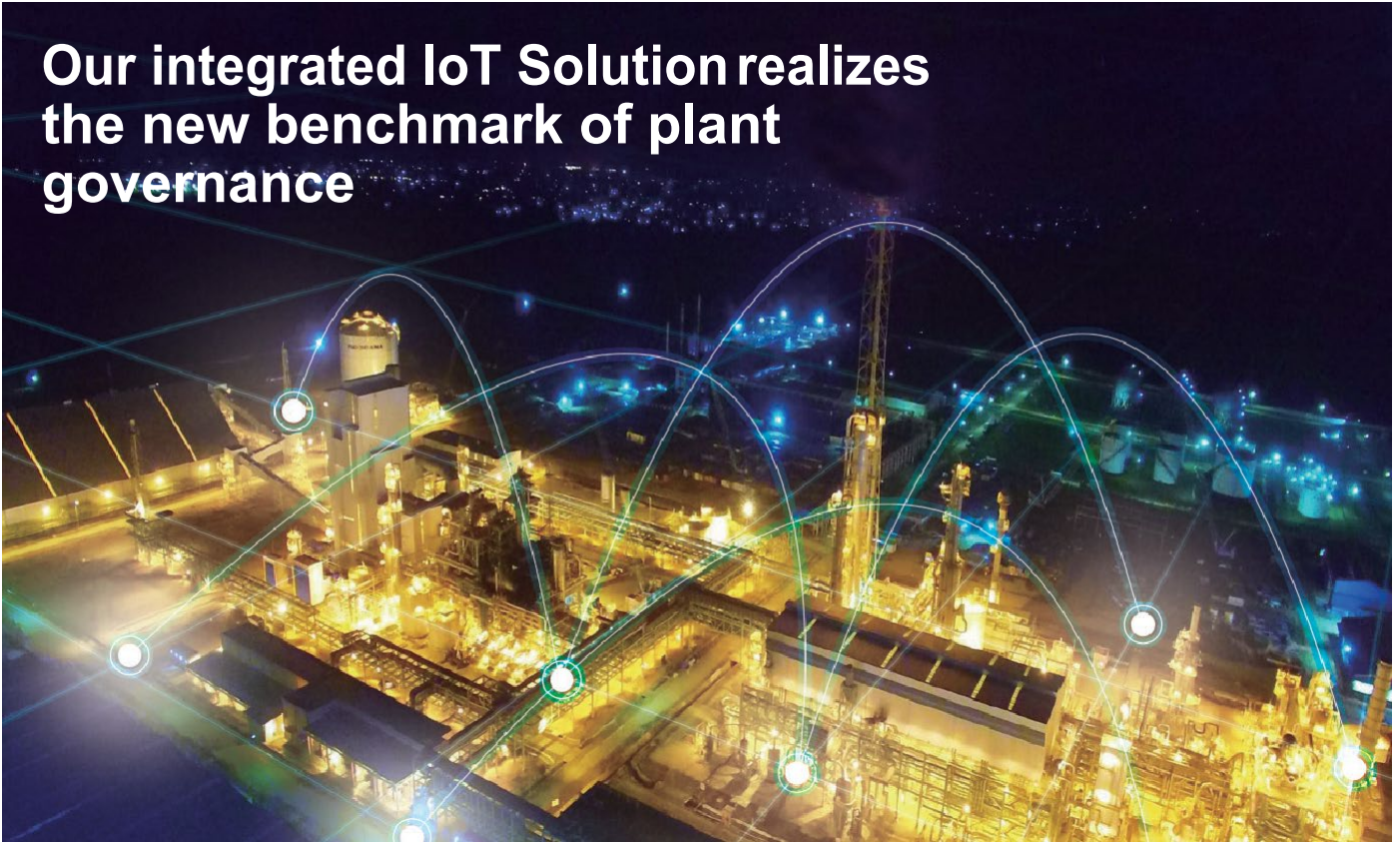


DX-PLANT®



Optimization of Engineering, Operation, Maintenance and Business

Our integrated IoT Solution realizes the new benchmark of plant governance



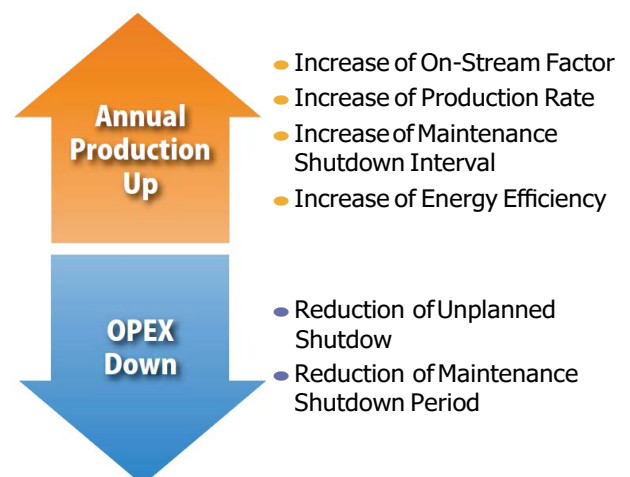
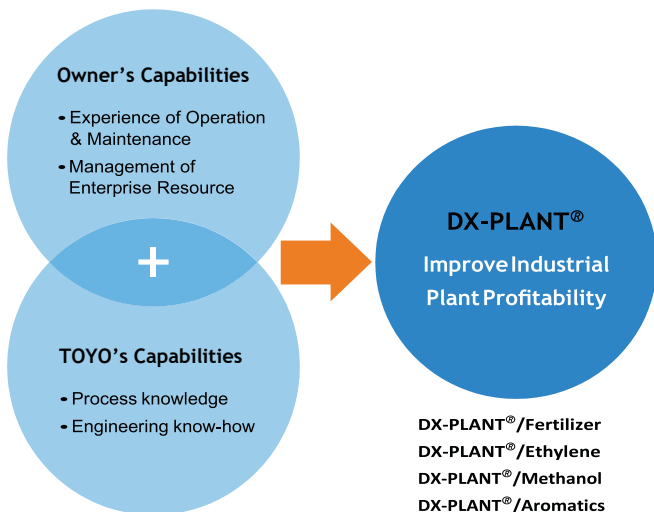
What is DX-PLANT®?

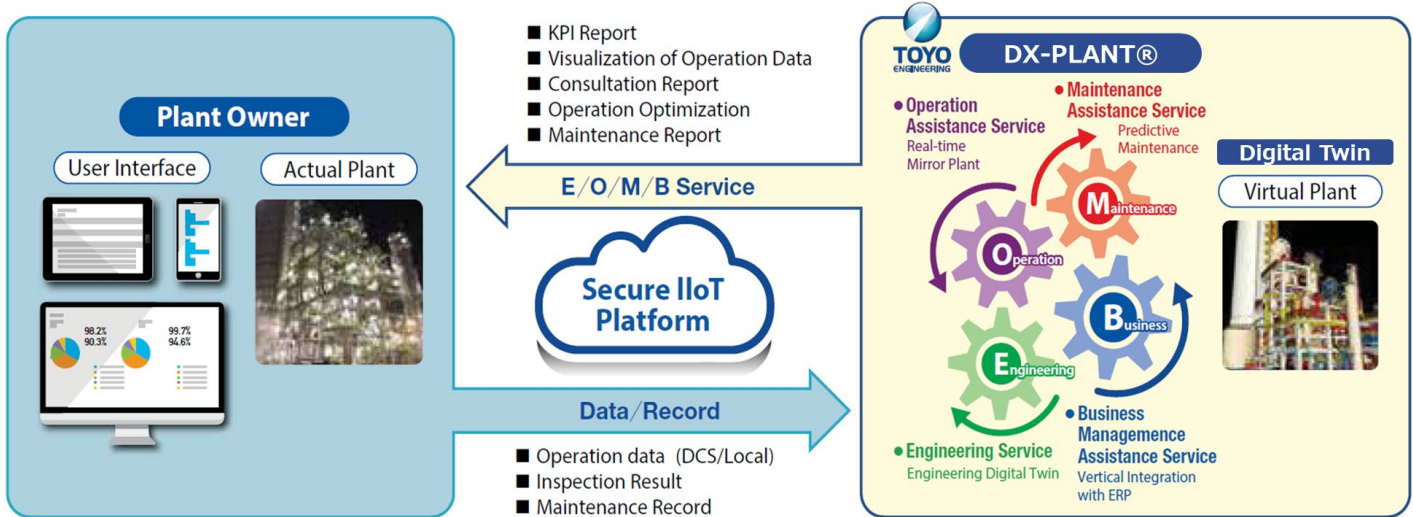
Amidst the fourth industrial revolution by IoT technology, TOYO developed system for Digital Transformation for Plant (DX-PLANT®). DX-PLANT® is aimed at maximizing client revenue and at minimizing expenses by leveraging TOYO's engineering expertise in chemical process technology and operations for industrial plants while providing services through the secured platform.

