DURAG GROUP

DATACEMS™

A Multi-dimensional Mathematical Modeling (MdM²)
Predictive Emission Monitoring System (PEMS)

VERSION
US EPA

DURAG
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DATA
SYSTEMS

The Challenge: Emissions regulations

Governments around the world have implemented or are working on stricter emissions regulations to measure and control the level of emissions by industrial processes. These regulations will require operators to monitor, self-certify and justify emissions of NO_x, CO, CO_2, SO_2 and unburned hydrocarbons to their country's environmental agency.

Predictive Emission Monitoring Systems, designed in accordance with specifications around the world, including US EPA 40 CFR Part 60 and 40 CFR Part 75, help to maintain emissions compliance and meet data reporting requirements of local and international regulatory agencies.

PREDICTIVE EMISSION MONITORING SYSTEMS

Predictive Emission Monitoring Systems (PEMS) are an innovative and cost-effective approach to continuously monitor source emissions as alternative to Continuous Emissions Monitoring Systems (CEMS).

PEMS are software-based systems utilizing process inputs to offer a continuous and real-time monitoring of pollutants such as NO_x, SO_2, CO, HC or diluents like O_2 and CO_2.

In general, PEMS are suitable for all gas and oil-fired emission sources providing equal accuracy and data quality as traditional CEMS at much lower CAPEX and OPEX costs.

A Predictive Emission Monitoring System cannot measure emissions directly but uses an empirical model to predict emissions based on historical and real-time process data.

PEMS exist as stand-alone versions but are widely used as part of an integrated environmental monitoring approach capable to address multiple sources in one plant. When combined with Data Acquisition and Handling Systems (DAHS) and integrated in plant-wide IT and communication networks, PEMS is a viable diagnostic tool to lower emissions and to improve combustion efficiency by surveillance of both, emission variations and associated changes in plant process conditions.

PEMS are used at multiple plant sites particularly in the U.S. but also in the Middle East and partly in Asia. In Europe, PEMS so far is common in selected countries.

Industry independent applications

PEMS solutions are industry independent and are able to deal with emissions from many different applications. However, fuels should not vary in their calorific values and composition. Typically they are used for gas and oil-fired plants in the utility, petrochemical, chemical and steel sector or other industrial plants or municipal sites.

IN PARTICULAR THEY ARE TAILORED FOR:

- Gas- or liquid-fired emission sources
- Boilers
- Turbines
- Reciprocal Internal Combustion Engines (RICE)
- Biogas plants
- Duct burner
- Dryers
- Chemical oxidizers
- Regenerative thermal oxidizers
- Process heaters
- Olefin furnaces
- Crude heaters
- Kilns
- Ships
- Offshore

SUITABLE FUEL TYPES INCLUDE:

- Fuel oils
- Natural gas
- Refinery gas
- Process gas
- Combined fuels
- And others

The DURAG Predictive Emission Monitoring Systems Solution

The DURAG PEMS (DATACEMS™) solution uses a Multidimensional Mathematical Modeling (MdM²) technology incorporating empirical models suitable for pollutants such as NO_x, CO or O_2 as well as first principle knowledge, regression type analysis or formula calculation for CO_2, SO_2 or stack flow to provide a continuous and real-time monitoring of emissions.

PEMS define the relationship between a number of characteristic parameters of an emission source and the corresponding emission concentration. By employing historical paired emissions and selected process data (e. g. load, fuel composition, flow, pressure and temperature data, environmental conditions, boiler and turbine settings) a model is generated which allows to determine the actual plant emissions for compliance purposes. The used process inputs for the model are selected according to their significance for influencing plant emissions.

As part of an integrated environmental monitoring approach PEMS is capable to address multiple sources in one plant. In combination with Data Acquisition and Handling Systems (DAHS) and integrated in plant-wide IT and communication networks, PEMS is a viable diagnostic tool to lower emissions and to improve combustion efficiency by surveillance of both, emission variations and associated changes in plant process conditions.

Compared to Continuous Emissions Monitoring Systems (CEMS), PEMS offer significant cost benefits with approx. 50% less capital costs and 10 to 20% of the operations and maintenance costs of a CEMS with equal accuracy and quality of emissions data.

