

OCTOBER 24, 2023

Leveraging Real Time Operational Data to Reduce Greenhouse Gas Emissions

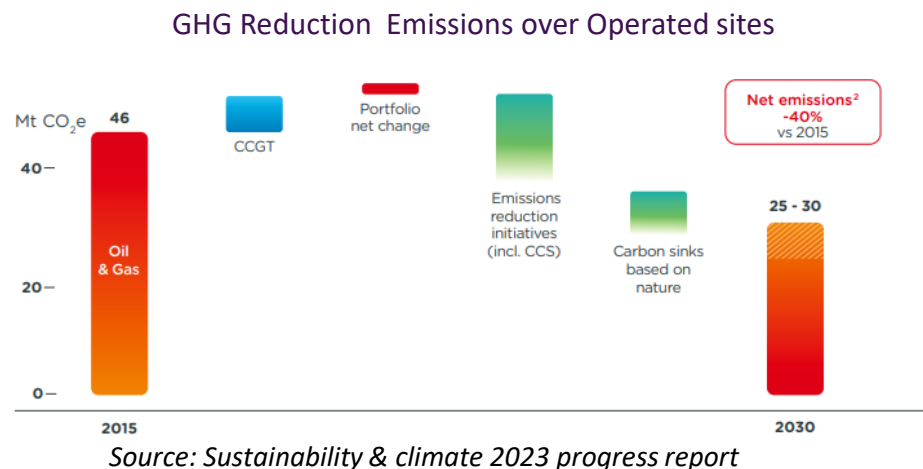
Juan Guzman – Digital Lead, TotalEnergies

AVEVA

About TotalEnergies

Meeting the Energy Transition Challenge

- Energy transition is underway however nowadays 81% of global energy needs are still met by fossil fuels (coal, oil, gas), posing a challenge to keeping global warming below 2°C, as per the Paris Agreement.
- TotalEnergies publicly committed in early 2019 to reduce net GHG Scope 1+2 emissions from operated activities by a minimum of 40% compared to 2015 levels.
- In 2022, TotalEnergies successfully implemented more than 110 GHG emissions reduction projects, demonstrating its commitment to sustainability.
- Generating energy savings in our operations offer's multiple benefits (Contributes to the global drive for energy efficiency, reduces our carbon emissions ,lowers our operational costs)



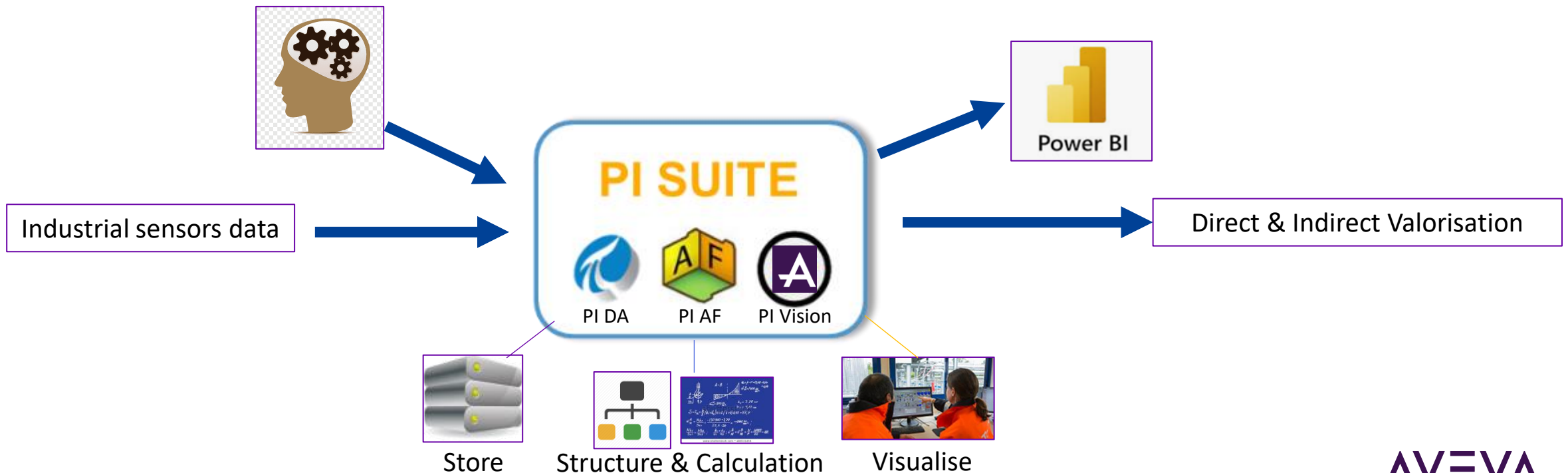
About Monitoring Center and PI

Our Objectives:

- **Data provider:** Recover and archive site instruments times series data.
- **Digital Solution maker:** Build, deploy and run monitoring applications
- **Digital Enabler:** Stream PI data to other digital solution

Some PI Facts

- 16 Affiliates
- 18 Years of Historical Data





Realtime monitoring of 85% Scope1 GHG emissions within the Company's E&P Operated asset

Challenge

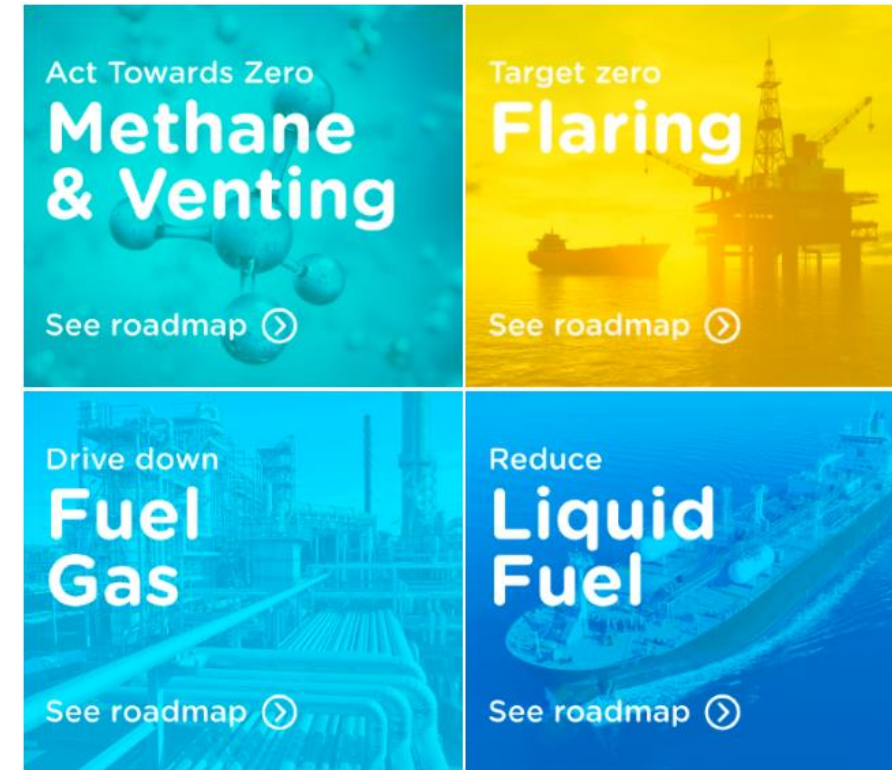
- Transform our operational practices toward greenhouse gases focus and environmentally friendly perspective by maximizing the utilization of existing field data and software resources
- Deploy an efficient, cost-effective digital solution that can be rapidly scaled up to broaden the range of monitored asset emissions,