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 and a virtual plant on a secured platform. This system is built from big data relating to operation data, inspection and maintenance records.

This cloud system is able to realize users' access whenever and wherever they desire and widely share the results of solutions for their plants. This system will increase annual production and decrease operation expenditure with the following effects:





Solutions of DX-PLANT®

E: Information Management Service:

As Engineering Service, DX-PLANT® offers Information Management System. Traditionally, information / data for Plant O&M (such as engineering documents, maintenance records, etc.) is stored and managed in multiple separate systems. Information Management System revolutionizes plant operations by eliminating data silos and automating integration. It efficiently integrates data from multiple systems, contextualizing it using equipment names. Leveraging AI, the system significantly reduces the time spent on information integration, allowing for streamlined access and display of necessary data. Furthermore, it seamlessly integrates with 3D models, enabling visual comprehension of facility status and information. Even without 3D CAD models, the system supports virtual plant construction using point cloud models. With web-based accessibility, workers can access information on-site, eliminating the need for paper documents and manual data input. This digitization enhances work efficiency, reduces access time, and unlocks new data insights for advanced decision-making. It also facilitates centralized information sharing, ensuring smooth workflow operations between the field and the office.

M: Maintenance Assistance Service:

DX-PLANT® assists migration from TBM (Time Based Maintenance) to CBM (Condition Based Maintenance) by real time monitoring and prediction of abnormal condition for rotating machine and static equipment instead of conventional time-based one. As use cases, DX-PLANT® offers **AOCM®** for online corrosion monitoring in urea process which monitor piping corrosion and predict abnormal corrosion in critical equipment. Also in ethylene plant, there is anomaly detection and root cause analysis application for critical compressor as collaboration with compressor vendor.

O: Operation Assistance Service:

DX-PLANT® provides various dashboards as default function that aggregate plant data, allowing users to gain valuable insights. In addition to default function, DX-PLANT® provides advanced applications for plant operation optimization. **ADVIDA®** for plant anomaly detection, users can identify abnormalities throughout the entire plant system by analyzing operational data. The user-friendly interface, featuring graphics based on P&ID, visualizes anomalies with circles of varying sizes based on severity. **PMOS®** automates plant performance evaluation by comparing process simulation outputs with actual operational and design conditions, providing valuable decision-making support. **RL-Tracker®** is an application that predicts the TMT (Tube Metal Temperature) used as an indicator for decoking in ethylene cracking furnaces. By utilizing historical operational data (DCS data, actual TMT values), a predictive model is built to predict TMT values from operational data. Furthermore, as use case for critical large compressor in ethylene plants, DX-PLANT® employs simulator to calculate real-time properties, enabling users to obtain more accurate compressor performance compared to conventional DCS-based design standards. This initiative aims to reduce the plant's bottlenecks.

B: Business Management Assistance Service:

DX-PLANT® establishes the integration between corporate and factory management using its stored information of operation and maintenance. This integration system will enable company-wide optimization to the plant management. DX-PLANT® offers corporate level real-time feedback and help users to make more appropriate decision.



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