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The Changing Model Of Limited Partners

More limited partners are stepping up to be co-investors.

BY **GREGORY DL MORRIS** | SPECIAL TO HART ENERGY

Just as private-equity (PE) management firms range in size and sophistication, so do the endowments, pension funds and other institutional investors that put their capital to work through the PE firms. The traditional model of a limited partner (LP) writing a check to a general partner (GP) firm and the GP then handling management and direct commitments to operating companies is changing. Increasingly, LPs are stepping up to be co-investors and in a few cases, even co-leads.

Stanford University has an endowment of $23 billion, administered by Stanford Management Co. Of the total assets under management, $1.8 billion is allocated to a natural resources portfolio under managing director Thomas Lurquin.

"The nature of the investment universe today in oil and gas is among the most dynamic in history. The mandate for this portfolio is very flexible, and I consider myself very fortunate," he said. About 80% of the portfolio is in oil and gas. "Over time that number will grow more diversified, but that is where we like it these days."

Stanford has been putting its capital into the upstream sector for more than 20 years and has a reputation among PE managers as a knowledgeable investor. "Our strategy has evolved over that time," said Lurquin. "We are in conventional as well as unconventional, and

we are happy to look across basins, on- and offshore. We have companies in most basins because unit economics are most important for us, not geography. We are agnostic about most things except team and asset quality as well as pricing.

"If those look good, we are always interested in new ideas and are actually willing to take some risks."

Indeed, Lurquin said his group is doing more direct investment. "We primarily invest through general partners, but direct investment has had a role for many years. Of the $1.8 billion in the portfolio, $1.3 billion is through GPs and half a billion is direct. There is a lot of focus on growing the direct portfolio."

This does not put Stanford in competition with its GPs; quite to the contrary, said Lurquin.

HIGHLIGHTS FROM TODAY'S EDITION

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"Direct investment takes its place alongside the investment through funds. We work in close cooperation with our GPs to take advantage of attractive opportunities. We have also gotten behind some IPOs. Those have been a compelling story in the past few years.

"Historically our bias has been upstream. We have found the midstream to be extremely competitive. There are huge opportunities, but they are well-known."

The portfolio also has small positions in oilfield services, midstream and in utilities.

Just as the bulk of the Stanford natural resources portfolio is in oil and gas, the bulk of the oil and gas segment is in private equity.

"We have a small public-equity sleeve and a small credit sleeve," said Lurquin. He explained that having those segments is less a matter of asset allocation or diversification, but more the flexibility to work with GPs to take advantage of opportunities.

"Our GPs give us broad exposure, and direct investing gives us the ability to take advantage of compelling opportunities or to overweight certain assets. We think of direct investments as just-in-time investments or thematic overlays where we can be co-investor with a GP." To be sure, Lurquin and his team are active investors—he has even on occasion brought opportunities to his GPs—but he said that for all their benefits direct investments take a great deal more involvement.

"Some models are moving more to direct investment," said Lurquin. "The furthest along are the Canadian plans, and also the sovereign funds. Among LPs that is a major trend in the last few years. Here at Stanford it started in our natural resource portfolios but now is into other portfolios as well."

That said, Lurquin stressed the importance of the GPs. "As an LP you are outsourcing some of your risk to people who can hold that for you. Managing assets is a very different skill set from finding investments. There are different resources required and different obligations to yourself and to the operating company. Doing some direct investment, we know firsthand what those varying skill sets are, and we appreciate the GPs we work with. It can be a real challenge to move from one to the other. Not every LP can step out to be a direct investor."

Returning to his main theme as both an investor and a fiduciary manager of assets for a major global research university, Lurquin emphasized prudence. "We always have to wonder why we are getting any given opportunity, and how does it fit with our objectives and methods. Every play has a cycle, and we always have to have our skeptical spectacles on. We have to be careful not to try to follow too fast in any new play."

Matching funds and funders

The key, representatives from both LPs and GPs said, is understanding and matching the investor to the opportunity.

"With over 30 years of history, we have a very well diversified group of investors," said Alex Krueger, president of First Reserve Corp. "We have strong funding from state pensions. We are also seeing more investment from overseas, including sovereign wealth funds. We recognize the benefits of matching the investments that we make to some extent with our investor base, so today around half of our investments are overseas. We have companies operating in approximately 50 countries doing about $30 billion in revenue."

As with other managers, Krueger has noted a rise in co-investment by LPs. "Energy investors are very interested in the midstream and the downstream, as well as equipment and services for co-investing and even direct investing," he explained.

"People can understand those businesses. E&P [exploration and production] is more complex and the group of co-investors is smaller; not insignificant, but smaller."

Still, overall Krueger sees more financial sophistication and understanding of risk management on the part of LPs. Beyond co-investors, he noted a select group of investors that are capable of co-sponsoring capital commitments. "There are a few that can partner in deals alongside GPs."

