



Green Transformation and Smart Upgrading Model Example —TVCM Lin-Yuan Plant

Cai, Ming-Guang Chen, Guan-Rong

2025/11/27

Summary

TVCM Lin-Yuan Plant, in line with the government's low-carbon guidance policy for the manufacturing industry, has systematically promoted equipment replacement and intelligent management. Through upgrades of key process equipment, integration of process data, and implementation of risk monitoring mechanisms, the plant has improved energy efficiency and reduced greenhouse gas emissions.

① Concrete Actions

The upgrade of two cracking furnaces (F-6201 and F-6202) addressed issues of aging refractory materials and low burner efficiency, which had resulted in poor energy performance.

- **Improve Energy Efficiency** : By upgrading the refractory material grade to 1,540 °C, the furnace surface temperature was significantly reduced from 93 °C to 70 °C.
- **Optimize Combustion Design** : The number of burners in a single cracking furnace was increased from 48 to 112, resulting in more uniform heat distribution inside the furnace and effectively preventing localized hot spots.
- **Material Upgrade** : The furnace tube material in the radiant section was replaced with INCOLOY 800H, enabling operation at temperatures above 1,000 °C and enhancing operational reliability.

② Introduce New Technologies and Quantify Results

- **Furnace Surface Temperature** : 93°C → 70°C
- **Annual Average Power Saving Rate(2015–2024)** : 1.58%
- **Greenhouse Gas Emission Reduction Volume** :
 - ✓ Issued : 3,129 tCO₂e
 - ✓ In Progress : 10,922 tCO₂e



③ Smart Transformation to Enhance Operational Resilience

In addition to equipment upgrades, the Taiwan Chlorine Lin-Yuan Plant is actively leveraging smart technologies to strengthen process safety (PSM) and enhance long-term competitiveness.

- **Plant Operations Management Platform** : A smart PSM management platform was established, integrating multiple modules such as Mechanical Integrity (MI), Compliance Audit (CA), and Hot Work Permit (HWP). The system digitalizes data and automates approvals, thereby improving audit efficiency.
- **AI Smart Surveillance** : AI-driven process optimization is being promoted, particularly through the application of AI models in distillation towers. By analyzing historical data, the system identifies optimal low-energy operating parameters, provides early warnings of data deviations, prevents acid accumulation, and reduces the risk of environmental air pollution emissions.
- **VOCs Emission Concentration Monitoring** : A VOC concentration diffusion monitoring platform has been established, utilizing multi-level monitoring systems such as GC-MASS to track real-time dynamics of volatile organic compound concentrations within the plant and its perimeter. Alerts are instantly delivered via LINE to ensure rapid identification of leakage sources and prompt handling of anomalies, which is expected to significantly reduce unplanned shutdown losses and environmental penalties.

④ TVCM Lin-Yuan Plant Moving Toward a Sustainability Demonstration

Through institutionalized equipment upgrades and smart management, energy intensity is reduced and process risks are minimized. A replicable low-carbon transition model has been established, serving as a reference case for peers in advancing low-carbon manufacturing.

Through technical demonstrations and on-site visits at the model plant, the industry is supported in gaining deeper insights into key aspects of greenhouse gas inventory, the application and benefits of high-efficiency energy-saving products and low-carbon technologies, thereby encouraging replication and implementation of improvements.