

Weel & Sandvig
ENERGY AND PROCESS INNOVATION

WS.PEMS

Accurate Predictive Emission Monitoring System

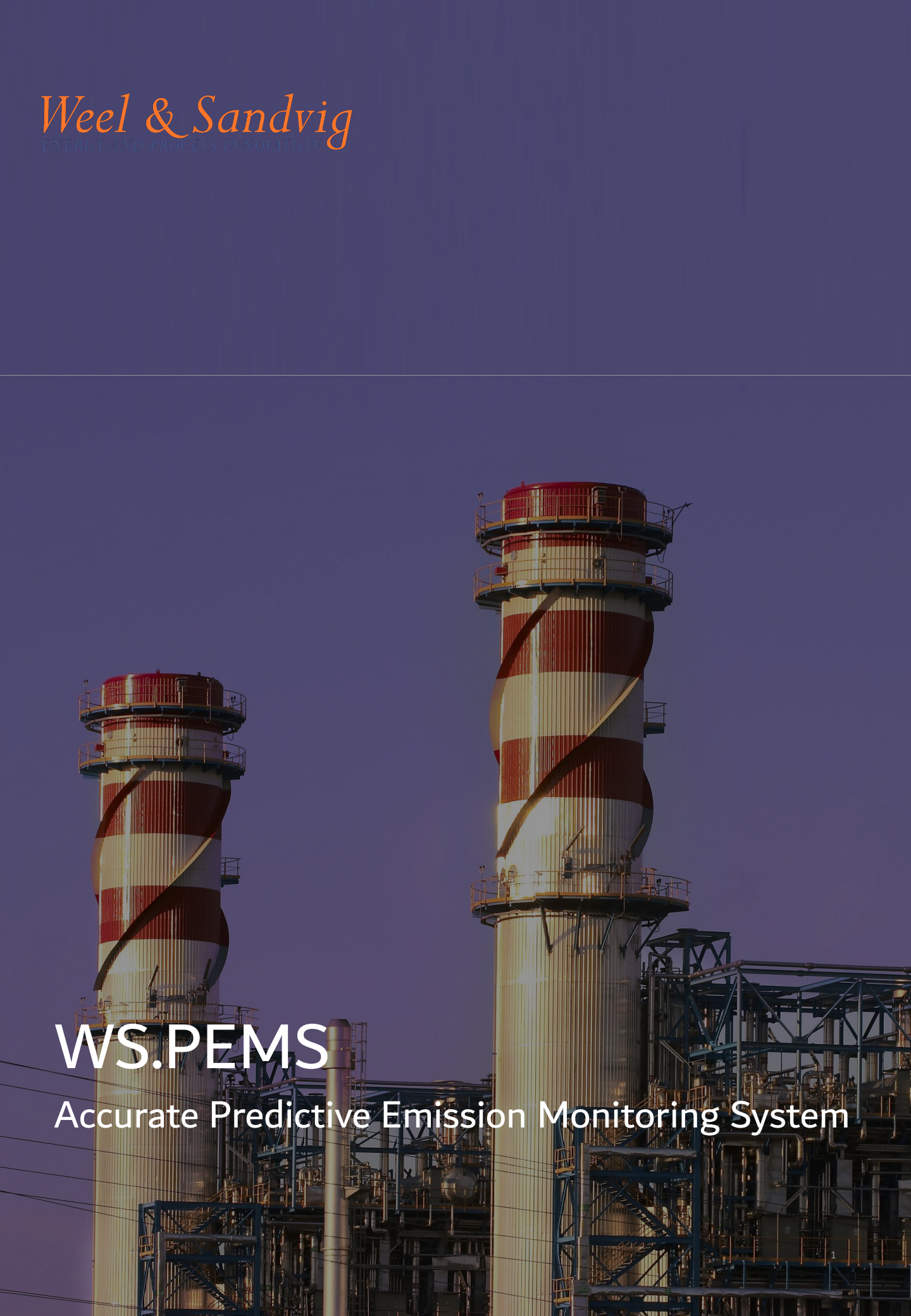




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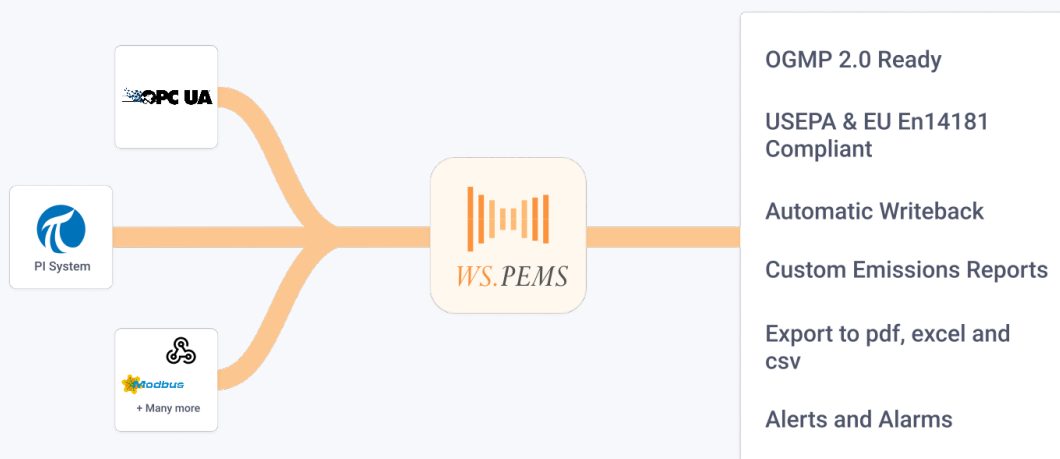
Introduction



Introducing WS.PEMS

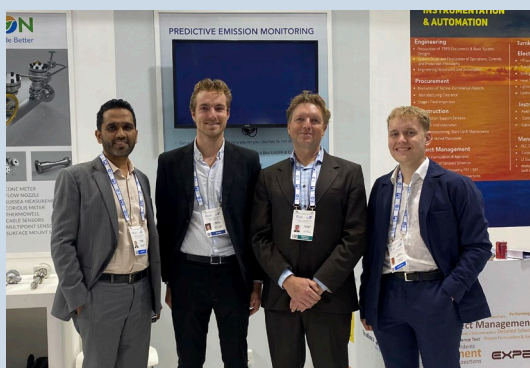
Predictive Emission Monitoring System

WS.PEMS is a state-of-the-art, software-based system developed by Weel & Sandvig to monitor harmful emissions continuously and accurately. This innovative system is especially crucial for sectors like power and oil & gas, enabling them to maintain stringent environmental standards and reduce their ecological footprint.



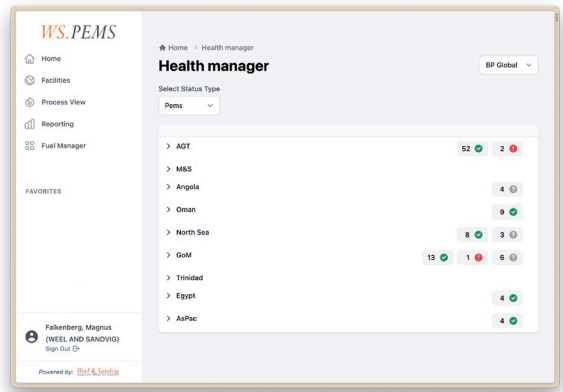
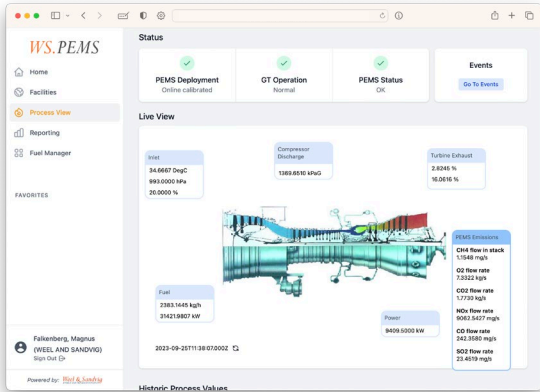
