

AI-POWERED SOFT SENSORS

Fuller's strategic partnership with Imubit

With this new partnership Fuller Technologies will provide the Cement industry with AI-based soft sensors, supported by Imubit's AI technology and knowledge, to address one of the cement industry's biggest challenges: the 'blind spots' in real-time process and quality data created by delayed laboratory results and the harsh operating conditions that limit physical sensor placement. The predictions can be fed into Fuller Technologies' industry-leading **ECS/ProcessExpert® (PXP)** enabling enhanced real-time optimization.



Proven Technology by Imubit

Imubit is a leader in industrial AI with 100 closed-loop applications deployed across refining, calcining, and cement. Trained on a plant's own operational and laboratory history, these models generate continuous predictions of critical parameters that may be unavailable due to the lack of real-time data.



Soft Sensors Powered by Fuller's Process knowledge and Imubit Technology

With soft sensor technology powered by Imubit for free lime, Blaine finesses and kiln inlet O2 soft sensors, PXP can operate with unprecedented precision, empowering cement plants to achieve greater quality consistency, improved energy efficiency, and enhanced sustainability outcomes. Fuller takes the responsibility to integrate the soft sensor predictions into later versions of PXP.



Continuous Adaptation

The soft sensors are built on deep learning architecture specifically designed for sustained, closed-loop performance in heavy process environments. Models are built from your plant's own process history, capturing the full non-linear dynamics across hundreds of variables. Every incoming lab result is validated and the model calculates the new bias. As raw material chemistry changes, fuel blends vary, or equipment conditions evolve, predictions remain accurate — sustaining performance over years, not weeks.



Closed-Loop AI Optimization

Predictions are feed directly into PXP as live input variables. The software then uses these enriched signals to write optimized targets every 5 to 15 minutes — enabling proactive control based on real-time quality data.

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The initial partnership targets three parameters where the gap between what PXP needs and what physical instrumentation delivers has the greatest operational impact.

PARAMETER	CURRENT INPUT	WITH AI SOFT SENSORS	OPERATIONAL IMPACT
Free Lime	Lab sample; 2+ hour delay. PXP reacts to stale data; over/under burning compensates.	Continuous free lime prediction enables faster target adaptation with better visibility when integrated into PXP control strategy	Tighter free-lime standard deviation, direct fuel savings (minimum 1% to 2%) with improved product quality
Blaine Finess	Periodic lab test with lag. Finish mill runs conservatively between samples.	Real-time Blaine prediction enables faster target adaptation with better visibility when integrated into PXP control strategy	Tighter Blaine standard deviation, direct power savings (minimum 1% to 2%) with improved product quality
Kiln Inlet O₂	Physical sensor in harsh environment; occasional maintenance outage and calibration drift.	Reliable O ₂ signal even during analyzer outages.	Optimized draft control. Reduced excess air leading to lowering heat consumption. Lower ID fan power draw.

How PXP's AI Optimization Layer Works

While PXP remains as the central optimization engine with the robust self-adaptive controller, the AI based soft sensors augment with accurate predictions, enabled by Imubit's proven deep learning capabilities using reinforcement learning trained on your plant's full operational history. PXP's control algorithms then use the enriched inputs to calculate and write optimized setpoints.

PXP Today



- ✓ Self-adaptive control actions to changing process conditions
- ✓ Site specific control logic understood by specialists
- ✓ Target frequency varies by strategy with actual lab values

AI Soft Sensors



- ✓ Deep neural networks trained on full plant history
- ✓ Continuous predictions in contrast to infrequent lab data
- ✓ Transparent dashboards explain every AI adjustment

*Targets adapted at high frequency (minimum 5 min) based on AI soft sensor predictions (2 to 3 min)

PXP complemented by AI Soft Sensors - What This Means for Your Plant

Kiln: Fuel Savings

Real-time free-lime predictions in close loop with PXP allow precise burning-zone temperature control — removing over/under burning that wastes fuel, produce off spec clinker and increases CO₂ intensity. Accurate, continuous O₂ prediction in closed loop with PXP reflects true burning-zone conditions, enabling operation at the minimum required excess O₂ for complete and efficient fuel combustion.

Finish Mill: Closed-Loop Blaine Control

Real-time Blaine prediction in closed loop with PXP enables precise control of key grinding parameters (mill load, elevator load), keeping product fineness tightly on target and improving mill productivity.

Integration Architecture

On-Premises computing (AI soft sensor's predictions)

- Standard OPC/OPC-UA connectivity to process control, historian, and lab systems
- Runs soft sensor inference and AI optimization
- Writes real-time predictions to PXP
- No inbound cloud connections, only one-way outbound data from plant
- Meets process control cybersecurity requirements, including SPC2 Type II certification and GDPR compliance

Cloud (Model Management)

- Model building, evaluation, monitoring, and retraining
- One-way outbound data flow from plant

**SOFTSENSORS ARE NOW AVAILABLE
FOR INTEGRATION IN NEWER PXP
INSTALLATIONS.**