PEMS 02 — CEMS 02 — Load — PEMS NOx — CEMS NOx

Sensor Validation Methodology (SVM)

The heart of DATACEMS™ is a Sensor Validation Methodology that meets the rigorous requirements of US EPA 40 CFR Part 60, Appendix B to Part 60 – Performance Specifications (PS-16) to continue to operate in the event of sensor failure. This requires a methodology to detect sensor failures or drifts and if possible compensate for those failures which is easily achieved with the DATACEMS™ Sensor Validation Methodology (SVM). It performs a sensor validation for all input parameters once per minute or once per prediction cycle.

MdM²

Multi-dimensional
Mathematical Modeling

One of the main advantages of a PEMS solution is its capability to generate substitute values (reconciled data) that are used when a sensor is perceived to have failed or is operating outside the approved envelope curve. In this case, a model detects the malfunctioning sensors and with information from the remaining sensors will reconstruct values to be used in place of the failed sensor values in order to accurately predict emissions.

It will also issue an alarm to inform the operator of a failed sensor.

The PS-16 compliant reconstruction model allows a continued accurate prediction of sensor values while the failed sensor is repaired or replaced.

Another key regulatory requirement for PEMS is a 95% monitoring uptime. The DATACEMS™ solution provides a data availability of more than 99% through the Sensor Validation Methodology.
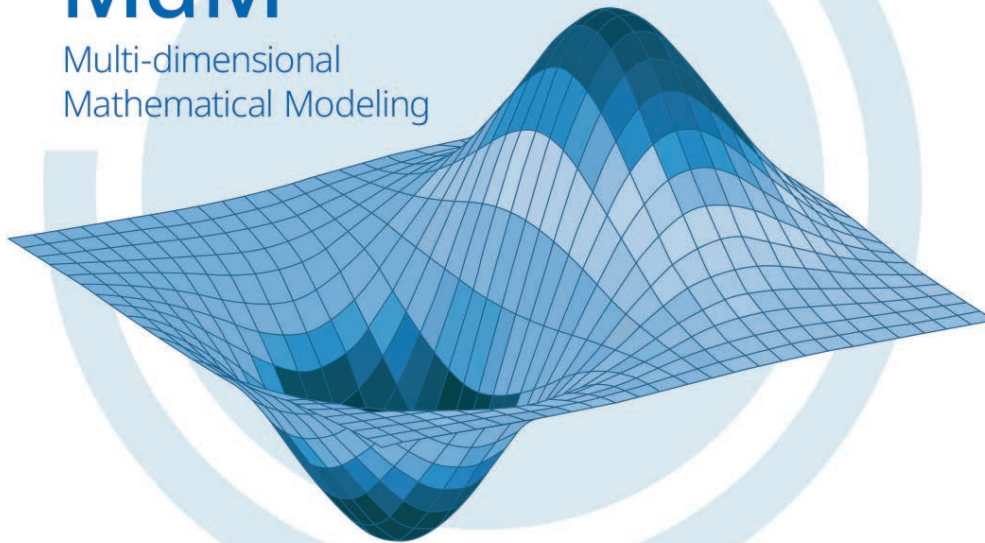
PEMS features + benefits

DURAG PEMS SOLUTIONS: THE CAPEX AND OPEX SAVER!

- **HIGH PERFORMANCE WITH LOW INVESTMENT**
  PEMS can accomplish the same accuracy and quality of emissions data of a CEMS with around half of the initial costs. Return on Investment (ROI) is usually achieved within a couple of years.

- **LOW OPERATIONAL AND MAINTENANCE COST**
  PEMS solutions reduce manpower requirements significantly as they are software-based and do not require gas analyzers or associated hardware. Instead, plant personal is able to focus on operational issues.

- **FULLY COMPLIANT TO ENVIRONMENTAL REGULATIONS**
  PEMS follows legislation requirements including sensor failure detection and management as well as monitoring uptime.

- **PROCESS INSIGHT**
  PEMS is a viable diagnostic tool to lower emissions and to improve combustion efficiency.

- **HIGH AVAILABILITY**
  A PEMS solution provides reliable emission prediction at all times with a data availability of more than 99%.

- **COMPACT**
  PEMS interface with plant control systems without any additional shelters or field devices. Without any spare parts or consumables, there is no need for warehouse storage.

- **INDUSTRY INDEPENDENT**
  PEMS solutions are industry independent and are able to deal with emissions from many different applications.