You gotta know the territory

"We believe the LPs who work with us regularly recognize that we are experts at the energy sector," said Greg Beard, senior partner and head of natural resources at Apollo. "They understand that this is a cyclical business and that we manage for value throughout the cycle. We structure our investments to survive the cycle. Our LPs are focused on operating performance, by us and by the operators in which we invest.

"One reason we believe our LPs invest with us is that the oil and gas sector is all about access to capital today. There are many fine boutique firms with knowledge of the industry. We have that knowledge as well but importantly, we also have the ability to invest billions of dollars. To us, that represents a significant advantage."

Having seen a lot of history and made a lot of deals, Peter Leidel, co-founder of Yorktown Partners, is enthusiastic about the options now open to PE firms and the LPs that invest with them. "There are a lot more PE firms and capital structures of different forms in the industry than ever," he said. "For example, some of the operators we have backed have taken capital from other PE investors in the form of working interest in wells or fields."

It is good to have those different forms of capital available at different levels, Leidel stated. "Some investors or managers are happy to be involved at the mid-teens level of returns, where they are not paying for acreage. They add capital at important points." He added that high-yield debt is also an important tool, though one that Yorktown does not use often.

"Our LPs tend to be university endowments and foundations that have a long-term outlook on energy. For them the sector produces solid returns and they want continued exposure as well as steady results," Leidel said. "Generally they have been pleased with the results. We have repeat investors just as we work with management teams on a recurring basis."

READ FULL ARTICLE ONLINE

NGL Prices Remain Static, But Dynamics Changing

BY **FRANK NIETO** | SENIOR EDITOR, MIDSTREAM BUSINESS

Current demand levels for NGL are flat, but market dynamics support price improvements in the near-term. Both ethane cracking and petrochemical capacity are expected to increase shortly as plant turnarounds and expansions are nearing completion.

The average prices for NGL in May were down across the board at both hubs, aside from Conway E-P mix and isobutane, as the shoulder season was especially weak for demand this season due to the facility turnarounds.

Ethane cracking capacity increased to nearly 1.1 million barrels per day (MMbbl/d) and is expected to increase to 1.2 MMbbl/b by July. Limited demand caused ethane to trade in step with gas prices, but once this cracking capacity is added, prices should separate with ethane possibly approaching 50 cents per gallon (/gal) by the fall.

Prices for ethane were static at both hubs the week of May 28 with the Conway price down 2% to 27 cents/gal and the Mont Belvieu price up 1% to 30 cents/gal, its highest in a little over a month. However, margins weakened as gas prices experienced solid gains when cooling demand increased. Mont Belvieu gas prices rose 9% to $4.68 per million Btu (/MMBtu) with Conway prices not far behind at $4.60/MMBtu following a 7% increase.

Propane prices were also nearly identical to the prior week as petrochemical plants are in the midst of turnarounds that are expected to end shortly. Prices have been supported by the market's

CURRENT FRAC SPREAD (CENTS/GAL)

June 9, 2014	Conway	Change from Start of Week	Mont Belvieu	Last Week
Ethane	26.53		29.55	
Shrink	30.50		31.03	
Margin	-3.97	-162.50%	-1.48	-295.89%
Propane	102.32		104.72	
Shrink	42.14		42.87	
Margin	60.18	-4.86%	61.85	-5.24%
Normal Butane	121.00		123.74	
Shrink	47.70		48.53	
Margin	73.30	-2.21%	75.21	-2.59%
Isobutane	173.00		132.40	
Shrink	45.82		46.61	
Margin	127.18	-9.25%	85.79	-0.54%
Pentane+	216.26		219.50	
Shrink	51.01		51.90	
Margin	165.25	-3.02%	167.60	-3.98%
NGL $/Bbl	42.19	-1.19%	41.95	0.05%
Shrink	16.80		17.10	
Margin	25.38	-5.68%	24.85	-5.09%
Gas ($/mmBtu)	4.60	6.48%	4.68	8.58%
Gross Bbl Margin (in cents/gal)	57.42	-5.90%	56.84	-5.25%
NGL Value in $/mmBtu (Basket Value)				
Ethane	1.46	-2.21%	1.63	0.75%
Propane	3.55	-0.50%	3.64	-0.03%
Normal Butane	1.31	1.04%	1.34	1.51%
Isobutane	1.08	-5.56%	0.82	2.49%
Pentane+	2.79	-0.93%	2.83	-1.28%
Total Barrel Value in $/mmbtu	10.19	-1.23%	10.25	0.14%
Margin	5.59	-6.79%	5.57	-6.00%

