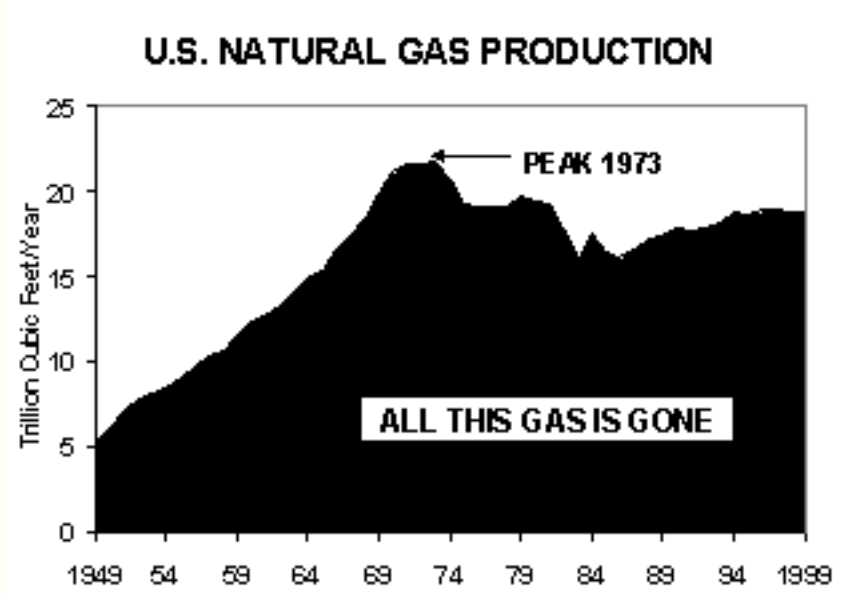
Methane Madness: A Natural Gas Primer

In 2000 the wellhead price of natural gas skyrocketed 400%. This was the sharpest energy price increase the nation had ever seen, outdoing even the oil spikes of the 1970s. The price hikes hit hard, hammering homeowners, business, and industry, contributing to rolling blackouts in California, weighing on the stock market, and unleashing a frenzy of new drilling. It was, one expert wrote, a "train wreck." So what comes next? The stakes are high; 70% of new homes are heated with natural gas, and the nation's electric utilities have wagered $100 billion that it is the "fuel of the new millennium." But what if they are wrong? Was this winter's crisis a passing anomaly, or the tip of an iceberg? This Natural Gas Primer examines the past, present, and future of our most versatile fuel.

SUPERIOR FUEL A transparent vapor, lighter than air, natural gas provides one-fourth the nation's energy. What we call gas is mostly methane, a wonderful molecule, ubiquitous and invisible, a polite servant which does many tasks well. Natural gas can heat your home, dry your clothes, grill your steak, run a car or a power plant. It is critical to agriculture, both as an energy source for food processing and as a key feedstock for fertilizer. About 45% of the nation's gas goes to industry-pulp and paper, cement and asphalt, chemicals, plastics, and petroleum refining. Gas is also the cleanest fossil fuel, producing about half as much carbon dioxide per unit of energy as coal. The nation has 320,000 gas wells. Per capita, we use about a dumpster's worth of gas each day. Each year, 280 million Americans use as much natural gas as 3 billion people in Europe and Asia.

THE PAST AT A GLANCE Gas is the "youngest" of the fossil fuels; its use has risen 1000-fold since 1900. Domestic production was negligible before 1920, rose sharply after World War II, peaked in 1973, dipped during the "gas bubble" of the 1980s, and has flat-lined since. In the past 80 years, we've consumed about 950 trillion cubic feet. By some estimates, almost half the gas that will ever be produced in this country has already been burned. Easy come, easy go. Half gone, half left. Much of the "gone" was cheap and easy to produce. Much of what's left will be relatively more expensive and difficult to extract. The Big Easy is over.



The U.S. consumes 28% of the globe's natural gas. But unlike oil, which we import from 25 nations, 99% of our gas is produced in North America.