Weel & Sandvig: Pioneering Sustainable Solutions

At Weel & Sandvig, we are dedicated to offering innovative services and products designed to enhance energetic and environmental performance in a cost-effective manner. We are a globally oriented company with a strong presence in Saudi Arabia, United Arab Emirates, and Indonesia, ensuring our solutions are accessible to a diverse range of industries worldwide.



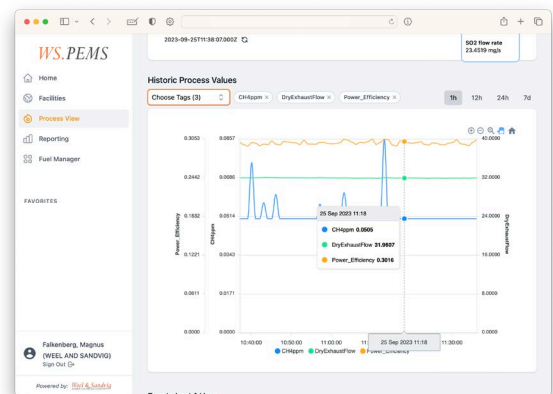
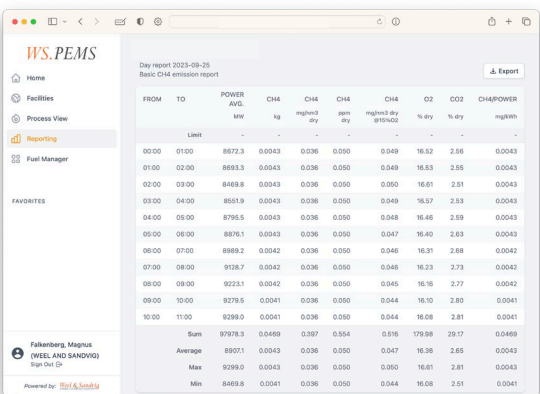
Key Features

Here are some of the key features of our WS.PEMS



Real-Time Monitoring: WS.PEMS provides continuous, real-time tracking of emission levels, allowing industries to ensure compliance with local and international environmental regulations and standards.