Solution

- Centralized and standardized approach, with a PI-AF model built once and then applied to hundreds of equipment and assets, supplying real-time data calculations, analysis and KPIs

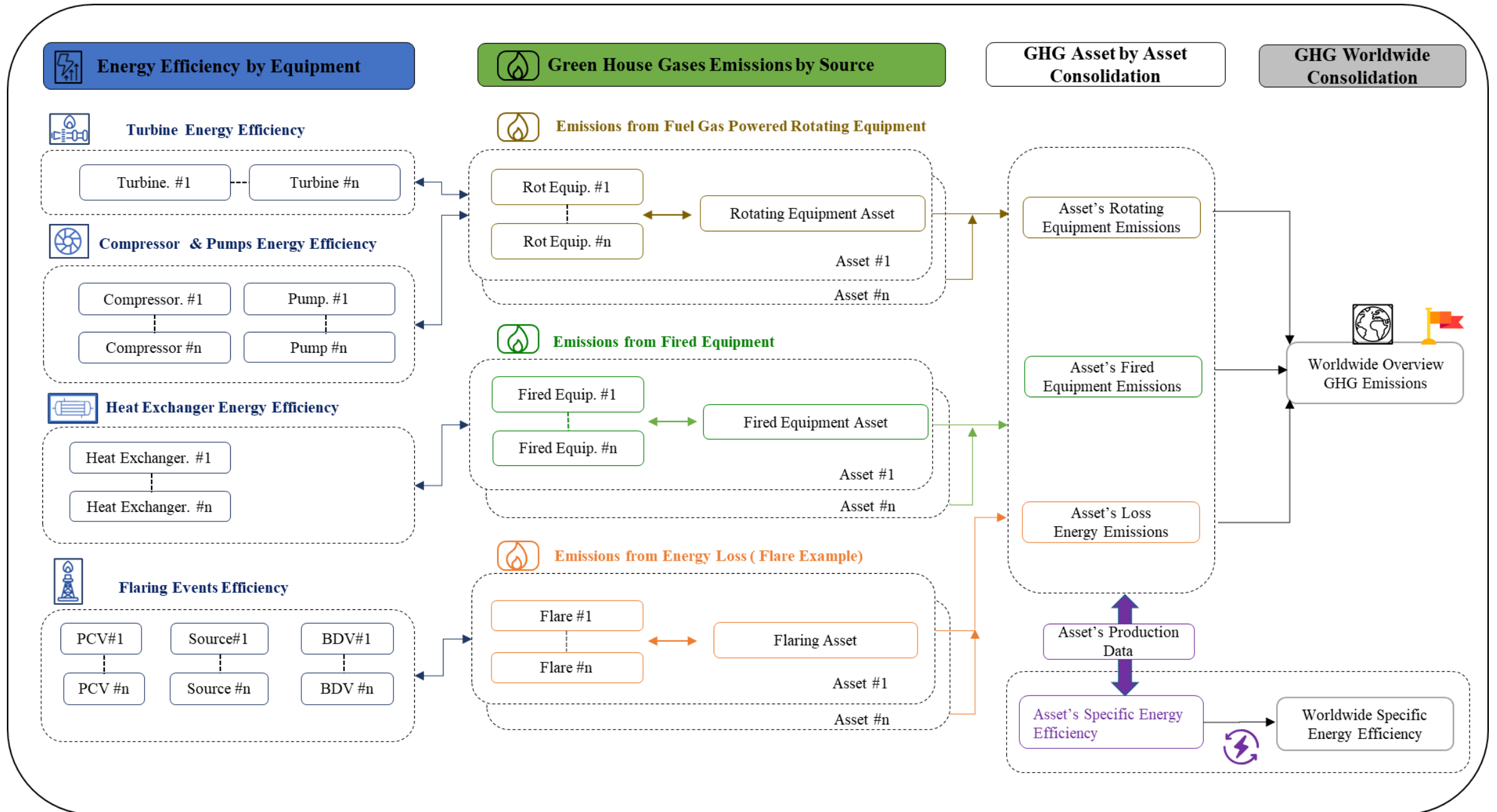
Results

- **Successful development of industrialized monitoring tool within a three-year timeframe**
- **Headquarters and operating centers relying on the solution's displays consistently for daily discussions and operational decision-making.**
- **Efficiently identification of poorly performing equipment and undesired process deviations that contribute to GHG emissions.**