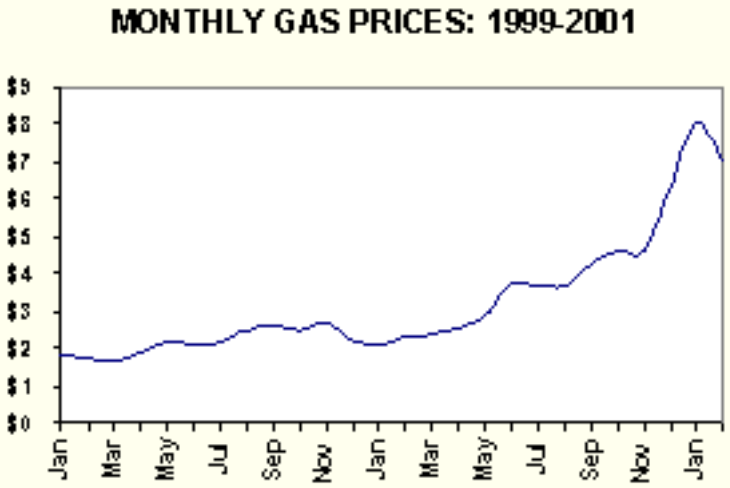
PERILS OF CONVENTIONAL WISDOM The roots of the current energy crisis date back twenty years. The 1979 Oil Shock unleashed a frenzy of petroleum exploration and in the early 1980s, 80,000 wells were spudded each year. As it turned out, we didn't find that much oil, but we did find a lot of gas. A glut was born. Between 1983 and 1996, the real price of gas fell by 46%. Everyone grew complacent. Industry, government, and environmentalists alike proclaimed that gas would be cheap and superabundant far into the future. Whatever your politics, this

was comforting news. Want to run millions of cars with natural gas? No problem. Order 180,000 Megawatts of gas-fired power plants to run the Information Economy? Makes perfect sense. As gas got cheaper and cheaper, frivolous uses joined essential ones. Snowmelt your driveway? Sure, why not? Install radiant tubing under golf course greens? Go for it. Little by little, wishful thinking morphed into conventional wisdom just in time to get blindsided by a perfect storm.

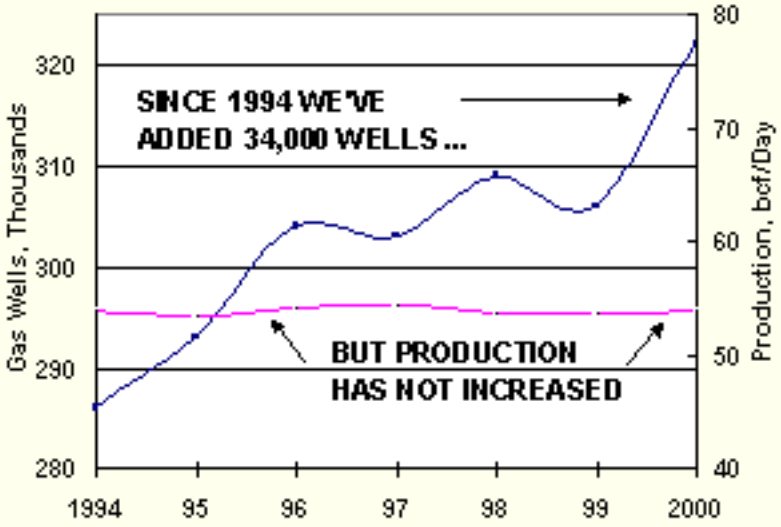
THE PERFECT STORM The metaphor was coined by Matt Simmons, an investment banker to the energy services industry who writes World Oil magazine's annual review of petroleum developments. Last year, as oil prices tripled and natural gas prices quadrupled, he advised the Bush campaign about our energy predicament. "An energy crisis is descending over the world," Simmons wrote. "The situation is grave. The world has not run out of oil and North America has not run out of natural gas. What we are short of is any way to grow our energy supply. North America has no excess natural gas capacity. What we do have is extremely aggressive decline rates, making it harder each year to keep current production from falling. A massive number of gas-fired power plants have been ordered. But the gas to run them is simply not there."

