

January 27, 1991

## Oil's Inconvenient Bonanza

By THOMAS C. HAYES

In almost any industry, a batch of quarterly earnings reports heralding huge profit gains would bring on buoyant appraisals from gleeful executives. But not Big Oil. Despite vigorous profit gains in the fourth quarter announced last week by several oil giants, few industry executives were celebrating.

In releasing 1990 results, leaders of the nation's largest, international oil companies took pains to stress that their stunning profits from the last three months of 1990 were a solitary event, a bonanza from high oil prices that was unlikely to be repeated anytime soon.

Oil prices have indeed dropped since war broke out in the Persian Gulf and an oversupply of crude is expected to depress prices further when the conflict ends, taking oil industry profits with them.

And oil companies say their earnings from the last quarter were dramatic in large part because the corresponding 1989 period against which they are compared was the worst in a decade for the industry. Analysts expect the fourth-quarter operating profits for the 12 largest oil producers to increase by an average of 70 percent over the same period in 1989.

The oil executives' somber tone is intended in part to blunt populist opposition in Congress. Given the public anger over high prices at the gas pump since the Iraqi invasion of Kuwait last August and the anticipated wild increases in oil company earnings, some representatives drafted bills earlier this month

proposing that oil companies be taxed on windfall profits made from the high price of crude.

The breathtaking collapse in crude prices immediately after war flared in the Persian Gulf on Jan. 16 -- prices fell by \$10.56 a barrel the next day -- may help muffle opposition on Capitol Hill for now. The closing price on Friday for the March contract of domestic light, sweet crude, was about \$21.35 per barrel, far below the average crude price of nearly \$30 a barrel in the fourth quarter.

But some longstanding adversaries of Big Oil may not back off so readily. "It is very disturbing to conservationists that the oil companies have profited so greatly by the war and the runup in oil prices," said Sharon Newsome, vice president for resources conservation at the National Wildlife Federation, one environmental group urging the oil companies to put profits into alternative energy sources.

The airline industry, which consumes huge quantities of jet fuel to power its 19,000 flights a day in the United States, is also up in arms and has appealed to Washington for help. It suspects that oil companies kept jet fuel prices high in the last months of the year to recapture profits lost when competition stiffened and demand lapsed in gasoline sales after the initial jump in prices this fall.

While the price of jet fuel was 8 cents a gallon below that of wholesale gasoline when Iraq invaded Kuwait on Aug. 2, it has ranged between 9 and 40 cents per gallon above gasoline since mid-August, according to the Energy Department.

"We have borne far more of the crude-oil price increase," said Edward A. Merlis, vice president of policy and planning at the Air Transport Association, the airlines' trade group in Washington.

Expecting newspaper headlines telling of huge, fourth-quarter profit increases that would soon appear, Kenneth T. Derr, Chevron's chairman, two weeks ago told reporters : "I would hope that we don't end up with a major political problem over a quarter that I would refer to as an anomaly. Today, we are earning at a significantly lower rate than the fourth-quarter average."

The quarterly gains reported by Exxon, Mobil, Texaco, Chevron, Amoco and Shell -- the nation's six largest companies ranked by sales -- were nevertheless dramatic. Net income for the world's largest oil company, Exxon, soared more than threefold, to \$1.56 billion. Mobil's profit rose 45.6 percent. Texaco was up

35 percent, and Amoco, by 68.6 percent. Chevron earned \$633 million, after a loss of \$883 million in the period a year ago, which was caused by write-offs and other charges totaling \$1.2 billion. Shell Oil's earnings jumped by 68.9 percent.

In fact, these quarterly profits might have been much larger. But each of the top five lowered their reported profits with bookkeeping tactics that oil giants often employ legally to pare taxes in periods when profits -- and public resentment -- are on the rise.

The five companies settled legal and tax disputes, wrote down the values of aging or unwanted oilfields, tallied losses from jettisoned refineries and plants and added millions to reserves for cleaning up oilfields and refineries.

But the oil companies point out that the write-offs were even heftier in last year's final quarter, another reason the final 1990 quarter appeared so prosperous. Exxon, for instance, wrote off \$800 million in the last quarter a year ago for costs to clean up the Exxon Valdez oil spill in Alaska. With that expense removed, Exxon's profit in the quarter a year ago was \$1.29 billion, and its percentage gain in the 1990 fourth quarter was 21 percent, not 221 percent.