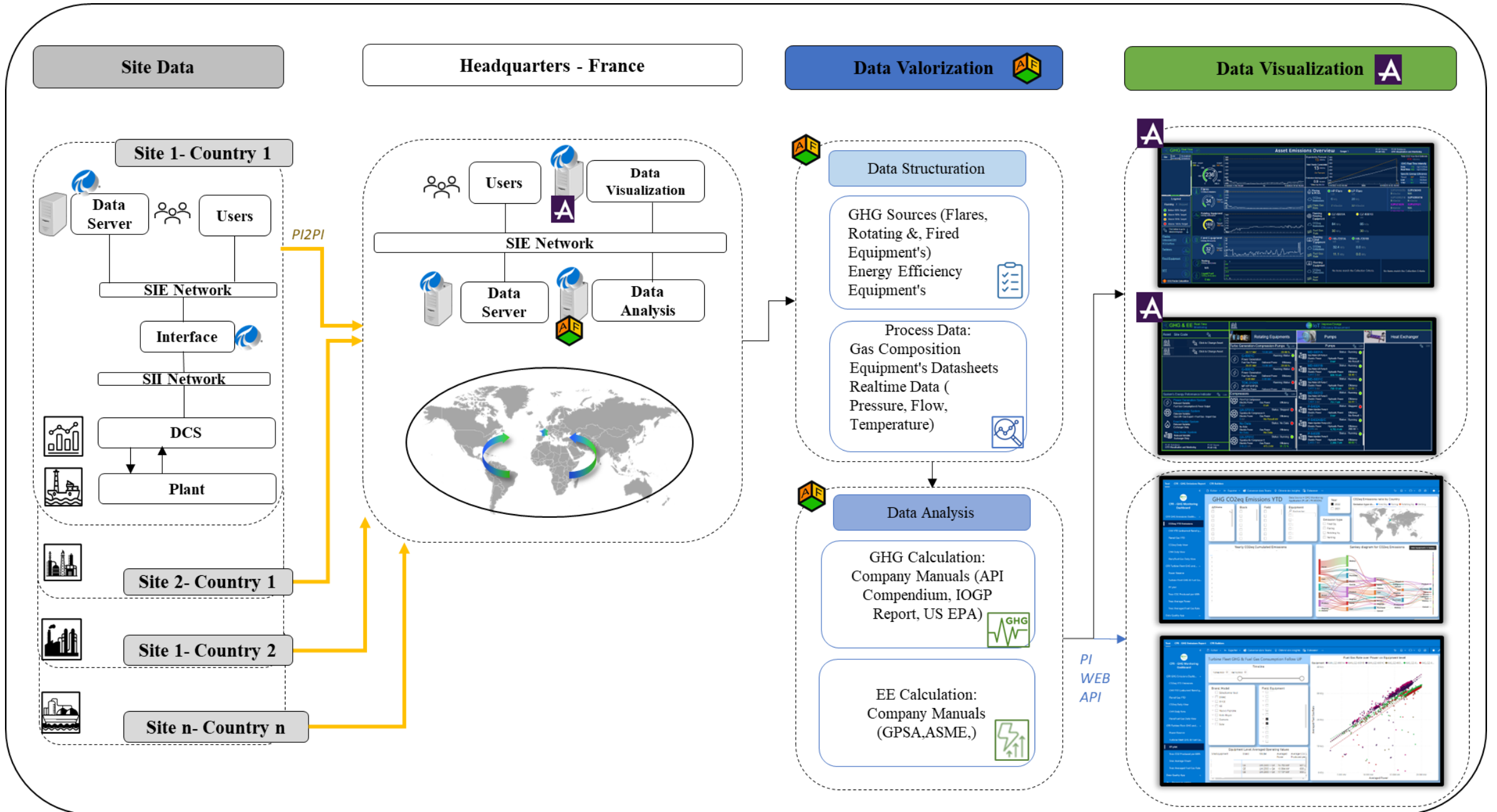


“To effectively reduce emissions and enhance energy efficiency, it is first needed to calculate and display this data through relevant indicators in suitable time for operational follow up.”

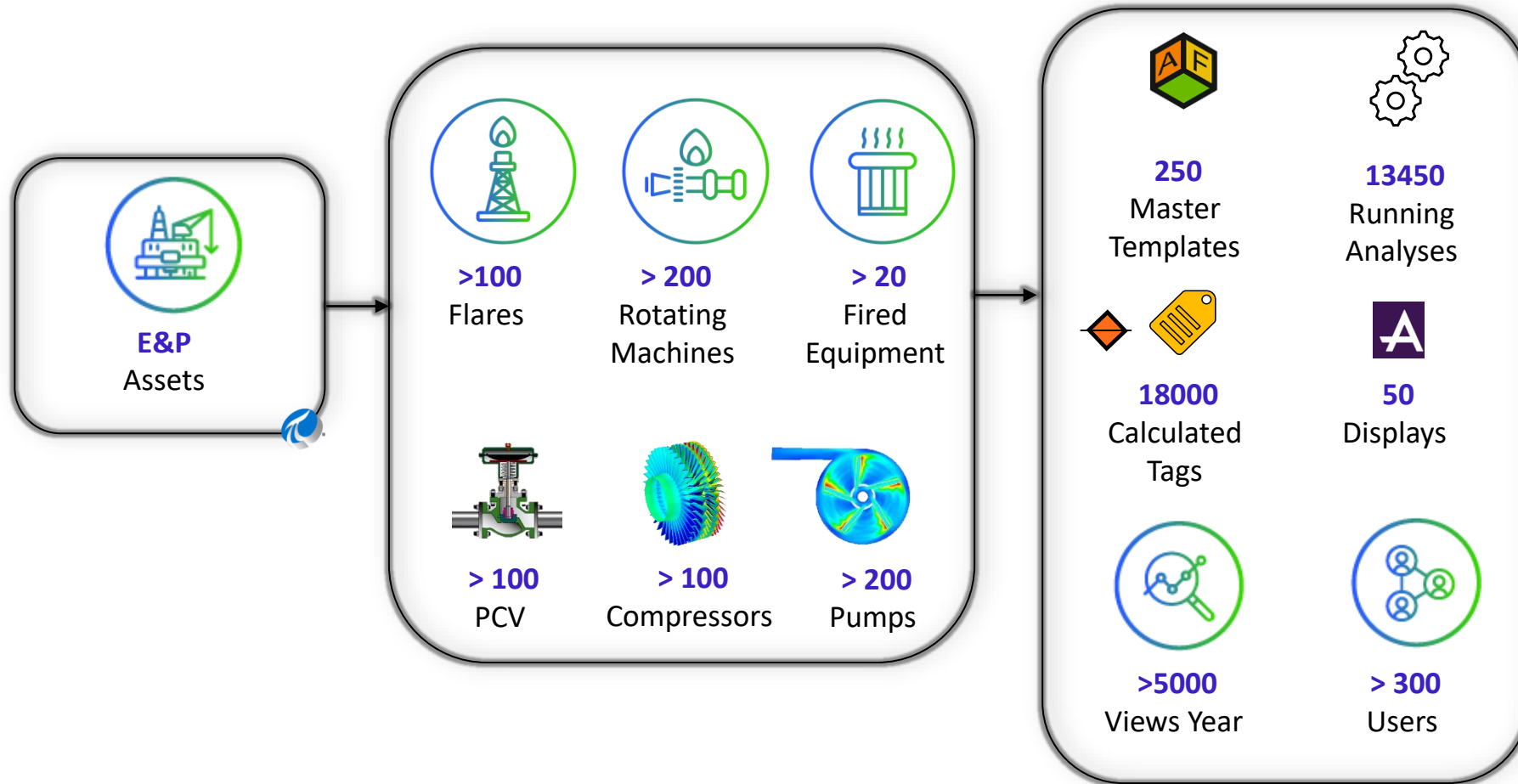
GHG & EE Real-time Monitoring Deployment Challenge



Implementing AVEVA portfolio for creating a centralized solution



Implementation perimeter & outcomes



Objective:

Monitor direct emissions (Scope 1) within site boundaries.