NGL PRICES

Mont Belvieu	Eth	Pro	Norm	Iso	Pen+	NGL Bbl
May 28 - June 3, '14	29.55	104.72	123.74	132.40	219.50	$41.95
May 21 - 27, '14	29.33	104.75	121.90	129.18	222.35	$41.93
May 14 - 20, '14	28.85	102.54	120.42	124.90	221.10	$41.31
May 7 - 13, '14	28.91	104.22	120.48	124.96	218.50	$41.35
May '14	29.09	104.57	121.69	127.46	220.20	$41.67
April '14	29.66	110.44	125.32	130.16	226.07	$43.11
1st Qtr '14	34.50	129.51	137.62	141.49	212.60	$46.16
4th Qtr '13	26.76	119.81	142.56	145.02	210.66	$44.03
3rd Qtr '13	24.87	102.65	132.06	134.86	215.56	$41.21
2nd Qtr '13	27.12	91.38	124.01	127.46	204.12	$38.82
May 29 - June 4, '13	27.28	90.44	123.50	126.77	200.83	$38.46
Conway, Group 140	**Eth**	**Pro**	**Norm**	**Iso**	**Pen+**	**NGL Bbl**
May 28 - June 3, '14	26.53	102.32	121.00	173.00	216.26	$42.19
May 21 - 27, '14	27.13	102.83	119.75	183.18	218.30	$42.69
May 14 - 20, '14	26.70	99.10	117.30	179.60	216.48	$41.83
May 7 - 13, '14	26.76	102.20	117.30	169.60	214.00	$41.77
May '14	26.85	102.21	118.73	173.37	216.73	$42.15
April '14	26.02	110.13	122.02	170.61	228.14	$43.83
1st Qtr '14	25.46	169.48	132.08	147.10	216.86	$49.93
4th Qtr '13	20.19	122.54	144.49	147.58	205.01	$43.33
3rd Qtr '13	20.80	99.22	129.23	142.77	209.94	$40.07
2nd Qtr '13	20.71	85.37	116.50	123.91	204.86	$36.89
May 29 - June 4, '13	18.06	84.98	115.58	123.72	195.70	$35.73

(Above) Data Provided by Bloomberg. Individual product prices in cents per gallon. NGL barrel in $/42 gallons | Source: Hart Energy

(Left) Price, Shrink of 42-gal NGL barrel based on following: Ethane, 36.5%; Propane, 31.8%; Normal Butane, 11.2%; Isobutane, 6.2%; Pentane+, 14.3%, Fuel, frac, transport costs not included. Conway gas based on NGPL Midcontinent zone, Mont Belvieu based on Houston Ship Channel.

Shrink is defined as Btus that are removed from natural gas through the gathering and processing operation.

NGL PRICES & FRAC SPREAD | Week in Review

willingness to reload inventories ahead of the upcoming winter after stocks were drastically reduced from this past winter's bitterly cold temperatures. The one possible headwind that could impact prices on a short-term basis is the possibility that Enterprise Products Partners LP may be taking its LPG export terminal along the Houston Ship Channel into a quick two-week turnaround at the end of June. It is unlikely that such action would have any sort of long-term impact on propane prices, but more information regarding that may be available next week.

Heavy NGL prices were a mixed bag with Mont Belvieu butane and isobutane prices trending upwards despite a downturn in WTI crude prices. Conway prices followed this crude price downturn with only butane prices experiencing any gains.

Conway isobutane prices fell 6% to $1.73/gal, their lowest price in a month, but are still trading at a hefty 41 cents/gal premium compared to the Mont Belvieu price. We've speculated that this was because of ONEOK's isomerization unit in the region being offline, but demand in the region may also be increasing because of an expansion at BP's Whiting, Ind., refinery, according to En*Vantage. This would explain the longer time that the premium has been in place. Since February, the Conway price of isobutane has consistently outpaced its Mont Belvieu counterpart. However, volatility still remains low at the hub.

The theoretical NGL bbl price was flat at both hubs as the Conway price was down 1% to $42.19/bbl with a 6% decrease in margin to $25.38/bbl. The Mont Belvieu price experienced a very small increase to $41.95/bbl with a 5% drop in margin to $24.85/bbl.

KEY NORTH AMERICAN HUB PRICES

2:30 PM CST / June 5, 2014

Gas Hub Name	Current Price
Carthage,TX	4.54
Katy Hub, TX	4.65
Waha Hub, TX	4.57
Henry Hub, LA	4.64
Perryville, LA	4.56
Houston Ship Channel	4.69
Opal Hub, Wyo.	4.60
Blance Hub, NM	4.57
Cheyenne Hub, Wyo.	4.55
Chicago Hub	4.74
Ellisburg NE Hub	3.23
New York Hub	3.36
AECO , Alberta	4.47

