
**THE REFINING INDUSTRY IN A NEW ERA: KEY FINDINGS AND
POLICY ISSUES**

The refining industry in the United States is very diverse in terms of the structure and size of its constituent parts and the markets they serve. Industry views of the business environment and trends in operations are accordingly diverse. In this concluding chapter, we draw together key findings on critical issues and trends that arose during RAND’s discussions with industry leaders. The chapter closes with an enumeration of several priority policy issues that, given the Department of Energy’s broad mandate in the sector, merit its attention in the coming years.

KEY FINDINGS

Refining Industry Views Are Consistent With Those of Other Industries

The refining industry plays a unique and important role in the U.S. economy. The statements of refining industry leaders tended to emphasize this perspective. However, the business environment and operating challenges portrayed by the RAND discussants are not unique and are faced by leaders in most other business sectors. Subjects raised in the discussions common to other sectors include

- weathering business cycles and working through periods of excess capacity and oversupply
- optimizing the use of and return from fixed capital assets
- enhancing product quality and reliability
- dealing with cost and price pressures imposed by competition
- managing uncertainty and planning for the future
- complying with regulations
- advocating for policies that improve the business climate.

This similarity suggests that the status of refining in the United States may be viewed as “normal.”

Refining industry leaders voiced significant differences of opinion on a number of topics, including

- the appropriate degree of consolidation and integration of the supply chain
- the future of refining markets and technologies
- receptivity to new technologies and practices
- the value of being proactive in environmental performance
- the degree of burden associated with regulation.

These differences are also not unexpected and can be viewed as normal for industry as a whole.

The United States Has a Sufficient Near-Term Refining Capacity Base

In contrast with industry warnings of chronic, widespread shortages issued in the late 1990s, no executives in the RAND discussions (held in 2002) believed that a fundamental imbalance in supply and demand in the United States was imminent. In recent years, the slowdown in the U.S. economy has eased demand pressures while refiners have added capacity through selective investments and productivity enhancements—efforts facilitated by corporate restructuring and consolidation. Meanwhile, the availability of imports continues to add liquidity to the supply environment, particularly on the East Coast.

At the same time, industry leaders identified two trends—tight capacity and boutique fuels—that have converged to render the supply-demand balance more volatile on a day-to-day and regional basis than has historically been the case. This has given rise to greater short-term volatility in regional product supplies and prices, and many industry leaders believe such volatility will increase, if not worsen, in coming years.

The Downstream No Longer Has Substantial Excess Capacity

Between 1985 and 2000, average refinery utilization increased from 78 percent to over 92 percent. This rate is expected to hold for the foreseeable future. The trend toward greater capacity utilization has been driven by several factors:

- Rising demand for refined products

- Shutting of refineries because of unprofitability and the cost of regulations
- More-conservative corporate resource allocation practices that have deterred investment in new capacity to gain market share or recoup regulatory expenditures
- Permitting requirements that have constrained refiners' ability to increase capacity
- New process control technologies and practices, enabling refineries to run at higher levels of capacity utilization more reliably and for longer intervals
- Better information about market demand, which has allowed refiners to adopt just-in-time production strategies.

For operating companies, the elimination of excess capacity represents a significant business accomplishment: Low profits in the 1980s and 1990s were blamed in part on overcapacity. Since the mid-1990s, economic performance industry-wide has recovered and reached record levels in 2001. However, the elimination of spare capacity in the downstream generates short-term market vulnerabilities and upward pressure on prices at the pump: Disruptions in refinery operations because of scheduled maintenance and overhauls, unscheduled breakdowns, or other incidents could lead to acute supply shortfalls and price spikes—which, industry leaders warned, were likely to occur. On the one hand, many industry leaders in the RAND discussions called for such measures as changing New Source Review rules, to reduce regulatory constraints on adding new capacity and to lower the likelihood of supply disruptions. On the other hand, some participants suggested that the challenge was for management to avoid overbuilding—a situation which may occur as a result of easier New Source Review permitting. Although high and low capacity utilization rates were seen as unsustainable for operating companies, the discussants did not identify a policy for achieving a utilization balance point that would be ideal for producers, consumers, and the national interest.

Boutique Fuels Add Complexity and Rigidity to the Supply Chain

The fuels industry is experiencing increased market segmentation and product specification, driven by federal, state, and local regulations. The number and complexity of formulations are expected to increase in the near term as ultra-low-sulfur diesel fuel is phased in for on- and off-road uses and as states ban MTBE. Over the long term, new fuels—natural gas, biodiesel, liquid fuels for fuel cells, and hydrogen—may enter widespread use.

