

refining investments are very high, historically this has not been the case. For much of the past ten years, returns on investment in the refining business were in the mid-single digits. Coupled with increasingly stringent environmental restrictions and other legislative obstacles, this represents a significant barrier to major capital investment.

Many other potentially more lucrative upstream investment options exist for oil companies that have historically provided higher returns than refining. Also, many companies are likely to return some of their recent profits to shareholders by increasing dividends, or to buy back stock and retire debt. Furthermore, some observers note that the easiest way for an oil company to gain refining capacity is to buy it. Large amounts of free cash might fuel a round of acquisitions by larger firms. This does not expand domestic supply in the short run, but may result in marginal increases if older, under-performing plants are improved and expanded as a result.

While it is true that no new refineries have been built in the US since 1976, it is only over the past dozen years that refined product demand has outstripped domestic supply. Refiners have expanded capacity by investing in existing facilities, particularly through debottlenecking. These projects require less capital per barrel of throughput added and therefore generate a higher return than new construction. This approach has increased domestic capacity by 2 million bpd since the early 1990s, equal to the output of several new refineries. This pattern will continue in 2006 with several recently announced expansion projects.

Price volatility in the global oil market also stifles investment because of the inherent uncertainty. With domestic refineries running near full capacity, even moderate-sized disruptions can result in price shocks; large disruptions such as the recent Gulf hurricanes result in huge price swings. The important question is how will this impact consumer behaviour in the long term? Unabated growth in demand will support profitable new capital investments in supply, while sustained conservation and reduced demand will likely result in refiners operating existing facilities at high-capacity factors (which generates the highest profits) and suffering periodic price shocks.

Imports of refined fuels will continue to make up the gap between demand and domestic refining capacity, yet there is likely to be increasing competition for these supplies, particularly from China. Internationally, only 500 000bpd of new refining capacity was built over the past seven years. Still, a host of factors such as less stringent environmental regulations, lower cost of labour and easier permitting may make building refineries overseas more attractive than in the US.

While GAS attempts to ease permitting burdens, it is unlikely to tilt the balance in favour of domestic construction. This is especially true in the face of current prices for refined fuels. The higher the price of the fuel, the more economical shipping from overseas becomes, as the shipping cost becomes a smaller percentage of the total price of the product. On the other hand, higher prices also mean higher returns for domestic investment.

This raises yet another potential problem: it can be difficult for overseas refiners to make the specialised fuel formulations required by US environmental regulations. In fact, these regulations were relaxed temporarily in the aftermath of the hurricanes to support the import of enough fuel to meet demand. The GAS bill would address this issue by limiting the number of gasoline and diesel fuel blends in the domestic supply to just six, restricting states' ability to specify their own "boutique" fuels as part of a state implementation plan (SIP). Doing so would not only make domestic refining less complicated (potentially increasing supply) and allow for

more imports, but ease local shortages by facilitating domestic trading of fuel.

Nevertheless, the bill as written leaves open the possibility for a finding that this provision be suspended if found to unacceptably reduce fuel supplies. Furthermore, full implementation would not occur until 2009. The uncertainty and long delay could likely create too much risk to spur substantial increases in either foreign or domestic investment directed at supplying the US market.

Finally, local opposition to building a new refinery is a major challenge that the GAS bill cannot address. Most communities are adamantly opposed to having a refinery in their midst. Even with a new permitting process to address the several required federal approvals, state and local governments often have the power to delay or halt construction of major industrial facilities. To effectively provide incentives to expand refining capacity, policies must address the particular challenges facing refiners. Foremost among these are the long-time horizon and high cost of building new refineries. Short-term policies enacted in response to individual crises such as this year's Gulf hurricanes are unlikely to fully address the complexity of the issue and to provide the consistency that will support a change in the investment climate.

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The refining industry's brief period of stability was interrupted in 2005 with the devastating natural disasters along the US Gulf Coast, the continuing war in Iraq, increasing unrest in Venezuela and Nigeria, and Brazil's impact on Latin American economies. Coupled with several unexpected and highly publicised incidents affecting refined product supply, these events triggered significant fluctuation at all levels of the refining supply chain and severe price spikes worldwide. They also highlight several important issues facing the industry in 2006 and beyond.