Alerts & Notifications: The system is equipped with instant alert mechanisms to notify users of any emission level anomalies, allowing for immediate corrective actions.



Comprehensive Reporting: Detailed and customizable reports provide insights into emission data, trends, and compliance status, facilitating strategic planning and environmental management.

Advanced Analytics: The system offers advanced analytical tools, delivering precise and reliable data on various emission parameters, enabling industries to make informed decisions to optimize their processes and reduce emissions.

Industries

Refineries



LNG Ships



Upstream Operations



Key Customer challenges

Here are some of the customer challenges our model based emission monitoring system solves.

C1 Regulatory Compliance:

Non-compliance can lead to shutdowns and fines. PEMS ensures continuous, accurate monitoring and reporting to meet regulations.

C3 Environmental Sustainability:

Balancing efficiency with sustainability is essential. PEMS enables effective emission management, contributing to environmental conservation.

C5 Operational Downtime:

Installation and maintenance of a monitoring systems can disrupt operations. PEMS minimizes downtime while maintaining productivity.

C2 Data Accuracy & Reliability:

Inaccurate data can lead to harmful decisions. PEMS provides precise, consistent data for informed decision-making and environmental integrity.

C4 Scalability:

Adjusting to operational scale changes requires flexible solutions. Scalable PEMS adapt to varying demands and capacities efficiently.

C6 Cybersecurity Concerns:

Protecting sensitive data from cyber threats is paramount. A secure PEMS safeguards information and maintains system integrity.

Reaching the gold standard in the **OGMP 2.0** framework with **WS.PEMS**

WS.PEMS is a predictive emission monitoring system that can be used by companies in the oil and gas industry to improve the accuracy and transparency of their methane emissions reporting. This is important because the Oil & Gas Methane Partnership 2.0 (OGMP 2.0) is a multi-stakeholder initiative that has established gold standard guidelines for methane emissions reporting in the sector. Companies that meet these guidelines are recognized as OGMP 2.0 gold standard companies.

What is OGMP?

Methane is a potent greenhouse gas that contributes significantly to global warming. The Oil & Gas Methane Partnership 2.0 (OGMP 2.0) is an initiative to improve methane emissions reporting in the oil and gas industry. The OGMP 2.0 framework is used by over 80 companies representing a significant share of global oil and gas production. The oil and gas industry is a major source of methane emissions and has the potential to significantly reduce them.

By using WS.PEMS to continuously calculate and quantify methane emissions, companies can improve the accuracy of their reporting and demonstrate their commitment to reducing methane emissions. This can help them achieve OGMP 2.0 gold standard status and progress towards their own emissions reduction goals. Additionally, WS.PEMS can provide valuable process insights and performance monitoring data, which can help companies to identify opportunities for further emissions reductions and improve the efficiency of their operations.

Case

In a recent development, bp has awarded Weel & Sandvig the global PEMS contract for monitoring methane emissions from its production facilities as part of its efforts to achieve the gold standard in the OGMP 2.0 framework. bp aims to become a net zero company by 2050 or sooner and reducing methane emissions is one of its 10 net zero aims. By installing methane measurements at its major oil and gas processing facilities, bp aims to reduce methane emissions by 50% by 2025. The use of WS.PEMS will help bp to accurately measure and monitor its methane emissions and take appropriate actions to reduce them.



WS.PEMS

In depth



WS.PEMS

Leveraging First Principle Method for Precision and Robustness

Foundational Balances in Modelling

In First Principle PEMS models, known physical relations are harnessed to calculate the specific effect of each input parameter. These models fundamentally utilize energy and mass balances. The energy balance model correlates all energy entering the process, such as fuel, air, and feed streams, with all energy exiting the process, including product streams, exhaust flows, and heat losses.

Similarly, the mass balance is executed both on total mass—relating the total mass flow entering the process with all mass exiting the system—and by component balance, where balances are established for each component like N₂, O₂, etc.

