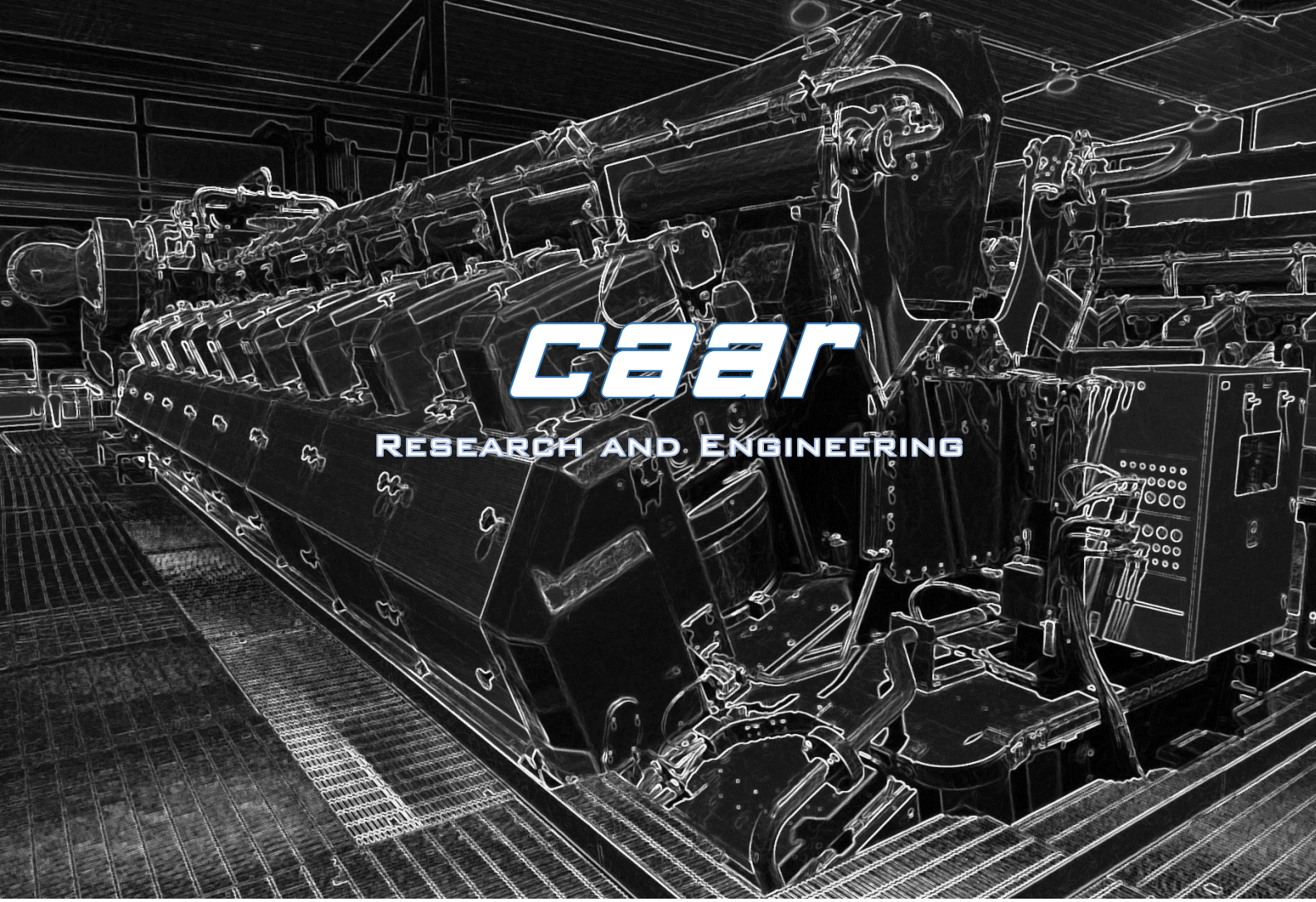
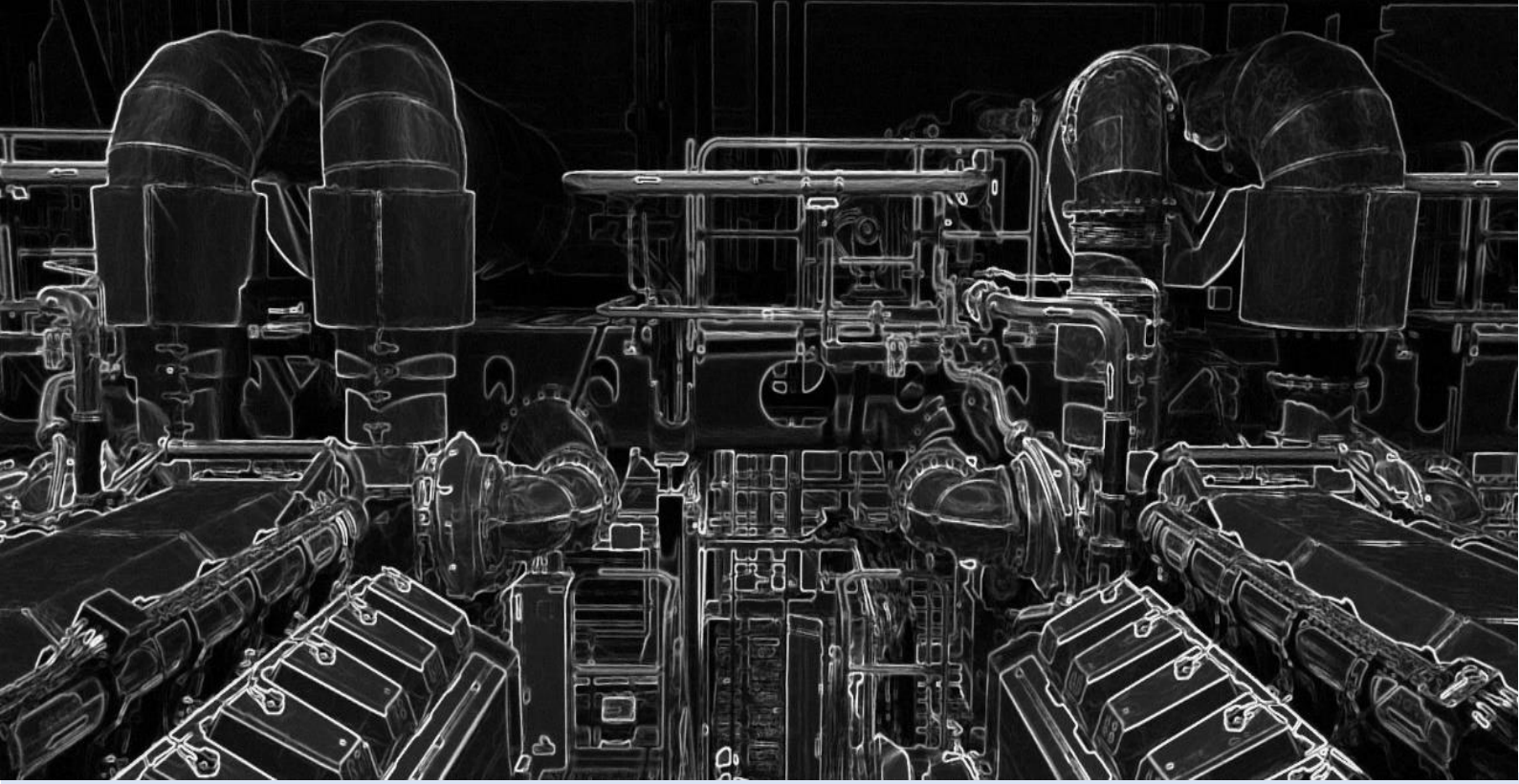


