Engineering success in Thailand

Provision of services to Dow's largest manufacturing site in Asia

PORNCHAI CHAIYAPON – Toward the end of 2011, Dow Chemical Company, together with joint venture partners Siam Cement Group and Solvay, completed one of the largest investments in the company's history – a multibillion dollar expansion of its manufacturing facilities at Map Ta Phut, Thailand. Known as the Thai Growth Project, the expansion encompassed five new plants and their integration with existing production units into a fully integrated complex of world-class downstream facilities – Dow's largest manufacturing site in Asia. ABB was one of Dow's key partners and largest suppliers in the project, providing and installing most of the electrical, control and instrumentation equipment, including the plant distributed control systems. All the facilities were commissioned and completed safely and successfully on time and within budget.

ABB has developed a number of features and functionalities for Extended Automation System 800xA on behalf of Dow.

Located 160 km south of Bangkok on a coastal site overlooking the Gulf of Thailand, the Map Ta Phut Industrial Estate is the heart of Thailand's petrochemical and petroleum industry. Dow Chemical Company, in collaboration with its joint venture partner Siam Cement Group (SCG), opened its first manufacturing facilities at the estate in 1993 – a styrene-butadiene latex plant and a polyurethane plant. These were followed by a long series of investments in new plants for the production of polystyrene, ethyl benzene and styrene monomer, solution polyethylene and a new naphtha cracker plant that was located on a separate site 6 km away → 1–2. Dow's investments did not stop there. By the end of 2008 the company had announced a new multibillion dollar investment in five additional plants that would strengthen its presence in Asia Pacific → 3.

The five plants were collectively known as the Thai Growth Project. They consisted of the following subprojects:

1) A new solution polyethylene train
2) A new specialty elastomers train
3) A new propylene oxide plant → 4
4) A new hydrogen peroxide plant, which is the largest in the world
5) Power, utilities and infrastructure for the entire site

In addition to the five core projects, Dow also invested in a new storage and export facility at the port of Map Ta Phut. Projects 1, 2 and 3 were joint ventures with SCG. Project 4 was a joint venture with Solvay.

Site-wide solutions

Dow provided the project management for all the aforementioned joint venture projects with SCG, while Solvay managed the hydrogen peroxide project. Foster Wheeler International Corporation was appointed the engineering, procurement and construction (EPC) contractor for several of the core projects. Toyo Thai provided the EPC services for the hydrogen peroxide facility, with Sino Thai performing most of the field construction work. ABB was a major contributor both in terms of project involvement and the value of its products, systems and services.

Both Foster Wheeler and Dow, with whom ABB has a number of frame agreements for the global supply of various power and automation products and systems, awarded the contracts. ABB's scope of supply was huge and extended across the complete spectrum of electrical, control and instrumentation equipment and technologies. In fact, except for the main construction contractor, ABB was the largest supplier of materials, equipment and services. ABB supplied most of the switchgear, transformers, motors and drives, all the analytical equipment, all distributed control system hardware and most of the related programming services and most of the electrical and instrumentation installation work → 5.

Title picture
Aerial view of Dow's plant

1 Thermoplastic polyolefin cooling area

2 Thermoplastic polyolefin C3 compressor

ABB solutions were deployed in all five core projects, including the naphtha cracker plant, which went on-stream in 2010. ABB was responsible for delivery of the products and systems under its existing frame agreements with Dow, and for the installation, commissioning and testing of the electrical and instrumentation systems at most of the plants.

ABB was one of Dow's key partners in the project, providing and installing most of the electrical, control and instrumentation equipment.

Switching to System 800xA

Of the frame agreements that ABB has signed with Dow, the most notable was a 10-year global strategic agreement that the two companies signed in 2001 with regard to process automation systems. At the time the agreement was unique. It broke new ground in customer-supplier partnerships for mission-critical systems like process automation, and was subsequently extended in 2011 following a highly successful first decade.

For Dow, the agreement signaled a strategic shift away from its proprietary manufacturing operator discipline (MOD) control platform of 25 years to ABB's Extended Automation System 800xA. The MOD system was the heart of Dow's operations; it contained all the company's process know-how and application expertise and was vital to daily production. The knowledge embodied in MOD is now integrated with System 800xA. This enabled Dow to concentrate on its core business activities of chemical production and leave control system development to its partner, ABB.

In brief, the agreement meant that ABB supplied Dow with new and retrofit process automation systems, as well as service and support, for all Dow manufacturing sites worldwide. In return, Dow shared knowledge of process automation technology and practices with ABB for incorporation into its automation products and solutions. On the human level, teams representing the two companies worked as a tightly integrated unit that thought, worked and operated as a single Dow-ABB entity.