CINDERELLA STORY Gas and oil are both hydrocarbons, and they are often found together in the same reservoir. But in the early years of the Oil Era, gas was considered the ugly stepchild of the petroleum family, a safety hazard with no market value, and drillers cursed when they found it. In many parts of the world gas is still worthless, you literally can't give it away. Here in North America, gas sold for 30¢ per thousand cubic feet as recently as 1974. At that price, a winter's heat for a Denver home would cost thirty bucks. But those days are history.

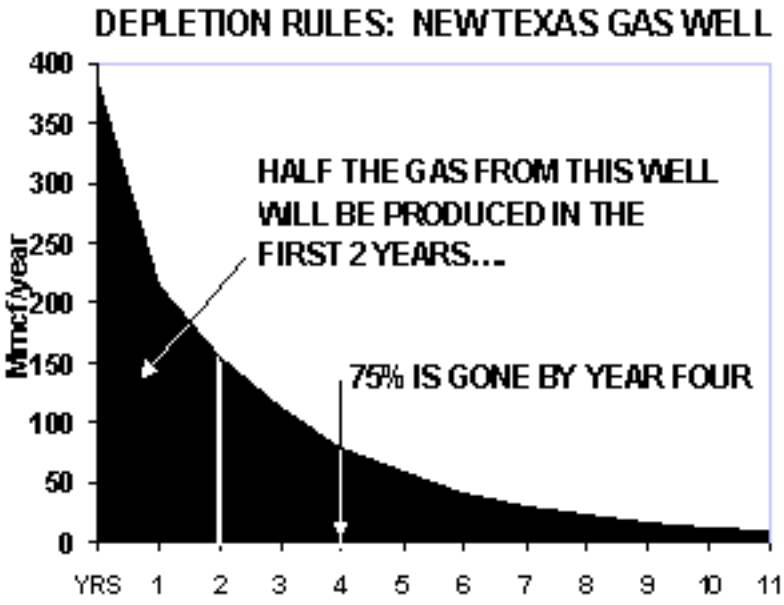
PROFANE BILLS In much of the U.S., the average home consumes its volume in methane each winter month. That much heat used to cost $80; this past winter, the cost nearly doubled. In December 2000, wholesale gas prices briefly touched $10 per thousand cubic-feet. In January 2001, prices averaged $8, and homeowners in Chicago, Boston, and Denver were hammered by $200 utility bills. But the shock to the national billfold didn't end there. Farmland Industries shut down some of its fertilizer plants because using pricey natural gas to make cheap fertilizer didn't make sense. Higher gas prices helped to torpedo California's ill-fated experiment with electricity deregulation, driving its two largest utilities to the brink of bankruptcy. By spring 2001, wellhead gas prices had receded from their dizzying heights, but were still twice what they were twelve months earlier.



DRILLING WITH CHARLIE One reason gas prices have skyrocketed is that there are only 1,350 drilling rigs searching for gas in North America. It takes 10 men to run a rig, they rotate 12-hour shifts night and day, one week on, one week off. Visiting a drilling site is to witness a remarkable display of American guts, ingenuity, and know-how. But, when you've only got 1,350 drill bits trying to meet the energy appetites of 280,000,000 Americans….is it any surprise the roughnecks are falling behind? During the last 15 years, while the rest of American prospered, the petroleum industry got hammered by wild swings in oil prices. More than 600,000 people were laid off, and as a result the oil patch lost a generation. Today the workforce is dominated by men in their fifties and kids in their teens. One driller named Charlie Brister, a thoughtful veteran who's been laid off four times, says this: "We live in the most energy intensive civilization the world has ever known, and yet the average American knows nothing about energy. But things may have to get a lot more critical before the public is ready to hear the truth. You piss everyone off if you try to explain to a typical Republican that 'There's not enough oil in the U.S. for us to be self sufficient' or tell a typical environmentalist that 'Wind and solar cannot meet 100% of our energy needs.'"

