The original documents are located in Box 8, folder: "Pipeline and Gas Journal" of the Frank Zarb Papers at the Gerald R. Ford Presidential Library.

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F.Y.I.

Mr. Frank G. Zarb, Administrator
Federal Energy Administration
Washington, D. C. 20461

Dear Mr. Zarb:

Thank you for your splendid contribution to the "Century III" section of our Bicentennial Issue.

Hope you will enjoy reading this issue...and the future projections of others...that complement your comments.

Cordially,

Dean Hale

Dean Hale, Editor

DH/lt

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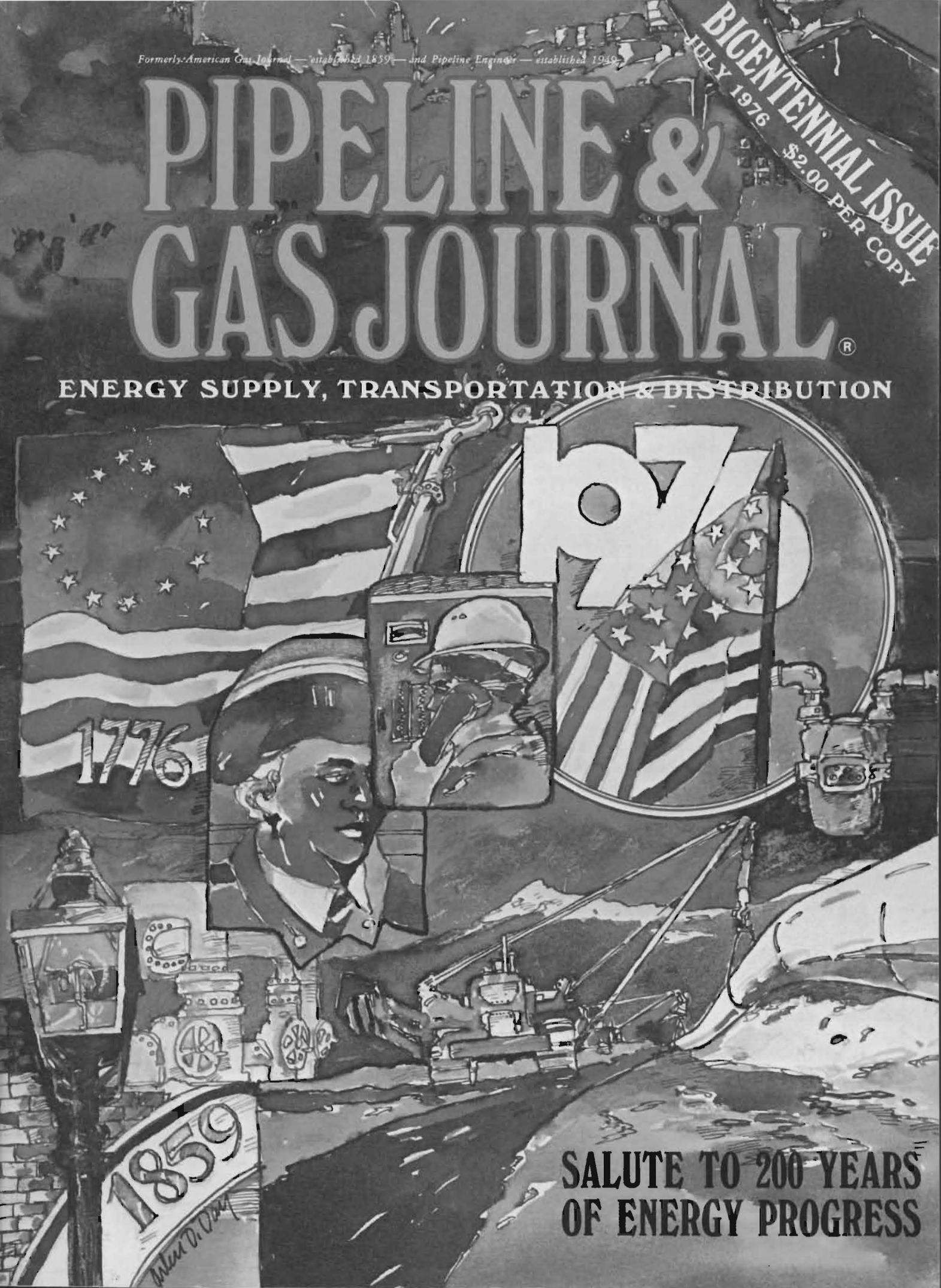

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NEXT MONTH

PIPELINE & GAS JOURNAL reviews the International Pipeline scene and reports on the latest developments around the globe . . . including reviews of major construction projects such as SUMED and Australia's 807-mile 34-in. major gas line . . . the Middle East . . . and other points of the compass.