In the fourth quarter of 1990, all of the majors reported spectacular profit increases in their exploration units because crude prices in the averaged about \$10 a barrel more than in the last three months of 1989. Mobil's profit in its domestic exploration unit rose more than fivefold, to \$68 million, and in its larger foreign unit by 72 percent, to \$505 million. The average global price for its crude was \$27, compared with \$17 in the similar period a year ago.

Because the five companies each refine much more crude oil than they produce, they must buy vast supplies on global crude markets. Exxon, for example, refined an average of 3.3 million barrels of crude a day in the fourth quarter, while producing half as much from its own oilfields, or an average of 1.6 million barrels a day.

Because the price of crude was falling for most of the quarter while retail prices remained steady, profit margins rose for refining operations in most companies. Crude costs moved lower through November and much of December, after rising the previous quarter, and that cut refiners' expenses. Profit margins increased because prices for wholesale and retail gasoline prices drifted lower at

a slower rate than crude prices. Those conditions were ideal for refining units of most big oil companies.

Despite the spectacular final quarter, the profit picture for all of 1990 was mediocre. That is because world oil prices averaged about \$20 a barrel in the first three months of 1990, before slipping below \$16 a barrel in the spring quarter. Analysts estimate that year-to-year gains were in a range of 10 percent to 12 percent. Exxon's net income, excluding the huge Valdez expense, rose 7.6 percent. Mobil's profit rose 6.7 percent and Amoco's, by 19 percent.

And contrary to a survey by Chevron showing that most Americans believe oil is more profitable than most businesses, the oil industry has been a weak sister. The industry earned an average of about \$12.50 on every \$100 of capital invested during the last 20 years, compared with \$13.40 for the average industry. Several industries like software, beverages, pharmaceuticals, hotels, gaming and publishing did much better during the 80's.

The surge in crude prices in the last half of 1990 pushed Chevron and Exxon to a rate of return on equity above 15 percent for every \$100. In Chevron's case, it was the first time since 1981.

But that kind of return may be short-lived. The world is awash with oil, a result of rising output, mainly from Saudi Arabia since the Persian Gulf flare up, and slumping demand for crude. And Saddam Hussein has not appeared able to disrupt supplies: Tankers have moved safely from Saudi loading ports on the Persian Gulf since war erupted, apparently out of the reach of Iraqi forces.

"The world has ample crude inventories now, and it is going to have more," said Richard J. Kruizenga, Exxon's vice president for corporate planning. He said global crude supplies amounted to 150 million barrels, and that the surplus was rising by 500,000 barrels a day. Consumption outside the Soviet Union is 54.1 million barrels a day.

Analysts agree that if it were not for trader fears about Saddam Hussein's potential for havoc on oilfields in the Middle East, crude would be selling for far less than \$20 a barrel. Dillard P. Spriggs, president of Petroleum Analysis Ltd., in New York, said crude prices could easily fall below \$15 if the war ends in a few months.

William L. Randol, an oil analyst at the First Boston Corporation, said oil prices should average a little more than \$20 a barrel in 1991 if war ends before summer -- a prospect that means the industry's quarterly gains would not be nearly as spectacular as for the last quarter of 1990.

"It is impossible to forecast what conditions we may face," Mr. Derr of Chevron said this week.

## THE OPTIONS IN ENERGY PATHS

The prospects of bloodshed in distant oilfields vital to the American economy is certain to intensify the call from Washington for reduced reliance on Middle East oil.

Large oil companies say they want new supplies, too, but will be unable to find them without improvements in profitability, which despite impressions to the contrary, have lagged behind other manufacturers.

A Texaco-sponsored survey showed that the public opposes the use of taxes to finance the search for oil and natural gas in places other than the Middle East, as well as other forms of energy like geothermal, synthetic fuels and methanol, according to a William K. Tell Jr., a company executive. "They want to see the money come from industry investments," he said. "But I don't see how they can expect that if they are critical of the earnings of an industry that is looking at such moderate rates of return."

Many environmentalists fault oil companies for devoting most of their capital budgets to extending their search for oil, preferring that they spend more on renewable energy sources like wind and solar power. "Oil companies have resisted those changes," said Sharon Newsome, of the National Wildlife Federation. "Their alternatives to oil, like oil shale, coal gasification and synfuels, are damaging to the environment and have an enormous impact on global warming."

Yet environmentalists and oil executives have found some common ground in recent years by promoting a cleaner-burning fuel: natural gas. The United States is nearly self-sufficient in natural gas, with known reserves much larger than for oil.