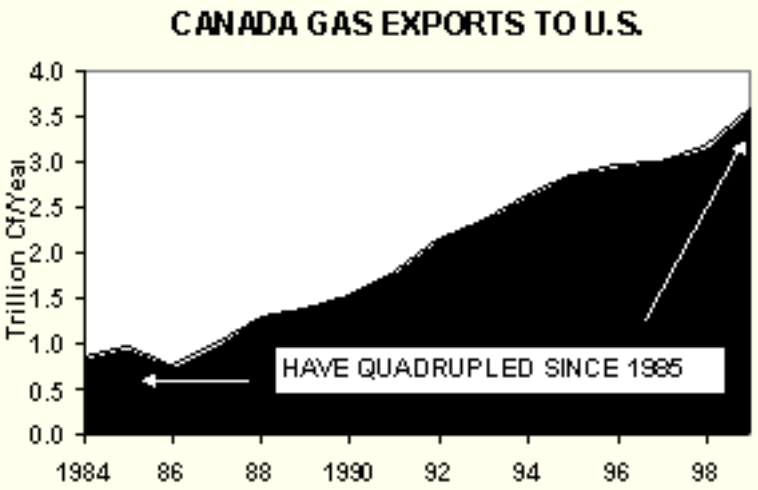


THE DEPLETION TREADMILL In June 1999, a disturbing article was published in Oil & Gas Journal. It described how Texas, which produces one-third of the nation's gas, must drill 6,400 new wells each year to keep its production from plummeting. That's 17 wells each day. As recently as 1998, the state only needed to drill 4,000 wells to keep annual production steady. The reason for the change? As drillers target ever-smaller pools, new wells experience steeper depletion rates. Indeed, a typical new well has an astounding first-year decline of 56%, which is another way of saying it begins dying soon after it is born. No one likes talking about depletion; it is the crazy aunt in the attic, the emperor without clothes, the wolf at the door. But the truth is that drillers in Texas are chained to a treadmill, and they must run faster and faster each year to keep up.



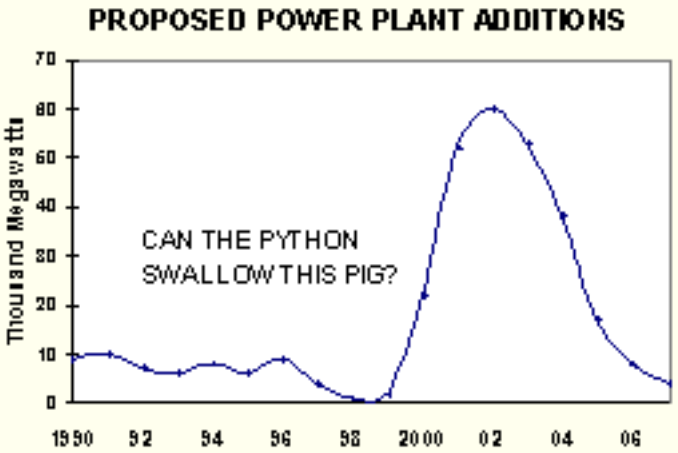
Only China and Canada drill more wells than Texas. But steep decline curves limit Texas' ability to expand gas production.

CANADA TO THE RESCUE? The United States is the world's largest importer of natural gas. But unlike oil, which we buy from 25 nations, 99% of our gas is produced here in North America. Domestic supplies meet 85% of our needs, the other 15% comes from Canada. Most Canadian gas is produced in Alberta, although significant new fields have been found near Nova Scotia. The Canadians have historically been eager to ship methane south, and today half the country's gas is exported to the States. But last winter, as Canadian gas bills doubled, a debate over this practice began. Canada is, after all, a frigid country and some Canadians are beginning to suggest capping the amount of gas sent to the "damn Yankees" so that future generations will have adequate supplies. Gas fields in western Canada are aging like those in Texas, and the Canadians are wrestling their own depletion demons, running their own treadmill. It takes 20 new wells per day, nearly 7,500 per year, to keep Alberta's production from declining.