NEWSREEL

HILITES OF MONTH'S NEWS

Weld Repair Could Delay Alyeska Hydrostatic Testing

Alyeska Pipe Line Service Co. won't take legal action to prevent release of its audit of X-rays of welds on the 800-mile, 48-in. line to date, after Alaska state attorney general Avrum Gross ordered state pipeline coordinator Chuck Champion to release the entire audit to the public. At question are some 1700 welds that reportedly have minor "imperfections" and represent a deviation from welding requirements made by the U.S. Department of Interior. Alyeska said the discrepancies do not raise concern over the integrity or safety of the line, however. Some 280 welds found during the audit have been repaired. If the state or the DOI required all of the welds to be repaired, or replaced, bellholes would have to be dug at many points on the buried portion of the line, and subsequent delays could prevent the line from going into operation as planned — creating a delay of months. Alyeska had been reluctant to release the details on the $4.5-million audit because it reportedly discusses some technical innovations used on the line's construction that are not in general use.

Four Energy-Deficient Eastern States Block LNG Terminals

The states of New York, New Jersey, Pennsylvania, and Delaware have asked FPC to defer action on four pending LNG import terminal applications and want FPC to prepare a comprehensive environmental report on LNG terminal sites and operations. The four said FPC should adopt far more stringent safety and environmental protection standards. Terminals presently under consideration include two on Staten Island, N.Y. and two on the lower Delaware River in New Jersey.

Colorado Carbon Dioxide Discovery May Mean New Pipeline

Shell Oil Co. reportedly has found carbon dioxide in quantity in Colorado and if further tests indicate a large CO_2 find, it might result in a pipeline from the Cortez area (Montezuma county) of Colorado to near Denver City, Texas, southwest of Lubbock, and just east of the New Mexico-Texas state line. The CO_2 would be used for injection into oil reservoirs as a secondary recovery measure.

Final Ninian Line Completed Quickly By Viking Piper

Work on the last section of the 100-mile, 36-in. line from the Ninian Field to the Shetland Islands for British Petroleum has been completed in record time by "Viking Piper," the semi-submersible pipelaying barge owned by Viking Jersey Equipment Ltd. The Ninian project was considered a major challenge because of severe weather conditions in the northern North Sea and the maximum water depth of 534 ft. Work on the Ninian line began in 1975. The final 60 miles were laid in 50 days in 1976. "Viking Piper" is now working on a 6-km, 24-in. feeder line from the Ninian central platform to the south platform.

Methane From Manure Sale Approved By FPC

Natural Gas Pipeline Co. of America finally has FPC authorization to buy gas from an unconventional source — methane produced from animal waste at a plant near Hooker, Okla. Up to 3.5-million cu ft per year for the next 25 years will be produced and sold by Calorific Recovery Anerobic Process, Inc. at a cost of $1.33 per Mcf. NGPL will build some $930,000 in facilities to receive the gas into its system.

Sohio's Alaska Crude Line Would Use California Gas Line

An existing 125-mile, 30-in. gas transmission line owned by Southern California Gas Co. between Blythe and Moreno (near Riverside) will be leased to Standard Oil Co. (Ohio) for its proposed California-to-Texas crude pipeline if other arrangements work out. SoCal Gas has created a separate affiliate, Blythe-Moreno Co., to handle its end of the arrangements. Because westward movement of natural gas has declined in the past few years, SoCal Gas has excess capacity and the gas line is unneeded. Removal from service would reduce fixed charges to Los Angeles area customers, says the gas company. The 30-in. line would connect with converted 30-in. gas pipeline owned by El Paso Natural Gas Co. that would carry the crude from Alaska through Arizona and New Mexico. Sohio would build a 78-mile, 42-in. line from Moreno to Long Beach Harbor to complete the western end of the system. If FPC approval on the El Paso section of the line is received expediently, construction and conversion would begin in early 1977 and the system would be ready to move crude by early 1978.

