EIM

Equipment & Process Energy Intensity Monitoring and AI Diagnostics for Process Industries

EI Monitoring and AI Root Cause Diagnosis & Action Guidance

EIM Diagnostic Flow

EI Calculation
Lot data & measurements

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Lot Assessment
vs. normal operation

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Root Cause of EI Rise
XAI impact + ontology

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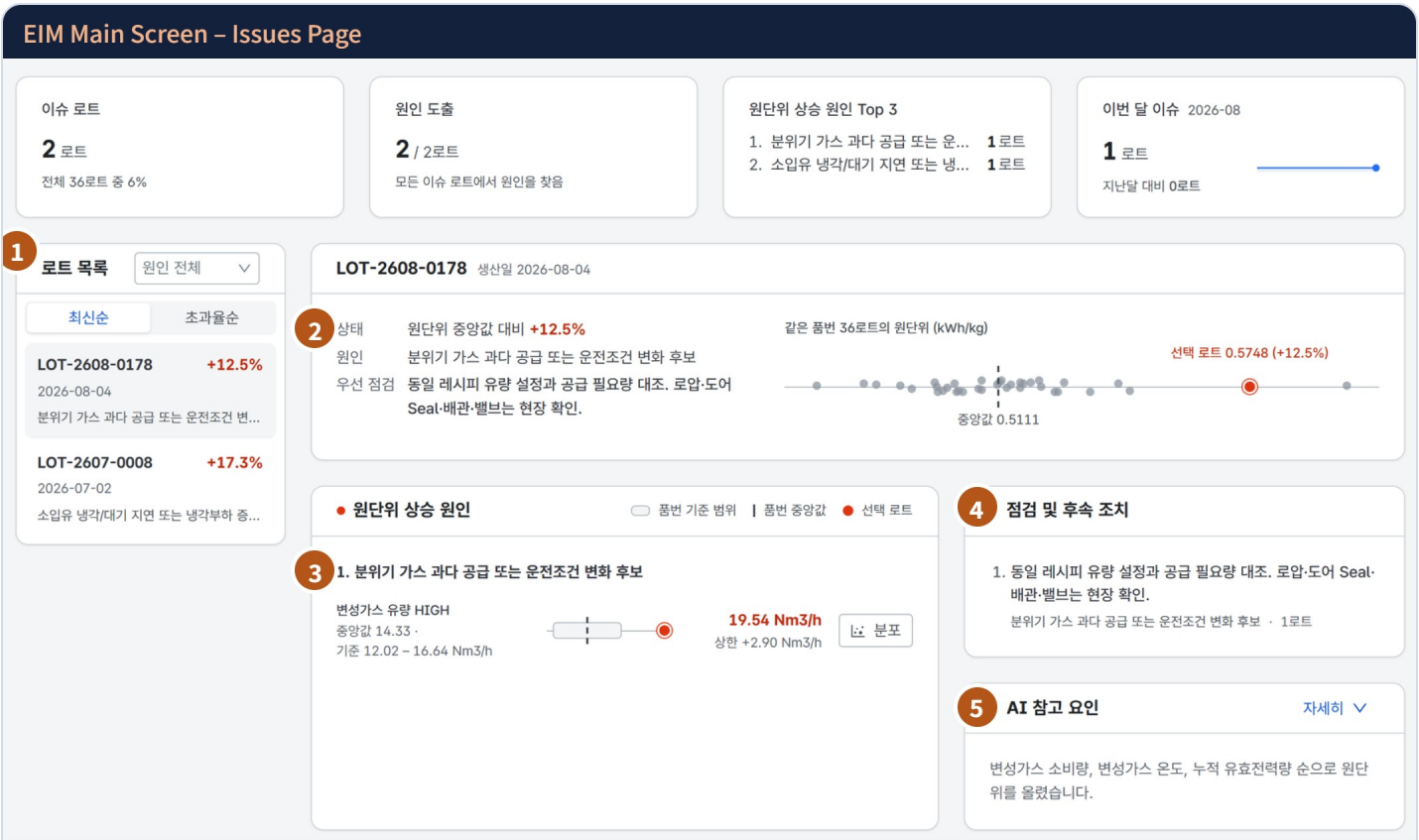
Action Guidance
Root cause & action

