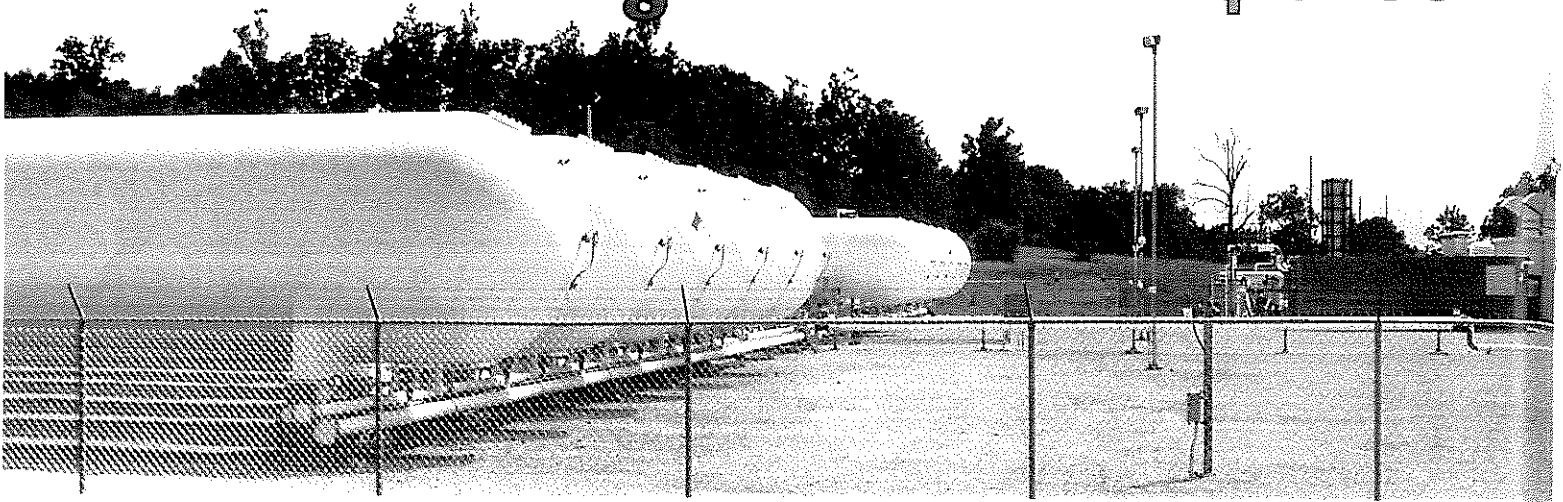


Peak Shaving That Makes \$ense



Wanted: Additional and guaranteed supplies of natural gas for local Missouri utility system at affordable price. Growing local residential and business population equals rising demand and requires more gas.

If City Utilities of Springfield, Mo., had used a classified ad to find a solution to its rapidly growing need for natural gas, this could have been it. Gas utilities, not to mention electrical generating plants and large industrial facilities, across the country have been on the lookout for additional supplies of natural gas. However, guaranteed supplies at rates utilities and other buyers are willing to and can pay are increasingly harder to contract for because of ever-rising gas demand and a national infrastructure of pipelines and gas plants that isn't keeping up with demand.

The monumental effort companies must expend to build new LNG import terminals is just one example. It's not easy. Proposed LNG import terminals are struggling to obtain the necessary approvals because of local opposition. In addition, they are very expensive to build and operate. And, they primarily augment coastal natural gas supplies.

Inland, utilities needing to augment their gas supplies require the cooperation (at an economical price) of gas transmission line operators to bring in more gas to meet not just one, but, now in many regions, two peak demand periods—summer for power generation, and winter for heating. Laying

new transmission lines or extending those in operation isn't cheap, and operators face almost as much scrutiny as LNG terminals.

One solution for local supply and deliverability issues is propane peak shaving, says Gary Eaton of Ely Energy (Tulsa). Propane is blended with air, creating synthetic natural gas (SNG), to supplement natural gas. The process creates a mix of about 45% air and 55% propane before the gas is injected into the gas grid.

Those criteria were defined more than 50 years ago by the American Gas Association's "Bulletin 36," which delineates the composition of SNG, its caloric value, discharge pressure required, and other details. Among the more popular quantitative techniques used to measure the interchangeability of two gases is the Wobbe Index, which can be generally defined as "energy content" of the gas flow. The goal when creating SNG is to match the Wobbe value of the natural gas it is augmenting or replacing as closely as possible. When the matching is done correctly, no adjustment of gas appliances or gas-fueled equipment is required.

