DX-PLANT™ / Ethylene

DX-PLANT™ Use Cases for Critical Equipment in Ethylene Plant

Through DX-PLANT™, TOYO provides solutions for the four fields of engineering (E), operations (O), maintenance (M) and business (B). This system will realize "digital twins" of an actual plant - a virtual plant created on a secured platform. Especially for ethylene plant, **TOYO introduced RL-Tracker™ for Ethylene Cracking Heater Run Length Optimization and CGC Digital Twin.**
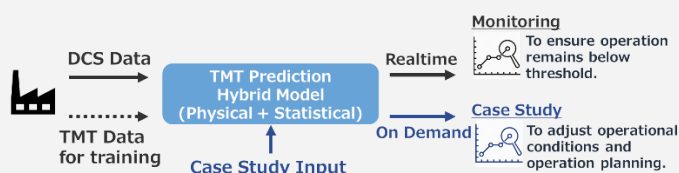
Solutions for Critical Equipment in Ethylene Plant

RL-Tracker™

for Cracking Heater Run Length Optimization

RL-Tracker™ estimates TMT (Tube Metal Temperature) from DCS Data
- Monitoring : Early anomaly detection (rapid TMT increase)
- Case Study : Operation condition for Run Length Optimization

RL-Tracker™ contributes…

| Reduce frequency of on-site TMT measurements | Save MH for operation planning | Minimize Production Loss | Maximize Production by data-driven analysis |

CGC Digital Twin

for performance monitoring and anomaly detection

TOYO developed CGC (Charge Gas Compressor) Digital Twin for Ethylene Plant together with CGC vendor
- Real Time Performance Monitoring
- Anomaly Detection System

Performance based on actual condition instead of design

Anomaly detection with RCA based on Vendor's Know-How
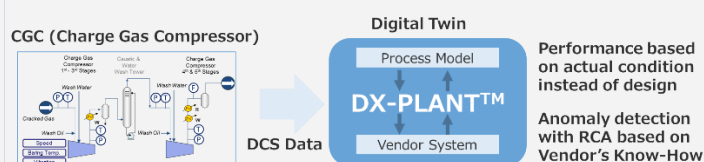
CGC Digital Twin enables…

| Accurate Performance Monitoring | Decision Making Support | Plant Load Up | TBM (Time Based Maintenance) to CBM (Condition Based Maintenance) |

RL-Tracker™

RL-Tracker™ is DX-PLANT™ web-based application for ethylene cracking heater operation. RL-Tracker™ predicts the TMT (Tube Metal Temperature) used as an indicator for decoking in ethylene cracking heater. The TMT prediction model is hybrid model (Physical and Statistical). **The model is created by training of past operational data** (DCS data and measured TMT values), and TMT is predicted based on given input to the prediction model. RL-Tracker consists of "Monitoring" and "Case Study" operation modes. **"Monitoring"** operation mode provides continuous TMT prediction based on DCS real time input. It enables early anomaly detection (abnormal rapid TMT increase). **"Case Study"** operation mode provides on demand TMT prediction based on users input for future operation condition. It enables to discover operation condition for run length optimization.

CGC Digital Twin

For CGC (Charge Gas Compressor) in ethylene plant, Digital Twin enables the calculation of compressor performance with higher precision than conventional design based DCS value. Digital Twin calculates properties of gases during operation, such as those not obtainable with conventional DCS, using a simulator, and CGC vendor system performs performance calculations based on simulation results, leveraging the vendor's expertise. By utilizing more accurate performance calculation results compared to conventional methods, it assists in decision-making and achieves reduction in plant bottlenecks. Additionally, Digital Twin incorporates features like anomaly detection for CGC and Root Cause Analysis (RCA), supporting the transition from Time-Based Maintenance (TBM) to Condition-Based Maintenance (CBM).