The problem is raising billions of dollars needed to shift a gasoline-reliant economy toward using more natural gas.

Some oil companies have formed partnerships with natural-gas distributors. "If they make a profit doing so, so be it and more power to them," said Jeffrey Seisler of the Natural Gas Vehicle Coalition in Washington. "In terms of national security and energy security, this is a very positive move forward."

Graph: "Oil Companies Benefit From Higher Oil Prices," tracking retail gasoline and crude oil prices, 1989-Jan. 25, 1991; operating income for major oil companies, 1989, 1990 and fourth quarter 1990 (Sources: Company reports, Lundberg Gasoline Report, Platt's Oilgram Price Report)

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## **Technology; Heating, Cooking and Now - Driving**

By JOHN HOLUSHA

As the nation's cities grapple with air pollution from automobile exhaust, natural gas - best known for heating homes and cooking dinners - is drawing increasing attention as a clean-burning alternative to gasoline and diesel fuel. The General Motors Corporation said last week it would sell a minimum of 1,000 pickup trucks powered by natural gas starting next year, and United Parcel Service said recently it would adapt up to half its 100,000 delivery trucks to operate on compressed gas.

For all the promise of natural gas to reduce noxious emissions, however, there are problems to overcome before many motorists will pull up to a natural gas pump and say, "Fill it up." Vehicles will have to be adapted to accommodate the heavy tanks needed to contain the pressurized gas, engines must be modified to prevent problems with burned valves and a nationwide network of refueling stations must be established.

And, as engineers are fond of pointing out, no fuel is perfect. Because it is a gas at all but very low temperatures, natural gas packs a lot less power than comparable amounts of liquid fuels. Gasoline, for example, has an energy density of about 114,000 British thermal units per gallon, compared with just

under 20,000 for a gallon of natural gas stored at a pressure of 2,400 pounds per square inch.

That means more fuel is needed to travel the same distance between refills. On some trucks the space is available for additional tanks, but there are few inches to spare on compact and subcompact cars, so operating range can be a serious problem. One way around it is to have dual-fuel capacity. If the natural gas runs out, a driver can switch back to gasoline or diesel. Indeed, virtually all the estimated 30,000 vehicles adapted to use natural gas in this country - cars, trucks and delivery vans - have dual-fuel capacity.

This means, however, that the gas is being used in an engine designed to produce peak performance using gasoline - most commonly unleaded regular with an octane rating of 89. Natural gas has an octane rating of 120, but this property has little value in a low-compression engine. Instead, as the low energy density gas displaces some of the air entering the cylinder, the engine's power declines by up to 20 percent. U.P.S. officials acknowledge there is a performance drop with natural gas, but say it is not a problem. "We do not operate at high speeds," said Don Parkinson, an automotive engineering manager. "The loss is not noticeable in the urban environments we operate in."

Natural gas is composed largely of methane, the simplest of the hydrocarbons. As such it is free of the toxic components of gasoline, like benzene. And since it is stored under high pressure in a sealed system, there are none of the problems of evaporation common to gasoline-powered vehicles in refueling and operation.

Unburned hydrocarbons, lost to the atmosphere through evaporation, are considered among the important contributors to the formation of low-level ozone in urban air.

Inside a car engine, natural gas burns more cleanly than gasoline, emitting fewer hydrocarbons and carbon monoxide. And because it has a higher hydrogen-carbon ratio than more complex hydrocarbons, natural gas emits less carbon dioxide, which is believed to increase global warming.

Because emissions regulations are being tightened at Federal and state levels and because restrictions on travel are being considered in such highly polluted areas as the Los Angeles basin, natural gas engines are being developed for trucks heavier than 8,500 pounds, as well as for light-duty vehicles like the U.P.S. vans

and automobiles. New buses bought by municipalities will have to meet the standards next year; big trucks that travel between cities, by 1994.

Not only is there less energy in a given amount of natural gas, but it burns differently. "The flame speed is slower with methane than gasoline," said David Hilder, an engineer at the General Motors Research Laboratories in Warren, Mich. "So that means you should advance the spark timing a few degrees." If you don't, he said, the engine will not deliver as much power at full throttle."

But many of the compromises inherent in gasoline engines converted to use natural gas can be avoided if they are designed to optimize the alternate fuel. And those dedicated engines seem to be on the way. An official of PAS Inc., which will modify the 1,000 G.M. trucks, said they will have modified valves and piston rings. Later versions may have altered compression ratios and combustion chambers as engineers gain experience with the fuel, he said.