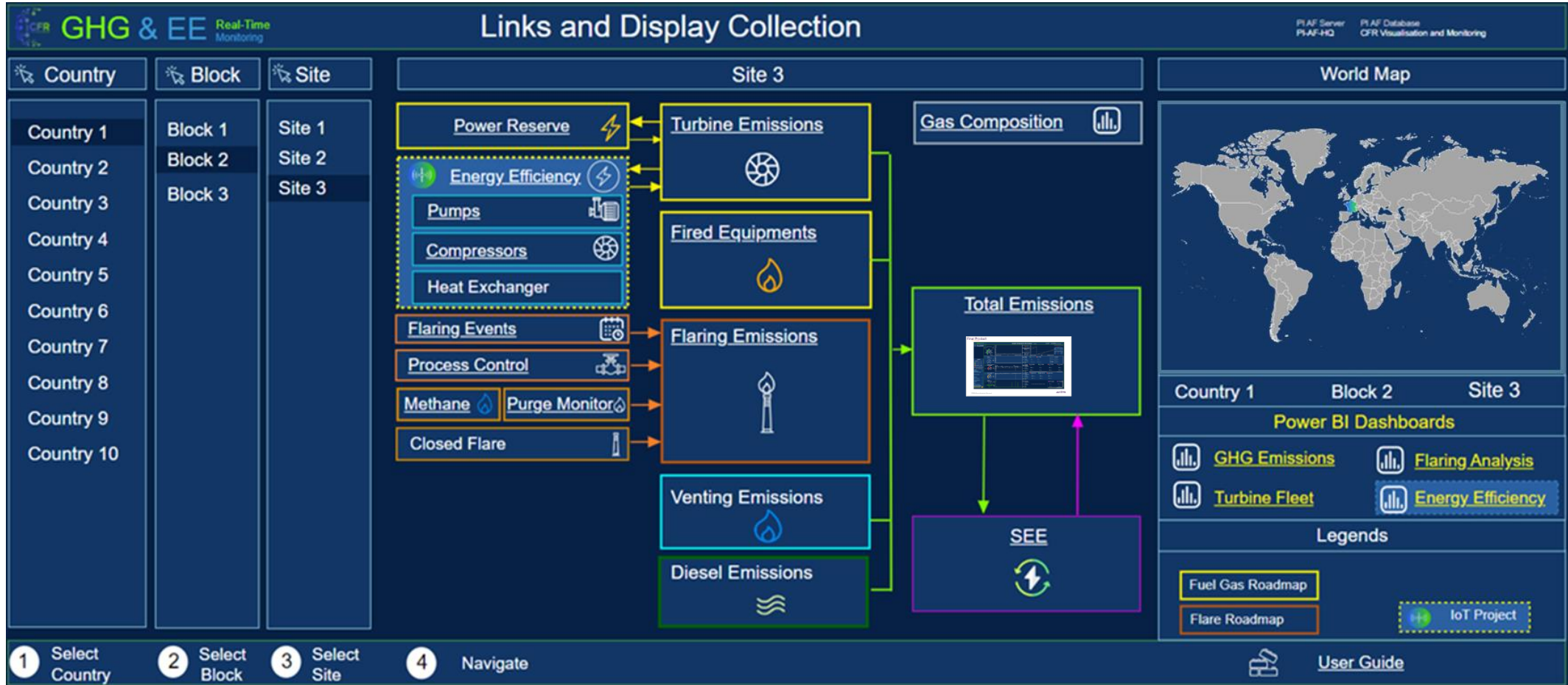
GHG Emissions:

Modular design to identify major GHG contributors. Started with Fuel Gas combustion emissions. Expanded to Energy Loss emissions (e.g., Flaring, Venting). Calculates emissions per equipment, offering comprehensive tracking. About 85% of emissions from operations effectively monitored.

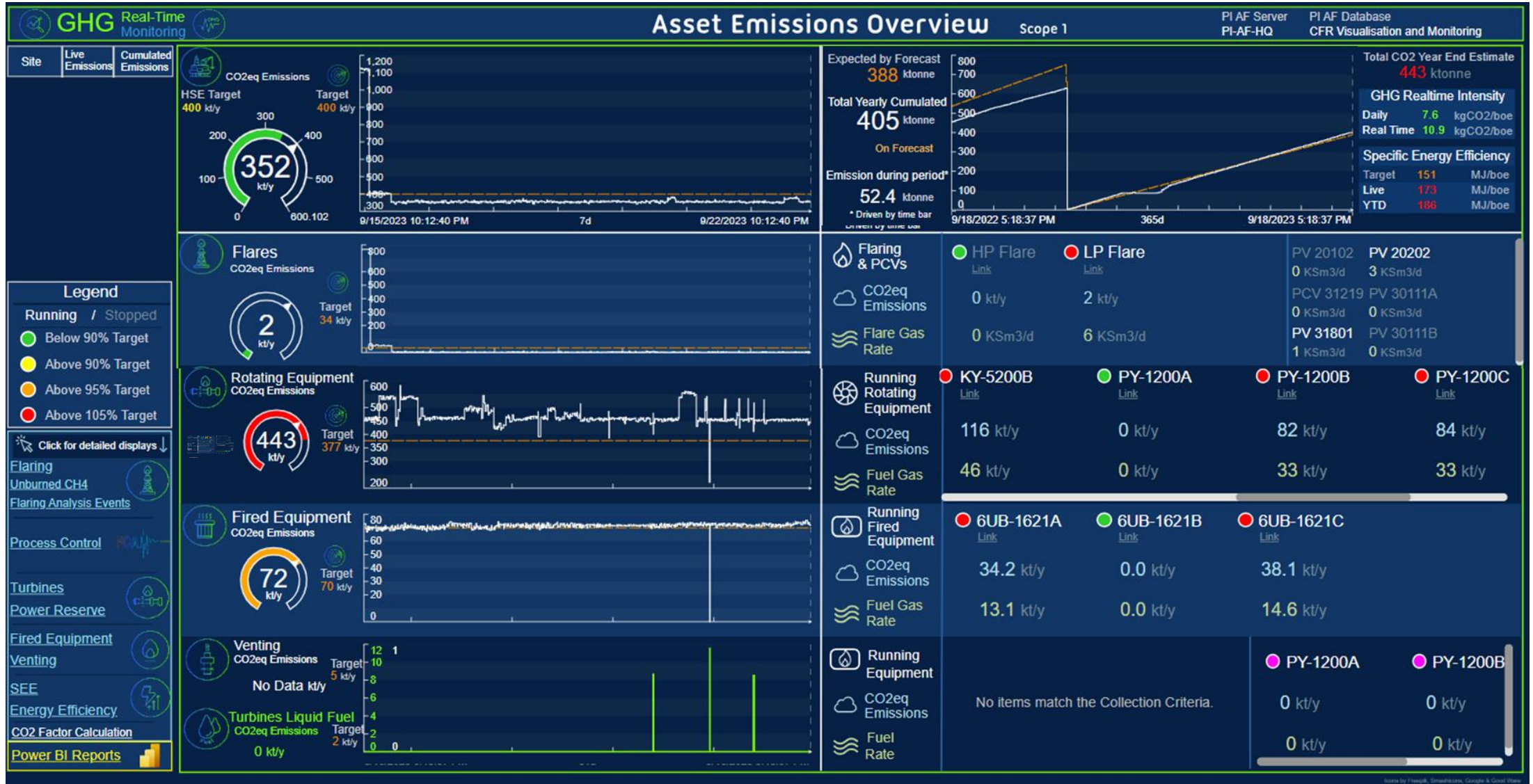
Energy Efficiency:

