We can get there by focusing on three primary operational and business goals:

• **Agility.** The refinery of the future will quickly switch between fuel and petrochemical product slates to take advantage of market demand and opportunities.

• **Reliability.** Top-performing refineries in 2026 will operate with virtually no downtime.

• **Shared Intelligence.** Successful future refineries will automate and simplify processes, enabling expertise and decision-making to be shared across multiple facilities.

With these three areas conquered, the refinery of 2026 will be ready for whatever challenges (and opportunities) that technological advances, market changes, and world events bring.

**Agility.** It’s likely that nothing in the next 10 years will separate winners from losers more than the pursuit of business agility.

In the future, top-performing refineries will be prepared to take advantage of opportunities as soon as they occur, not weeks or months later. Market demand will determine feedstock and product slates in real time once business leaders are armed with integrated data analysis, from the crude source to the gas pump and everywhere in between. Just-in-time inventories will become the new norm as they occur, not weeks or months later. Market demand will determine feedstock and product slates to take advantage of market

**Reliability.** Downtime, and the high costs that go with it, will become a thing of the past if the industry finally solves the problem of poor reliability. For example, “hot turnarounds” could eliminate the need to take process units out of service to repair or replace parts. By redesigning valves and other equipment to allow easier access to wearable components, crews will perform overhauls in-situ without interrupting production.

Dedicated online asset reliability networks are another promising development. These will give operators a virtual “dome of awareness” over their entire facilities, with the kind and quantity of information needed to execute condition-based maintenance strategies remotely. With the aid of self-diagnosing equipment and early alerts, maintenance managers will know about abnormalities far enough in advance to prevent any breakdown or upset from affecting production capacity.

Today, the average refinery is equipped to continuously monitor the health of less than 20% of its assets.
but in a decade it will monitor as much as 60% due to cost-effective wireless technology. Micro-sensors could even float along inside the product itself, transmitting up-to-the-second quality readings as they pass from one process unit to another.

**Shared Intelligence.** The nature of organizations will change fundamentally in the future. Onsite staff could shrink by 50% over the next 10 years. Soon, personnel might venture onsite only to carry out certain manual tasks. Decision-makers—management, operations, reliability, engineering and integrity functions—could be remotely linked to one or more plants, able to direct an entire fleet of refineries from a single, centralized operations theater.

Automation will continue to transform many of the routine jobs traditionally handled manually. Augmented-reality helmets with heads-up displays will allow maintenance crews to effectively bring the control room into the field. Robotic flying drones will sniff out fugitive emissions, search for hotspots, and identify piping and vessel integrity issues in hard-to-reach places.

These innovations will have a dramatic impact on safety by identifying potential problems before they occur, and by minimizing the time workers spend in hazardous areas. Additional advances could include:

- Breakthroughs in chemical engineering might lead to catalysts that continually regenerate while the process keeps running.
- Machine learning might make it possible for plants to "absorb" operator knowledge and adapt to changing conditions instantaneously.
- As technology improves, refineries could one day be able to automatically start up and shut down process units without manual intervention, helping further increase safety.
- Refineries might soon be able to recycle almost all of the waste they create, and new carbon capture and sequestration methods could forever change the way producers handle regulatory compliance. By 2026, flares and waste water dumps could be outdated.

Achieving such progress might seem like a tall order, but the fact is that much of the knowledge and technology needed to realize this future-proof vision already exists today.

For example, information technology has progressed in recent years to the point of allowing businesses to remotely access huge amounts of data and to leverage expertise no matter where it is. As a result, refineries are beginning to integrate their operations in ways that take advantage of big data insights and new collaborative techniques.

In addition, recent improvements in human centered design are already making it easier to operate with fewer experts onsite, wireless instrumentation is becoming widely used throughout the industry, and some refineries are starting to employ remote control drones to gather needed measurements.

To reserve a seat at the table in 2026, refineries should move to adopt and integrate innovations now, rather than take a wait-and-see approach. Prospering in the face of uncertainty often means challenging the status quo. Overcoming resistance to change will become even more crucial as world events reshape the industry.

After all, as someone once said, the future belongs to those who are willing to prepare for it today.