Big diesel engines may undergo even more change. Faced with stiff new emissions limits for heavy trucks in 1994, most heavy-duty engine companies are working on adapting diesels to alternate fuels.

Engineers say one important change for a gasoline engine would be to take advantage of natural gas's high octane by increasing the compression ratio, or the amount the fuel-air mixture is squeezed by the rising piston. Typical gasoline engines have ratios of between 8.5 to 1 and 9 to 1. With natural gas, that could be increased to 12 or 13 to 1, thus increasing the density of the charge and restoring the lost power.

"You can get most of the power back by increasing the compression," Mr. Hilder said. "Or you can keep the old ratio and use a turbocharger," which increases the amount of air crammed into a cylinder. But too aggressive an approach can cause pollution problems, warns Kelly M. Brown, an engineer with the Ford Motor Company. Regardless of the fuel used, most of the content of the cylinder is air, which is about 20 percent oxygen and 80 percent nitrogen.

At normal temperatures, the oxygen and nitrogen do not interact. But in an engine, they can combine to form various oxides of nitrogen, which are pollutants whose emissions are subject to government regulations. "Natural gas is low on hydrocarbons and carbon monoxide, but it is not necessarily as good on oxides of nitrogen," Mr. Brown said.

In a recent report on the effects of light vehicles powered by natural gas, the Environmental Protection Agency said that keeping oxides of nitrogen emissions down "will be the most difficult technical area and is clearly one in which more research, development and demonstration is necessary."

Mr. Brown said new catalysts will have to be developed to break down these oxides in the oxygen-rich environment natural gas engines will most likely operate. Current catalysts have been developed for a mixture that has just the right amount of the reactants.

Another problem with engines running on natural gas is burned valves. Some Ford Rangers designed to use natural gas had specially hardened valve seats because a totally gaseous fuel does not have the lubrication properties of a liquid. Even so, some pitting and scarring was evident when the engines were torn down after use.

In heavy-duty engines, the modifications needed to operate on natural gas are so extensive that it will be hard to refer to them as diesels. Diesel engines operate by compressing the air-fuel charge until it becomes hot enough to self-ignite. This requires compression ratios on the order of 19 to 1. Even with its good anti-knock properties, gas would probably ignite prematurely with this much compression, so ratios in gas-powered engines will probably not be above 15 to 1, according to the E.P.A.

But it is also difficult to make natural gas auto-ignite predictably, the way diesel fuel will. So engines powered by natural gas will probably need a spark ignition system, like an automobile.

"Some people call them 'giesels,' " said Jeffrey Seisler, director of the Natural Gas Vehicle Association. "Steady state diesel engines have been running on natural gas for years." Steady-state engines power equipment that runs at one speed.

Manufacturers of heavy duty engines are preparing natural gas modification kits for existing diesel engines to help them meet upcoming pollution standards intended to eliminate their characteristic black smoke. New engines are also being developed exclusively for natural gas use.

On larger vehicles, the storage requirement for natural gas are likely to be less of a burden than with automobiles. "Heavy duty vehicles generally have sufficient

space available" to store gas cylinders, an E.P.A. report notes, and "are not greatly affected by the added weight of the fuel cylinders."

Diagram: The diaphragm-operated Air-Gas Mixer: The fuel-air mixer is a central component in engines using compressed natural gas, serving the same function as a carburetor or fuel injectors on conventional engines by metering the fuel into the air at the proper ratio. A typical mixer, above, is mechanical in nature and injects the fuel in proportion to changes in the amount of air coming in.

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## **COMPANY NEWS; G.M. to Sell Trucks Fueled by Natural Gas**

By THOMAS C. HAYES, Special to The New York Times

The General Motors Corporation today entered the market for vehicles powered by cleaner-burning compressed natural gas.

The company said it would build, issue warranties and sell at least 1,000 of its GMC Sierra pickup trucks next year with V-8 engines modified to run on natural gas.

Congress is expected to mandate that commercial and public operators of truck, bus and auto fleets begin converting to vehicles powered by alternative fuels like compressed natural gas, methanol and ethanol as early as 1994. The final version of the Clean Air Act is expected to be completed before the November election.

William G. Rosenberg, assistant administrator for the air and radiation section of the Environmental Protection Agency, applauded the decision by General Motors but said it was not a surprise. He noted that United Parcel Service said earlier this month that it would convert 2,700 of its gasoline-powered trucks in Southern California to compressed natural gas by 1995.