Kelly Cites Need For ERDA Coal Gasification Program

ERDA needs to develop a new coal gasification program with a special test facility using two first generation processes — Lurgi and Koppers-Totzek — to test different coals, to test process developments, and to test equipment operated for long periods of time. Robert E. Kelly, vice president, fuel supply development department, Public Service Co. of Colorado, testifying on behalf of A.G.A. at an ERDA public meeting on the 1976 national plan for energy research, development and demonstration, said ERDA's plan indicates a greater responsiveness by the federal agency to the expressed objective of "creating energy choices for the future." ERDA's insistence, however, for 50/50 cost sharing by industry for two demonstration plants, using "second generation" processes, jeopardizes the selection of the best "second generation" coal gasification processes. Project sponsors for the best processes may be unable to provide 50 per cent of the project costs, says Kelly.

First Steel Pipe Mill For 48-Inch Pipe In U.S. Planned

First large diameter steel pipe mill in the U.S. capable of producing 48-in. pipe for pipeline use will be built at U.S. Steel's Texas Works at Baytown. The mill, planned for completion in early 1978, will be able to fabricate a variety of pipe sizes and grades as well as the largest diameter submerged arc weld steel pipe produced in the U.S. Production rate for 48-in. is to be approximately three miles per day of Arctic grade line pipe with heavy walls and in high strength steel grades, including X-70. The new line pipe mill is under construction in Baytown, where U.S. Steel has a 160-in. plate mill.

Clean (?) Air Or Electricity — That's the Question

Antipollution legislation, now being considered in Congress, and new rules, adopted by Environmental Protection Agency, will seriously hamper construction of new energy plants throughout the U.S. The most controversial Clean Air Act provision states that significant deterioration in air quality is not permitted in regions having air far cleaner than national standards. In addition, EPA's recent policy statement to its regional offices makes it difficult to build new plants or expand existing ones in areas with substandard air quality. The EPA policy states "the location of major new and expanded sources may be allowed only to the extent that the resulting emissions do not exacerbate current violations of the primary standards and do not interfere with making reasonable further progress toward the timely attainment of the primary standards. It is important to note that this guideline constitutes the minimum stringency under which preconstruction review procedures must be carried out."

ERDA Abandons Gas Producing Nuclear Blast Sites

Project Rulison and Rio Blanco sites, used in experiments to stimulate gas production with nuclear blasts, are being abandoned by ERDA. The two western Colorado sites will be returned to the original owners. Equipment contaminated with radioactivity will be shipped to an approved disposal site. Atomic Energy Commission used the sites as part of the "Plowshare" program to develop peaceful uses for nuclear explosives. Gas produced at the project Rulison site near Grand Valley was flared during the winter of 1970-71. Gas produced at project Rio Blanco, near Meeker was flared in 1973-74.

A.G.A. Urges Government Participation in Gas Reserves Reporting

A.G.A. says the federal government should join with it in reporting natural gas reserve estimates. Roger D. Stanwood, chairman of A.G.A.'s committee on natural gas reserves, said the committee "welcomes government participation in the reserves reporting process." Federal and state employees regularly attend meetings as observers of ex officio committee members. Citing past criticisms of the industry's estimates of gas reserves, Stanwood charged "these criticisms have done little to assist our national energy policy formulation. At a time when energy problems seriously threaten our national economic growth, extensive debate over fundamental data consumes badly-needed time." Stanwood, vice president of gas supply for Transcontinental Gas Pipe Line Corp., cautioned, however, a confidentiality of data must be maintained. "Exploration for gas and oil is extremely competitive and it is in the best interest of the American public that it be kept that way," he emphasized.

GOVERNMENT GUIDELINES

STATE & WASHINGTON REGULATORY HOTLINE

President's proposed Alaskan Natural Gas Transportation Act would prevent construction delays of a pipeline from Alaska's North Slope supplying gas to the lower U. S., says Eric Zausner, FEA deputy administrator. Adoption of proposed Act would insure a final decision on a route no later than October 1, 1977. Zausner rejects the more time consuming proposals trans-Alaska and trans-Canada pipeline routes, currently under consideration by FPC. Citing the yearly decline of natural gas production since 1973, Zausner urges the development of all possible secure sources of natural gas, a vital U. S. energy source, accounting for 30% of total U. S. energy consumption.