InCyTh

In Cylinder Thermodynamics

COMPLETE MONITORING SOLUTION FOR LARGE BORE ENGINES - ONLINE IN CYLINDER PRESSURE ANALYSIS

HFO / MDO – DIESEL – GAS – DUAL FUEL



MONITOR

IDENTIFY

ANALYSE

EXECUTE

InCyTh is a real time data acquisition and analysis tool for in cylinder pressure signal that allows engine operators to monitor performance trends for key indicators calculated from the combustion pressure signals. It also provides valuable insights on components performance, triggering predictive maintenance activities and avoiding unplanned downtime.

MONITOR YOUR ENGINE

SIMULTANEOUS MEASUREMENT OF ALL CYLINDERS

Cycle based parameters for each cylinder:

- Peak pressure amplitude and location
- Combustion phasing (several burn angles)
- Indicated Power and coefficient of variation
- Pumping Losses (gas exchange process)
- Maximum rate of pressure rise
- Percentage of misfire and late fire
- Knock metrics and many others

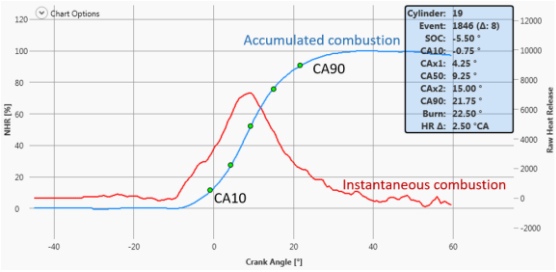
Fault detection

- Peak pressure exceeded and Knocking alarm
- Early detection of spark plug failures
- Abnormal Combustion (misfire, late fire, poor phasing)
- Deviation among cylinders (Power, peak pressure, etc)
- Excessive Pumping losses
- Compression loss (faulty valves, rings, liner)
- Fault history with recorded values at occurrence

YOUR ENGINE IN REAL TIME

The combustion data is continuously acquired and processed, fault thresholds may be trigger during operation directing further investigations and preventive actions.

Heat Release Analysis



Optionally, the system may include: continuous temperature measurements and associated alarms (eg. 20 Liner Thermocouples); NO_x emissions monitoring in ppm or mg/m^3 corrected for the required O_2 reference.