Richard A. Pennell, a truck manufacturing executive for G.M.'s GMC division, said the vehicles would be made at a GMC truck plant in Pontiac, Mich., and would have a range of approximately 200 miles between refuelings.

G.M. will subcontract work to replace gasoline-burning engines on the selected 1991 models and will conduct its own tests to certify and issue warranties for the new models. He declined to say whether G.M. would charge more for the compressed natural gas models. Current models of the Sierra pickup are priced at \$14,000.

A group of nine natural-gas utilities in California, Texas and Colorado will contribute \$935,000 to G.M. to cover most of the auto maker's warranty costs. Many of the utilities have committed to buying the trucks.

"This is the biggest commitment by any auto manufacturer so far," said Jeffrey M. Seisler, executive director of the Natural Gas Vehicle Coalition, a lobbying group in Washington.

There are currently 30,000 vehicles operating on compressed natural gas in the United States, and 600,000 in the world, Mr. Seisler said.

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## **Restricting Oil Use, Texas Expects Gas Sales to Rise**

By THOMAS C. HAYES, Special to The New York Times

In this state where oil money has long been politically powerful, lawmakers have approved what would seem to be a remarkable move for Texas: a stiff tax on burning fuel oil at industrial plants.

But energy industry executives either raised few objections to the tax and other restrictions on oil use or publicly embraced the measures, which would encourage broader use of natural gas as a way to clean the state's air. And

environmentalists, who also supported the measures, praised natural gas as a safer, cleaner fuel.

This unlikely coalition was born mainly because a fifth of the nation's known supplies of natural gas are in Texas. Many energy companies in the state have been unable to replace oil reserves with new discoveries, but they retain fields still rich in natural gas. So, they are looking for ways to increase natural gas sales.

"We see this as another way to move our gas to other markets," said Michael B. Barrett, president of the Natural Gas Company of Texas, a pipeline company in Midland. "We in Texas have the gas available. And we have enough people in the gas business who can supply it to end users."

The nation burned 17.5 trillion cubic feet of natural gas in 1987, the Energy Department said, extending a downward trend that began in 1973, when demand was 22 trillion cubic feet. Prices have been depressed for several years.

Texas has 20 percent of the 1,188 trillion cubic feet of proven natural-gas reserves in United States, including Alaska, the Energy Department said. Garry Mauro, the Texas Land Commissioner, estimated that if all states adopted laws as strict as those pending in Texas, the nation would still have more than a 50-year supply of natural gas. Texas Is a Model

When President Bush on Monday called for an alliance of industry and clean-air advocates, Texas was a model for the approach he had in mind, a White House official said.

Environmental groups said the two bills adopted by the Texas Legislature last month would give Texas the broadest restrictions on petroleum products in any state excepted for California. In March, officials in the Los Angeles area announced drastic steps to reduce oil use sharply.

The Texas bills are expected to reduce the use of diesel fuel, gasoline and other crude oil products in industry and in fleets of vehicles operated by companies and public agencies, including metropolitan bus systems.

State and local lawmakers in Oregon, Colorado, Nebraska, New Mexico, Arizona, Louisiana and Oklahoma have also passed or are debating tougher restrictions on oil use. Texas Is a Leader

"Texas is one of the leading contenders for promoting alternative fuels, and with good reason," said Jeffrey Seisler, executive director of the Natural Gas Vehicle Coalition in Washington. "The laws have an economic development aspect as well as a clean-air benefit."

Natural gas is considered cleaner than gasoline because it cuts carbon monoxide emissions by 50 percent.

One bill in Texas would require greater portions of state and transit fleets to use natural gas or other fuels, like methanol or ethanol, until a minimum of 90 percent of the fleets are burning the cleaner fuels in 1998.

If, as expected, the cutbacks in diesel fuel and gasoline trim air pollution, the Texas Air Quality Board can order additional conversions in 1996 of 650,000 cars, trucks and buses by 2006, at a cost in current dollars of \$2.3 billion.

The Texas law goes beyond existing standards of the Environmental Protection Agency. It also covers city transportation departments and private fleets or more than 25 vehicles, like those owned by large newspapers and utility companies.

Tax on Fuel Oil Use

The other bill would tax the use of fuel oil in utility and industry boilers between April 15 and Oct. 15, the peak period for ozone pollution, in the 21 counties that do not meet Federal air quality guidelines.

Gov. Bill Clements is expected to sign the bills into law later this week.

In the Los Angeles area, air-quality officials require that cars be converted to electric power or "clean" fuels by 2007. Other rules, beginning as early as this year, include bans on starter fluids for barbecues and gasoline-powered lawnmowers.