South Texas Natural Gas Gathering Co., has had a proposal requesting approximately $4.6-million in rate increases to two pipeline companies suspended by the FPC. FPC said proposed rate increases were not shown to be just and reasonable and suspended the proposed increase till July, at which time it will receive another hearing. South Texas, a wholly-owned subsidiary of Coastal State Gas Producing Co., wanted to raise its rates to Transcontinental Gas Pipeline Co., and Natural Gas Pipeline Co. of America.

Central Illinois Light Co. has become the 192nd company partially or totally exempted from FPC jurisdiction under the Hinshaw Amendment of the Natural Gas Act. Central Illinois purchases gas from several transmission companies within the state of Illinois and resells all its gas within the state's boundaries. The Illinois Commerce Commission told FPC that it exercises jurisdiction over rates, services, and facilities of Central Illinois Light.

FPC has directed 28 interstate gas transmission companies to show cause for not filing required reports on gas conservation measures taken by the companies and their customers. FPC also ordered the companies to show cause why they should not be held in violations of the Natural Gas Act pertaining to the required reporting. The requirement was established in late 1973 and ordered natural gas pipeline companies to report action taken by them and their customers to conserve natural gas, and file said reports by the first of January and July of each year. Included among the 28 companies involved are: Arkansas Louisiana Gas Co., Black Marlin Pipeline Co., National Fuel Gas Supply Corp., Lone Star Gas Co., Washington Gas Light Co., Oklahoma Natural Gas Gathering Co., and Stingray Pipeline Co.

FPC is hearing oral arguments by Tenneco Oil Co. and an affiliate, Tennessee Gas Pipeline Co., concerning imbalances in deliveries by the former to the latter. Case began over a year ago when FPC ordered Tenneco and Tennessee to show cause why Tenneco should not immediately repay 12.5 billion cu ft of gas which it owed Tennessee. Tenneco requested oral arguments because of "inaccurate and incomplete" understanding of the situation by FPC, House Subcommittee on Energy and Power, and the press. Tenneco contends oral arguments are necessary to insure a "fair and impartial hearing and decision." FPC disagreed with the premise of Tenneco's oral argument contention, but agreed to handle the case in the requested manner so there would be no doubts as to the fairness and impartiality of the matter.

Virginia SCC has authorized a gas surcharge for Commonwealth Gas Distribution Corp. to allow it to earn an additional $187,000 per year. SCC approval came because it found the company was earning substantially less than the 8.8% return authorized earlier by the commission. The surcharge must be accounted for separately to provide for a customer refund, including 8% interest, if the surcharge is found to be excessive.

Plant City Natural Gas Co., a Florida gas distribution company, has been granted interim relief from curtailment by Florida Gas Transmission Co. FPC authorized up to 780 Mmcf/d for Plant City which serves three heavy industry customers who, in turn, use the gas for process needs. In its petition, Plant City said it does not have storage facilities and, consequently, is forced to curtail service directly in response to Florida Gas curtailments. Plant City also said alternate fuels are not available to its customers. Earlier this year the three industries supplied by Plant City were forced to shut down operations entirely for one week due to Florida Gas curtailments.

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Northern Illinois Gas Becomes NICOR, Inc. Holding Firm

NICOR
The basic energy company

Northern Illinois Gas Co. has reorganized into NICOR Inc., a holding company with a utility subsidiary named Northern Illinois Gas Co.

"NICOR will have more flexibility to capitalize on a broad spectrum of energy opportunities, "notes C. J. Gauthier, chairman and president, adding, "the initial effort of NICOR will focus on expanding oil and gas exploration and production as well as coal activities."

Other NICOR companies are Mid-Continent Gas Storage, providing underground gas storage; Mid-Continent Gasification, concerned with gasification of coal and other feedstocks; NI-Gas exploration and NI-Gas Supply, both involved in oil and gas exploration and development.

Northern Illinois Gas will continue to operate the largest gas distribution business in the state under Illinois Commerce Commission regulation.

A new symbol, identifying "the basic energy companies" represents cycles essential to life — the solar system, photosynthesis of plants and vital elements such as oxygen, nitrogen and carbon; but interrupted cycles, indicating man's ability to utilize these resources.

C. J. Gauthier

Measurement Course To Emphasize Safety

The 1976 Appalachian Gas Measurement Short Course will be held Aug. 10-12 on the Moon Township Campus of Robert Morris College in Coraopolis, Pennsylvania. Course includes over 50 classes covering all phases of gas measurement, regulation and control, with emphasis on safety requirements.

