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BUSINESS

The refinery of the future

Intelligent, flexible and adaptable facilities will be fully demand-driven.

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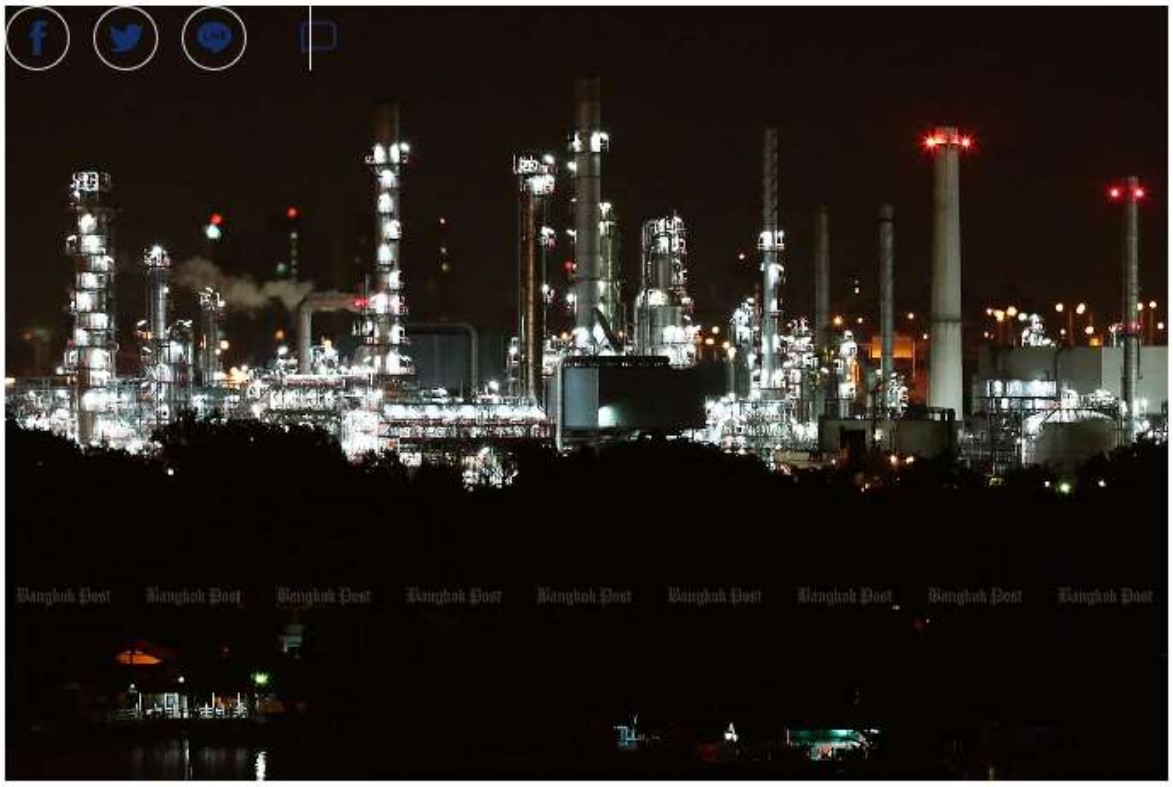

(Bangkok Post file photo)

We all remember Yoda's admonition to Luke Skywalker in The Empire Strikes Back: "Do or do not, there is no try." His advice is certainly relevant to anyone wondering about the degree of commitment needed to succeed in our digital future.

With an all-in mentality, digitisation has accelerated across process industries, with an impact comparable to how the sharing economy has revolutionised the way people live, work and play. We are seeing the results in the world's fastest growing economies, many of which are in Asia.

Burgeoning middle-class populations in Asia are driving market demand for plastics and related chemicals. Renewable energy and electric cars are affecting demand for hydrocarbon fuels. The demand for petrochemical feedstocks is also affected by economic growth in Asia and the level of

use for plastics. How can the industry expand quickly and yet remain flexible enough to meet demand?

