



plant's cryogenic unit. The \$350,000 cost of changing out the turbine would have to be added to the next year's budget. Using Copano's price assumptions and results of a complete cost analysis, B&C generated a four-year cash flow model for each revenue source in the Houston Central assets.

**Favorable Developments.** As a hedge against volatile processing margins, Copano is developing a fee-based business in gas treating, stripping CO<sub>2</sub> from the Lower Wilcox gas prevalent in the area. Duke has been sending excess volumes above the 200 MMCFD

capacity of its Wilcox plant to Copano for processing. Perhaps the biggest boon to Copano's new venture is the new extension of KMTP to a border crossing to Mexico. This will provide an outlet for some lean gas to flow south, opening up space for richer volumes in the line going north to Houston Central. The plant will likely get a further boost from the shutdown of ExxonMobil's Katy plant expected at the end of 2003. With the lowest fuel costs in the region at 1.6% of inlet volumes, Houston Central should become the primary destination plant for undedicated volumes.

## Starting a CO<sub>2</sub> Pipeline Business

**Passively-Managed Systems.** Back in 1985 amid the first great wave of CO<sub>2</sub> flooding for enhanced oil recovery in Permian Basin oilfields, Big 3 Industries installed a 126-mile CO<sub>2</sub> pipeline from Denver City TX down the Texas-New Mexico line to around Jal, then southwest to the Ford Geraldine field near Orla TX. Within a month of this project launch, another company announced the Llano CO<sub>2</sub> pipeline, a short spur from the Tatum terminal on the Cortez CO<sub>2</sub> pipeline to oil fields west of Lovington NM. Only 35 miles in its first phase, Llano was later extended to Conoco's Maljamar field to complete a 59-mile system.

A year later, the acquisition of Big 3 was announced by Air Liquide, Europe's largest industrial gas company. Shortly thereafter, Air Liquide approached Llano's owner and bought their CO<sub>2</sub> system to assemble a critical mass of assets for Permian CO<sub>2</sub> floods. Then for 14 years, the systems stayed in a holding pattern, well run and well maintained but with little effort put into adding to the original base-load customers.

**Trinity Pipeline L.P.** In 2000, a small group of individuals in Midland and Dallas saw the potential in acquiring Air Liquide's orphaned Permian CO<sub>2</sub> business and actively managing it by adding to the service portfolio and bringing in new customers. Directing the effort to implement the business plan was Barry Petty, former head of Arco's Permian Basin CO<sub>2</sub> supply business. With a pretty good idea of the cash flow generated by the business, they figured it could be purchased for about half of replacement cost. That left only one detail to be resolved – where to come up with the millions of dollars for the purchase. The solution was backing from the oil and gas unit of a major energy investment firm.

For Trinity and their investors, it was a natural move to supplement their own financial and technical expertise – many of the team are petroleum engineers and geologists – with expert guidance on an array of issues ranging from CO<sub>2</sub> flood economics to mechanical integrity of the pipeline.

In this instance, the scope of Barnes & Click's work was limited to an examination of the physical facilities and an opinion attesting to their viability for continued service. There's no glamour in an assignment like this, but it is one area where the financial experts have no tools with which to do the evaluation. The B&C team toured many miles of right-of-way and personally inspected every receipt point and delivery point on the system.

It helps that B&C engineers know what to look for in identifying potential trouble spots. An aside in their report notes, "CO<sub>2</sub> leaks are easy to spot because vaporization of the supercritical fluid generates cryogenic temperatures that invariably result in formation of an ice ball, even in the dry air of West Texas." Besides the physical inspection, B&C compared delivery volumes to receipt volumes for each system and detected a consistent difference between the two systems indicative of a metering bias somewhere.

**New Business Home Run.** Trinity completed the acquisition late in 2000. For the first year and a half, the primary concern was sustaining the business by renewing or expanding existing producer contracts and installing a new SCADA control system. But the elephant on the horizon was the launch of CO<sub>2</sub> flood operations at the North Hobbs Unit, which had passed into the hands of Oxy Permian when Occidental bought out Altura in 1999.

When presenting this to the industry, Oxy declared North Hobbs to be the biggest CO<sub>2</sub> flood in 15 years. Bidding among CO<sub>2</sub> transporters was spirited, and Trinity has recently has been chosen to transport CO<sub>2</sub> with a long-term contract. Their competitive advantage was having the West

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**Senior Consultants:**

Charles Collins, *Chairman*  
Jack Whiteside, *President*  
Bill Wilson, *Vice President*  
Richard Denney  
David Freyman  
Jeff Spearman  
Larry Smith  
Randy Miller  
Tom Stelmar, *Senior Analyst*  
Jack Brewster, *Editor*



Texas mainline only 10 miles from North Hobbs Unit. From the start of CO<sub>2</sub> flooding next summer, Trinity expects volumes at North Hobbs to rise from 55 MMCFD at the outset to 110 MMCFD

within a year. At that rate, they'll be moving a total of 170 MMCFD in both systems and rank as the Permian Basin's number three CO<sub>2</sub> transporter after Kinder Morgan Partners and Occidental.

## Barnes & Click's Virtual Gas Plant

**Cure for the Energy Crisis.** It was March 1977, sandwiched between what would turn out to be the two coldest winters of the last 130 years. Interstate pipelines were desperate to lay their hands on every scrap of gas they could find to fill the gap between supply and demand. Deep down in the skunk works of a major interstate, the idea people came up with a tactic to cram more Btus into their overloaded pipeline. They would spike butane into the south end of the line and thereby raise the Btu level of the delivered gas stream.