In explaining the benefits of peak shaving at the 2007 World LP Gas Forum in Chicago, Eaton pointed out that natural gas interchangeability strategies make sense when the economic investment to provide the SNG is less than obtaining the pipeline capacity to deliver the same amount of natural gas. Additionally, "an SNG

system can be a tangible investment in both long-term security and flexibility of a gas supply."

Eaton said that because of today's highly accurate flow meters, PLCs (programmable logic controller), and precision control valves, a peak shaving plant can provide near-perfect gas quality, more so than ever. Advances in controls technology allows peak shaving operations to be extremely flexible, more user-friendly, and safe—at affordable prices. Modular "plug and play" pre-packaged, wired, and piped systems constructed inside ISO containers are becoming more common worldwide because of the reduced construction costs and commissioning time.

An Economic Decision

For City Utilities, the decision to augment its natural gas supply by adding a propane peak shaving plant made economic sense. The utility had started looking at the economics of a peak shaving plant more than three years ago, with some preliminary studies being done at that time. Then, in the early spring of 2005, City Utilities management decided it was time to proceed with a more definite plan for the plant. Both the utility's board of directors and management realized that their gas system's projected peak day demand would soon surpass its contracted pipeline peak day capacity.

Gary Gibson, who was then City Utilities' gas department manager, and who has since been promoted to direc-

tor of distribution for gas, water, and electricity, was given the go-ahead to proceed. Pat O'Bryant was assigned as the utility's project manager. The earlier studies served as a starting point for a more formal study that was presented to City Utilities' board in the late summer of 2005. After receiving the board's approval, planning began in earnest for the design and construction of the plant.

Early this year, the utility's gas system came close to reaching its projected peak day demand, 125,000 decatherms on a zero degree day. Luckily for the utility, demand has not exceeded this level due to relatively mild recent winters. However, if winter weather should return to levels of those experienced in the past, then the utility expects to reach peak demand. The region's average degree days based on a 30-year average number 3725.

Taking into account that the number of its natural gas customers has grown annually over the past decade, rising to more than 80,000 in the city and surrounding suburbs, and that there is only one natural gas transmission line delivering gas to City Utility—and most of Southwest Missouri—as well as a continuous increase in prices for gas, utility management looked at several ways it could augment its supplies in addition to propane peak shaving.

Among the options was paying much higher costs for additional pipeline capacity. Another was to wait it out for an additional line to bring in more gas, but also probably at a much higher cost, and hope it could meet demand if and when temperatures dropped for any length of time. The cost for just purchasing additional capacity was estimated at an additional \$2.5 million a year. An LNG peak shaving plant was also considered, but the costs were also high.

Or, it could invest in a propane peak shaving plant that would allow its system to continue meeting heavy demand as it did for a short time this past winter, and especially during a protracted period like the winter of 1989. Economically, the propane/air or so-called "SNG" peak shaving plant made the most sense.

To select an SNG system supplier, City Utilities used a bid package designed to measure experience, tech-

nical capabilities, organization depth, etc. Ely Energy was selected to design, manufacture, and install the peak shaving system, and work began in the summer of 2006. O'Bryant said the utility is very pleased with its supplier decision and the work done by Ely Energy, which was recently completed, including capacity testing of the system and the training of the utility employees. The SNG plant went on line in late October 2007. Ely Energy's Jim Buenzow, director of engineering, was the lead design engineer, and Ely's Frank Stoll was the project manager. According to Ely's president Eaton, both did a terrific job.

The \$7.5-million plant was built on vacant land adjacent to City Utility's power plant that the utility had fortuitously purchased several years earlier. The closest residential area to the plant is about a quarter mile away, but due to the topography, the plant is shielded from view for these customers. The next largest concentration of residential areas is nearly a mile away from the plant. Called the Lake Springfield Natural Gas Peaking Station, the plant has twelve 60,000-gal. Trinity storage tanks installed above ground. There is pre-designed accommodation for six more 60,000-gal. tanks if demand continues to grow. Propane can be unloaded at the three truck unloading stations.