Incorporation of Various Relations

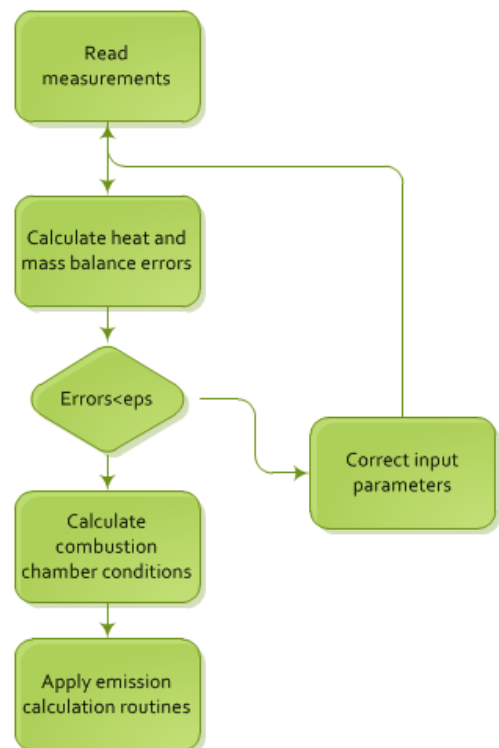
Beyond these fundamental relations, WS.PEMS exploits additional physical or empirical relations. Various equipment model relations are incorporated, allowing the system to calculate the condition in the core of the combustion process meticulously. This includes component composition, combustion temperatures, and pressure, considering each stage of the combustion process in the emission prediction.

Kinetic Reaction Models for Accurate Predictions

With the specific conditions determined during the combustion process, WS.PEMS applies kinetic reaction models to accurately predict specific emissions. This approach ensures that the predictions are not only precise but also reflective of the actual combustion conditions and subsequent emissions.

Sensor Reliability and Error Detection

The energy and mass balances in a First Principle PEMS model serve as invaluable tools for evaluating sensor reliability. Since these balances are calculated in multiple ways, it is possible to compute heat and mass balance errors. By assigning a weight to each input signal, the system can statistically estimate the measurement error on each sensor. If any of these errors exceed a predetermined level, the input value can be discarded in the model, and a warning or alarm signal can be raised, ensuring the integrity and reliability of the monitoring process.



Pollutants

Comprehensive Emission Insights for Enhanced Environmental Compliance

In the dynamic landscape of the industry, environmental responsibility takes center stage. Our predictive software delivers detailed emissions analyses, empowering your business to not only stay ahead of regulatory requirements but also to exceed sustainability goals. Leveraging real-time data and predictive analytics, gain a comprehensive overview of emissions from all your sources, reduce environmental impact, and elevate operational performance.

Standard Components

NO_x Nitrogen Oxides

Produced from high temperature combustion in air. They can contribute to smog and acid rain and are significant greenhouse gases.

SO_2 Sulfur Dioxide

Arises from the burning of fossil fuels containing sulfur and can lead to acid rain, which can harm ecosystems and structures.

CO Carbon Monoxide

Produced from high temperature combustion in air. They can contribute to smog and acid rain and are significant greenhouse gases.

CH_4 Methane

A potent greenhouse gas often released during the production and transport of fossil fuels.

O_2 Oxygen

Not a pollutant but monitoring oxygen levels is important for combustion efficiency and control of other emissions.

CO_2 Carbon Dioxide

The primary greenhouse gas emitted through fossil fuel combustion

Special Applications

Beyond the common pollutants, our system also monitors substances that have specialized concerns or applications within