GAS ON ICE As traditional fields decline, Canadian and U.S. producers are dusting off plans to tap Arctic gas. There's lots of gas on Alaska's North Slope and at the Mackenzie River Delta. But to tap either field will require a feat of civil engineering, snaking 2,000 miles of steel pipe across tundra, permafrost, and muskeg, doable but not quick or cheap. Current estimates are that Arctic gas is at least 6 years and $8 billion away. And no miracle cure, either, since a five-foot pipe could provide only about 5% of our current consumption. Other supply options? The shallow Gulf of Mexico is in steep decline, but the deepwater Gulf is producing increasing amounts. Coalbed methane from Wyoming and Colorado is now meeting 7% of the nation's needs. New England has begun to receive gas from Nova Scotia. The industry wants to drill in areas that are now off-limits, including offshore California, the eastern Gulf of Mexico, and parts of the Rockies. It is also possible to import liquefied natural gas, chilled to minus 260° F, on special tankers. The U.S. now gets about 1% of its gas this way, a percentage that should increase to 3% by 2010.

POWER SURGE The nation's long-standing glut of natural gas and electrical capacity, along with the world's spare oil capacity, vanished simultaneously in spring 2000. Prosperity and the Internet are partly responsible. Fueled by cheap energy, the U.S. economy grew 60% since 1986, an astounding 5% in 2000 alone. Gas consumption grew 36% over that period. But it was the demand for electricity-up 5.4% in 1998, an astounding rate for such a large economy- that

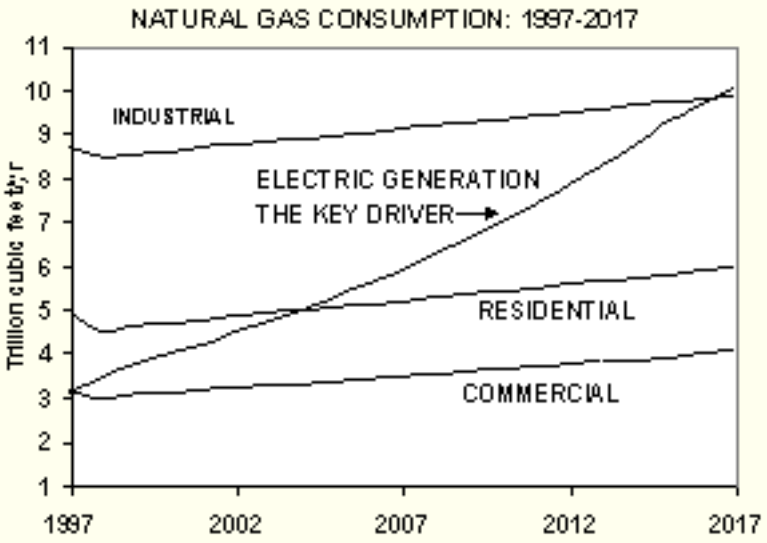


has had the biggest impact on gas prices. To meet our growing electricity needs, utilities have ordered 180,000 Megawatts of gas-fired power plants to be installed by 2005. It was a logical thing to do: gas is the cheapest, cleanest way to convert fossil fuel to electricity. But if ordering one gas turbine makes perfect sense, ordering 1,000 is a recipe for disaster. No one in the utility industry asked the key question: can we produce enough gas to run all those plants? Many experts think the answer is no.

PIPELINES & CAVES During the summer, gas is pumped into underground caverns for use the next winter. This schedule is now being crimped by Sunbelt air conditioners, whose demand for gas-fired electricity is soaring. Gas used to keep us warm; now we ask it to keep us cool, too. Since the storage system was never sized for the A/C load, we've depleted our storage cushion. In March 2001, gas-in-storage reached its lowest level in history. Pipelines are another critical part of the gas puzzle. Without a pipeline, natural gas is worthless, a constraint first recognized by the Chinese. They were drilling for gas in 1000 A.D.-but their pipeline materials were limited to bamboo. American pipelines today could stretch to the Moon. Most date to post-World II, when Gulf Coast supplies were tied to markets in the Midwest and New England. Since pipelines are prone to corrosion, beer keg-sized diagnostic tools called "pigs" are pushed through the lines to search for weak spots, not always in time. In August, 2000, a pipeline exploded in New Mexico, killing 10 people, and crimping gas deliveries to California. Many aging pipelines need to be rebuilt, replaced, or expanded to deliver more gas to urban areas, where the new fleet of gas-fired power plants will be moored. In December 2000, gas delivered to L.A. briefly fetched $69, equivalent to $400 for a barrel of oil.