Air pollution in Texas is among the worst of any state, the E.P.A. said. Refineries, industrial plants and automobiles have dirtied the skies of its big population centers - El Paso, Houston, Dallas-Fort Worth and the Gulf Coast region from Beaumont to Orange - and their air quality falls below minimum E.P.A. standards. The American Lung Association estimates that air pollution poses health problems for eight million people in those areas, especially young children and older people. Search for New Markets

Energy experts say natural gas reserves in the United States are now more abundant and more easily accessible than crude oil reserves. Crude oil production fell to 1.9 million barrels a day last year from a peak of 3.5 million in 1972. Active drilling in the state is at the lowest level in nearly 50 years.

The search for new markets for natural gas led Mr. Mauro, the Land Commissioner, into a political bond with environmentalists and energy executives to force solutions to Texas's air-quality problems.

Economists at Southern Methodist University concluded in a study for Mr. Mauro that a sustained rise in natural-gas consumption of one trillion cubic feet nationwide would add 50,000 to 100,000 jobs in Texas over five years.

"We were in one of those unique positions where we were the right solution to the right problem with the right price tag on it," Mr. Mauro said. 'Very Important Showpiece'

Officials of some environmental groups who pushed for the changes said the biggest effect of the Texas laws should be to encourage car owners and businesses during the 1990's to demand engines and vehicles burning compressed natural gas, methanol or other "clean" fuels for their own use.

"A lot is going to depend on the implementation of the laws," said Ken Kramer, the director of the Sierra Club in Texas. "But it's potentially very significant. If we see a great deal of benefit in emissions cutbacks and money savings, then it could be a very important showpiece. Companies and individuals might begin thinking seriously about conversion."

Environmental groups and Texas energy companies still disagree on many issues. "But I think we've got a lot more in common," said John E. Watson, a senior vice president of the Mitchell Energy and Development Corporation. "This is the first time I've ever seen a piece of legislation that we were all supporting. It's probably a first in the energy field." Cost Advantage of Natural Gas

The cost advantage for vehicles using compressed natural gas is significant at current prices. Compressed natural gas costs about 60 cents a gallon, compared with \$1.10 for diesel fuel and gasoline.

The Dallas suburb of Garland converted a small part of its school bus fleet to natural gas in 1982, when gasoline prices were above \$1.20 a gallon. Last year, 80 of its 150 school buses were powered by compressed natural gas.

"It's the way to go," said Robert Sewell, assistant superintendent of public schools in Garland.

He said Garland schools saved more than \$100,000 in fuel costs in the school year just ended. Several thousand dollars more were saved because of lower maintenance and refueling costs.

Under Garland's maintenance schedule, natural-gas engines get new spark plugs every 40,000 to 50,000 miles, compared with 15,000 for gasoline engines. Oil is changed every 10,000 to 12,000 miles, against every 5,000 miles for gasoline engines. A Market for Engines

The main companies manufacturing or testing natural-gas-powered engines for new cars, trucks and buses are the Cummins Engine Company, of Columbus, Ind., and the Detroit Diesel Corporation, of Detroit. Stewart & Stephenson Services Inc., of Houston, has started selling equipment to convert diesel engines.

David F. Merrion, senior vice president for engineering at Detroit Diesel, said the Texas approach "does create a market" for natural-gas engines. Detroit Diesel is the largest producer of diesel engines used in the nation's public bus systems.

C. Jim Stewart 3d, marketing vice president at Stewart & Stephenson, said Federal emission standards and engine conversion laws like those proposed in Texas "are pushing us rapidly toward the limits of technology."

"We're all for it and we take it very seriously," he said. "The company that is smart enough to be on top of the alternate-fuel technology won't miss a beat."

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May 31, 1989

# No Headline

By JOHN HOLUSHA, Special to The New York Times

Doug Williams pulled into a Shell station in this Vancouver suburb on a recent Friday evening to fill his 1973 Ford LTD for the weekend. But instead of using a gasoline pump, he opened the hood and attached what looked like an air hose to a fitting in the engine compartment.

Like thousands of other residents of the area, Mr. Williams powers his car with compressed natural gas, a fuel normally associated with home heating and cooking. Attracted by a price half that of gasoline, he is participating in a project intended to demonstrate that natural gas is an economical, convenient and safe alternative to conventional automotive fuels.