Calculates Specific Energy Efficiency (SEE) for each asset. Focus on individual equipment (turbines, compressors, pumps, heat exchangers) and system-wide Energy Performance Indicators

Final Product



Final Product



Final Product

GHG Real-Time Monitoring
Rotating Equipment CO2eq Emission Monitoring

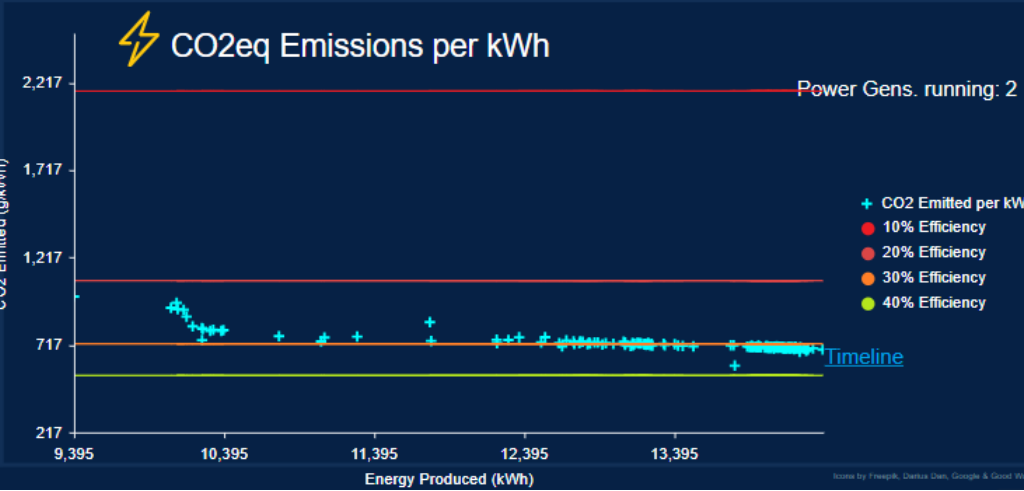
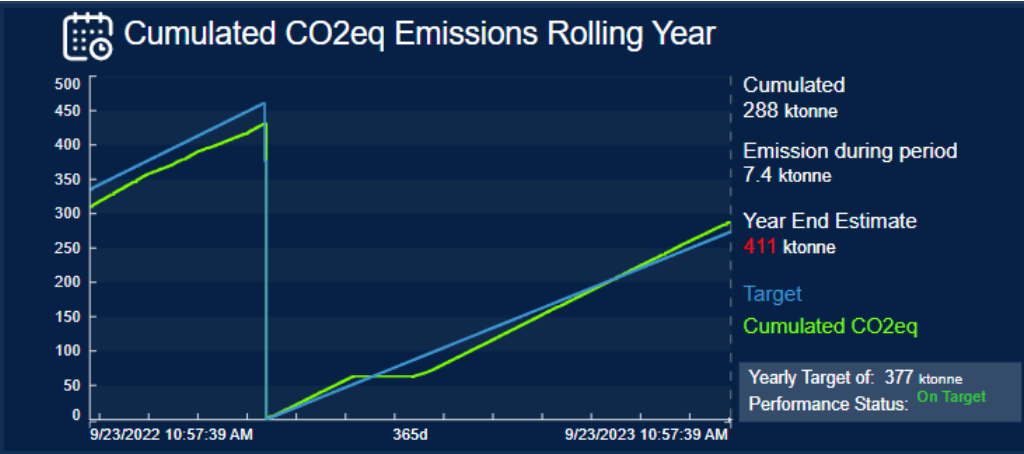
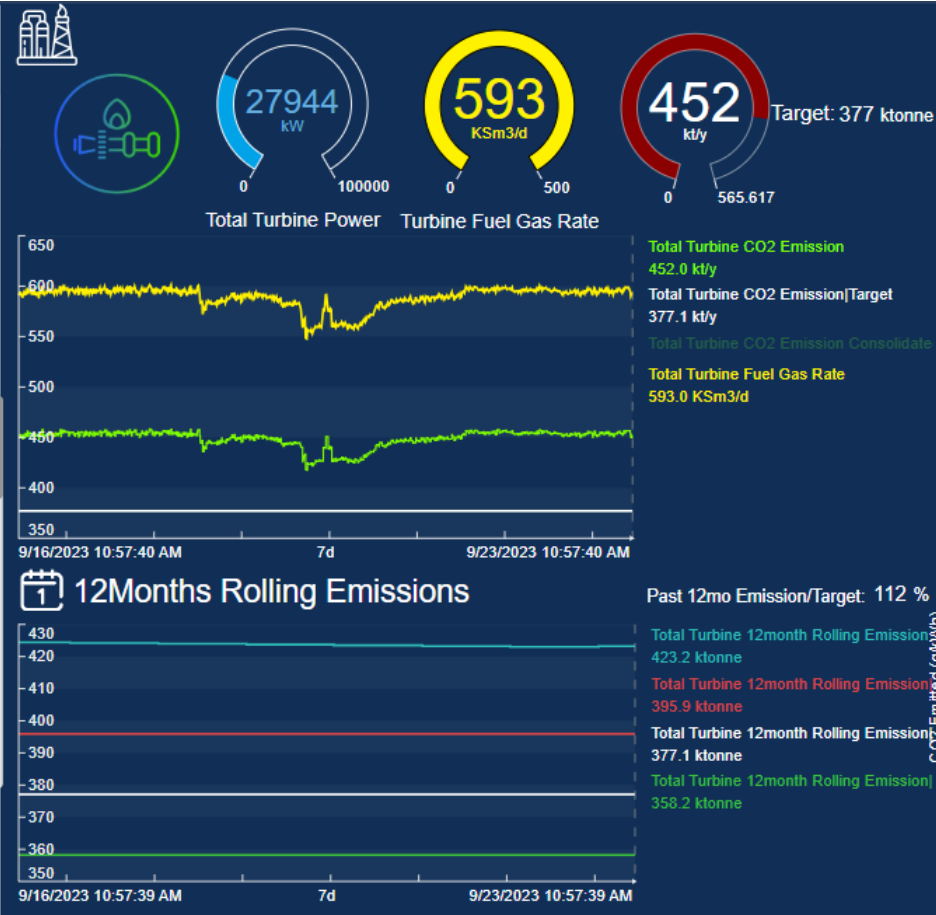
Site Code	Total Turbine Power	Total Turbine CO2 Emissions