FLAG, ANALYSE AND FIX PROBLEMS PREVENTIVELY

Oscillating Power due to Combustion failures

Poor combustion phasing impacting fuel consumption

Compression loss on power units

Faulty pre-chambers / injectors / fuel pumps

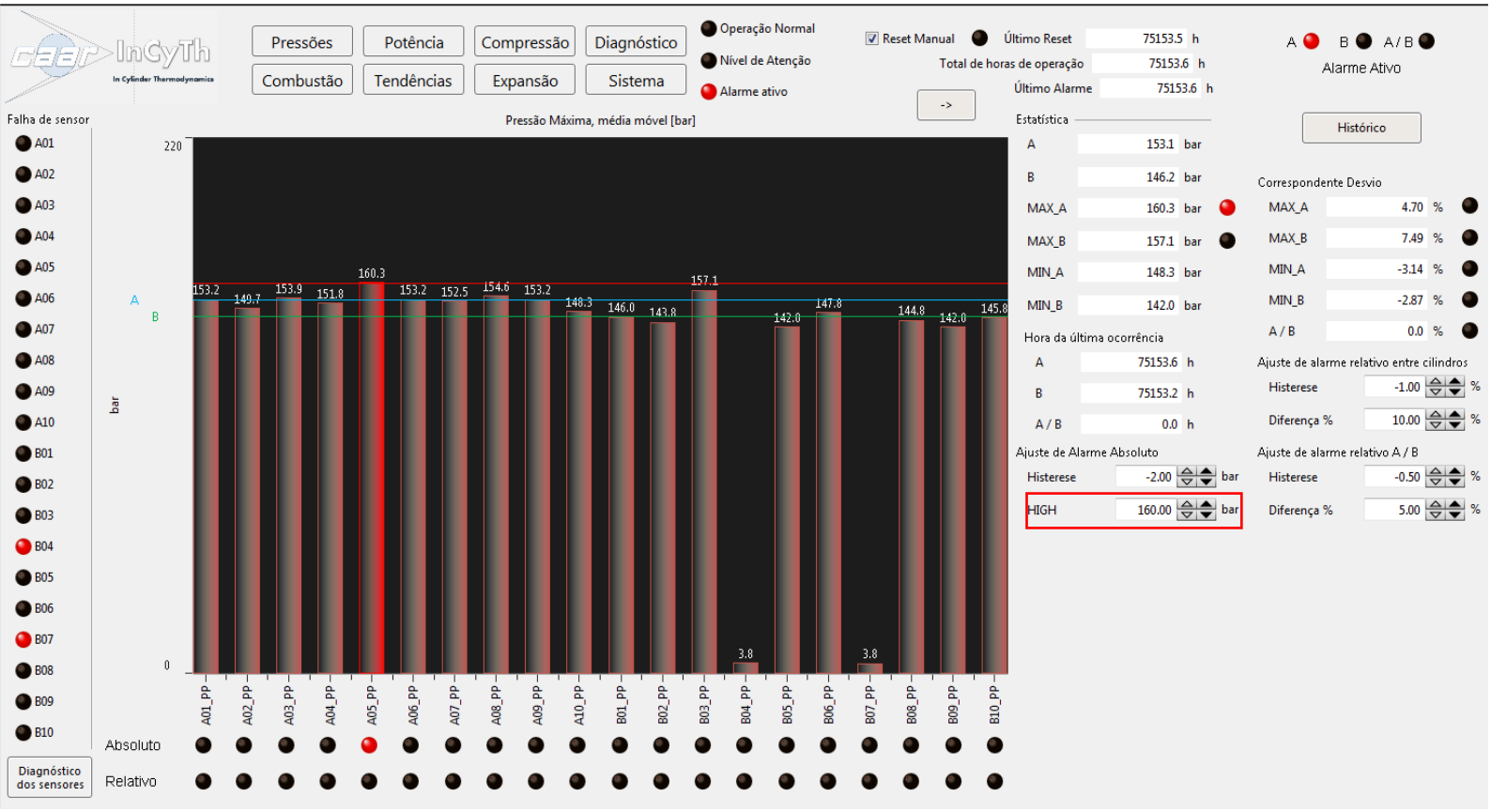
Direct knock quantification

Uneven power distribution

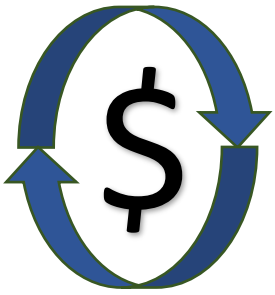
Leaky poppet valves / piston rings

Early Spark plug failure identification

Unbalanced Cylinders

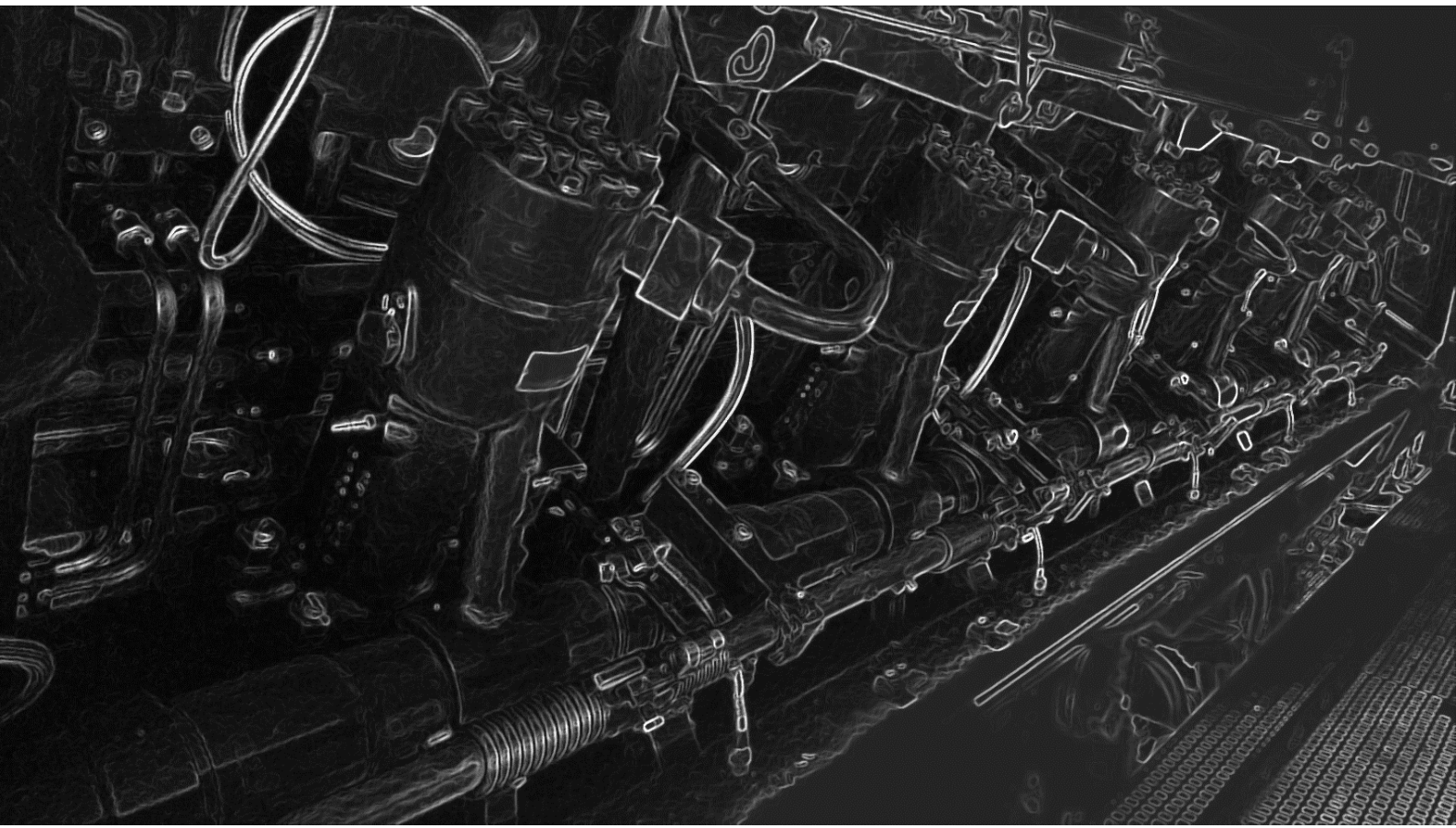


SHORT PAYBACK: The InCyTh employs the latest sensing technology reducing to about a third the acquisition cost of the pressure sensors, when compared to the industry standards. If the engine itself has embedded cylinder pressure sensing, the same signal can be routed do the InCyTh modules, extracting all the potential diagnostic capabilities and reducing even further the initial investment.