H_2S Hydrogen Sulfide

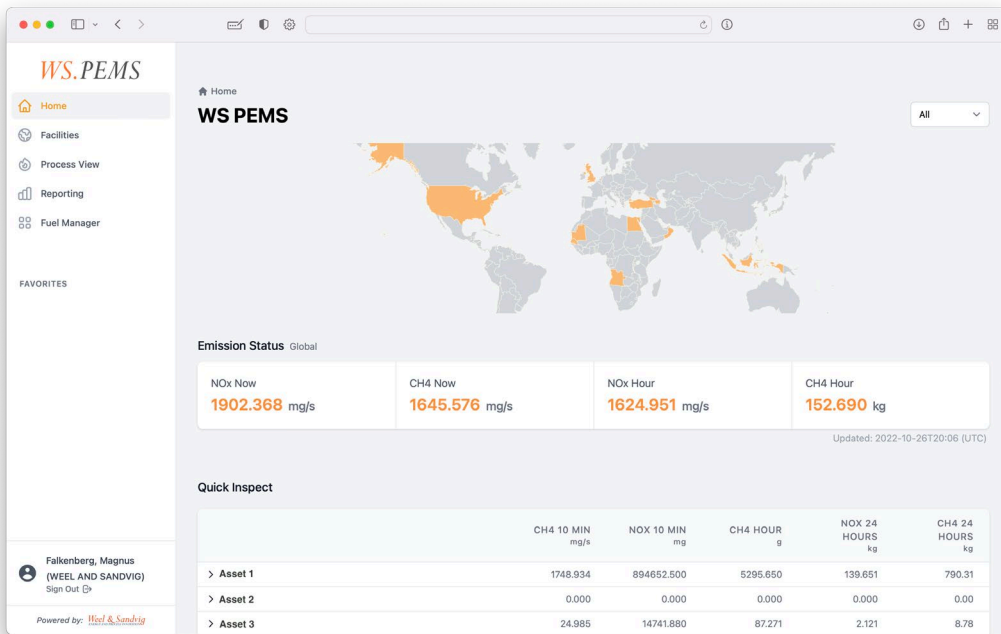
PM Particular Matter

NH_3 Ammonia

N_2O Nitrous Oxide

Web Interface

Here is an example of how our web interface and real-time dashboards streamline emission tracking and sensor evaluations

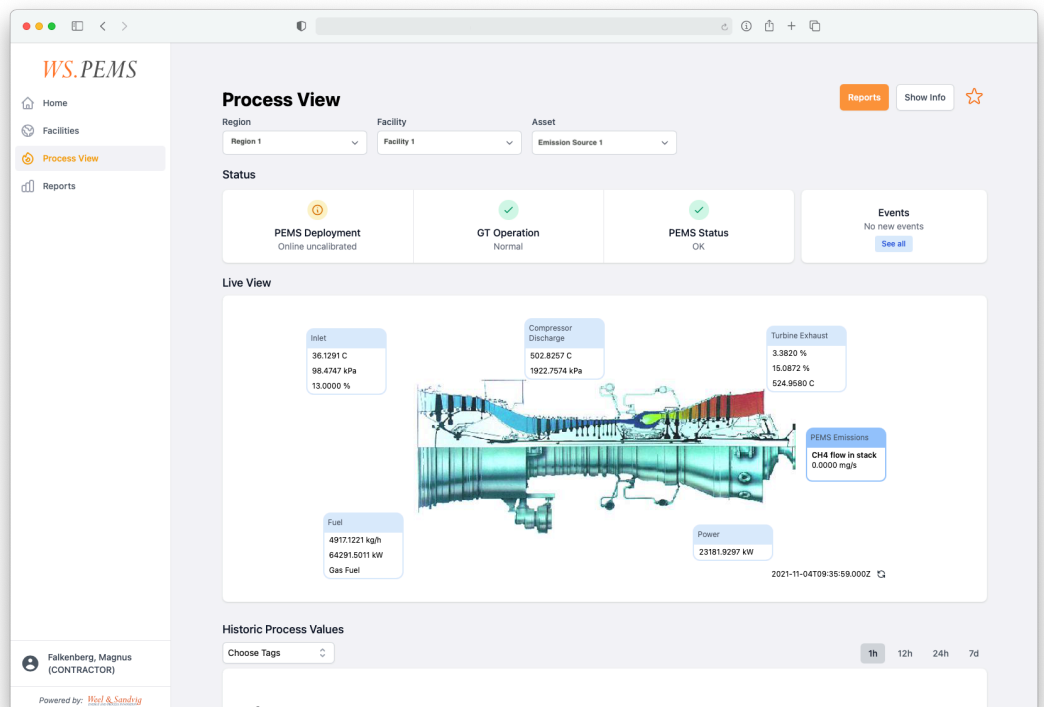


Secure web interface
Connect securely to the cloud or self hosted platform

Real Time Dashboard
An intuitive user interface to get an overview of emission and process values