It was really a pretty bold plan. In a gaseous state, butane contains about 3200 Btus per cu ft, three times the Btu content of pipeline-quality natural gas. They figured that 10,000 barrels/day of butane going in at the head of their huge mainline, running 1.4 BCFD, would raise the Btu content in the whole line from the normal level of 1030 Btu/cu ft to 1060. With only a 0.9% increase in volumetric flow, they could increase total Btu deliveries by 2.9%, a significant boost when we're talking about volumes like this. The butane would raise total daily deliveries from 1442 billion Btu to 1484 billion, and thus represent the equivalent of 40 MMCFD of incremental gas.

**Threat of Liquid Slugs.** In the skunk works, they anticipated a potential problem from the formation of slugs of heavy liquids resulting from the presence of butane in the line. In the normal state of pipeline operations, minute amounts of compressor lube oils and glycol from dehydration operations are entrained and largely vaporized in the flow of methane. Maybe the introduction of butane would shift the equilibrium, in effect giving the heavy contaminants something to "cling" to, and lead to condensation in the line. But they weren't sure of this. So their first question for Barnes & Click was whether or not their hypothesis about liquid condensation was correct.

From his years in gas plant operations, founding partner Brunner Barnes had compiled a valuable data bank of fluid behavior from a host of actual plant tests. From this raw data, Brunner developed a thick notebook of curves establishing equilibrium values (or k-values) where liquid turns to vapor through a range of temperature and pressure combinations. The skunk works had access to k-value curves in the *GPSA Engineering Data Book*, but these were theoretical values based on laboratory results. Brunner's curves, based on actual plant performance, confirmed the hypothesis

that liquid condensation would probably occur in the lines as a result of the presence of butane.

**Elegant Process Solution.** This led to the next question from the skunk works: What do we do to strip out those heavy ends so that the butane can keep flowing in the line and enrich the gas stream? Brunner came up with an incredibly simple, yet elegant, solution to the problem, and turned it over to the firm's newly arrived partners, Charles Collins and Jack Whiteside, to flesh out with detailed engineering calculations. The facility they planned was an oil absorption plant near the delivery end of the pipeline that would receive the full flow from the mainline yet strip out only the unwanted heavy fractions.

The breakthrough was the idea of using butane as the absorption oil (a concept later patented by Ryan and Holmes for CO<sub>2</sub> extraction). It would be the lightest fluid ever used in an oil absorption train. The reason it had never been considered for that function in "normal" gas processing was that too much butane would be lost out the top of the absorber column in the residue gas. But wait . . . wasn't that exactly the result the pipeline was trying to accomplish? Butane "loss" in this process would be a plus rather than a minus. All they wanted to strip out were those very heavy fractions, C6-C16, keeping as much of the butane as possible flowing with the residue gas.

The heavy "rich oil" stream coming out the bottom of the absorber would be mostly butane. This stream would be sent to a distillation column where the butane would be stripped off, leaving all the heavy fractions as a product stream to go to a storage tank. The recovered butane would then be recycled to the absorber column as absorption oil. By adjusting temperatures in the absorber, the operator could regulate the amount of butane going out the top with the gas as well as the amount going out with the bottom product to ensure a stable supply of absorption fluid.

Sad to say, despite the elegant logic of its design, the plant never got built. After 1978, the winters grew decisively warmer and the gas shortage was followed by a multi-year gas glut. But if the gas supply situation should ever reverse itself, Barnes & Click has the perfect gas plant design to enable pipelines to inject large volumes of butane while preventing liquid slugs that would jeopardize pipeline operations.

## The Barnes and Click Family Continues to Grow



Tom Stelmar joined the firm this year as a senior analyst responsible for economic and financial analysis and modeling that are incorporated in major projects and due diligence engagements. After attending University of Texas at Arlington, Tom joined the technical services finance

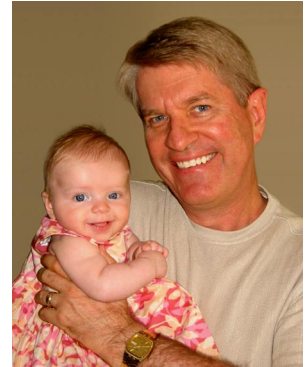
group at Electronic Data Systems in 1988. In this role he was charged with product line expansion, technical costing and pricing, competitive analysis, new business development and sales support.

Seeking an opportunity to broaden his scope of work, Tom entered the consulting business with Muse, Stancil & Co. in 1995. He was now able to apply his analytical and modeling skills to energy projects worldwide involving asset purchases and valuation, market studies, and corporate strategy analysis. As an adjunct to this role, he was given IT responsibility for systems development and administration.

At B&C, a high proportion of due diligence projects involve modeling of anticipated cash flows re-

lated to asset acquisition or financing. B&C can create a model from scratch if the client needs one, or develop special-purpose models that will perform the analysis sought by the client. Sometimes B&C's model is used to verify the internal logic and results of an existing model. Tom's experience will help the firm become even more efficient and bring economies of scale to developing the models used across the spectrum of B&C's work.

The B&C family also grows through means other than new hires. B&C president Jack Whiteside was delighted with the arrival of his first grandchild on May 16. Elizabeth Anne weighed in at 7 lb.11 oz. Jack says, "She is perfect in every way, an absolute delight. I had fun with my kids, but grandchildren are even better."



*Jack and EA (3 months)*

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Contact us at 214.855.0264, fax: 214.855.0455, e-mail: [mail@engineers1.com](mailto:mail@engineers1.com), web site: [www.engineers1.com](http://www.engineers1.com)



**BARNES AND CLICK, INC.**  
*International Energy Consultants*

3320 Oak Grove Avenue, Suite 100  
Dallas, Texas USA 75204-2371