Source: Bloomberg

RESIN PRICES – MARKET UPDATE – JUNE 5, 2014

TOTAL OFFERS: 20,933,744 lbs		SPOT		CONTRACT	
Resin	Total lbs	Low	High	Bid	Offer
HDPE - Inj	4,432,280	0.7	0.78	0.69	0.73
PP Homopolymer - Inj	3,253,244	0.79	0.82	0.74	0.78
HDPE - Blow Mold	3,042,072	0.7	0.78	0.69	0.73
LDPE - Film	2,917,336	0.76	0.81	0.75	0.79
PP Copolymer - Inj	2,248,692	0.81	0.83	0.75	0.79
HMWPE - Film	1,807,772	0.705	0.78	0.72	0.76
LLDPE - Inj	1,587,312	0.765	0.81	0.72	0.76
LDPE - Inj	881,840	0.795	0.81	0.74	0.78
LLDPE - Film	763,196	0.72	0.79	0.71	0.75

Source: Plastics Exchange – www.theplasticsexchange.com

The most profitable NGL to make at both hubs was C_{5+} at $1.65/gal at Conway and $1.68/gal at Mont Belvieu. This was followed, in order, by isobutane at $1.27/gal at Conway and 86 cents/gal at Mont Belvieu; butane at 73 cents/gal at Conway and 75 cents/gal at Mont Belvieu; propane at 60 cents/gal at Conway and 62 cents/gal at Mont Belvieu; and ethane at negative 4 cents/gal at Conway and negative 2 cents/gal at Mont Belvieu.

Natural gas storage levels posted another week of strong injection levels of the season the week of May 30, as the EIA reported that they increased 119 billion cubic feet to 1.499 trillion cubic feet (Tcf) from 1.38 Tcf the previous week. This was 33% below the 2.236 Tcf level reported last year at the same time and 37% below the five-year average of 2.395 Tcf. Injection levels have been greater than the five-year average injections for six consecutive weeks, although it is still touch and go whether storage levels will be able to fully reload in time for winter.

Injections should remain strong the week of June 11 as the National Weather Service is forecasting slightly warmer-than-normal temperatures along the East Coast and the Southwest. However, the rest of the country is expected to experience normal late-spring temperatures.

DUG Permian: Teaching An Old Dog New Tricks

BY **FRANK NIETO** | SENIOR EDITOR, MIDSTREAM BUSINESS

The Permian Basin wasn't garnering as much support in terms of spending for unconventional drilling in the eight years between 2004 and 2011. When the oversupply of natural gas saw a downturn in gas-directed rigs, producers began to focus more on the play. In the past three-plus years the play has since accumulated increased interest from producers and the second-highest spending for unconventional drilling from any play after the Eagle Ford.

Wood Mackenzie anticipates approximately $18 billion to be spent on horizontal drilling and fracturing in the Permian in 2014 with two-thirds of this activity being focused on the Wolfcamp. "The Permian was a little later to the [unconventional] game. It wasn't until producers in the region began to see the returns out of the Bakken and Eagle Ford and decided to utilize the same techniques in the Permian," Shattuck said.

These producers assumed that their learning curve would be higher since they were already operating in the Permian through conventional drilling. Since they were already familiar with the region, they theorized they could achieve some of the same production rates in the Permian that were coming out of the Bakken and Eagle Ford. As it turned out, this assessment has been correct so far. "Being familiar with the Permian has been a key driver of success," he said.

Indeed, Darrel Koo, senior associate, energy research at ITG Inc. stated that the Permian is now one of the "three big oil plays" in the U.S., alongside the Eagle Ford and Bakken with unconventional activity accounting for the bulk of all future production going forward.

In fact, ITG found that the unconventional region in the Permian is similar to the Bakken and that it could reap similar results. "The Midland Basin/Wolfcamp-Cline is similar to the Bakken in that it has ten-times gross thickness in its shale, which means more resources," Koo said. In just three years this region has led to a 50% growth in production due to horizontal drilling with horizontal rigs surpassing vertical rigs for the first time in October 2013.

"Productivity increases with depth," Koo said, which should continue to grow as laterals and proppant have doubled since 2011 and are still evolving. By 2025, ITG forecasts that the horizontal rig count will increase production out of the Midland Basin by 750,000 barrels per day (bbl/d) based on its 5 million acre fairway.

ITG is forecasting up to 1.8 million bbl/d (MMbbl/d) of oil production growth out of the Permian by 2025, with a base case of 2.5 MMbbl/d of oil production out of the entire Permian and a best case scenario of 3.2 MMbbl/d of oil production by 2025. Koo said that the play is currently producing 1.5 MMbbl/d. Not only will production ramp up due to unconventional drilling, it will also be fiscally attractive with solid margins with West Texas Intermediate prices below $80/bbl.

"Each type of oil play across the Lower 48 needs to be evaluated a little bit differently and the Permian Basin is a shining example of that," Ben Shattuck, of Wood Mackenzie, said at Hart Energy's recent DUG Permian Basin conference. (Source: Hart Energy)

These economics help to explain why activity in the Permian continues to trend upwards despite an increasingly bearish oil futures market, Raphael Hudson, director of upstream research at Hart Energy, said.