A new group of classes, under "Wellhead Measurement and Control," will be offered.

Latest gas measurement equipment will be displayed by over 40 manufacturers and suppliers.

El Paso Natural Gas Appoints Steen Vice-Chairman

H. F. Steen has been appointed vice chairman of the board of El Paso Natural Gas Co., where he will continue as chief executive officer.

Travis H. Petty has been appointed president and chief operating officer of El Paso Natural Gas Co.

AIChE Fuels Division Names New Officers

New officers and directors of Fuels & Petrochemicals division of American Institute of Chemical Engineers were installed at F&PD's 81st national meeting in Kansas City. Carl D. Spangler, director of domestic refinery process engineering, CONOCO, was elected chairman. Larry O. Stine, Vice president, technical service department, UOP, has been named first vice chairman. Margaret P. Skillern, principal, Purvin & Gertz, Inc., consulting engineers, is newly elected second vice chairman. J. G. Potts, Union Oil Co. of California, is secretary. Carl B. Sutton, Gas Processors Association is the 1976 treasurer.

New directors include Bernard S. Lee of IGT and Robert N. Maddox of Oklahoma State University.

AEI Names Selby President

Dr. Cecily Cannan Selby, scientist, educator and former national executive director of the Girl Scouts,. has been named president of Americans for Energy Independence (AEI). She succeeds acting president Endicott Peabody, former governor of Massachusetts who continues as AEI's secretary and as a member of AGI's Board of directors.

AEI is a non-profit organization founded by consumer, scientific, academic, professional, conservation, labor and business leaders to stimulate action towards energy self-sufficiency.

A.G.A. Publishes 1975 'Gas Control Manual'

A.G.A. has recently made available the 1975 "Fundamentals of Gas Controls." Manual describes devices utilized in gas appliance controls, how they work, and how they are used in systems to provide automatic control of residential gas appliances. Manual provides a text for professional self-study in the gas controls field. Copies of the manual, catalog #XH 1275, can be obtained for $2 per copy from A.G.A., Order & Billing Dept., 1515 Wilson Blvd., Arlington, Va. 22209

Gaido-Lingle Adds Three To Staff

Gaido-Lingle has made three recent additions to its staff in conjunction with its recent expansion.

Pete Lunn has been named manager of Gaido-Lingle's new fusion bonding facility in Houston.

N. Ray Warmack is in charge of coordinating pipe transportation to the company's three plants. He is also responsible for price quotations for on-site protective painting division and pipe coating/fusion bonding.

Tom Sharp has been named sales representative for northern Texas and Oklahoma.

New Energy Consulting Firm Opens NYC Office

A new energy consulting firm, Econergy Consulting Associates, servicing industry and government in fields of energy utilization, development and conservation, has been established in New York City.

ECA is currently evaluating energy project programs for ERDA. The eight U.S. and overseas engineers in the consulting group have held key management positions in industry. The organization is international in scope.

PROJECTS

NEW SYSTEMS/EXPANSION/DEVELOPMENTS

Cochin Modifies Plans For Dome Project

Cochin Pipe Lines Ltd. proposed products pipeline project for Dome Petroleum Ltd. has been modified extensively. Cochin will now split its construction program into two nonrelated segments, although the two lines will follow the identical route from Fort Saskatchewan to the international border between Saskatchewan and Montana and from the Michigan-Ontario border to Sarnia.

First phase consists of 610-mile, 12-in. products line from Fort Saskatchewan to the border crossing point at Elmore, Sask. and 90-mile 10-in. line in southwestern Ontario between a point near Windsor and Sarnia. The intermediate distance, 1,180 miles through the northern states, will carry batched ethylene, ethane and propane. Ethylene will be carried by AGTL's line from Alberta Gas Ethylene Ltd.'s plant at Joffre to Fort Saskatchewan. Expected date of completion is Dec. 31, 1978.

Second phase includes a 610-mile, 10-in. line from Fort Saskatchewan to Elmore and 95-mile 10-in. line from Dome's Empress gas processing plant in southeastern Alberta to Kerrobert on the main line. Line will connect with a 10-in. U.S. line parallel to the 12-in. line to Windsor. Completion date is set for July 1, 1983.