Boutique fuel specifications have been a principal cause of some acute regional supply imbalances in recent years, it was noted. Localized product speci-

fications add cost and complexity to refinery operations and distribution channels. They tend to reduce competition and add rigidity to markets because fuel supplies are less easily moved to deficit regions if manufacturing operations or distribution channels are disrupted. Imports also are deterred. Again, when a refinery, pipeline, or other component of the supply chain does go off-line for maintenance or overhaul, or because of an accident, local supply and price impacts are potentially greater than in the past.

Some refiners, it was observed, have supported boutique fuel formulations for the business opportunities they create. Others opposed them and encouraged harmonization of fuels specifications to facilitate greater interregional trade.

Market Trends and Volatility Vary Greatly by Region

Arguments made by industry leaders to RAND suggest that market volatility and potential supply shortfalls—resulting from refinery outages in the near term or chronic capacity constraints in the long term—are most likely to be of regional, not national, scope. The regionalization of the U.S. market is a function of refiners' regional business strategies, the uneven distribution of refinery capacity across the U.S. market, and the limited coverage and capacity of the nation's distribution infrastructure, specifically, refined products pipelines.

Discussants view the Gulf Coast, Eastern Seaboard, and Southeast as the least vulnerable regions because of the concentration of refineries and pipelines there and the greater accessibility of imports. The West Coast is perceived as the most exposed, both in the short and long terms, for the following reasons:

- A rapidly growing population, especially in the Las Vegas and Phoenix areas and in Central and Southern California
- The region's large geographical distance from alternative suppliers and its limited port and pipeline infrastructure for receiving products imports
- Stringent air pollution emissions limits and a complex permitting process in California, which constrain refineries' ability to increase capacity
- Stringent fuel specifications for large portions of the California market, which deter suppliers from outside the region.

To reduce regional supply imbalances, some participants in the RAND discussions recommended efforts to extend product pipeline coverage and capacity into deficit regions such as the Southwest and Rocky Mountains region. It also was noted that improved pipeline access could force smaller existing refineries to close down.

Executives Question the Transition to Ultra-Low-Sulfur Diesel Fuel

Contacted in 2002—more than three years ahead of scheduled implementation of the on-road ULSD rule—industry leaders with whom RAND spoke presented widely differing scenarios for the market. Speaking in the abstract, discussants raised a number of technological and economic issues. It was predicted that some refiners would opt out of the market or curtail production, leading to substantial supply shortfalls and price spikes. Some technology and services providers reported unusually protracted decisionmaking among operating companies (a possible consequence of the recent wave of mergers and acquisitions), raising concerns about delays in compliance. On the other hand, many supplier representatives stressed that refiners have no viable option for exit and predicted a repeat of past experience: timely compliance with the possibility of subsequent economic hardship for the operating companies as a result of overbuilding.

Speaking with RAND about their own firms' plans, no operating company executives suggested that they would be exiting the diesel market in the coming years. Smaller firms in particular, stated or implied that they would remain in the market and meet the sulfur limit in a timely manner.

ULSD supply problems, if they should occur, were largely seen by participants in the RAND discussions as a transition issue. Potential contamination and downgrading of ULSD stocks outside the refinery gate generally were not viewed as a chronic show-stopper: Either adequate know-how and management strategies would be developed before the implementation deadline or problems would be quickly mitigated and corrected thereafter. Price spikes as a result of undersupply or contamination would handsomely reward successful producers and attract new entrants to the market, giving them an incentive to restore balance within a matter of months.

Refiners See Both Challenges and Opportunities in Regulation

Operating company representatives who spoke with RAND were uniformly proud of their past accomplishments in promoting worker health and safety at their facilities and improving the environmental performance of their facilities and products. Looking to future prospects of regulation, they evinced a strong divergence in opinion. One group, while still valuing environmental protection, expressed grave concerns about return on investment, capital availability, and regulatory flexibility and uncertainty. They saw regulations as a threat to refiners' bottom line and their ability to meet demand in a reliable manner. Diesel desulfurization and the replacement of MTBE with ethanol were frequently cited as examples of these problems.



Refineries in California must comply with stringent stationary source emissions and refined product regulations. Industry leaders reported that these refineries also tend to be the most profitable in the nation.