10 YEAR LIFECYCLE COSTS
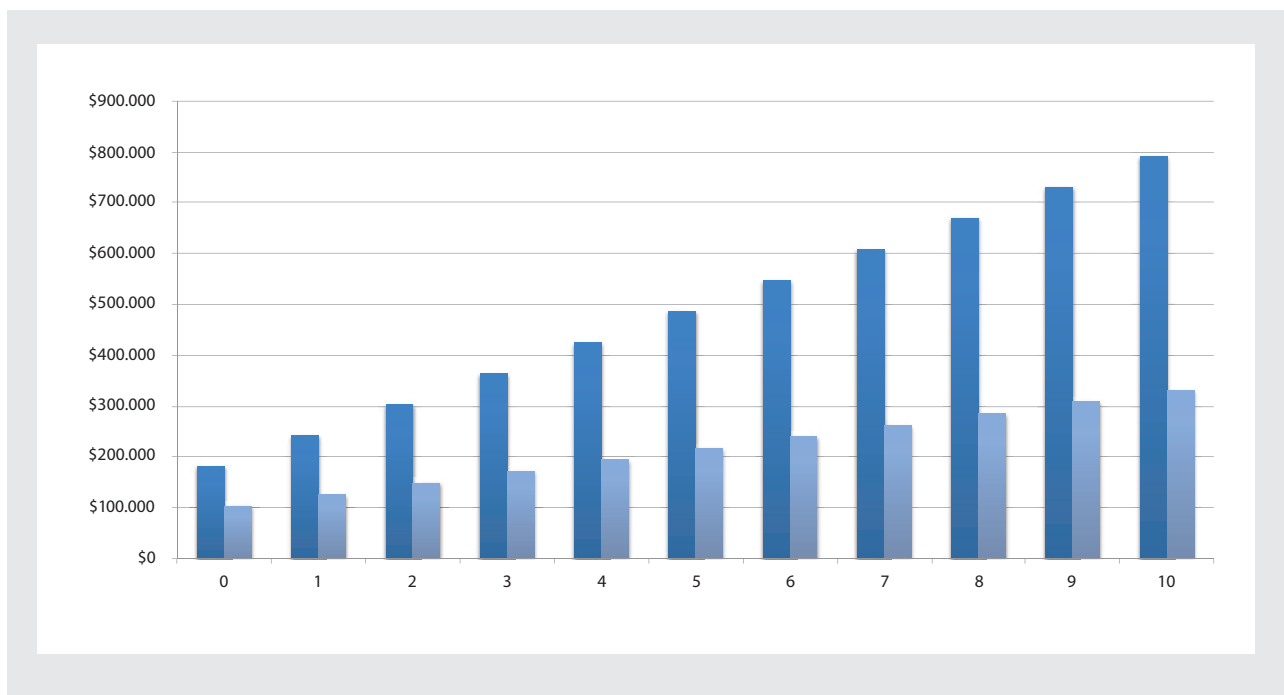
■ Hardware CEMS   ■ DATACEMS (PEMS)

Complete compliance monitoring solutions

DURAG PEMS solutions can either be used as stand-alone versions or as fully integrated in the modular and adaptable D-EMS 2020 environmental and process data management system. Both solutions perfectly meet the demand of today's customers of a software product.

The D-EMS 2020 system fulfills all customer needs towards a modern, flexible and easy to use user interface. It provides comprehensive reporting and visualization options and communicates with all types of plant control systems as various types of fieldbus and software interfaces are supported.

With respect to IT-security requirements, the D-EMS 2020 offers a multi-level user management with role based access control, prevention of data manipulation, encrypted and secured data base etc.

With more than 1,500 integrations worldwide, DURAG is well experienced in integrating Data Acquisition and Handling Systems (DAHS) as a D-EMS 2020 in plant-wide IT and communication networks.

D-EMS 2020 and dataCEMS™ as packaged solution for a complete compliance monitoring.

