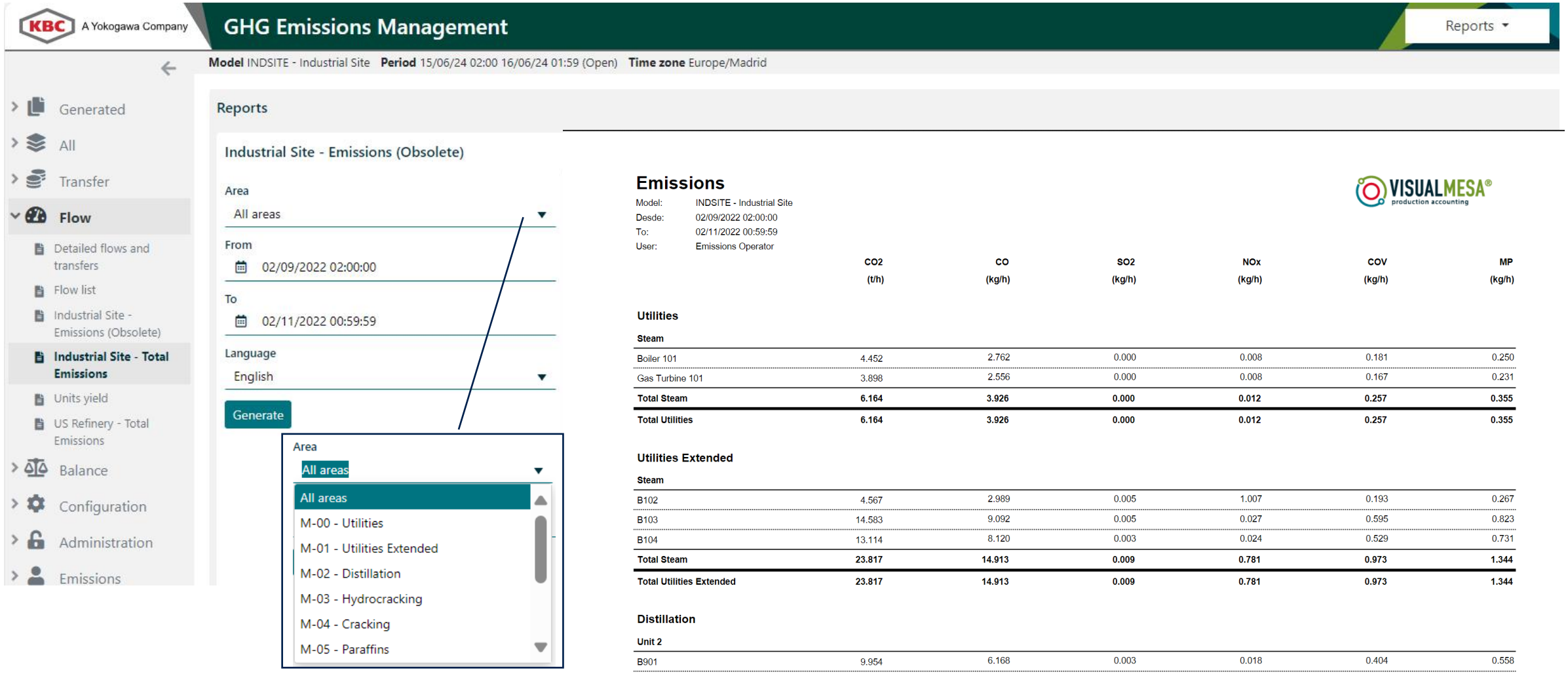
Results

Property	Source	Current	13/06/2024 01:5	Difference	
CO2 daily emission	Man	250.000	270.188	-20.188	t
CO daily emission	Cal	176.339	177.201	-0.862	kg
SO2 daily emission	Cal	0.000	0.000	0.000	kg
NOx daily emission	Cal	0.524	0.527	-0.003	kg
VOC daily emission	Cal	11.549	11.605	-0.056	kg
PM daily emission	Cal	15.953	16.031	-0.078	kg
CO2eq daily emission	Man	0.000	0.000	0.000	t
Flue Gas daily emission	Man	0.000	0.000	0.000	t

Automated Auditable Reporting



Automated Auditable Reporting



Actionable Recommendation for Operations

KBC A Yokogawa Company — Visual MESA Energy Real Time Optimizer — All about EXCEL