On the supply side, new multi-billion-dollar production complexes are nearing completion or being designed in Southeast Asia and India. Companies engaged in these projects need to adopt an effective end-to-end digital software environment to empower workers and allow them to make complex decisions, as accurately as possible. Efficient companies need to be integrated from oil production to finished goods.

Sustainability and cybersecurity are important elements to consider. While jobs are tailored differently, humans will still be in control. Machine learning and artificial intelligence (AI) can decode a treasure trove of data streaming from sensors in smart plants. By applying low-touch machine learning, companies can now deploy business generalists to make the best decisions possible.

NEXT-GENERATION REFINERY

Intelligent, flexible and adaptable, the refinery of the future will be fully demand-driven, as decisions are made quickly and at the appropriate level. Knowledge workers will need to constantly address customer needs better than the competition. Integrated systems and visual interfaces will be created for the customer, showing how assets are being optimised to meet market demand and profitability.

Using Amazon's experience as a benchmark, this connected supply chain will apply powerful AI-assisted analytics to understand business opportunities presented by changes in market demand and supply.

This next-generation refinery will operate with knowledge worker pods. Planning and scheduling will be fully integrated. The planner will be supported by an AI expert dashboard showing trade-offs in areas, such as economics, sales, sustainability and operations. The creation of optimal schedules will be fully autonomous.

Prescriptive maintenance systems will flag situations that can disrupt the achievement of targets. Data analysis will provide traders with insights into how and where to procure the best crudes. In doing so, operators can derive the best possible asset utilisation, safety and profitability.

This integrated plan and schedule will autonomously provide closed-loop optimisation, using AI-assisted advanced process control (APC) software. Other functional departments will have actionable insights on the changing imperatives of plans, schedules and optimised production.

To make optimum use of the Industrial Internet of Things, data sensors will be pervasive in this plant. Real-time analytics will provide process stream compositions. Catalyst nanosensors will add to the array of data to better drive control over process performance. All of this will drive APC and the underlying control software to operate via dynamically adjusted set points to achieve and exceed targets.

Major process units and equipment will be smart plant building blocks. This built-in intelligence will greatly improve the ability to run process operating limits, which will be critical to asset flexibility.

The next-generation prescriptive maintenance system will not only flag future failure models for equipment and units, it will also link the planning and process models to process operating changes. With this approach, the risk of future failure is delayed or eliminated.

SAFER FOR HUMANS

Advanced technological capability will also take humans out of dangerous and remote areas of the refinery. Intelligence can be derived from further development of sensors, prescriptive maintenance AI solutions and unit analytics.

The futuristic refiner will be able to better understand physical asset conditions, trends, risks and emergencies. This reduces the need for workers to be physically present to inspect equipment and units for issues. AI-enabled virtual solutions can plan and manage startup and shutdown procedures from remote locations in most instances.

Online optimisation models will constantly optimise energy and water use in the asset and throughout the value chain. Individual knowledge workers will keep tabs on the contribution of workers to help companies improve their sustainability standing with the investment community.

Mr Beck believes future refineries will be safer for humans.

The refinery of the future will also operate in a hyper-competitive, globalised and dynamic market. Management teams will need to adopt trust-based, blockchain-enabled connections between regional enterprises to negotiate and rapidly conclude agreements to collaborate and capture business opportunities.

For example, supply and delivery agreements can be negotiated and concluded using blockchain-based contracting and commitment systems, which enables rapid sign-offs by the refinery's designated executives. This further entrenches the concept of leadership in the plant.

Companies need to be prepared and accelerate towards becoming sustainable, highly diversified and integrated energy enterprises. As Obi-Wan Kenobi reminds us: "In my experience, there is no such thing as luck."

Ron Beck is the director of marketing strategy with Aspen Technology Inc, a US-based specialist in software and services for process industries.

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