Group To Research Mediterranean Line

SEGAMO (Société d'Etudes de Gazoduc de la Méditerrannée Occidentale), owned 50% by SONATRACH (Algeria), 25% Gaz de France (France), and 25% Enagas (Spain), has awarded a contract to a group of companies including: SOFREGAZ (French), Beicip (Institut Français du Pétrole — Compagnie Generale de Geophysique, Centre National d'Exploitation des Oceans (CNEXO)), Compagnie Maritime d'Expertise (COMEX), Omnium Technique des Transports Par Pipeline (O.T.P.).

Contract is for research work on the Mediterranian sea bed with objective of selecting a path for laying several gas pipelines as deep at 2000 metres to form the main underwater pipeline between Algeria and the European Continent, via Spain.

SOFREGAZ is the leader of the group of companies.

Tennessee Gas Connects Offshore La. Platforms

Tennessee Gas Pipeline Co. plans to connect offshore Louisiana platforms with 9.5 miles of pipe. 1.36-mile, 8-in. line will connect offshore platforms in West Cameron Block 66. 5.3-mile, 16-in. line from platform in West Cameron Block 66 will connect Tennessee's platform in Block 68. 2.7-mile, 20-in. onshore loop line will be built extending westward from station 507-F.

Project includes two 660 hp compressor units built near Oak Grove, La. Facilities designed to enable Tennessee to attach and move onshore reserves committed to it by Atlantic Richfield and Getty Oil in the West Cameron Area.

Estimated cost of project is $6,758,503.

Film Depicts Alaskan Pipeline Project

A 28-minute film depicting construction of the trans-Alaska Oil Pipeline project, is available from H.C. Price Co. Film, emphasizing individual worker's role in project, was filmed on section 3 of the line, covering 144 miles south of the Yukon River. Filming also took place in the Fairbanks vicinity. Winter and summer construction activities are shown. H.C. Price Co. is sponsor of the joint venture, Price-Potashnick-Codell-Oman, constructing that section.

Available without charge for showing to civic and industry groups, film may be obtained by contacting Jim Curd at the Price Company offices in Bartlesville.

UGPL Plans Bienville Storage Field Increase

To increase capacity of its storage field in Bienville Parish, La., United Gas Pipe Line Co. has filed with FPC to construct 4.26 miles of pipeline, including 1.76 miles of 16-in., 1.54 miles of 8-in., 0.8 miles of 12-in., and 0.16 miles of 6-in.

Project also includes installation of two 8,000-hp compressor units, 8 meter stations, 7 injection-withdrawal wells, and the reworking of an observation well for use as an injection-withdrawal well. Total cost of project will be $15,193,620.

IPLCA Names Minard As Deputy Executive Secretary

Oliver Minard has been named "Deputy Executive Secretary" of the International Division of Pipe Line Contractors Association at its headquarters in Paris.

Minard, formerly a project estimating engineer for Grands Travaux de Marseille (G.T.M.), with which he has remained ever since, joined G.T.M. in 1952 and has worked on many projects both in France, Africa, Near East, Persian Gulf, Far East, U.S.A., U.S.S.R. and South America. He spent 1955 and 1956 in the U.S.

Panama Williams Gets Final Seaway Segment

Panama Williams, Inc. has received a contract from Seaway Pipeline Co. for the final segment of the 500-mile, 30-in. Freeport, Tex. to Cushing, Okla. crude oil line.

The contract calls for 90 miles of 30-in. pipe between Waller and Freeport, Tex. Work is underway and should be complete by early June.

Governmental Delays Jeopardize Alaska Line

An Interior Department spokesman told a special Senate panel that the potential delays to construction of an Alaskan North Slope gas pipeline are almost infinite, and court actions already pending against the proposed pipeline could delay construction as much as 10 years.

Although a ruling from FPC is expected sometime this year giving the nod to either the El Paso LNG project or the Arctic Gas project, construction would not be complete on the line until 1981, provided there were no legal or governmental hold-ups.

John A. Hill, deputy administrator of the FEA, said that obviously one of the two projects will be approved, but added he is concerned over, "the length of time needed to reach all the decisions which are necessary to implement either system."

Agreement Cancels 216-Mile Pipeline

An agreement reached by Colorado Interstate Gas and Northern Natural Gas, and approved by FPC, has cancelled an original filing by CIG for a 216-mile pipeline in Montana and Wyoming.