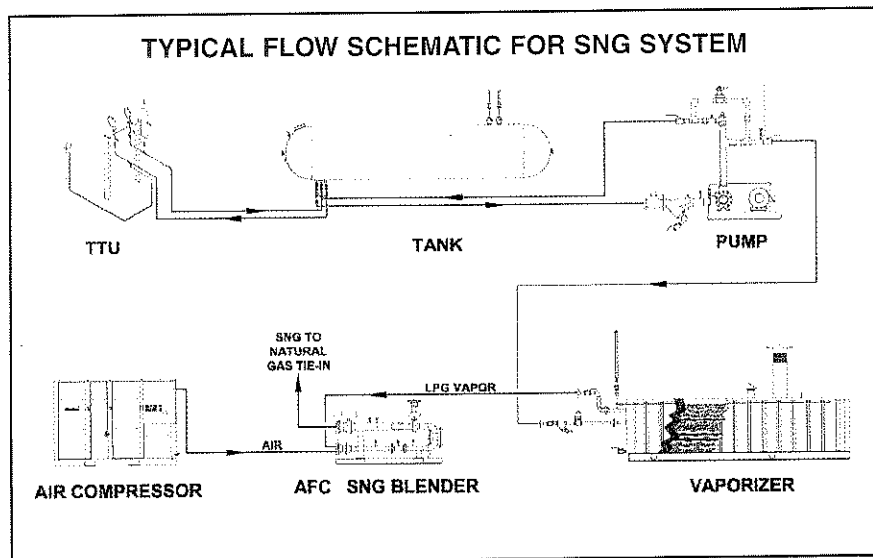
The fuel supplier chosen was Ferrellgas (Liberty, Mo.), and the tanks were filled about three-quarters full by September. More than 50 transports had delivered fuel before press time. Ferrellgas is supplying commercial-

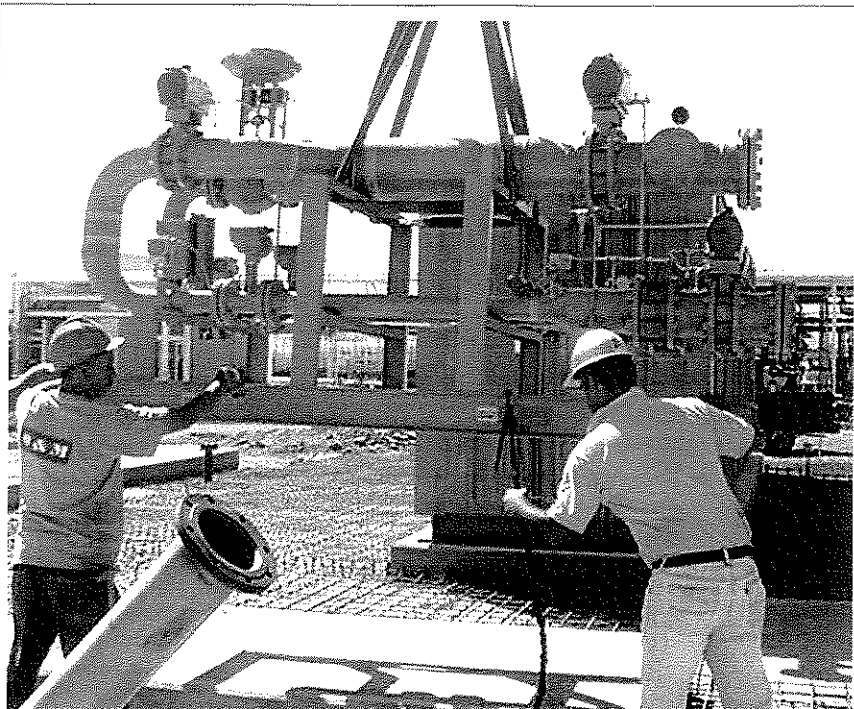
grade propane to the plant from the Mt. Vernon, Mo. Cherokee pipeline terminal, about 30 miles away, off a major highway.

Although City Utility has a rail spur that serves its coal-fired power plant next door, the fuel is being trucked to the peak shaving plant because it also made the most sense financially. While the utility could have added, at a substantial price, a short rail spur and rail-car offloading plant at the facility from the rail line that delivers coal to its power plant, the coal cars keep that line very busy. The scheduling of propane deliveries intermixed with the coal deliveries could be an operational problem. However, the utility hasn't ruled out the possibility if its need for propane increases sufficiently.

City Utility's plant is one of the largest in the U.S. in terms of SNG capacity, says Eaton. Its design load is 1.7 billion Btu/h at 160 psig, and it can deliver 25,000 decatherms a day. Computer systems at the utility's main offices remotely monitor the SNG system. To meet projected demand, the system was designed with two 13,000-gph waterbath vaporizers, a propane/air blender module, flare stack, and four 600-hp air compressors. An integrated control system oversees the fire detection system, including gas and fire detectors, 10 emergency shutdown stations, as well as the cameras that monitor the plant.