Site Equipment

GY-7510B
 Water Injection Pump
 Performance Status: **Below Target**
 Fuel Gas Rate: 0 kt/y
 Power: Stopped
 CO2 Emissions: 0 kt/y

GY-7510C
 Water Injection Pump
 Performance Status: **Above Target**
 Fuel Gas Rate: 11 kt/y
 Power: Running
 CO2 Emissions: 29 kt/y

[Return to block level](#) Power Reserve



Final Product

GHG Real-Time Monitoring

Rotating Equipment CO2eq Emission Monitoring

Equipment Tag	Running Status	Service Type	Performance Status
GY-7510B	Stopped	Water Injection Pump	Below Target
GY-7510C	Running	Water Injection Pump	Above Target
KY-5200A	Running	Gas Compressor	Above Target
KY-5200B	Running	Gas Compressor	On Target
PY-1200A	Stopped	Power Generation	On Target
PY-1200B	Running	Power Generation	On Target
PY-1200C	Running	Power Generation	On Target

General Information:
 Latest Fuel Gas Composition Update
 No Data
 PI AF Database
 CFR Visualisation and Monitoring
 PI AF Server
 PI-AF-HQ
[Return to asset level](#)

PY-1200C Power Generation

Running

Fuel Gas Info
 35 kt/y
 N/A
 N/A

CO2 Emission Rate
 Instantaneous 88 kt/y
 10mins Average 88 kt/y

Power
 13870 kW

Running Target: 0 kt/y

Average Fuel Gas Rate
 116 KSm3/d

Live CO2eq Emissions
 K Site Constant: 2.5081

Averaged CO2 Emissions
 88.2 kt/y

Running Status/Enum Set
 Running

Averaged Power
 13870 kW

Average Volumetric Fuel Gas
 116.3 KSm3/d

Averaged CO2 Emissions Cor

Average Volumetric Fuel Gas

12Months Rolling Emissions
 Past 12mo Emission/Target: 149 %

Rolling Cumulative (YEAR)
 73.1 ktonne

Rolling Cumulative (YEAR)Hi
 53.9 ktonne

Rolling Cumulative (YEAR)Hi
 51.4 ktonne

Rolling Cumulative (YEAR)Ta
 49.0 ktonne

Rolling Cumulative (YEAR)Lo
 46.5 ktonne

Rolling Cumulative (YEAR)Lo

Cumulated CO2eq Emissions Rolling Year

Cumulated CO2eq Emission
 35 ktonne

Year End Estimate
 50 ktonne

Target
 Cumulated CO2eq

Yearly Target of: 48.971 ktonne

Performance Status:
 On Target

CO2eq Emissions per kWh

CO2 Emitted (g/kWh)

Energy Produced (kWh)

- + CO2 Emitted per kWh
- 10% Efficiency
- 20% Efficiency
- 30% Efficiency
- 40% Efficiency

[Timeline](#)

Final Product





<p>Asset Site Code </p>	 <h3 style="text-align: center;">Rotating Equipments</h3>	 <h3 style="text-align: center;">Pumps</h3>	 <h3 style="text-align: center;">Heat Exchanger</h3>																																																																								
	<p style="text-align: center;">Turbo Generation-Compression-Pumps </p> <div style="margin-bottom: 10px;"> <p>KY-5200A Running Status ●</p> <p>TCA</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Fuel Gas Power</td> <td style="text-align: right;">Delivered Power</td> <td style="text-align: right;">Efficiency</td> </tr> <tr> <td style="text-align: right;">68.19 MW</td> <td style="text-align: right;">22.98 MW</td> <td style="text-align: right;">33.69 %</td> </tr> </table> </div> <hr style="border-top: 1px dashed white;"/> <div style="margin-bottom: 10px;"> <p>KY-5200B Running Status ●</p> <p>TCB</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Fuel Gas Power</td> <td style="text-align: right;">Delivered Power</td> <td style="text-align: right;">Efficiency</td> </tr> <tr> <td style="text-align: right;">62.38 MW</td> <td style="text-align: right;">20.59 MW</td> <td style="text-align: right;">33.01 %</td> </tr> </table> </div> <hr style="border-top: 1px dashed white;"/> <div> <p>PY-1200A Running Status ●</p> <p>Power Generation</p> <table style="width: 100%; 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<p>System's Energy Performance Indicator </p> <div style="margin-bottom: 10px;"> <p>Power Generation System</p> <p>Relevant Variable: Fuel Gas Consumption & Power Output</p> </div> <div style="margin-bottom: 10px;"> <p>Compression System</p> <p>Relevant Variable: Gas Lift+ Gas Export + Fuel Gas - Import Gas</p> </div> <div style="margin-bottom: 10px;"> <p>Fired Heater System</p> <p>Relevant Variable: Exchanger Diuty</p> </div> <div> <p>Sea Water System</p> <p>Relevant Variable: Exchanger Diuty</p> </div>	<p>PIAF Database CFR Visualisation and Monitoring</p>	<p>PIAF Server PI-AF-HQ</p>																																																																									

