1.1.4 Smart Manufacturing Cement 4.0

Upholding the principle of self-dominiating technology, as early as 30 years ago, Asia Cement Hualien Plant had aggressively started to invest into the development of cement production control system. The Company was the first in the cement industry to adopt the strategy of self-design, self-manufacturing and self-repair and maintenance for the cement production and waste heat power generation. This control system was installed in all Asia Cement's warehousing and shipping stations and grinding plants in Taiwan, Asia Cement's dedicated cement ships, warehousing and shipping stations in Guam and Singapore, all plants in mainland China and affiliated companies. As a result, the Company has not only trained and prepared an engineering and technical group with aboundant experiences, but also cumulated a huge production database.

In 2018, the Company started to work with Yuan Tse University on this basis, a cooperation with academic sector to introduce "AI theory" and to enhance "learning and deep learning algorithum" in order to introduce the original control system into "ACTEC AI Control System" and to launch "Cement 4.0" project. Furthermore, under the assistance of Far Eastone Telecommunications Co., an affiliated company, the Company built IT infrastructure and data analysis platform which were applied to various IoT to build a smart factory.

Based on the development status and needs of each implementation item in Asia Cement "Cement 4.0" program, the boundary of scope is adjusted accordingly, and the saved staffs can be assigned to production unit for easier allocation of manpower. The target of 2050 is to deepen the smart manufacturing capability and to widely apply to various scenarios.

The First Stage

1 Smart shipping

Content of Impelemntation

Building a shipping information communication platform for the entire automatic shipping.

Results of Implementation

① Installed a smart cloud platform for handling product shipping. Completed a warehouse unman product shipping window, installed a smart port warehouse product shipping system.

② Installed a port (outside of the Plant) cement warehouse monitoring platform to timely control the status of stocks and equipment.

③ Warehousing and shipping station smart shipping system, in 2022, it was installed at Kaohsiung, Keelung and Taichung warehousing and shipping stations. It is expected in 2023 to install the system at Hualien warehousing and shipping station, Chiahsin International and Nanhwa Cement.

2 Smart quality control

Content of Impelemntation

Analyzing automatically and in realtime fashion the composition of limestone, establishing data base of limestone composition and realtime auto-notification, and handling for abnormal composition.

Results of Implementation

Installed a platform for limestone big data analysis to show the real-time ingredient by visualized figures and tables, and to send out the notice of abnormality and the request for treatment.

The Second Stage

3 Cloud monitoring (Asia Cement situation room)

Content of Impelemntation

Integrating internal, external and public information; increasing information transparency and level of realtime; compiling and analyzing information, presenting in the form of charts and figures.

Results of Implementation

① Install a digital management platform covering from ground to cloud.

② Install a cloud visualized instrument panel to integrate the important data and indexes including production, quality and environment and to provide inventory information of all storage stations around Taiwan and the real time positions of cement vessels.

③ Currently, the entire development and design are completed, subsequently, the scope will be increased corresponding to the new needs.

4 Production lines pre-learning and maintenance

Content of Impelemntation

Establishing smart inspection system and on-line pre-learning and maintenance database, developing the diagnosis of vibration measurement analysis and oil sampling analysis technique.

Results of Implementation

① Installed a smart tour inspection system and an online pre-learning maintenance database to present the analysis and prediction via visualized figures and tables.Installed a management platform for technical specifications, troubleshooting and maintenance of equipment.

② The technology of vibration measurement analysis and diagnosis was under development.

③ Precognition maintenance system has been introduced and installed to all plant complexes in Asia Cement China including Jiangxi Ya Tung, Hubei Ya Tung, Huanggang Ya Tung, Sichuan Ya Tung and Sichuan Lanfong.

5 Smart mining

Content of Impelemntation

Optimizing preliminary grinding auto control system, establishing the volume of mine, good quality database and multi-function computing system.

Results of Implementation

Completed the consolidation and the software system optimization of the primary and secondary crush systems control rooms to achieve an unman primary crush control system.

The Third Stage

6 Smart system for the safety of work LINE Bot

Content of Impelemntation

Establishing bio-recognition system for controlling the entry and exit of the contractor personnel, control system for the access of special construction zone and site inspection position check point system.

Results of Implementation

On the basis of installing LineBot chat robot platform:

① Contractor service area: Provide a channel for contractors to exchange information with the Plant; integrate information including occupational safety training, inspection, defects correction, fine paid for violations and information announcement.

② Occupational safety special area: Provide timely inquiry of environmental and circular economy data, mobilized defects report platform and occupational safety training information, that is, a mobilized operational channel for occupational safety personnel.

③ Online price negotiation system: In coping with COVID-19 pandemic, the construction application and build and repair order were switched to online price negotiation on LINE.

④ On the basis of line@ to install the dedicated digital portal for the employees of Hualien Plant to provide the digital services for daily work and living needs.

⑤ Production Messsage Push: Regulary pushing messages including production, air pollutant emission and situation room portal everyday to all department supervisors for them to timely capture the status of the Plant.

7 Smart control (Optimization)

Content of Impelemntation

Optimizing the control parameters of the cement grinding system and the raw material system.

Results of Implementation

The cement grinding production system was converted into a smart control system with no manual operation.

8 Big data analysis

Content of Impelemntation

The data analysis is applied to the cost analysis of the production, quality control and segments.

Results of Implementation

Launched a data analysis management program to perform data analysis through visualized platform.