Under the new agreement, CIG will, over a six-year period, build production and gas gathering facilities in the

projects

Bear Paw area of central Montana, and Northern will build additional facilities in the area to transport CIG's gas. Most of the gas will move through the existing Tiger Ridge lateral.

Cost of entire project is set at $21-million.

Transco plans 103-Mile North HIOS Project

Transcontinental Gas Pipe Line Corp. plans to install 103 miles pipe offshore Texas & onshore Louisiana connecting northern portion of High Island and Galveston to its existing Southwest Louisiana Gathering System near Johnson's Bayou in Cameron Parish, La.

The "North High Island Offshore System" will have 62.85 miles of 24-in., 0.5-mile of 16-in., 29 miles of 8-in., and 11 miles of 6-in.

Design capacity of proposed new system is 230-million cu ft per day. Estimated cost of project is $56,000,000.

HNG Sells Distribution Properties To Entex

Houston Natural Gas has decided to leave the gas distribution business and is selling its entire Houston residential and small commercial distribution business to Entex, Inc., which also serves the Houston area.

The $64-million price tag will allow Entex to begin serving HNG's approximately 225,000 residential and small commercial customers (approximately 50% of the Houston market).

Entex presently serves more than 739,000 retail customers in Texas, Louisiana, and Mississippi.

An HNG spokesman said Entex takeover of its residential and small commercial accounts is total, but the company will continue to service large industrial accounts.

The spokesman said distribution revenues during 1975 accounted for only 10% of fiscal 1975 revenues of nearly $820-million. HNG sold about 34.1 billion Mcf to residential and small commercial accounts in 1975 compared to total sales and deliveries of 604.5 billion Mcf during the same period.

Gas bills in the Houston area should not be affected since both companies now charge the same rates. Entex should begin serving HNG's customers by May.

Saipem-McConnell Gets Contract For Maui Line

Saipem s.P.a. and McConnell Construction have received contract from the New Zealand government for construction of the Maui Pipeline Project.

Contract calls for 155 miles of 30-in., 27 miles of 34-in., and 5 miles of 16-in. gas line. Also included is 28 miles of 8-in. condensate line.

Briefs

Ford, Bacon & Davis has received a contract for a feasibility study from Michigan-Wisconsin Pipeline on a proposed 70-mile, 12-in. line in Northwest Colorado.

Mid-Mountain Contractors has received Montana Power Co. contract to lay 77 miles of 8 and 10-in. gas line, and an additional 54 miles of small-inch gas gathering line in Montana.

Sheehan Pipe Line Construction Co. is laying a 20-mile, 10-in. line in Wheeler County, Texas for Michigan-Wisconsin Pipe Line Co.

U-T Offshore System is ready to begin construction of a 42-in. pipeline in the Gulf of Mexico off Cameron Parish, La. U-T offshore, a joint venture of United Gas Pipe Line Co. and Transco Companies, Inc. plans to build a 30-mile, 42-in. pipeline to connect with the proposed High Island Offshore System to transport natural gas from the High Island area of the Gulf of Mexico.

Pace Pipe Line Co. has begun construction of a 19-mile, 26-in. gas pipeline in Randolph and Upshur Counties, W. Va., for Columbia Gas Transmission Corp. Pipeline is expected to be completed by Sept. 1.

NFG Supply Corp.'s storage expenditures total $2,537,000. Of this figure, $1,600,000 is allocated to the new storage in West Independence. Other costs include land structures and improvements, wells, lines (replacement and corrosion control) and compressor stations.

Shell U.K. has awarded Land and Marine Engineering Ltd. a contract to pull the Brent natural gas pipeline from the North Sea to Landfall at Rattray Head, St. Fergus, near Peterhead. Project is expected to be underway by late July.

Lakehead Pipeline Co. has awarded Welded Construction Co. a contract to build a 72.6-mile 30-in. pipeline in Oakland, Ingham, Jackson, Macomb, Calhoun and Cass Counties, Michigan and in Porter and Laport Counties, Indiana.

Peninsula Resources Corp. plans to purchase for $1-million cash a 72-mile 8-in. pipeline from Colorado County to Montgomery County, Texas. Daily capacity is more than 50,000,000 cu ft of gas.

Texas Oil & Gas Corp. has purchased Western Transmission Corp., which owns 66-mile natural gas gathering system in Carbon and Sweetwater Counties, Wy., plus 30,000 net acres of undeveloped leases. Western was a subsidiary of Aquitaine of Pennsylvania.

