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REFINERY OF THE FUTURE

MARCH 2023

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www.pilko.com
info@pilko.com
US +1 713.357.1000

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REFINERY OF THE FUTURE

by CHERYL MCKINNEY | MARCH 2023

The energy transition seeks to solve two fundamental problems: increase the production of affordable energy and simultaneously reduce the total amount of carbon emitted related to the production and consumption of that energy. This transition will play out over several decades and how it transpires remains uncertain. It will differ regionally and be influenced by political, technical and economic forces outside the energy industry.

Refined petroleum products have played a leading role in the delivery of economic transportation fuel, but global transportation methods are changing. Renewable energy sources have become viable, particularly in regions with strict regulation, carbon incentives and/or available subsidies. For the foreseeable future, traditional petroleum refineries will be necessary; but as demand for petroleum transportation fuel eventually declines, the total number of refineries will decline as well. The refinery of the future must adapt to be successful.

Factors affecting refinery viability include **national, regional and local regulations**. Energy security concerns may result in facilities running beyond economic timelines. Climate change, water availability (for both logistics and cooling) and increasing weather extremes place additional strain on refining economics. Energy security concerns throughout the world will influence carbon regulation and the pace of change. Uncertain and evolving regulatory action and legislation will impact investment and strategy.

Thriving refineries will continue to be those with the highest level of personal and process safety, operational reliability and turnaround efficiency.

That said, new factors are coming into play, making it difficult to achieve these longstanding goals.

Talent is leaving the refining industry and competition for new talent is fierce. The refining and chemical industry is no longer a preferred employer. **Industries such as semiconductors and renewable energy are viewed more favorably.** This pressure caused by talent drain may negatively impact safety and reliability due to reduced experience and staff levels.

The refining industry is also seeing an almost unprecedented period of ownership change. Public, multinational integrated oil companies, under shareholder pressure to reduce carbon emissions, are reducing refining capacity. Refining assets are being transferred to smaller oil companies, private equity or other industry owners. Any asset transfer runs the risk of reducing institutional knowledge. Some buyers lack industry knowledge or central support functions. Some could choose to operate with lower staffing to drive efficiency, which may provide only short-term gain.

How does an enterprise manage this change and how do leaders prioritize limited resources?

Success requires a view of the competitive position of your asset, understanding of the regional and local pressures affecting your bottom line, a long-term approach to asset management and access to expertise when needed.

The ability to attract and retain human resources will remain critical. Necessary strategies may include competitive employment terms coupled with local efforts to increase access to talent. In parallel, accelerating digitalization will improve results. Real-time data visibility and improved decision making offered by sensors, artificial intelligence programs and advanced control systems may also present a competitive advantage. Results will include improved safety and reliability and reduced exposure to talent availability.

Turnaround excellence must now include:

- Evaluation of the longevity of the asset
- Planned retirement of declining technologies
- And investment in emerging technology, renewables and low carbon options

Future investment will focus on optimization versus capacity.

Energy efficiency initiatives alone will not meaningfully reduce carbon emissions. Renewable electricity sources and even refueling refinery furnaces with low carbon hydrogen would be required to significantly impact scope 1 and 2 emissions. Scope 3 emission reduction is tied to investment in petrochemical feedstock production and higher quality transportation fuels, which improve fuel efficiency.

Growing demand for Blue and Green hydrogen, as a replacement for natural gas and H2 fuel sales, will drive investment in hydrogen production. Steam-methane reforming with carbon capture technology, particularly in regions with a diverse heavy industry footprint and proper geology for sequestration, are likely investments. Hydrogen production, carbon capture, use and sequestration technology reaches across historically upstream and downstream technologies as well as emerging businesses. Technology, particularly digitalization technologies, are changing rapidly. Partnerships and new business models may be required to stay competitive as these markets mature.

Gasoline demand will decline before other transportation fuels due to pressure from EV mandates, improved engine efficiency, and other factors. Regional decline rates will vary. New technology internal combustion engines continue to favor higher octane fuel than some regions currently require, which may continue to incentivize octane production. The refining industry is likely to self-impose greater HF Alkylation safeguards; and regulation of this technology is probable at some point. Hydrogen demand and the need for higher octane will favor high octane reforming technologies.

Jet fuel is likely the most difficult transportation fuel to replace. Investments unlocking distillate production will likely be profitable and could include renewable investments, particularly where hydrogen and hydrotreating capacity is available. The cost of green/brown field hydrocracking facilities with the subsequent utility and logistics required for standalone renewable distillate facilities now exceeds the sales price of existing refineries. Incentives exist to convert less competitive refining assets to renewable fuel or terminal facilities.

Refineries thought to be disadvantaged could become strategic based on renewable feedstock and market access. Marine access is increasingly important for inbound logistics of bio feedstocks and outbound logistics of product. Refiners will increasingly compete for limited renewables feedstocks until new feedstock and logistical paths emerge. Partnerships with bio feedstock producers may reduce the financial risk of new facilities. Renewable fuel success will become dependent on pre-treatment technology of low carbon intensity feedstocks and pathways to market in incentivized regions like British Columbia, California, and REG II in Europe. These incentives will regionally drive investment.

New processing technologies to convert waste materials to fuel are progressing, in spite of concern over the scalability. Managing technical risk of emerging technology is a matter the refining industry has needed to consider for some time, this real risk must be factored into investment decisions.

The future of refining creates both challenges and opportunities. Good asset management of the fundamentals of safety, reliability and efficiency continue as the foundation. Executives will now need to consider how to access expertise and digitalize while taking a longer-term view of asset strategy than in the past.

Evaluation of new technologies, rethinking the use of assets, retiring old technology, payback time and regulatory risk must factor in management process to ensure success.

ABOUT THE AUTHOR:

Cheryl McKinney retired from BP after 25 years of service where she was most recently the President of the BP Toledo refinery holding company.

Cheryl was Joint Venture Board Chairman, overseeing strategy, investment, and governance for $200m/yr refining joint venture between BP and Cenovus (formerly Husky Oil).

She was accountable for contractual oversight for BP, including crude supply and product sales agreements for the enterprise. Prior to this, Cheryl filled many executive positions at BP.

Since retiring from BP, Cheryl is a Senior Business Consultant at Solomon Associates and is also on the Board of Trindent Consulting and on the President's Advisor Board at the University of Akron.

Cheryl is a dynamic, pragmatic, results driven executive. Her expertise lies in strategy and the balance between operations and growth. Cheryl has subject matter expertise in both traditional transportation fuels and infrastructure as well as in emerging technologies like biofuels and hydrogen.

Cheryl received her Bachelor of Science, Chemical Engineering/Chemistry from the University of Akron.

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