Others said that environmental improvement was part of the normal, even welcomed, evolution of their industry. Environmental regulations typically were portrayed as just one business challenge among many. Diesel desulfurization and ethanol blending, according to this group, would be implemented in a fairly smooth manner. Some went further to suggest that regulation accelerated modernization, often stimulated capacity additions, and could be good for a refiner's bottom line. For illustration, they noted that both federal and regional fuels specifications can increase barriers to market entry, thus offering local incumbents a more reliable share of the market and enhanced profitability. Refiners in California, the state with the most-stringent regulations, enjoy the highest profit margins, observed several discussants.

Medium- and Long-Term Trends Are Viewed as Highly Uncertain

Industry leaders supported the notion of medium- and long-term goal-setting and planning for fuels supply, through, for example, creating greater certainty in the regulatory process. On the other hand, discussants reported that the industry is extremely preoccupied with current regulatory compliance and business management challenges, such as resolving the implications of corporate restructuring and consolidation, making longer-term planning difficult.

Some medium-term trends, out to 2010, were identified. Most refiners expect, though they do not welcome, a gradual phase-out of MTBE nationwide. After on-road ULSD implementation, most refiners expect additional clean fuels initiatives to come into force. Some of these have already been proposed—for example, desulfurization of off-road diesel—but the refiners did not offer specific views on them. Most refining industry members expect demand for petroleum products to grow at the brisk rates seen in the 1990s, as predicted by the Energy Information Administration. Without the cushion of excess capacity, however, leaders questioned the industry’s ability to keep up with demand.

Looking to the long term, beyond 2010, refining industry members with whom RAND spoke seriously doubted the availability of imports to fill the expected supply gap. They cited market disincentives, logistical barriers, and stringent fuels specifications, even though the EIA predicts rising imports of refined products over the next two decades. Interestingly, a few refiners are contemplating the potential for a significant easing of demand, perhaps as soon as 2010–2012, prompted by the introduction of highly efficient motor vehicles. Such thinking may create pressure to minimize capacity increases and other investment in plant and equipment in the mid term, thus contributing to higher and more volatile prices and better profit margins. If refiners become more concerned about scenarios of eventually declining product demand, it may make more sense over the long term to expand capacity in foreign locations with more flexibility to redeploy products to other growth markets, should U.S. demand decline.

Also in regard to the long term, few discussants suggested that refineries might diversify their operations and engage in more power generation and hydrogen and chemicals production. Most refiners felt that their industry was well situated to provide a petroleum-based energy source for fuel cell vehicles. They did not, however, express a clear view about how the refinery of the future might be configured to produce such a fuel or about the technical challenges in getting there.

Operating Company Representatives Are Optimistic About Their Future

The refining industry often is portrayed as facing significant financial hardship and operational challenges. Many RAND discussants shared this perspective. When expressing misgivings about regulations and timely implementation, however, discussants often referred to *other firms* about which they might not have full information. Discussants were more optimistic when speaking about the prospects of *their own firms* meeting impending business and regulatory challenges. This suggests a more benign future than is often portrayed.

Industry views of hardship were shaped during the early and mid-1990s when the downstream was characterized by excess capacity, low crude oil prices, high regulatory spending, and weak economic performance. By 2000–2001, economic performance overall had recovered. Despite a dip in aggregate industry performance in 2002, the discussants were very upbeat when sharing their views about their own firms' current and future prospects. This suggests that cost-cutting, consolidation, and the adoption of new business strategies, combined with the gradual reduction of excess capacity, have had the corrective effects intended and that the refining industry has entered a new era of enhanced profitability and sustainability.

Small refiners are commonly considered to be most threatened by industry consolidation and regulation—a view expressed in the RAND discussions by several representatives from larger refiners and from technology and services providers. Smaller operating company representatives, in contrast, were much more sanguine about their business environment and their ability to prosper in it, and they reported making strategic investments in acquiring refineries and upgrading processing to secure their future.

The Downstream Is Not Technology Constrained

From the perspective of industry representatives with whom RAND spoke, the applied technology R&D innovations currently in the pipeline and the pace of innovation are adequate to meet higher performance fuels production requirements and other challenges facing operating companies. The prospects for fundamental innovation in the downstream are limited, given operating companies' incentives to preserve their substantial existing capital base. Most refining industry members, except those in academia, are not concerned that DOE funding for refining R&D has been very low and has recently experienced further decreases, arguing that the private sector can manage the R&D process faster and more effectively on its own. They generally were supportive of a federal role in long-term R&D directed at improving knowledge of fundamental phenomena.