LOWERING OPERATIONAL AND MAINTENANCE COST: The InCyTh diagnostics and preventive maintenance actions enable higher operational reliability and availability, while avoiding unplanned stops and corrective maintenance costs related to parts affected by catastrophic failures (e.g. Turbocompressor, cylinder heads, pistons, liners are typically damaged upon poppet valve failures).

ENGINE OPTIMIZATION: InCyTh is the perfect tool for dynamic settings of the engine parameters by presenting online thermodynamic analysis, allowing for injection/ignition timing, charge air pressure and temperature tunning for varying fuel/ambient conditions, reducing fuel consumption while still within peak pressure and emissions limits.

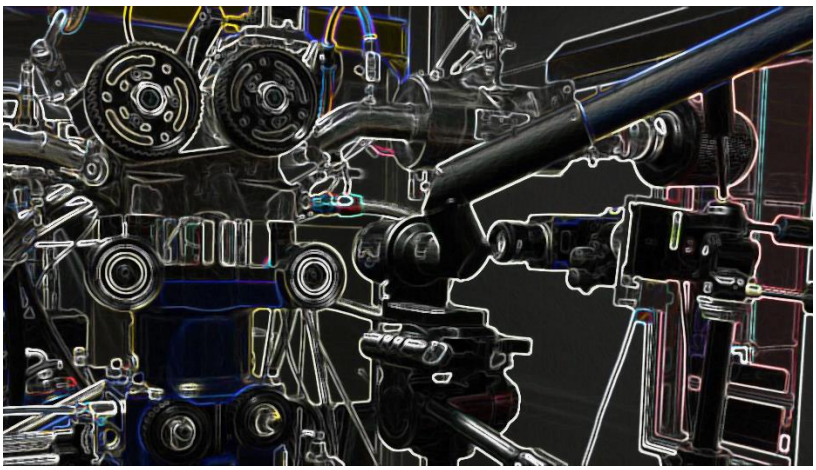


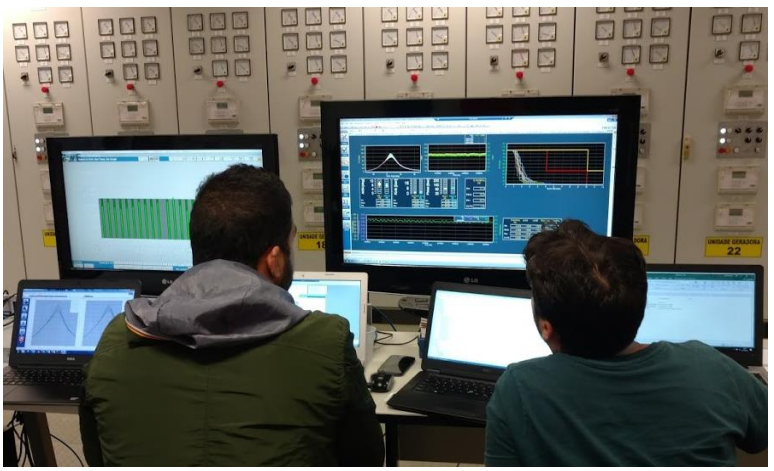
ABOUT CAAR

The CAAR team has a broad academic and industrial background, within the energy and automotive sector. Bridging cutting edge technology to practical and valuable engineering projects is our passion.

Besides InCyTh, we offer technical solutions for the needs of energy companies, adding value through processes improvement, staff training and development of cost-effective projects. These are the core services we can provide:

- Remote support to provide further insights on InCyTh diagnostics.
- Consulting activities on HFO/Diesel engine conversions to Natural Gas operation
- Technical training for operational staff of engine-based power plants
- Consulting activities on continuous improvement and digital transformation projects within the powerplant / ship automation environment
- Pollution measurement and control consultancy





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