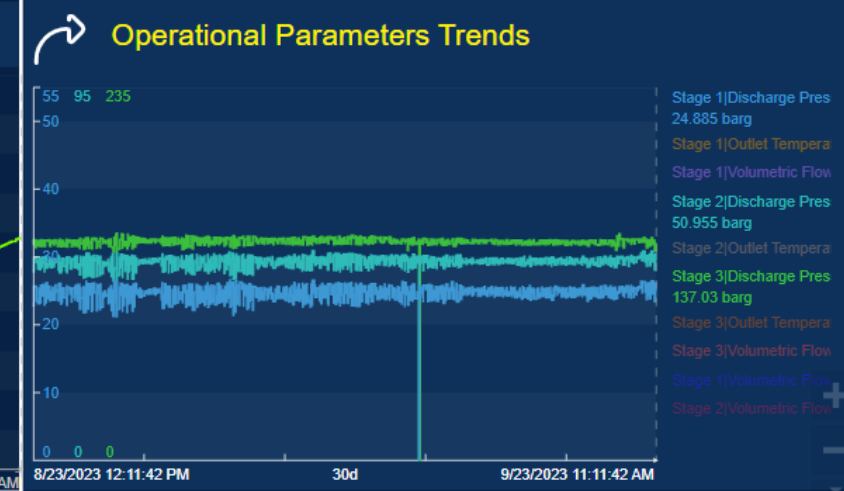
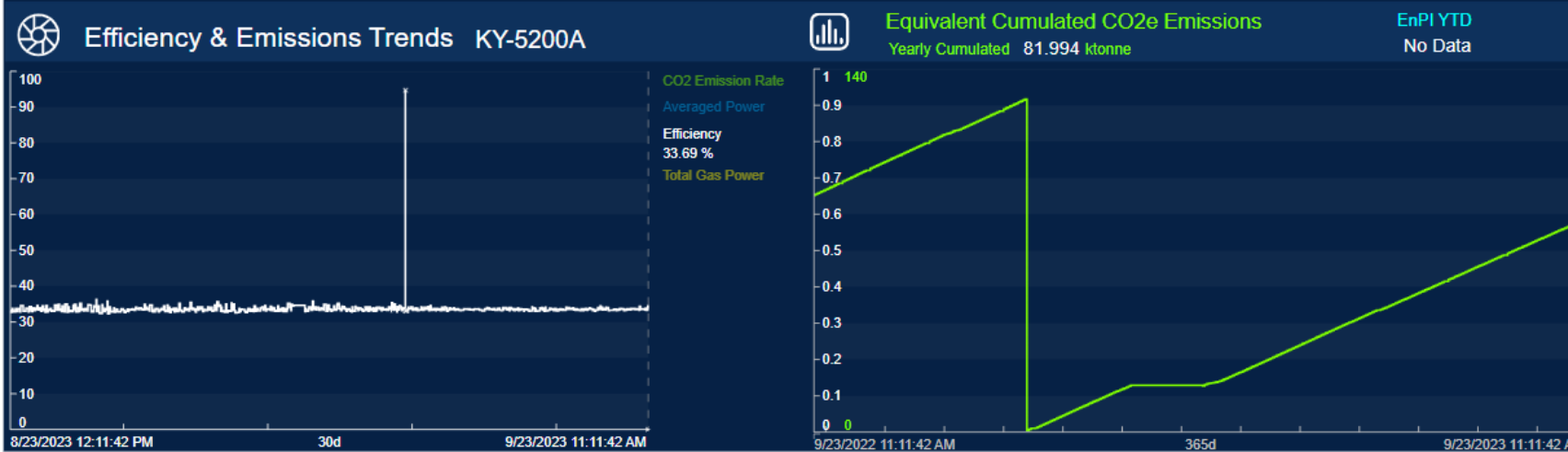
Final Product

Equipment Tag	Description	Running Status	CO2e Rate	CO2e Cumulated	Averaged Power	Ratio to Total Power	Cumulated Power Consumption	Gas Power	EnPI	EnPI YTD	System Efficiency
6-KB-5110_5120	LP/MP Gas Compressor	●	752 Kg/h	4.19 ktonne	1.03 MW	3.64 %	5.54 GWh	0.72 MW			6-KB-5110_5120 68.95 % ▲ +129.83% Target: 30.00
6-KB-5410	Gas Export Compressor	●	1,852 Kg/h	10.23 ktonne	2.71 MW	9.60 %	14.30 GWh	1.67 MW			6-KB-5410 65.23 % ▲ +117.43% Target: 30.00
KY-5200A	TCA	●	132 kt/y	81.99 ktonne	22.98 MW	73.24 %	374.78 GWh	22.98 MW			KY-5200A 33.69 % ▼ -3.73% Target: 35.00
KY-5200B	TCB	●	119 kt/y	76.45 ktonne	20.59 MW	65.64 %	354.15 GWh	20.59 MW			KY-5200B 33.01 % ▼ -6.69% Target: 35.00

Equipment Details

Equipment Tag: KY-5200A
Description: TCA
Efficiency: 33.69 %
Target: 35.00
-3.73%

Parameter	1 Stage	2 Stage	3 Stage
Delivered Power	4,329 KSm3/d	4,357 KSm3/d	4,307 KSm3/d
22,975 kW	1 Stage Gas Power: 7,003.45 kW	2 Stage Gas Power: 6,885.11 kW	3 Stage Gas Power: 9,086.78 kW



“Now that we've established all the monitoring tools, let's proactively identify opportunities to reduce greenhouse gas emissions”

Use Cases

- Purge Gas Optimization
- Categorizing flaring sources to decrease flared gas
- Detecting Passing Valves
- Detection of Process Control Anomalies to reduce flared gas
- Optimize the power delivery configuration to reduce emissions