The experiment, the largest of its kind in North America, is taking place at a time when rising concerns about air pollution, the greenhouse effect and increased dependence on oil imports in the United States are renewing interest in alternative fuels like natural gas, ethanol and methanol. While the United States Government has limited its support to small demonstration projects, Canada's Government has provided financial incentives for relatively large efforts like this one. The Need for Incentives

The experiment here, which has been growing in scope since it began in the early 1980's, demonstrates that any alternative fuel will need time, financial incentives and imaginative marketing to win acceptance. But it also indicates that some drivers will indeed alter their habits. About half the 8,000 natural gas-powered vehicles here are privately owned cars. The rest are fleet vehicles, taxis and delivery trucks.

Soon, drivers will even be able to refuel at home.

Mr. Williams said he was generally pleased with the conversion of his car, which can now use natural gas or gasoline. "I was only getting 12 or 13 miles a gallon in the city on gasoline, so I liked the savings from the half price," he said. The car starts easily in the cold because the fuel is already gasified, he added, and needs less maintenance because the fuel is clean.

But the capacity of the two natural gas tanks in the trunk has not been adequate for his large car. "I have to fill it up every three or four days," he said. "I wish they had put in a third tank."

A shorter driving range is the most common complaint about natural gas conversions, according to the United States Energy Department. The Supply of Natural Gas

Like Canada, the United States has vast reserves of natural gas that could be substituted for fuels made from imported oil. "We have 163 trillion cubic feet of proven reserves; that is a 10-year supply," said Michael Waters, a spokesman for the Natural Gas Supply Association, a group of producers. "And there are estimates that there are another 900 to 1,000 trillion cubic feet unproven in the ground. We can go a long way on natural gas."

Because the infrastructure for distributing gasoline and diesel fuel is so well established, even advocates of alternative fuels doubt that they will gain adherents on a lower price alone. But a national energy policy to limit oil imports and exhaust emissions could increase pressure on motorists to switch.

Because natural gas is composed mostly of methane, a simple hydrocarbon, vehicles powered by natural gas emit less of certain pollutants than those burning gasoline or diesel fuel. Industry officials say natural gas vehicles can meet emission standards without the catalytic converters needed on gasoline-powered vehicles.

But natural gas needs a lift. "Government support is critical in establishing any alternative fuel," said Jeffrey Seisler, executive director of the Natural Gas Vehicle Coalition, a group of companies interested in promoting the use of natural gas-powered vehicles. "It is always more expensive to launch something new. But government can make a difference in the economic pull toward clean fuels and the environmental push."

### The Use of Subsidies

Federal and provincial subsidies have been heavily used to promote natural gas as a motor fuel here, along with aggressive marketing by the local utility, BC Gas Inc. "The Government wanted to promote energy independence and we wanted to sell gas," said J. R. Higginson, manager of the company's motor fuel program. "We saw vehicles as a new market."

The big obstacle to the introduction of any alternative fuel is what is inevitably referred to as the chicken-and-egg problem. Without widespread availability of a

fuel, motorists are reluctant to convert from gasoline. But without a mass market, fuel suppliers hesitate to make the investment in distribution operations.

BC Gas worked on both sides of the problem. With gasoline selling at about 52 cents a liter in British Columbia (about \$1.71 a gallon in United States dollars), the amount of natural gas needed to drive the same distance was priced at 25 cents. Accounting for part of the difference is that the provincial government does not tax natural gas fuel; there is a tax equivalent to 22 United States cents a gallon on gasoline.

Government grants are used to help cut the cost of converting a car or truck to \$1,175 in United States dollars from about \$2,100, and the province charges no sales tax on the conversion kits. In addition, the utility provides low-cost financing. And it leases the storage cylinders, the most expensive part of the conversion, for \$9 a month. Simplifying the Change

At the same time, BC Gas persuaded several oil companies, including Shell, Chevron and Petro-Canada, to add natural gas pumps at some of their high-volume stations. The pumps were designed to look like those for gasoline or diesel fuel, and quick-release couplers were used to simplify refueling. "You can self-serve the fuel and pay with a credit card," Mr. Higginson said.

Because of the cost of installing a compressor at each filling station, only those with heavy traffic are likely to be equipped to dispense natural gas, BC Gas officials said. As a result, the gasoline apparatus is left on cars so drivers can run on gasoline in areas where compressed gas is not available.