Over the years, ABB has developed a number of features and functionalities for System 800xA on behalf of Dow. These features were subsequently made commercially available to other customers as part of the System 800xA offering. Two examples of this joint product development, which are now firmly established as System 800xA differentiators, are Load-Evaluate-GO and High Integrity integrated control and safety systems.

Load-Evaluate-GO allows users to modify, download and evaluate a new or revised application, without interfering with

3 Piling activity started in 2008

4 Propylene oxide plant

the running application. They can see how the new application will work with their controllers and I/O systems and how it will affect the production process, while still continuing to run the current application. This capability significantly reduces the risks associated with making application changes in the running process, and improves overall efficiency by avoiding production stops, missed or delayed product deliveries and costly downtime.

System 800xA High Integrity is a complete, scalable IEC 61508 and IEC 61511 compliant safety-instrumented system that spans the entire plant safety loop.

The 10-year global strategic agreement broke new ground in customer-supplier partnerships for mission-critical systems like process automation.

Providing embedded safety and control within the same architecture offers a common high-integrity-system environment for production control, safety supervision and production monitoring. This flexible architecture makes it possible to combine control and safety functions within the same controller or keep control and safety functions separate within the same system.

Both capabilities are true to ABB's System 800xA philosophy – that the system extends beyond the scope of traditional control systems to include all automation functions in a single operations and engineering environment, so that plants can run smarter and better at substantial cost savings. Its unique engineering environment manages one set of consistent data, for single-point entry, single-point change and reuse across the plant.

Best contractor awards

Being part of a project of this size and complexity was both a privilege and a huge challenge. The schedule was tight – 30 months from start to finish – and the demands were exacting. Roughly 9,000 contractors were working on-site at various times throughout the project. On a macro level there was the 2008 global financial and economic crisis to contend with and on a local level there was political instability in Thailand for several months and a number of unexpected regulatory issues that had to be resolved.

As a supplier, ABB was required to execute its obligations flawlessly by meeting all delivery schedules punctually and by enabling plant start-up to take place on time and problem-free. The ability to think with the customer and quickly adapt to changing requirements were key attributes in a project of this size. In fact, ABB was rewarded with five awards for achieving major milestones in project execution and three awards for safety.

The two milestones were connected with the propylene oxide plant: one from Foster Wheeler for completing the electrical and instrumentation installation within a very demanding timeframe; and the second from Dow for completing and energizing a 115 kV substation on time, despite a delay of almost three months caused by regulatory issues that brought the entire Thai Growth Project to a halt.

Health and safety benchmark

What is remarkable about the Thai Growth Project is that it was accomplished with an outstanding record in environment, health and safety issues (EH&S). Some 41 million man-hours were expended throughout the project's duration. The injury/incident recordable rate was less than 0.07 and there was no time lost to injuries. This was an exceptional achievement that is thought to have set a new benchmark in the global chemical and petrochemical industry.

With all five core projects completed, the process will be rounded off in 2012 when Dow evaluates the lessons learned from the Dow-ABB collaboration in the Thai Growth Project as part of the ongoing process of improving work procedures and practices between the two companies. A sixth core project, for a new propylene glycol plant, is currently under construction and scheduled for completion in 2012. ABB has already been selected by Dow to provide the process automation system and much of the electrical equipment, instrumentation and analyzers, including installation and commissioning.

ABB was rewarded with five awards for achieving major milestones in project execution.

5 Operators working in the control room

The next Dow-ABB project

Dow announced in 2011 that along with its partner, Saudi Arabian Oil Company (Saudi Aramco), it had formed a joint venture – Sadara Chemical Company – to build, own and operate a fully integrated chemicals complex in Jubail Industrial City, Saudi Arabia.

The complex will comprise 26 manufacturing units with capacities of more than 3 million metric tons a year and will be the world's largest integrated chemical facility ever built in single phase. The manufacturing units will produce a wide range of performance products such as polyurethanes (isocyanates, polyether polyols), propylene glycol, elastomers, linear low-density polyethylene, low-density polyethylene, glycol ethers and amines.

Construction began in late 2011, with the first production units expected to come online in 2015 and all units up and running by 2016. Sadara is expected to deliver annual revenues of $10 billion within a few years of operation. Total investment for the project, including third-party investments, is approximately $20 billion.

ABB has been selected as the main automation contractor for the Sadara project. ABB's scope of supply is comprehensive and critical. It includes process automation systems, safety systems, project management, project engineering, commissioning assistance, post-commissioning site support, as well as engineering, operator and maintenance technician training.

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