Industry Leaders Envision a Focused Policy Role for DOE

Despite some calls for greater regulation of product imports, most industry discussants said that government involvement in the downstream, however well-intentioned, is highly undesirable. DOE does play a valued information-gathering role: EIA data and analyses were frequently cited by the industry executives with whom RAND spoke. Many discussants explicitly called for the Department of Energy to take a stronger policy role on refining industry and fuels issues. Representatives noted that the federal government's analyses of

policy alternatives or trends in refining that affect the supply of products largely have been conducted by the Environmental Protection Agency as part of its rulemaking and compliance-monitoring functions. The general sense in the industry was that DOE should apply more resources in the policy arena.

Industry representatives were supportive of the Department of Energy conducting or sponsoring scientific and technical research required to inform such policy and regulatory issues as ethanol blending in gasoline, ULSD quality assurance in product distribution and marketing, and diesel cetane content. Industry executives also repeatedly called for the Department of Energy to either conduct or sponsor objective policy analyses to aid decisionmaking issues such as the use of ethanol as a transportation fuel, refined products imports, New Source Review permitting, and energy supply for fuel cells.

POLICY ISSUES OF IMPORTANCE

The National Energy Policy calls for the securing of reliable, affordable, and environmentally sound energy supplies for the nation. In their comments to RAND, refining industry leaders mentioned or implied many policy opportunities and challenges that may affect the health and sustainability of the downstream and its ability to meet the objectives set forth in that document. Refining industry leaders also recommended that DOE assume a more prominent policy role in addressing such opportunities and challenges. In this concluding section, we list top-priority questions that emerged—both explicitly and implicitly—from the RAND discussions. These questions may merit close attention by Department of Energy and other government decisionmakers now and in the coming years.

Near- to Mid-Term Refined Products Supply Balance

- What are the likely intensity, duration, and regional distribution of price spikes should supplies of on-road diesel not match demand in 2006? What measures could government take to avoid disruptions? What actions are available to the government to restore supplies and market confidence in the event of supply and price shocks?
- To what extent are regional/local fuel specifications an efficient solution to local air pollution problems, considering environmental quality, refinery costs, and impacts on competition and market volatility? Are more-efficient options available?
- Does ethanol blending increase national energy security? What are the net economic, environmental, and energy independence benefits of ethanol use?

- What physical barriers constrain product movement in the United States, and the West Coast market in particular? In what ways do public policies related to infrastructure investment influence market liquidity?

Long-Term Refined Products Supply Balance

- Should domestic demand continue to rise over the coming two decades, will U.S. refining or capacity or import capability be sufficient to meet this demand?
- What are the costs and benefits of policy options intended to dampen chronic (i.e., recurring) supply and price volatility in key markets?
- Do more stringent environmental standards governing petroleum product content give domestic refiners an advantage relative to foreign refiners? What are the costs and benefits of harmonizing standards with major trading partners?
- What is the potential mid- to long-term impact on petroleum product demand of evolving consumer preferences, use of alternative fuels, and efforts by automakers to implement advanced vehicle technologies?

Refined Products Imports

- Should the demand for imports grow, will foreign refiners have the processing capacity and capabilities to service the U.S. market with either intermediate or finished products in a reliable and sustained manner?
- What port security, shipping safety, and environmental protection measures will be required to accommodate an increase in product imports?
- What level of imports of refined products represents an appropriate balance between local supply needs and national energy security priorities?
- How do differences in environmental standards between the United States and its trading partners governing petroleum product content and plant emissions influence trade in refined products?

Regulatory Environment

- What alternative regulatory strategies could provide refiners with more operational flexibility without increasing environmental impacts from the production or consumption of petroleum products or generating excessive administrative complexity?

- How are changes in the implementation of New Source Review affecting investments in capacity additions, compliance with new fuels specifications, and net emissions?
- What market-oriented and other regulatory tools can government use more aggressively to give refiners greater incentive to be proactive and innovative in meeting environmental goals?
- Can government establish and enforce performance standards for fuels without dictating the content of the fuels?
- What are the net benefits of longer lead times to plan for new regulations, provide more certainty and stability about regulation, and reduce the costs to refiners?

Research

- What basic or long-range technology research can government support that industry itself is unlikely to fund?
- What is the appropriate role for the refining industry in the federal fuel cell-related initiatives?
- How can the government partner better with the refining industry to foster demonstration of new technologies and practices?