Powitec solutions for Waste-To-Energy Plants

Upgradable intelligent solutions for process optimisation
SENSE  
Sensor Supported Process Description
Generation of high resolution on-line process characteristics

PiT Indicator

ANALYSE  
Data Mining and Process Intelligence
Mathematical-statistical correlation analysis via intelligent algorithms

PiT Data Mining

PREDICT  
Soft Computing
On-line computation of expected development for selected process values

PiT Predictor

CONTROL  
Intelligent Closed Loop Control
Auto-optimising closed loop control for complex processes

PiT Navigator

for

- Boiler
- Flue Gas Cleaning
Boiler

SENSE

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ANALYSE

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PREDICT

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Flue Gas Cleaning

CONTROL

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PiT Video
Video camera for permanent visual flame inspection.

Benefits:
- Flame inspection allows for in time reaction
- Visual supervision of burn out line

Features:
- Rugged German design
- Endoscope: Electronic is temperature protected
- Air or water cooling
- Supervision of temperatures and cooling media supply
- High availability

PiT Indicator
Intelligent Thermography for indicating temperature and flame variations in their transient behaviour

Benefits:
- Chronological display of location and volume of flame body and slagging = Active flame control and slagging detection
- Temperature Analysis = Information direct from the boiler inside
- Integration of Process Control System data = Correlation of temperatures and slagging with process data
- Possible upgrade to PiT Navigator = fully automatic combustion optimisation by closed loop control of the air/fuel ratio

Features:
- RGB Camera = Reliable temperature analysis
- Adaptive Electronic Dust Filter = Clear pictures even in dusty situations
- Robust German design = Low Maintenance
- Freely definable Regions of Interest and Polylines = permanent information from decisive areas
- Output from and Input to the PCS = Correlations show variations
**PiT Indicator Burn Out Line**  
Permanent indication and automatic analysis of the Burn Out Line position

**Benefits:**
- Full automatic analysis of Burn Out Line position
- Alarming of unwanted situation with percent-indication and/or traffic light
- Avoidance of unburned material in the slag

**Features:**
- RGB Camera = Reliable temperature analysis
- Adaptive Electronic Dust Filter = Clear pictures even in dusty situations
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**PiT FluxStylus**  
Spatial defined heat flux measurement

**Benefits:**
- Spatial temperature resolution even from mounting positions at confined spaces
- Temperature Analysis = Information direct from the boiler inside

**Features:**
- Measurements 9 to 5 from different positions
- Robust German design = Low Maintenance
- Sophisticated data processing, sophisticated data displaying tools
- Output from and Input to the PCS = Correlations show variations
**PiT SlaggingDetector**
Detect the amount of slagging at the steam generator walls and at the super-heater with Powitec's advanced picture analysis tool on basis of optical information in correlation with temperature information. Gained information can be used for alarming function.

**Benefits:**
- Chronological display of position and volume of slagging = Active supervision of slagging
- Temperature Analysis = Information direct from the combustion chamber and the super heater
- Displaying data of process control system = Visual correlation of temperatures and slagging with process data
- Possibility to upgrade to PiT Navigator = Reduction of slagging by auto-optimising and air-/ fuel-ratio

**Features:**
- RGB camera (see page 4) = reliable temperature analysis
- Adaptive Electronic Dust Filter = clear pictures even in dusty atmospheres
- Robust German design = low maintenance
- Air or water cooled
- Optionally: Retraction Unit or Anti Slagging Unit
- Free definable Regions of Interest and Polylines = permanent information from decisive areas
- Bi-directional PCS connection = Correlation analysis
PiT Data Mining
Analysis of historical DCS/PCS data towards optimisation potential with the aid of statistical software and neural nets; recommendations for hardware modifications; on site test measurement with mobile optical sensor

Benefits:
◆ Optimisation potential with calculated amortisation time
◆ Information about priorities depending performance
◆ Comparability of different production lines
◆ Findings of new significant correlations
◆ Discovering new optimisation potentials

Features:
◆ Data mining supported with mobile sensors (PiT Indicator)
◆ Data significance analysis with
  o Classification and cross correlation
  o Deviation Analysis
  o Dependence Analysis
  o Multidimensional regressions
  o Clustering
  o Impact Prognosis
◆ Identification of the most important process channels or process information
◆ Elimination of idle time through the process sequence
◆ Recognition of interdependencies
◆ Generation of models representing the behaviour of processes
◆ Finding potential areas for optimisation and drafting solution strategies
◆ Explanation of unusual situations and phenomena of the processes
**PiT Online CFD**

Online CFD (*Computational Fluid Dynamics*): Determination of temperature, convection, heat radiation, flue gas mass flow every 15 seconds.

**Benefits:**
- Online inside view of heat allocation (and/or NOx) in the first draft according to the current process status (waste type, slagging)
- Fast manual interventions
- Discovering new optimums
- Analysis of cause of damage
- Analysis for optimising changes (i.e. SNCR lances/nozzles and spray amount)
- Online analysis in different operating states

**Features:**
- Modelling of the boiler, online modelling of convection and heat radiation, online calibration against existing measurements
- Refresh rate: Every 15 seconds
- Free definable viewing angles, temperature areas
- Manual or full automatic reporting
- Export-Function

*Orange boxes only displaying temperatures between 900 and 1000°C, the optimal temperature window for SNCR spraying*
PiT Predictor
Timely knowledge of process changes through permanent on-line information on process values like NOx, SOx, CO