Hudson agreed with the assessment that the Permian plays well in a lower economical range for oil prices, stating that lower well costs combined with higher EUR can make horizontal production cost-effective in the play with prices between $75 to $80/bbl.

The Delaware Basin has deeper, overpressured formations, which has caused operators to use flowing completions more frequently than in the Midland. "Wells drilled in the Wolfberry were already economical at $70/bbl in 2009, but its horizontal wells were not economical at that price," he said. Improved drilling techniques have helped to reduce these costs and Hudson anticipates the improving its economics going forward.

"Operators continue to report impressive Delaware Wolfcamp IP rates, but from a low base: we expect near-term upside to tilt towards the Bone Spring, as wells are cheaper and development is at a more mature stage," Hudson said. This maturity should result in the Bone Spring achieving average breakevens of about $50/bbl by 2020. Overall, Hart Energy's Upstream Research group expects the Delaware Basin's contribution to Permian unconventional production to increase from 34% in 2013 to 45% in 2020.

EPA Seeks Deep Cut In Power-Plant Emissions

BY **JACK PECKHAM** | HART ENERGY

The U.S. Environmental Protection Agency (EPA) on June 2 released a long-awaited proposed rule that will require U.S. states to slash greenhouse-gas (GHG) emissions from existing power plants 30% (from 2005 baseline) by 2030.

Natural-gas substitution for coal-fired power would be among the most likely methods by which states can achieve the 30% cut in GHG power-plant emissions, the EPA calculates.

However, the EPA isn't dictating any particular method, fuel or technology. Rather, states could choose from a suite of options, among which is the substitution of coal-fired power with natural-gas-fired power.

Carbon capture and storage (CCS) won't be mandated at any existing power plant, but if CCS emerges as a practical option in certain individual cases, then states could order CCS as a compliance method.

Integrated-gasification combined-cycle (IGCC) power plants are especially suited to CCS because IGCC technology creates a pure stream of byproduct CO_2, rather than a dilute stream in flue gas—the latter found in conventional coal- and gas-fired power plants.

"Although some individual [power-plant] facilities may find implementation of CCS to be a viable CO_2-mitigation option in their particular circumstances, the EPA is not proposing and does not expect to finalize CCS as a component of the BSER [Best System of Emission Reduction] for existing EGUs [electric-generating units] in this rulemaking," according to the agency. "Nevertheless, CCS would be available to states and sources as a compliance option."

States also could boost the portion of electricity output from wind, solar, geothermal, tidal or other "green" sources, or possibly nuclear, which doesn't emit CO_2. They also could boost the use of demand-side management, which encourages end-users to cut back on energy use particularly during high-demand periods. And they could join some existing GHG emissions-credit trading programs, such as the one pioneered in California, or create a new one.

The new GHG rules simultaneously are likely to slash emissions of particulate matter, NO_X and SO_X "by more than 25%, the EPA calculates.

"The proposal provides guidelines for states to develop plans to meet state-specific goals to reduce carbon pollution and gives them

the flexibility to design a program that makes the most sense for their unique situation," according to the EPA.

"States can choose the right mix of generation using diverse fuels, energy efficiency and demand-side management to meet the goals and their own needs. It allows them to work alone to develop individual plans or to work together with other states to develop multi-state plans."

State plans for meeting the 30% GHG cut must be submitted to the EPA by June 2016, although the agency will allow some leeway on meeting that deadline.

"To-date, 47 [U.S.] states have utilities that run demand-side energy-efficiency programs, 38 have renewable portfolio standards or goals, and 10 have market-based GHG-emission programs. Together, the agency believes that these programs represent a proven, common-sense approach to cutting carbon pollution—one in which electricity is generated and used as efficiently as possible and which promotes a greater reliance on lower-carbon power sources," according to the agency.

Natural gas conversion

"Natural gas co-firing or conversion at coal-fired steam EGUs offers greater potential CO_2-emission reductions than heat-rate improvements, but at a higher cost—although less than the cost of applying CCS technology," according to the proposed rule.

"Because natural gas contains less carbon than an energy-equivalent quantity of coal, converting a coal-fired steam EGU to burn only natural gas would reduce the unit's CO_2 emissions by approximately 40%. The CO_2 reductions are generally proportional to the amount of gas substituted for coal, so if an EGU continued to burn mostly coal while co-firing natural gas as, for example, 10% of the EGU's total heat input, [then] the CO_2-emission reductions would be approximately 4%.

"The EPA determined that the most significant cost associated with natural gas conversion or co-firing is likely to be the incremental cost of natural gas relative to the cost of coal. Using Energy Information Administration (EIA) fuel-price projections, we estimated that the CO_2 reductions achieved through natural gas conversion or co-firing at an average coal-fired steam EGU would have costs ranging from approximately $83 to $150 per metric ton."