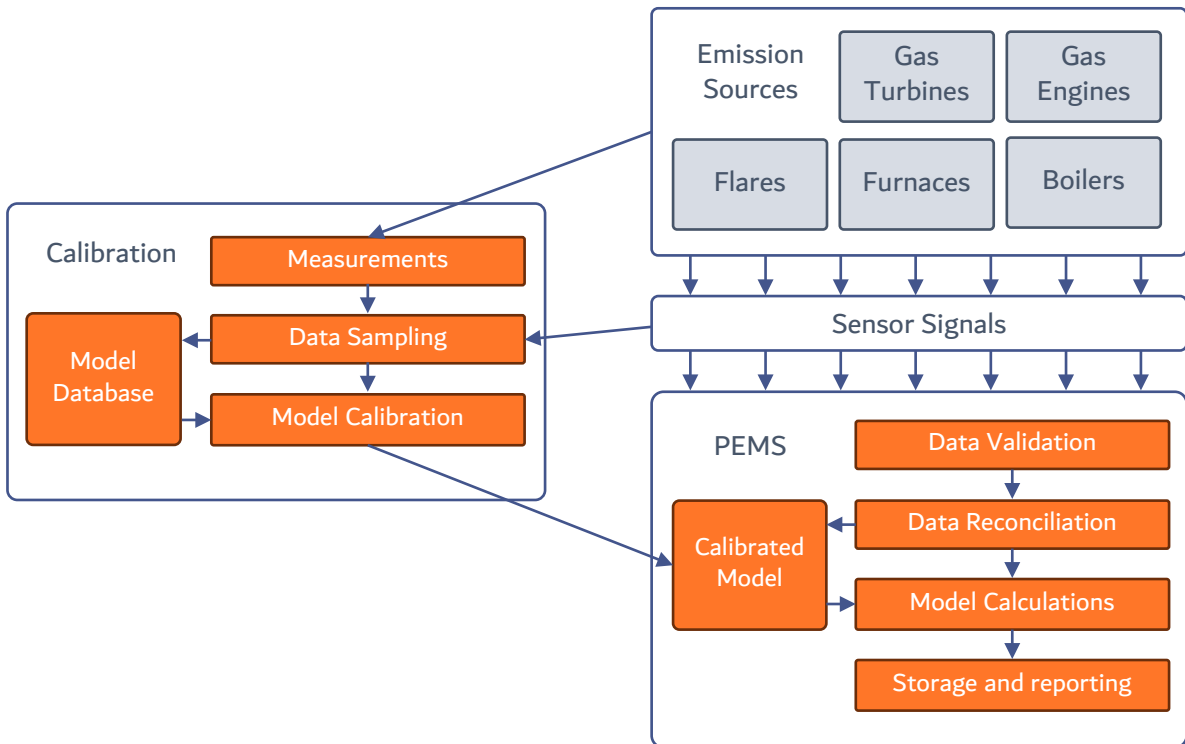
Live Sensor Evaluation
Get live feedback on the quality of sensors.

SSO + MFA
Login with existing single-sign-on solutions



Data Flow

At the heart of WS.PEMS's reliability is a meticulous validation process, ensuring each sensor input value is rigorously verified for accuracy and precision. Leveraging advanced algorithms and statistical methods, WS.PEMS conducts a multi-step validation, each designed to scrutinize the input values, detect anomalies, and uphold the highest standards of data integrity.



Robust Validation for Enhanced Reliability:

At the heart of WS.PEMS's reliability is a meticulous validation process, ensuring each sensor input value is rigorously verified for accuracy and precision. Leveraging advanced algorithms and statistical methods, WS.PEMS conducts a multi-step validation, each designed to scrutinize the input values, detect anomalies, and uphold the highest standards of data integrity.

Adaptive Error Handling for Uninterrupted Performance:

WS.PEMS is engineered with a resilient and adaptive error handling mechanism, ensuring the system's robustness and reliability in the face of anomalies or errors in sensor input values. When an error is detected, WS.PEMS doesn't just isolate the invalid input; it employs advanced algorithms to estimate fallback values, allowing for uninterrupted monitoring and analysis.