Actionable Items

GOOD SOLUTION - SQP = 3
Last execution: 6/14/2024 4:45:53 AM

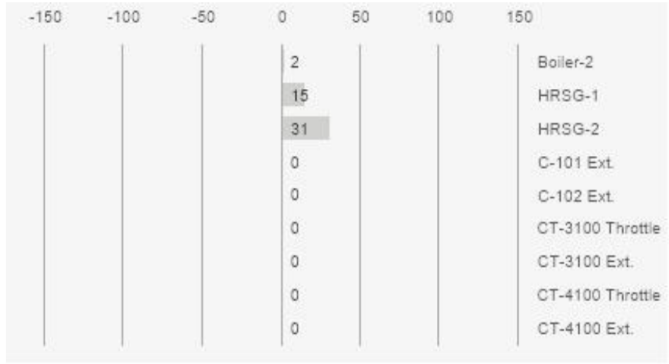
	Actual	Optimized	Delta	
CO2 Emissions				
Total Site CO2 (klb/h)	433.7	430.7	-2.9	↓
Boiler Plant				
Boiler-1 FO (klb/h)	2.3	2.0	-0.3	↓
Boiler-2 Coal (klb/h)	7.4	9.5	2.1	↑
GTs				
Turbine-1 Electric power (MW)	39.0	27.0	-12.0	↓
HRSG-1 Steam (klb/h)	223.9	239.3	15.4	↑
Turbine-2 Power (MW)	39.0	34.5	-4.5	↓
HRSG-2 Steam (klb/h)	228.8	260.1	31.4	↑
Re-Gasification Plant Compressors				
BOG C-101 Extraction (klb/h)	113.5	113.5	0.0	=
C-102 Extraction (klb/h)	85.3	85.3	0.0	=
Steam Cracker Compressors				
CT-3100 Throttle (klb/h)	630.9	630.9	0.0	=
CT-3100 Extraction (klb/h)	502.9	502.9	0.0	=
CT-4100 Throttle (klb/h)	210.2	210.2	0.0	=
CT-4100 Extraction (klb/h)	94.2	94.2	0.0	=
Crude Furnace				
FO flow (GAL/HR)	417.7	381.0	-36.8	↓
FG flow (MSCF/h)	99.6	106.0	6.4	↑
CO Boiler				
NG to COB (MSCF/h)	14.1	14.1	0.0	=

Turbines and Motors Swaps — **Total T/M Swaps: 0**

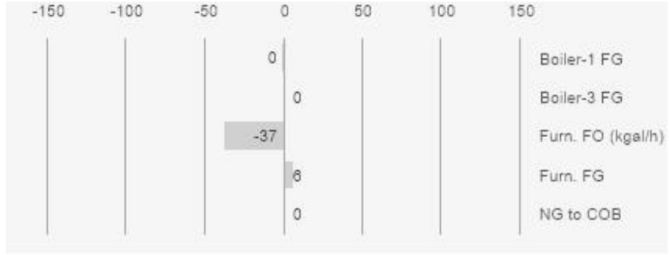
Unit	Driver	Actual Status	Optimized Status
		Stopped	Running
		Running	Stopped
		Stopped	Running
		Running	Stopped
		Stopped	Running
		Running	Stopped

Changes

Steam (klb/h)



Fuels (MSCF/h)



Power (MW)

Collector Block	Property	Simulation klb/h	Optimum klb/h	Reduction klb/h	Reduction %
Total Site EMI	Carbon Dioxide Mass	433.65	419.46	14.20	3.27

Costs	Simulation $/h	Full Optimum $/h	Delta $/h
Fuel	26176.05	24517.94	1658.11
Power	-738.92	344.43	-1083.35
Others	1649.37	1648.83	0.54
Total	**27086.50**	**26511.20**	**575.29**

Solution Code: 2 — GOOD SOLUTION: SQP STOP DUE TO FRACTIONAL CHANGE IN OBJECTIVE FN — Duration (s): 48

Case Implementation: Acelen Mataripe, Brazil

We are very satisfied with the job performed by KBC on implementing this emissions management solution. The attention to detail and professional support was essential to achieve our goals.

~Brazilian refinery

- **With Visual MESA GHG Emissions Management platform, refiners can optimize their operations and reduce emissions by making data-driven decisions. Resulting in:**
  - 6% decrease in electricity consumption
  - 268,000 tons reduction in CO_2 emissions
  - 41% reduction in sulfur emissions

Key-Away Messages

Visual MESA GHG Emissions Management

- All-in-one: Monitor, optimize, account, report
- Minimize efforts to produce auditable and compliant emissions reports
- Tackle all required operating and reporting frequencies
- Simultaneously reduce energy costs and increase efficiency, while lowering GHG emissions
- Produce reliable results

YOKOGAWA

Co-innovating tomorrow™