Benefits:
- Accurate prediction of i.e. NOx, SOx, CO
- Prediction accuracy worldwide unbeaten
- Timely knowledge of process changes through permanent on-line
- Process stabilisation

Features:
- Continuous Online-Prediction of key process parameters
- Self learning adaptive software based on Neural Nets
- Integration of additional Information from the process (PiT Indicator, PiT FluxStylus) where helpful
- High availability, security features
- Upgradeable to PiT Navigator = Full Automatic Combustion Control
PiT Navigator
Advanced Auto-Optimiser for a permanent optimisation of the air/fuel ratio and distribution. Digital image processing and modell predictive control optimise Waste To Energy plants. A combination of sophisticated optical sensors with self learning neural nets reduces steam variations and increases throughput

Benefits: (depending on individual target combination)
- 3 – 7 % production increase (same or better emission levels)
- Less than +/- 2 % steam variation
- Significant saving of supportive fuels
- 70% less CO
- Uniformisation from shift to shift
- Fast reaction to changing heat values
- Permanent self learning (automatic re-adjusting)
- Easy to handle, targets easy to change
- Up to 99% fully automatic operation

Features:
- High-Speed cameras observe the combustion and - through a patented pattern recognition process - extract significant features of the ignition-, combustion- and burnout- behaviour, temperatures, position and emissions
- Process data from the PCS are permanently correlated with optical information through a software based on neural nets
- Self learning adaptive software based on Neural Nets, adapting themselves to changing process situations
- Integration of expert knowledge and improving this knowledge self-learning
- Easy changes in optimisation targets without reprogramming or re-parameterisation of software
- Fast installation (2 to 3 weeks on site with 5 to 10 man days of customer involvement)
- Round the Clock, 24-7 closed loop control optimisation of the air / fuel ratio
- Results guaranteed
Solutions for the
Flue Gas Cleaning

CONTROL:

PiT Navigator SNCR
Advanced Auto-Optimiser for permanent optimisation of spray amount, slip and NOx peaks; suitable for Urea or Ammonia.

Benefits:
- Save NOx and slip compliance
- Reduced spray amount and reduced slip
- NOx and slip limits compliance
- Reduced primary NOx
- Reduced NOx peaks
- Less temperature tilts
- Fast adaptation to waste changes
- Better measurement, better control

Features:
- Step 1: Combustion Optimisation for primary NOx reduction
  Step 2: Optimising control of SNCR (Powitec SNCR or 3rd party)
- Integration of additional sensors (PiT FluxStylus: Heat flux radiation sensor measuring from 9 different directions; PiT Indicator: Intelligent Thermography)
- On-line CFD (computational fluid dynamics) every 15 seconds: Determination of temperature, convection, heat radiation, flue gas mass flow.
- Automatic feature selection and extraction (significance ranking) of existing process data
- Automatic model generation (regression, neuronal networks, probabilistic nets, Gray-Box-Models)
- Set point integration into the DCS/PCS
- Advanced signal processing on acoustic measurements
- Modular system: Upgradeable to Boiler-Optimiser
PiT SNCR
Complete SNCR with advanced Auto-Optimiser for permanent optimisation of spray amount, slip and NOx peaks; suitable for Urea or Ammonia

Benefits:
- Reduced investment costs (compared to SCR)
- Save NOx and slip compliance
- Reduced spray amount
- Reduced primary NOx development
- Reduced NOx peaks
- Less temperature tilts
- Fast adaptation to waste quality changes
- Reduced steam variations
- Complete solution from a single supplier

Features:
- ‘PiT Navigator SNCR’ - Optimising-Software-Licence (adaptive, multidimensional and self learning control on basis of neural nets; Nonlinear Model-Predictive-Control, NMPC)
- Optical sensors for image processing
- Urea / Ammonia storage, handling and injection
- Automatic control of reacting agent injection and combustion air using NMPC
- Engineering and commissioning including parameterisation
- Modular system: Upgradeable to Boiler-Optimiser

Artificial Intelligence - Real Benefits
PiT Smart Box
Optimised spray amount in the dry sorption process. Suitable for white fine lime only or (2-stage MKT-process) combination of white fine lime with activated carbon and hydrate with high surface for the 2nd stage (dry sorption):

**Benefits:**
- Reduced consumption of reduction additives (5% to 10%)
- Shift towards cheaper additives (15% to 30%)
- At the same time emission improvement (-30% HCl, -20% SO2)

**Features:**
- Works on the basis of self learning adaptive neural nets
- Permanently analyses different plant values
- Permanent optimising variables are integrated in the DCS
- No fixed control rules or formulas
- Reacts continuously and autonomously to the current plant situation
- Reaches the optimum operation mode
References:

- BKB TRV Buschhaus (Alstom, 3 PiT Navigator),
- Haz. Waste: AVG Hamburg (rotary kiln, Blohm & Voss, 2 PiT Navigator)
- L90 Esbjerg (Babcock & Wilcox Vølund, 1 PiT Navigator),
- Vattenfall WTE MVB Borsigstraße (Fisia Babcock, 2 PiT Navigator),
- Vestforbraending (Babcock & Wilcox Vølund, 2 PiT Navigator),
- ZAW Coburg (Martin, 1 PiT Navigator),
- MVA Bonn (VonRoll, 3 PiT Navigator)
- ACS Urbaser Cantabria (LurgiLentjes, 1 PiT Navigator)

Approved Competency:

2010: German Innovation Award Climate and Environment for Outstanding and Sustainable Technology. Powitec prevailed against a 145 companies field. Scientific evaluation through Fraunhofer-Institute for System and Innovation Research (ISI).

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