Key Features

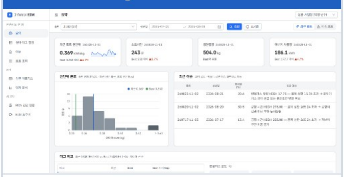
EIM Main Screen – Issues Page



1. **Issue Lot List** · High-EI Lots and rise rate
2. **EI Assessment** · Rank among same-part Lots
3. **Causes of EI Rise** · Causes and evidence tags
4. **Inspection & Follow-up** · Actions per cause
5. **AI Reference Factors** · Variables by XAI impact

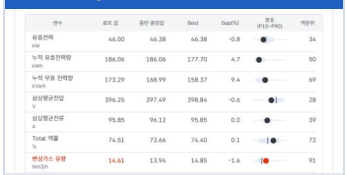
※ EI : Energy Intensity · XAI : Explainable AI

Summary



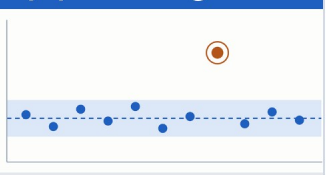
Recent Lot EI vs. Best Lot, same conditions

Lot Explorer



Variables vs. normal range & Best Lot

Equipment & Tags



Out-of-range tags and Lot trends

EIM Assistant



LLM answers questions on diagnosis results

Expected Benefits

Inspection Priorities
Ranks high-EI Lots and items to check first

Early Fault Detection
Flags EI rises not explained by operation

Field Know-how as an Asset
Know-how kept in an ontology knowledge base across staff changes

EIM | Equipment & Process Energy Intensity Monitoring and AI Diagnostics for Process Industries

Site-Specific XAI & Ontology-Based Root Cause Diagnosis

System Architecture

EIM Legacy System

Site Systems
- MES
- PLC·Meters
- Solar Power
- Grid Intake
- Equipment
- Formulas

Collect

Data Storage
- **RTDB** Tag time series
- **SQL DB** MES Lots · results

Analysis Engine · On-site Server
1. **EI Calculation** Lot-window totals, site formulas
2. **Lot Assessment** Same-product baseline
3. **AI Prediction** XAI variable impact (Explainable AI)
4. **Cause Inference** Ontology rules, causes & actions

- **Model Registry** Validated release, rollback
- **Knowledge** From engineer interviews

Engineer interviews → rule registration

Web Service



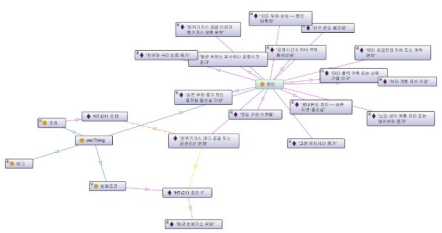
- Summary
- Equipment
- Issues
- Lot Explorer
- Correlation
- RCA Status
- **EIM Assistant (AI Q&A)**

Production & energy staff
Field engineers

STEP 1 Data Integration Collect Lot & sensor data
STEP 2 Analysis · Diagnosis Automated from EI calculation to cause inference
STEP 3 Service Dashboard · Assistant

Digitizing Field Knowledge with an Ontology Knowledge Base

Field know-how on causes and actions is stored as rules; measurements are matched to derive causes and actions



Ontology knowledge base (Protégé)

Variable	Condition	Cause	Action
Vacuum · Low Time · High	Met → Vacuum low **AND** Time high	Then → **Leak suspected**	Do → **Check vacuum line**

When diagnosis reveals recurring abnormal causes,

Infotrol SOP Automation · MPC
Linked with our proprietary technology and experts

EIM Configuration

Data	Analysis · Diagnosis			Service · Operation	
EI Calculation	**Lot Assessment**	**AI Prediction**	**Root Cause**	**Web Screens**	**Operations**
MES Lot link	Peer Lots	Prediction model	Site knowledge	Summary · Issues	Auto diagnosis
Lot-window totals	Normal range	Expected EI per Lot	Cause-action rules	Equipment & tags	On-premise install
Energy & output	High-EI flag	Predicted vs. actual	Interview form	Correlation	Model versioning
EI per Lot	Best Lot selection	XAI impact analysis	Evidence tags	RCA status	KB versioning
Scheduled runs	Weekly rebaseline	Action priority	Advised actions	EIM Assistant	Run logs