Shale Hydrocarbons Favor Propylene Production

BY **RENE G. GONZALEZ** | SPECIAL TO HART ENERGY

Shale gas production is fortifying the North American petrochemical industry to the extent that previously prohibitive high-capital, "on-purpose" propane-dehydrogenation (PDH) technology is now lucrative.

PDH technology targets the production of one of the petchem industry's most valuable olefins—high-purity polymer-grade propylene (PGP). The profit potential is based on the differential between the relatively high global prices for PGP ($1,396 per metric ton [/mt] in May) and low-cost U.S.-based shale gas ($4.55 per million Btu [/MMBtu] in May)—of which propane feedstock is derived.

In addition to the potential margins realized from these propane-to-PGP differentials, another driver for PDH-technology investments is dwindling refinery naphtha supplies as an ethylene steam-cracking feedstock.

What's more, the hydrogen byproduct from a PDH plant is a valuable consideration, and Enterprise Products Partners LP's 1.654 billion-pound-per-year (Blb/year) PDH complex in Mont Belvieu, Texas, is a perfect example.

By mid-2015, the facility is expected to provide a reliable supply of high-purity hydrogen for surrounding refinery hydrotreaters. The PDH unit—without carbon-capture and storage technology—is expected to cost $1.3 billion, according to a permit request filed by Enterprise Products in December 2012.

Other competitive propylene-producing technologies certainly exist, including propylene production from refinery fluid catalytic-cracking (FCC) units and propylene-byproduct production from ethylene steam-cracking.

But ethylene steam crackers that utilize naphtha feedstock yield significantly higher PGP yields relative to ethane-based steam crackers. That could present a problem, because at least six ethylene steam crackers currently planned for North American would be based primarily on ethane-based feedstocks from shale gas (i.e., from Eagle Ford, Marcellus, etc.)—not naphtha.

In 2005, 30% of feedstock for ethylene steam cracking originated from refinery naphtha and 70% was ethane-based, according to a 2013 ICIS report.

By 2012, just 12% of ethylene steam-cracking feedstock was naphtha-based and 88% originated from shale gas-based ethane. This shift in naphtha-to-ethane feedstock triggered a 40% decrease in U.S. propylene production—from 13 Blb in 2005 to only 7.6 Blb seven years later.

By definition, this propylene production included PGP, chemical-grade propylene and refinery-grade propylene, with PGP being the most valuable form of propylene.

This is where PDH technology—with as many as six units announced to-date in the U.S.—could play a vital role in offsetting the noted 40% decrease in propylene production. The additional propylene volumes can be produced from new or revamped gasoline-centric FCC units, which can be configured for higher propylene yields at the expense of gasoline production.

With that in mind, several petrochemical players are investing heavily in PDH technology.

Dow Chemical Co. recently announced plans for a 750,000 mt/year PDH plant in Freeport, Texas—expected to enter service in 2015—and C3 Petrochemicals, an affiliate of Houston-based polymer and fiber maker Ascend Performance Materials LLC, has requested permits for a new PDH unit at Ascend's site in Chocolate Bayou, Texas. That plant is expected to be operational by late-2015.

Taiwan-based Formosa Plastics Corp. U.S.A. has announced plans for a 600,000 mt/year PDH plant in Point Comfort, Texas, with a potential start-up in 2016, and South Africa's Sasol Ltd. is conducting the feasibility study.

In Canada, the Williams Cos. are planning to build that country's first PDH plant—a 500,000 mt/year plant in Redwater, Alberta—expected to enter service in 2018.

It's also worth noting that shale-based propane fed to a PDH unit isn't the only route to on-purpose propylene production.

Decades ago, the Sinopec Research Institute of Petroleum Processing in Beijing invented a process called Deep Catalytic Cracking (DCC)—utilizing a zeolitic catalyst with gasoil in a conventional refinery FCC unit—to produce more propylene and less gasoline than conventional cracking. Seven DCC plants are currently operating or are under-construction in China, and one facility is located outside China.

In a presentation to the annual meeting of the American Fuel and Petrochemical Manufacturers (AFPM) earlier this year, Technip Stone and Webster's Dilip Dharia noted that on-purpose LPG and propylene production based on FCC process technology and ZSM-5 catalyst additives have resulted from 6 wt% (percentage by weight) to 12 wt% propylene yields.

However, yields as high as 20 wt% are possible with DCC-based FCC technology, Dharia observed.

"The lack of propylene production from the [ethylene] steam cracker associated with shale-gas feed leaves a supply gap, which the FCC unit is perfectly poised to fill," Dharia stated in his presentation.

As the relative margins for propylene versus other FCC products increase, so does the trend for maximum propylene production, he told attendees. Using refinery feeds such as vacuum gasoil, heavy atmospheric or vacuum residual fuel, LPG and propylene yields of 40 wt% and 20 wt%, respectively, are achievable on a "fresh-feed" basis.