D-EMS 2020
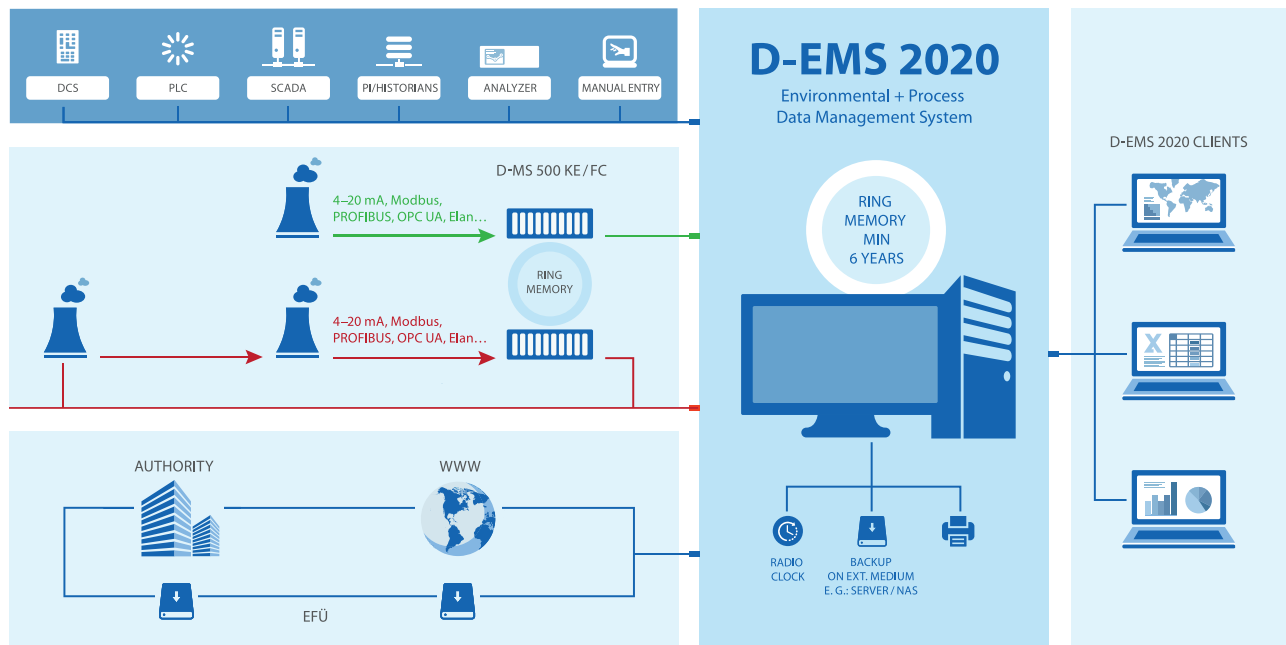
Why DURAG

DURAG has more than 40 years of experience in supplying soft- and hardware products and solutions for emissions data evaluation. Our dedicated team of experts will support you in designing your PEMS solution including full-fledged data acquisition and handling systems (DAHS).

ONE-STOP SHOP FOR RELIABLE PRODUCTS THAT FIT YOUR PROCESS

SUPPORT 24/7
Quick, comprehensive + competent

SERVICE
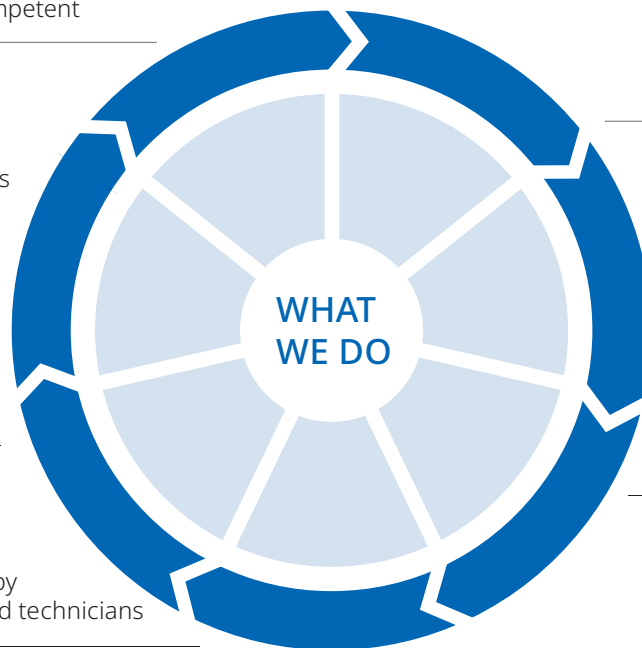Qualified service technicians worldwide

TRAINING
Comprehensive training for maintenance personnel

COMMISSIONING
Worldwide commissioning by highly qualified, experienced technicians

WHAT WE DO

CONSULTING
Expert consulting Application know-how

DEVELOPMENT
Made in Germany Customer specific solutions

INSTALLATIONS
Quick + reliable

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