Lippin

In the world markets, growing demand will drive large refining capacity increases over the next 20 years. Significant growth will occur in the Middle East, Central and South America, but Eastern Europe and the Asia/Pacific region will see the greatest increase, especially in China and India. Just as the US and Western European markets invested heavily in advanced technology to meet growing demand, these regions and other developing countries will employ similar strategies as demand and market complexity increase.

In North America, hurricanes Katrina and Rita created higher margins for refiners by damaging the Gulf Coast's supply infrastructure and refinery operations. This shortfall makes the current and projected balance between petroleum product supply and demand so tight that small changes can create severe market reactions.

These storms also renewed the call for US refiners to increase capacity. While financial and legal considerations make the construction of new US refineries unlikely, market conditions suggest further consolidation. Utilisation rates at existing plants will remain high — between 92% and 95% — while more efficient processing and capacity expansion will increase the production of higher-value products, such as

gasoline and jet fuel. In addition, regulatory changes, including reduced sulphur content, will require ongoing process and procedure improvements. The events of 2005 marked two interrelated investment paths for refineries in 2006: investments that will increase refinery capacity, and investments that enhance the refinery's ability to deal with abnormal operating situations, ranging from brief power outages to Category 4 hurricanes, to terrorism. Many of the technologies that support these two paths are the same, especially when they enhance the abilities and performance levels of refinery workers.

Safety and security, in particular, are driven by the ability of employees to react swiftly and effectively to changing conditions within the facility. According to the Abnormal Situation Management (ASM) Consortium, 42% of abnormal situations or plant upsets are due to people or their work processes. Capturing and sharing that knowledge of "what do I do if ..." is becoming increasingly important, particularly for US companies, which face an unprecedented departure of long-time employees.

Knowledge management tools that increase safety can also increase profits. Refineries can transform their process operators into profit operators by making available real-time information and knowledge on how their actions affect profitability, moving traditional process operations functions to the field and providing them with tools to avoid abnormal situations. These tools include full simulation, context-sensitive information, improved situation notification, and sequence automation and tracking.

Additional investments should focus on creating layers of safety that protect and enhance refinery operations from the process control network to the perimeter of the plant. Chief among these is the ability to safely shut down a facility in a time of crisis and restart quickly and efficiently as soon as the crisis has passed, as well as the ability to locate personnel in a plant in the event of an incident. A plant's response to an incident hinges on the mechanisms in place to protect the plant and its personnel.

In a related trend, we expect a continued increase in sales of wireless devices that improve data access, allowing employees to optimise operational and business decisions. Wireless is increasingly being used to extend the wired plant control network for two main reasons: cost reduction and technology developments that provide more reliable and secure wireless implementations. Modern wireless networks use mesh networking technology with proprietary protocols and encryption that provide high enough reliability and security levels to encourage many customers to start experimenting with wireless monitoring networks.

What is really needed for wireless applications to become mainstream is the development of a common communication standard and increased progress in the technology to power wireless sensors. The Wireless Industrial Networking Alliance (WINA www.wina.org) is working on standardisation, as well as a newly formed ISA standardisation effort. We expect to see a more consistent standard in two to three years. Battery technology is still improving, but research continues into methods of "self-powering" devices using solar energy or even the energy of the process itself.

The ultimate benefit to the industry is that wireless sensing, according to Honeywell's research, reduces the installation cost of getting a piece of data into the control system by 70%. The additional data that is gathered opens the door to a plethora of new applications, such as advanced control applications and equipment health monitoring applications. Better productivity (higher production and better quality) and greater availability result — necessary elements for success in today's ever-changing market.

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Rosenberg

Over the past two years, oil markets have been characterised by two parameters: rapidly rising crude oil prices, and even more rapidly rising major product prices. While rising global demand was the underlying force driving both increases, slightly different influences on crude oil and products account for the disparity.

Crude oil prices were initially driven by an imbalance of supply and a spiralling demand in developing countries such as China, India and Brazil, as well as an unexpectedly robust demand in the US. The tightness in the market, combined with decreasing spare capacity, widespread geopolitical challenges and general nervousness, resulted in increasing price volatility and high crude oil prices.

This period was also marked with a widening gap between the price of crude oil and products, made even worse by a worldwide refinery capacity shortage, which created more competition for supply. Product demand has increasingly shifted to light products, which have continually been subject to regulations requiring lower and lower sulphur content. This, coupled with a conservative approach to refining investment, has resulted in an imbalance between the types of products demanded, the crude oil