The margins potential for propylene is so favorable that both PDH and FCC technologies are widely accepted as viable alternatives to declining propylene production from ethylene steam-cracking operations, and that trend is expected to continue over the next several years.

Best Advice To Execs: 'Act Like You're Interested'

BY **JOSEPH MARKMAN** | ASSOCIATE EDITOR

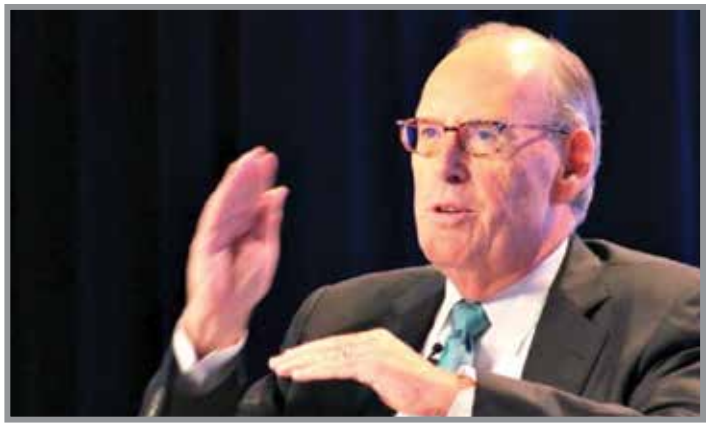
"Get out from behind your desk!" Robert Best beseeched the audience of oil and gas executives at KPMG's recent Global Energy Conference in Houston. "You're not God! CEO is a man-made title!"

The Atmos Energy Corp. chairman was in the middle of providing his outlook for the future of the U.S. natural gas industry when KPMG's John Kunasek gifted him with the proverbial soapbox by shifting the topic to corporate leadership. Best responded by channeling his inner corporate evangelist.

"Act like you're interested in something besides yourself," the expressive Best urged, sharing a 40-year career's worth of wisdom and exasperation with the thoroughly engaged crowd. He described the language at Atmos reflecting that sentiment as "be here now."

"That means, when you come into my office, I pay attention," he said. "I've got time to spend with you."

Best, whose Dallas-based natural gas distributor has 3 million customers, a market capitalization of $5 billion and a stock price that's climbed 23% over the past year, dismissed the notion that senior executives are too busy to connect with employees. "Leaders should have more time than anybody to get out, shake hands, see people. The leaders are doing no work!" he said, a comment that was greeted by a round of chuckles. "They're accountable," he clarified, "but they're not doing the work anymore, and that's another thing that people in leadership have to understand: You're developing people, you're not doing the work."



Robert Best, chairman of Atmos Energy Corp., delivers his point of view at KPMG's Global Energy Conference in Houston. (Source: Hart Energy)

Outlook on gas

Best also shared his insight on a number of gas industry issues, including:

- Acquisitions: "The thing about making acquisitions: You really have to manage for the long term because a lot of times when you make an acquisition, the analysts will say you overpaid. You may have a dilution of earnings for a year or two, so you have to have good continuity of leadership and good board support to do that;"
- Corporate focus: "I think sometimes, we start thinking that we can be other things. We can be a trucking company, we can be a barging company. It didn't work out for [Atmos] as it didn't work out for a lot of companies. I said, 'Let's be the very best we can be at this pipeline, this distribution, this gas marketing;'"
- Other sources: "Coal is on the outs—clean coal is an oxymoron. We were working on coal gasification back in 1976. Fuel cells have always been five years away—for 40 years it's been five years away;" and
- Making the case: "I think we have a strong anti-carbon sentiment in the environment today—anti-energy, anti-carbon. Two states, New York and Vermont, have banned fracking altogether. We haven't been aggressive enough in telling our story. We get knocked back and we don't come out and punch. Our whole way of life in this country is based on energy. We're the fourth-

largest industry in terms of jobs created and we let people tell us there's something wrong with us. What's wrong with us? We've got to do a better job of selling what we are and what we do."

How to succeed in business

But it is the subject of leadership that moves the son of a basketball coach from northern Indiana.

"What (my father) taught me early on was: fundamentals, attention to detail and getting people to understand their roles in being team players," Best said. "And that's hard—everybody wants to shoot the basketball. It really takes leadership to fuse that team."

Best listed his five aspects of leadership culture:

- Quality: "Being good at what you do and trying to be the best you can;"
- The value of collaboration: Best started his career at what he terms "a dysfunctional company. We had leaders who didn't get along and, to be honest, didn't like each other that well. And there wasn't a lot of joy in it. When leaders didn't get along, it affected people down below because they were afraid of being too cooperative;"
- Bosses, good and bad: "One of the toughest guys I ever worked for, I went into his office and I was kind of not sure what to recommend. He threw me out, he turned the air blue and he said, 'Don't you ever come back in here unless you have a point of view.' Another boss micromanaged like crazy. He wouldn't let anything go out without looking at it. And I thought: 'This is not the right way to develop people. You can't learn from mistakes this way;'"
- The team: "The two most important things to having a successful organization are 1) getting the right people on the bus, getting them in the right seat, and getting the wrong people off the bus; and 2) Have leaders who care more about the organization than they do about themselves;" and
- Know when to fold 'em: "I've seen people who hung on too long and they hung on for the wrong reasons: their title, their company plane, the money that they made. And I've seen people ruin companies by doing what they're doing. And I thought, 'If I ever get the chance, I'm going to learn from all this and I'm going to try and do it differently.'"