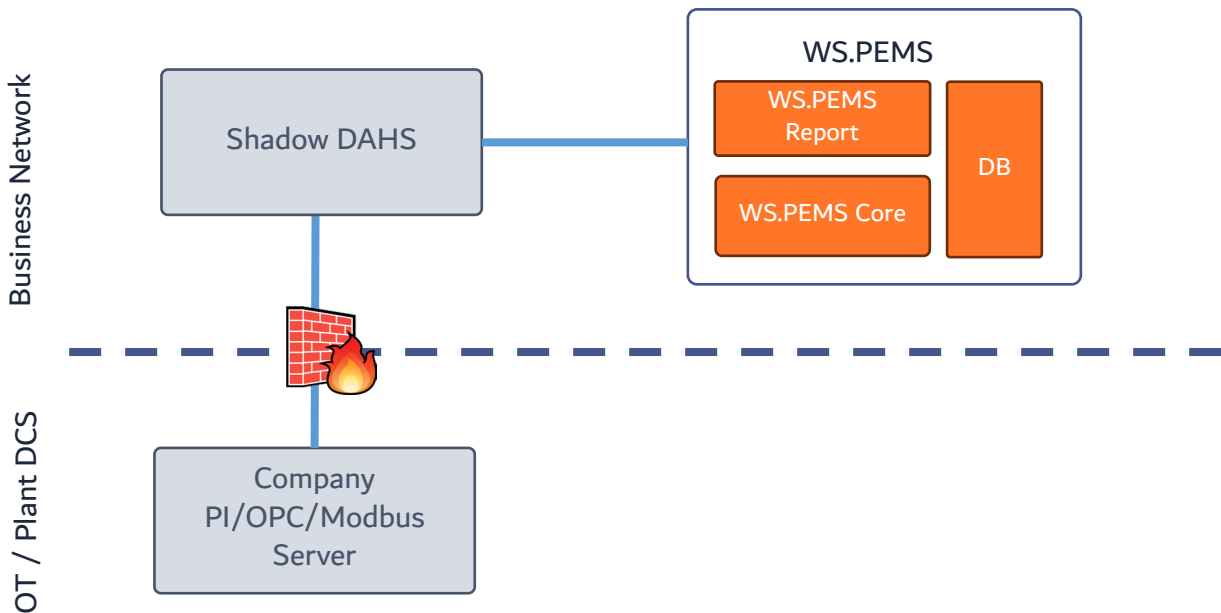
Versatile Integration of WS.PEMS

In today's dynamic and diverse industrial landscape, the need for flexible and adaptable solutions is more pronounced than ever. Recognizing this, Weel & Sandvig has designed WS.PEMS to offer versatile deployment options, catering to a range of organizational structures and operational preferences. Whether an organization operates on a centralized network layer, prefers direct interaction with the PI/DAHS system, or requires a blend of both, WS.PEMS is equipped to integrate seamlessly and perform optimally.

The adaptability of WS.PEMS ensures that organizations can leverage the most suitable deployment method to align with their operational needs, security considerations, and reporting preferences. This flexibility is pivotal in enabling organizations to achieve precise and reliable emission monitoring, fostering enhanced environmental compliance and operational efficiency.

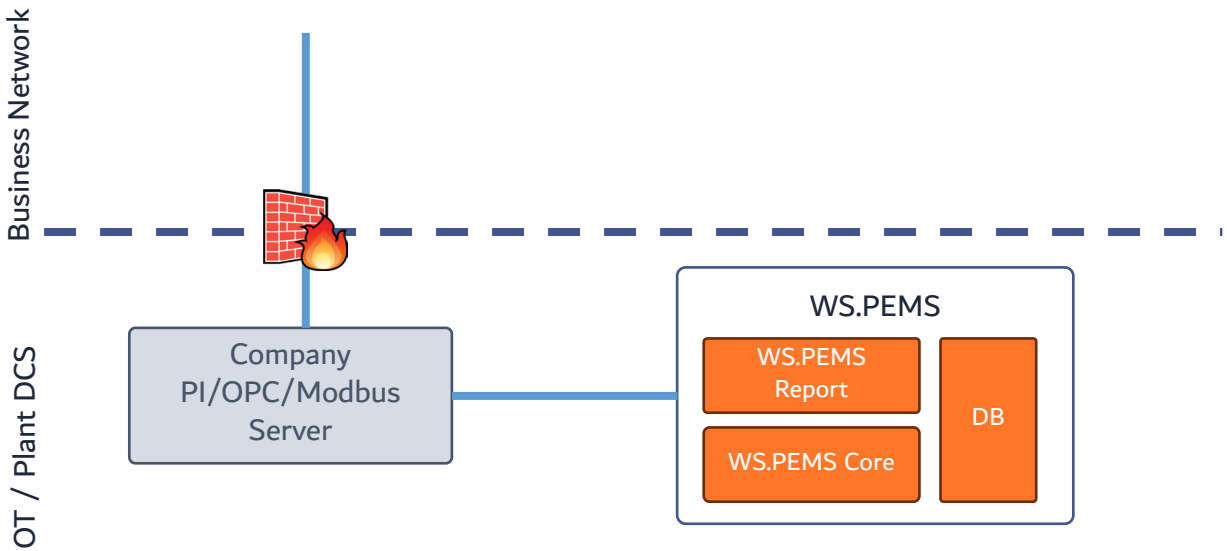
Centralized / Cloud

WS.PEMS can be deployed on a higher network layer, often interfacing with a shadow PI/DAHS system. This centralized approach is beneficial for organizations looking to manage and monitor emissions from a unified location, especially when overseeing multiple operational sites. It allows for consolidated management and comprehensive oversight, ensuring uniformity in emission monitoring and reporting across different units.