The result is a compromise that does not take full advantage of natural gas's attributes, advocates said. Because gas has an octane rating of 130, compared with about 90 for gasoline, higher-compression engines could be used if it were the sole fuel, improving performance and mileage. BC Gas officials said the converted cars now lose about 10 percent of their power when operating on gas. U.S. Car Makers Cautious

American auto manufacturers have built a few prototype vehicles powered by alternative fuels, but have been reluctant to go into higher-volume production without more evidence of public demand. So conversions from conventionally fueled models are the most likely to be available in the near future.

Driving a car powered by natural gas is not much different from driving a conventional model. A small dial switch on the dashboard controls which fuel is to be used. The car is slightly less responsive than when gasoline is used.

The gas is stored in one or more cylinders, usually mounted in the trunk, at 3,000 pounds per square inch of pressure when full. Despite the high pressure, gas officials said, the system is at least as safe as the existing gasoline system in a car. The natural gas tanks are much stronger than sheet-metal gasoline tanks, they said, and natural gas has a much higher ignition point, which means it is less likely to be touched off by a spark if it leaks. Best Candidates for Gas

Even with the conversion subsidy and lower price for natural gas, BC Gas officials acknowledge, natural gas is not for everyone. "Most of our users are commercial vehicles and commuters who do a lot of driving near the city," Mr. Higginson said. "Anyone spending \$150 or more a month for gasoline is a good candidate."

At that rate of usage, he said, a car owner would pay for the conversion in about two years. Taxis, delivery vehicles and big, old cars with thirsty engines like Mr. Williams's fit this profile, while fuel-efficient subcompacts could neither accommodate the tanks and other equipment nor justify the investment. Next: Refueling at Home

BC Gas's fueling network now amounts to 54 stations in the Vancouver area, but company officials concede that finding the right station when the tank is running low can be bothersome. So later this year the company is planning to offer home refueling stations. They will be tapped into the line feeding a home's heating unit and cooking appliances.

The \$2,000 station is basically a compressor that can increase the gas pressure from a few pounds per square inch as it comes into the house to the needed 3,000 pounds. The home stations are planned for slow overnight fills, in contrast with the one- or two-minute fills at gasoline stations.

Barry Cavens, an engineering manager at the utility, said the station, designed by the Sulzer Group of Switzerland, had been carefully engineered for safety. Adapting a Car to Natural Gas Present automobiles can be converted to burn natural gas or gasoline using components that bolt on. No internal changes to the engine are necessary. REFUELING CONNECTOR: The filling-station pressure hose connects to a fitting in the engine compartment. GAS/AIR MIXER: A unit

that blends natural gas with air for combustion by the engine replaces the vehicle air cleaner. It also filters the air for gasoline use. FUEL SELECTOR: A dashboard switch selects operation with either gasoline or natural gas. FUEL GAUGE: A pressure gauge indicates how much natural gas is in tanks. STORAGE TANKS: The most popular storage tanks hold 300 to 600 cubic feet of natural gas, equivalent to 3 to 6 gallons of gasoline. Larger cars are fitted with two tanks. PRESSURE REGULATOR ASSEMBLY: Reduces natural gas pressure to a level suitable for the engine. SHUTOFF VALVE: Stops natural gas flow when the car is running on gasoline.

Photo of a customer at a self-service station in Burnaby, British Columbia (NYT/Doug Wilson) (pg. D1); diagram (pg. D6) Taking Natural Gas for Test Drive

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## **POSTINGS; HOT TIPS**

### **Conserving Energy in Older Homes**

Here's some more bad news for the members of the international oil cartel: A how-to-save-energy guidebook for owners of older homes - whose publication had been canceled by Federal budget cuts - is in print after all. Jeffrey Seisler, who headed the team that wrote the guide for the Department of Housing and Urban Development, decided not long ago that - Government financing or not - his product should be available.

It is estimated that one out of every two families in the country lives in a house built before 1950.

Mr. Seisler went through the red tape necessary to get permission to produce the guide, found a printing house and is now offering the guide by mail order for \$4.95, plus 65 cents postage. Well illustrated and 44 pages long, the guide is like a handbook replacement for the grandparent who knows that if you tilt a steam radiator at the right angle, you might get it to stop banging. But it also

incorporates modern thinking about how to make rooms with high ceilings warmer without turning up the heat, and how to make windows with sash boxes airtight - a need that was not so pressing in days of 18-cent-a-gallon heating oil.

Copies of "Conserving Energy in Older Homes" can be ordered from Mr. Seisler's firm, ANALYTECH, Suite C-30, 915 King Street, Alexandria, Va. 22314. Discounts are available for bulk orders.

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