A WICKED HANGOVER In hindsight, the 1990s were the Big Bonfire, an unprecedented energy binge. As natural gas and gasoline prices shrunk, new houses and cars grew gargantuan. Soccer moms bought SUVs and Americans consumed their body weight in natural gas and oil every five days. Happy Hour is now over, and we are nursing a wicked hangover. The road ahead is strewn with energy potholes and related economic hazards. For decades natural gas has been our most versatile fuel and obedient servant. Versatility is a virtue, but it is also a curse for it allows everyone to make methane plans without "checking the gas tank." According to the Energy Information Administration, by 2005 we may need 20% more natural gas than we use today; by 2015, 50% more. But U.S. production has flat-lined for fifteen years, and Canada is treading water, too. So where's the new gas going to come from?

TRILLION DOLLAR GAMBLE With no debate, and little consideration of the long-range implications, the nation has embarked on a "dash for gas." This chart shows how future gas prices will be driven by skyrocketing demand for gas-fired electricity. To meet the electricity sector's gluttonous appetite-forecast to triple by 2015-we will need to build a pipeline to Alaska, double the number of drilling rigs, and open large swaths of federal land now off-limits to drilling. But even that may not be enough. In truth, the dash for gas may be the ultimate pipe dream, a dangerous delusion, a risky chimera, an ill-considered "vision in search of reality." If it turns out that we can't find sufficient gas to run hundreds of new powerplants, then what? Pick from this list: build new coal or nuclear plants; get serious about renewables, particularly wind power, now cheaper than gas; or invest real money in energy efficiency. Coal is our most abundant fossil fuel, but it also carries the specter of climate change; no nuclear plants have been ordered in 22 years; renewables are increasingly cost-effective but intermittent. Efficiency is a proven winner, but it's not a "free lunch." All solutions require time and capital. During the interim, we may soon hit an "energy ceiling," beyond which consumption can not grow.



HOLD 'EM OR FOLD 'EM President Bush has been dealt a tough hand. Indeed, he has inherited the most severe and complicated energy challenge the nation has ever faced. The average American family will spend more than $3,000 on electricity, oil, and natural gas this year. The economy is going south. Wall Street is struggling. Blackouts threaten to become a way of life, and not solely on the Left Coast. Two-thirds of the nation's oil and almost half the nation's natural gas have been burned. The world is almost out of spare oil production capacity. The President's instincts are to find more energy wherever he can. He wants to play the "ANWR card," drill in the Arctic National Wildlife Refuge, which would have no effect on the nation's energy posture for at least five years. But if events have conspired against Bush, they have also created an historic opening. The former oilman has a tremendous opportunity, perhaps even an obligation, to do what no President has ever done: level with the American people about our energy challenges and, as important, our efficiency opportunities. Just as the fervent anti-communist, Richard Nixon, was the only American politician who dared make peace with Communist China, Bush's background enables him to speak truth to power. This fireside chat is long overdue. "As a former oilman, I'd like to believe that we can drill our way out of the current crisis," the President might say. "But our oil and gas fields are aging, and no one can turn back the clock. Any attempt to solve the nation's energy problems by increasing energy supplies without reducing the growth in energy demand is doomed to failure. Yes, we need to drill more wells and tap new supplies, but we also must become much more productive in our use of energy. Indeed, our prosperity depends on it. Tonight I am proposing an eight point, bipartisan plan to make America the most energy efficient country on Earth…" Farfetched? Perhaps. But even a great nation can deny reality only so long. If Bush doesn't ante up, his successor will.

MORE INFORMATION? This pamphlet is designed to provide a quick introduction to our natural gas predicament. If you need additional information, we've compiled our favorite sources, articles, and web sites in a Natural Gas Resource Summary. View it at www.altenergy.org/core or request a hard copy at core@aspeninfo.com.

THE AUTHORS This Natural Gas Primer is published by the Community Office for Resource Efficiency. It was written by Randy Udall, CORE's Director, with the able assistance of Steve Andrews, a Denver energy analyst. To contact the authors: rudall@aol.com, sbandrews@worldnet.att.net. Or write CORE, Box 9707, Aspen, CO 81612.

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