The amount of propane storage required for a peak shaving plant is determined based on the projected hourly propane consumption, the logistical ability to replenish the propane,





Fuel Interchangeability Creates Opportunities Worldwide

A clean, reliable fuel supply that meets local demand ranks near the top of most governments' list of necessities, right below food and clean water. However, while local economies can produce their own food and drill for water, it's harder to produce fuel if local resources are lacking.

Synthetic natural gas (SNG), in its various forms, has been a solution to this vexing problem for several decades. The break-up of the former Soviet Union brought not only social and economic upheaval within its borders, but also throughout Central and Eastern Europe. Access to cheap gas, often subsidized, and petroleum products was sharply reduced, forcing countries such as Hungary to make a key decision—continue the subsidies and keep prices low or pass on market prices. Augmenting the local natural gas grid using SNG could be part of the solution for Hungary's gas system when its supplies from the former Soviet Union are curtailed, as they were in January 2006.

In his presentation on SNG peak shaving at the 2007 World LP Gas Forum, Gary Eaton of Ely Energy (Tulsa) explained that local shortages of natural gas present opportunities for fuel interchangeability worldwide. Facing a shortage of natural gas, a number of countries such as Hungary have spent a considerable amount of time studying their options, including the installation of peak shaving plants. While Hungary hasn't taken steps to add SNG systems,

a growing number of SNG plants have been installed elsewhere.

Since the mid-1990s, Chile has purchased essentially all of its natural gas from Argentina, about 70% of Argentina's exports. A substantial amount of its natural gas is used for electrical generation. As Chile's gas imports from Argentina have grown to meet rapidly-rising demand, so too has Argentina's domestic demand for natural gas. This has resulted in a shortfall of imports from Argentina. At one point in the Southern Hemisphere's fall of 2004, Chile's supplies were reduced 14%.

This past winter, Chile again faced trouble meeting demand, when both countries were hit hard by a long, cold spell. Recognizing the potential for shortages, the country's gas distributors not only looked for alternative supplies from nearby countries and LNG imports, but also increased their SNG capacity. Contracts for LPG imports from a variety of suppliers in the Pacific basin were also lined up. A number of gas utilities in Argentina have also added SNG systems, said Eaton, and the interest from other South American countries continues to grow.

Today, Chile's largest city, Santiago, and surrounding suburbs have several SNG systems augmenting the natural gas grid. Their availability was beyond "handy" this year, providing crucial gas during what was a demanding winter. In excess of 30,000 tonnes of propane was supplied as SNG in the metropolitan Santiago area alone this past winter.

and other factors, said Eaton. When an SNG plant is in operation, the propane is transferred via a forwarding pump to a vaporizer, where, as it passes through, it is heated to the vapor phase. The vaporizer also provides super-heat to prevent recondensation. After vaporization, the propane is blended with air supplied from the compressor to the specific ratio, creating the SNG. The mixing occurs in a proportional blending system, which then allows the injection of the SNG into the gas distribution grid as required.

There are two common control methods for peak shaving of natural gas. One is by ratio control; the other is by pressure control. Using ratio control, the utility company selects what percent of the total gas being supplied should be SNG versus natural gas. If the utility peak shaves based on pressure, the SNG that is injected into the grid simply ensures the pressure set-point of the grid is maintained.

In Missouri, the state's Department of Agriculture—Division of Weights and Measures reviewed the plans for the plant and conducted inspections. Whether this agency or another one will have jurisdiction over the plant is currently being reviewed by the state. The Missouri Public Service Commission—Gas Safety Section has authority over natural gas systems, and may be taking over jurisdiction. A representative of the Gas Safety Section was on hand when the plant was inspected by the agriculture department. The local fire jurisdiction and city fire department were also part of the planning and inspection process, which O'Bryant said went fairly well. Planning for, designing, building, and getting the plant up and running went smoothly, for the most part, with little opposition and few requests for major changes.

What's in store for this winter? The three-month forecast for Springfield and Southwestern Missouri is mixed, according to the National Oceanic and Atmospheric Administration. Its forecast as of early October indicated the region has equal chances of having above- or near-normal temperatures during late 2007 and into early 2008. With or without a very cold winter, City Utility says it's ready.

—Ann Rey