

FULLER[®]



AI-POWERED SOFT SENSORS FOR CEMENT PROCESS OPTIMIZATION

BETTER DATA. BETTER DECISIONS.

ECS/ProcessExpert® (PXP) powered by AI-driven insights. Unprecedented precision, greater quality consistency, improved energy efficiency, and enhanced sustainability outcomes.

KEY BENEFITS

01

CONTINUOUS QUALITY VISIBILITY

Real-time predictions of free lime, fineness (Blaine), and kiln O₂ eliminate sensor blind spots.

02

MEASURABLE ENERGY SAVINGS

Tighter closed-loop control of the kiln and finish mill delivers fuel and power savings of 1–2% or more.

03

IMPROVED PRODUCT CONSISTENCY

Rapid prediction updates allow PXP to keep critical parameters closer to the target.

04

SELF-CORRECTING OVER TIME

Models are validated against incoming lab results and automatically recalibrated.

CLOSING THE DATA GAP

Cement plant operators face a persistent challenge: critical quality parameters such as free lime, cement fineness (Blaine), and kiln inlet O₂ are either obtained through delayed laboratory analysis or rely on physical sensors that are unreliable in harsh, high-temperature environments. As a result, advanced process control systems operate with inherent gaps in real-time process and quality data.

AI-powered soft sensors change this. Using deep neural networks trained on a plant’s own operational and laboratory history, soft sensors generate continuous, real-time predictions of parameters that were previously unavailable between sample intervals. The models capture the full non-linear dynamics of the process, drawing on hundreds of process variables simultaneously, to produce predictions that reflect what is actually happening in the kiln or mill at that moment.

The predictions are then fed into our ECS/ProcessExpert® (PXP) advanced process control system, enabling enhanced real-time optimization. The self-adaptive controller at the heart of PXP serves as the control engine, continuously adapting process conditions in real-time. When augmented with soft sensors, the system’s capabilities are further extended, allowing PXP’s control algorithms to calculate and write even more accurate, optimized setpoints.

Once deployed on-premises, the soft sensors run inference continuously, generating predictions every two to three minutes. Laboratory results are used to validate the model and recalculate its bias, keeping predictions accurate as process conditions evolve. As raw material chemistry shifts, fuel sources change, or equipment ages, the models adapt, sustaining accuracy over years rather than weeks.

THREE MODULES. MEASURABLE IMPACT.

The technology initially targets three modules where the gap between what advanced process control needs and what conventional instrumentation provides has the greatest operational impact.

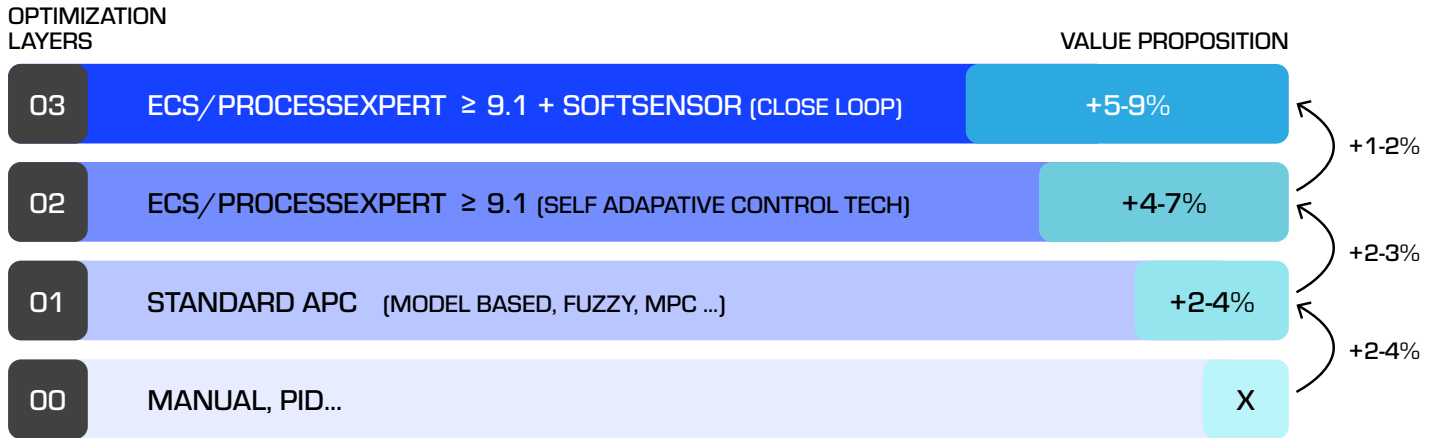
MODULES	CONVENTIONAL INPUT	WITH AI SOFT SENSORS	OPERATIONAL IMPACT
Free lime AI	Lab sample; 2+ hour delay. PXP reacts to stale data; over- and under-burning to compensate.	Continuous free-lime prediction enables faster target adaptation and better visibility when integrated into the PXP control strategy.	Tighter free-lime standard deviation, direct fuel savings (minimum 1% to 2% or more) with improved product quality, i.e., reduced off-spec clinker.
Blaine AI	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 the PXP control strategy.	Tighter Blaine standard deviation, direct power savings (minimum 1% to 2% or more) with improved product quality, i.e., reduced Blaine standard deviation.
Kiln O₂ AI	Physical sensor in a harsh environment; occasional maintenance outage and calibration drift.	Reliable O ₂ signal even during analyzer outages.	Optimized draft control. Reduced excess air, leading to lower heat consumption. Lower ID fan power draw.

Building the value proposition

PXP with soft sensors extends the value proposition of advanced process control over manual operation, but it is built on several optimization layers that must be in place first to ensure the full benefits are delivered and sustained.

Integration architecture

Soft sensors run on premises with standard OPC/OPC-UA connectivity to process control, historian, and laboratory systems. Data flows outbound from the plant, with no inbound connections to the Cloud. The architecture meets process control cybersecurity requirements, including SPC2 Type II certification and GDPR compliance. Cloud-based model management provides model building, evaluation, monitoring, and retraining.



PXP 9.1 is preferable on subscription model so both the softsensor and PXP are having the lifecycle support

FULLER TECHNOLOGIES AND IMUBIT

AI-based soft-sensor capabilities are offered as part of a strategic partnership between Fuller Technologies and Imubit. With more than 100 closed-loop applications deployed across refining, calcining, and cement, Imubit is an established industrial AI specialist, providing the deep learning platform and expertise to build, evaluate, monitor, and retrain models throughout their operational lifecycles.



Soft sensors are now available for integration in newer PXP installations.
Contact your Fuller representative to discuss AI soft sensors and integration.