'Culture trumps strategy'

Best emphasized that few employees are familiar with a company's revenues or profits, but all have clear notions of how they feel about their workplace. It is that feeling that can inspire great customer service.

"Culture trumps strategy," Best said. "I'm not sitting here and saying that if you don't have great culture, then you don't have great strategy or you don't have a vision for your company. You've got to have that. You've got to have a philosophy about how you do things.

"The reason you create a great culture is not so you can make everyone feel good. You want them to feel good, but it's to create high performance," he said. "That's why you want a great culture. If you don't have a leader or leaders who support that type of culture, that will never happen.

"You have to believe in your heart and your mind that employees are the heart of the company. Without a healthy heart, nothing else can be healthy."

CSV Midstream Enters Strategic Partnership With Apollo

CSV Midstream Solutions Corp. entered into a strategic partnership with Apollo Global Management LLC to construct midstream facilities in the Western Canadian Sedimentary Basin. Funds managed by Apollo provided CSV Midstream with $500 million in equity to fund CSV Midstream's business plan.

CSV Midstream will mostly focus on sweet and sour gas processing, liquids handling and fractionation and gas gathering and transmission pipelines.

FERC Approves Pattern Energy's Southern Cross Project

Pattern Energy Group LP received final regulatory approval from the U.S. Federal Energy Regulatory Commission for its Southern Cross power transmission project. The project is a 400-mile high-voltage direct current transmission line that will run from north of Dallas through northern Louisiana into northern Mississippi.

Frame Debate For Lifting Crude Oil Export Ban

In light of indications that the Obama administration is considering changes to current crude oil export restrictions, Chicago-based investment research firm Morningstar Inc. laid out the case for lifting the restrictions in its most recent *Energy Observer*. IHS also released

a separate study on May 29 about the potential impact lifting the ban would have on the economy. Both Morningstar and IHS said the benefits of allowing crude exports justify ending current restrictions.

The main points made in the *Energy Observer* include:

- The export ban prevents U.S. producers from realizing world prices for light crude production and generates windfall profits for refiners—if the ban were lifted, key questions for oil markets are how much crude could be exported from the U.S. and how exports would affect global oil prices;
- The interplay of supply growth from tight oil and demand destruction is responsible for relative price stability during the past three years;
- Even with additional refining capacity, the U.S. refining system cannot process increasing light crude production, which could be available for export with a lifted or eased ban;
- Continuing the ban will drive significant discounts in U.S. oil benchmarks relative to Brent; and
- Without crude exports, U.S. refiners are clear winners, and U.S. exploration and production (E&P) companies are relative losers over the years.

The IHS study, titled *"U.S. Crude Oil Export Decision: Assessing the Impact of the Export Ban and Free Trade on the U.S. Economy,"* found that making U.S. oil available to global markets would increase domestic oil production enough that U.S. net imports of petroleum would decrease. It would lead to an additional $746 billion in investment from 2016-30 and an average of 1.2 million barrels per day (MMbbl/d) more oil production per year. It would also cut gas prices by an annual average of 8 cents per gallon, leading to a savings for motorists of $265 billion from 2016-30. The increase in economic activity would support an average of 394,000 additional U.S. jobs per year.

Other key findings from the study include:

- U.S. oil production would increase, beginning with an additional 949,000 bbl/d in 2016. The ability to export crude would then result in more than 1 MMbbl/d in extra production every year, peaking at 1.3 MMbbl/d in 2030;
- U.S. crude exports would reach 665,000 bbl/d in 2016 and rise to more than 1.5 MMbbl/d in 2020, with exports peaking at more than 1.7 MMbbl/d in 2025 and averaging more than 1.5 MMbbl/d through 2030;
- GDP would rise by almost $73 billion in 2016, increasing to more than $134 billion additional GDP in 2018 and settling at $106 billion in 2020. It would then average an additional $73 billion through 2030;
- Total government revenues would increase by a combined $1.3 trillion from 2016-30; and
- The average disposable income per household would increase by $391 in 2018 as benefits from increased investment, more jobs and lower gas prices are passed along to consumers. That figure is expected to increase an additional $332 in 2020 and another $193 each year through 2030.

With light crude production on track to exceed refining capacity, Morningstar and IHS both said allowing export of crude oil would reduce the negative economic impacts caused by the gridlock.

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