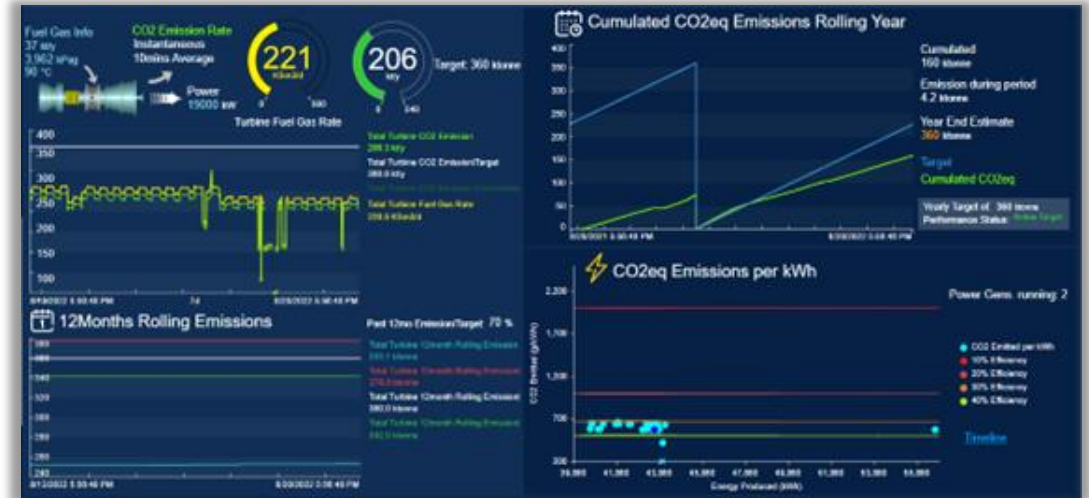
- Reducing emissions by recycling less gas on compression system
- Reducing emissions by adjusting Water Injection pump pressure
- Detection of anomalies in pumps performance
- Reducing power consumption through gas compressors
- Closed Flare performance analysis

Study Case : Optimize the power delivery configuration to reduce emissions

Site Power Generation Overview



Site Power Generation CO2 Emissions



Introduction

Focus: Power Reserve Module

Significance: GHG Emissions Implications

Key Metric: Power Reserve (Required vs. Delivered)

Efficiency and Load

Correlation: Turbine Efficiency & Load

Maximizing Efficiency: Load Optimization

Inefficiencies

Scenario: Excess Power Reserve

Consequence: Lower Efficiency, Increased GHG Emissions

Reliability vs. Redundancy

Considerations: N+1 Configurations

Context: Reliability vs. Efficiency Trade-off

Result: Equipment Deactivation

Impact: Reduced Power Demand, GHG Emissions

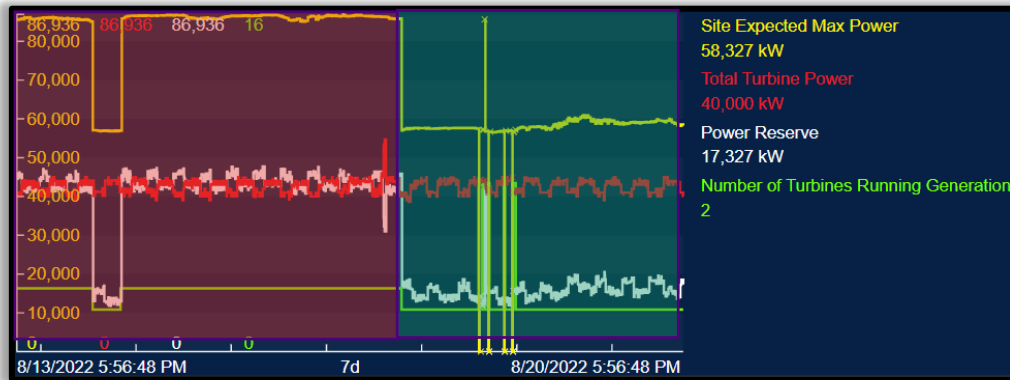
Enhanced Efficiency: Closer to Optimal Operating Point

Emission Reduction

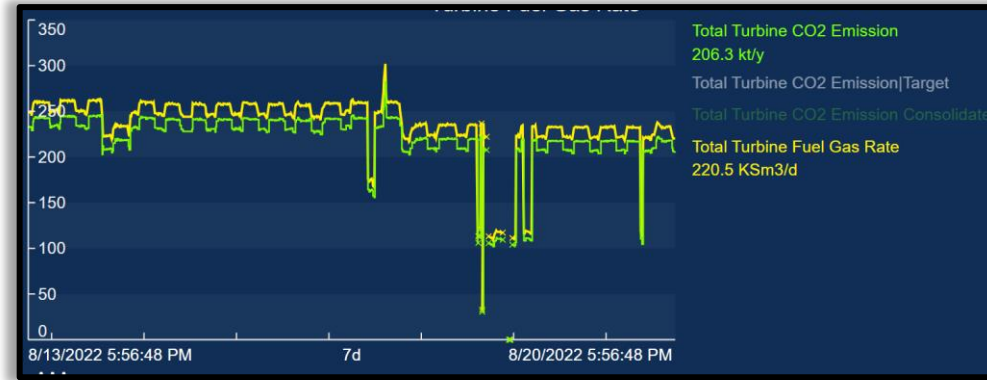
Achievement: 15% CO2 Emission Reduction Annually

Study Case : Optimize the power delivery configuration to reduce emissions

Power Reserve at Site Level



Turbine CO2 Emissions



Introduction

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Significance: GHG Emissions Implications

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Efficiency and Load

Correlation: Turbine Efficiency & Load

Maximizing Efficiency: Load Optimization

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Enhanced Efficiency: Closer to Optimal Operating Point

Emission Reduction

Achievement: 15% CO2 Emission Reduction Annually

Conclusions and Take-aways

- **Achievements:**
 - Effective reduction in GHG emissions through practical & cost-effective solutions.
 - Tangible benefits observed across the company.
- **Strategy & Approach:**
 - Standardized model: Built once, applied across multiple assets.
 - Streamlined process for quick industrialization, allowing expanded monitoring and real-time data analysis.
- **Benefits of Real-Time Tool:**
 - Instant Insights: Real-time visibility on operational changes.
 - Operational Excellence: Informed decision-making based on comprehensive data.
 - Emission Reduction: Identification and benchmarking emissions from equipment.
 - Financial & Environmental: Boost in revenues and a decrease in environmental impact.
- **Operational Improvements:**
 - Easy optimization of energy efficiency and emissions through minor adjustments.
 - No capital expenditure needed—focus on studying existing configurations.
 - Identify major contributors with just a few clicks, initiating impactful emission reduction projects.
- **Final Thoughts:**
 - Shift in operational practices towards a greenhouse gas focus.
 - Demonstrated feasibility of reducing GHG emissions in pursuit of a net zero carbon energy transition.

Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



Thank you!

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ABOUT AVEVA

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Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com