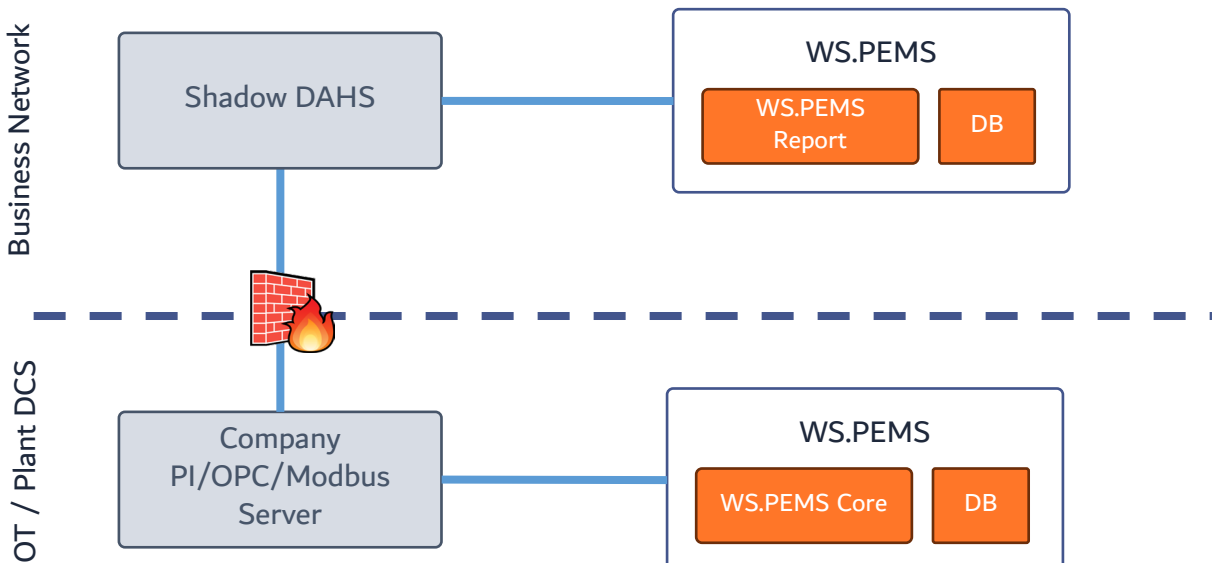
On-Premises

For organizations preferring direct interaction with the PI/DAHS system, WS.PEMS offers on-premises deployment options. This method allows for enhanced control and immediate access to data, enabling real-time processing and analysis. It is particularly suitable for organizations with specific security considerations and those requiring instantaneous data access and processing.



Hybrid

WS.PEMS also supports a hybrid deployment model, where calculations are performed on-premises, ensuring immediate data processing, while the reporting system is centralized. This model combines the benefits of both on-premises and centralized deployments, offering a balance between immediate data processing and consolidated reporting. It provides organizations with the flexibility to adapt the deployment model to their specific operational and reporting needs.



References



References

Customer	Location	Description
DONG Siri	Danish North Sea	WS.PEMS installation (NOx, CO, O2, CO2). Used for NOx tax payment. Gas turbine GE LM2500, Diesel use and flaring
HESS South Arne	Danish North Sea	WS.PEMS installation (NOx, CO, O2, CO2). Used for NOx tax calculation.2 gas turbines Siemens
Indonesia Power	Bali, Indonesia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For environmental compliance.GE frame 5 Gas turbine
Saudi Aramco Tanajib	Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For environmental compliance. 2 furnaces
Saudi Aramco Safaniya	Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For environmental compliance. 4 furnaces
Saudi Aramco Abu Ali Gas Plant	Jubail, Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For environmental compliance. 3 Siemens Low NOx gas turbines – direct drive
GASCO (ADNOC Gas)	Ruwais, UAE	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For environmental compliance. 3 GE Frame 5 gas turbines.
Occidental Oil	Safah, Oman	WS.PEMS installation (NOx, CO, O2, SO2, CO2). For compliance. Include Performance monitoring. 12 gas turbines (Siemens, Solar) power generation. 3 gas turbines – direct drive.
Bunduq (ADNOC group company)	Offshore, UAE	WS.PEMS installation (NOx, CO, O2, SO2, CO2). 2 Flares
Novo Nordisk	Denmark	WS.PEMS installation on boilers. (NOx, CO, O2, CO2). Used for NOx tax calculation.
Qatargas	Qatar	WS.PEMS (NOx, CO, O2, CO2). Used for demonstration. Gas turbine GE Frame 9
Saudi Aramco Qatif	Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). Two boilers and two gas turbines
Saudi Aramco Khurais	Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2, PM10). Four gas turbines
Saudi Aramco Juaymah	Saudi Arabia	WS.PEMS installation (NOx, CO, O2, SO2, CO2). Six steam boilers
ADMO OPCO (ADNOC Offshore)	Zakum Central Super Complex, UAE	WS.PEMS installation (NOx, CO, O2, SO2, CO2). 2 Flares

References

Customer	Location	Description
bp AGT	Azerbaijan	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 61 gas turbines
bp Angola	Angola	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 4 gas turbines
bp Oman	Oman	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 9 gas turbines
bp North Sea	UK, North Sea	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 18 gas turbines
bp GoM	USA	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 20 gas turbines
bp Trinidad	Trinidad	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 11 gas turbines and gas engines
bp Egypt	Egypt	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 4 gas turbines
bp AsPac	Indonesia	WS.PEMS installation (CH ₄ , O ₂ , CO ₂) 6 gas turbines
bp Shipping	Global	WS.PEMS installation (CH ₄ , O ₂ , CO ₂ , NO _x , CO, SO ₂). 6 vessels, each with 6 engines