Canadian News

Brascan Resources Ltd. has awarded contract to Gascome Projects Ltd. for a gas gathering system in Athabasca field. Project involves 15 miles of 4 and 6-in. pipe and compressors totaling 2520 hp in three small compressor stations. Pipeline completion is scheduled for early summer. Compressor stations will be completed by August.

Alberta Energy Co. Ltd. will probably call tenders in late summer for the crude oil pipeline from the Syncrude Canada Ltd. lease in the Athabasca oil sands to East Edmonton pipeline terminal area.

Project consists of 270 miles of 22-in. pipe and will be built as a combined winter and summer job with kickoff after freezeup next fall, winter portion of construction in muskeg terrain during the winter of 1976-77 and the summer portion after breakup in the spring of 1977. Completion will probably be scheduled for late summer or early fall next year.

A new right-of-way will be set up from Fort McMurray (Mildred Lake sector) to Redwater and the remaining small portion of the route will represent a loop of an existing oil pipeline used originally by Interprovincial Pipe Line Ltd.

Amoco Canada Petroleum Co. Ltd. will build a 16-mile, 3-in. line in the West Paddle River area of north central Alberta connecting gas processing plants at Paddle River South and Mayerthorpe. Another 21-mile 4-in. line will run from Mayerthorpe to the pumping station at Blueridge on an existing parallel oil pipeline. Both lines will carry natural gas liquids. Two pumping stations will also be built at the gas plant sites. Completion is scheduled for July 31.

Alberta Gas Trunk Line Co. Ltd. has awarded contract to Henuset Rentals Ltd. for lateral gas transmission line out of Killam field involving 11 miles of 6-in. pipe. Completion is due late spring.

Survey of Senate and House

Congress Spills Views On Energy

by Ernestine Adams, *Editor, Energy Management Report*

A survey of Congress on baseball or apple pie might get a majority to answer but evidently a lot of people are polling Congress these days wanting to know how they stand on this and that. Some members claim they get three or four surveys a week. That's the reason a poll on energy comes down like an astronaut's splash. Only trained and confident people will touch a poll on energy.

It is remarkable then that about one-third of the House and Senate replied to our 10-question survey which was devised to learn what members' attitudes are toward energy problems.

Remember that the nation's energy policy is still divided among 36 Senate, House and joint congressional committees and 96 subcommittees (Environment Information Center) and they all listen to different sectors of the energy industry.

Among the respondents a number did not fill out the questionnaire but did supply their opinions. Rep. Koch (D-NY) who votes about 100% against the oil industry, sent a copy of the Congressional Record in which he says, "We consume vast amounts of political energy getting nowhere," and "the federal government does not employ the means now available to deal with the immense economic and political power of the major oil companies."

He also tells how to increase car mileage per gallon of gas by up to 57%. (Auto manufacturers should be after him.)

In the opposite corner, Rep. Esch (R-MI) writes "I believe we should use the market system to provide for development of our domestic oil reserves. Our policy should be to encourage domestic oil resources."

Along the same line, Rep. Frenzel (R-MN) replies, "Generally I believe that the U.S. energy policy is counterproductive and encourages use of offshore (imported) oil rather than providing incentive to locate and produce domestic supplies of gas and oil."

One congressman objects to the way the questions were stated. He says questions like "Do you believe U.S. oil producers should be paid the same price for crude oil as foreign producers?" are plainly slanted to produce responses favorable to the oil and gas industries. Rep. Ottinger (D-NY) said "I could no more answer that question fairly than I could answer one worded 'Do you believe domestic producers should be allowed to price-gouge the American people the same way the OPEC cartel does?' "

He adds, "I hope you'll have the guts to use this letter in your journal." The guts were easy to come by but not the space. He wrote two pages single-spaced.

Sen. McGovern (D-SD) gives his energy philosophy which reads smoothly. For example, "Conservation and the elimination of energy waste must be given greater priority so that, together with increased exploration, the economy will not be impeded." You couldn't tell by that that McGovern is pretty strong for government running the oil industry.

Sen. Hartke (D-IN) put in a plug for coal saying "We must begin now to perfect and make economical the liquefaction and gasification of coal." He puts that at the head of national priorities and looking farther beyond stresses solar energy as the most obvious energy source.

Getting down to cases again, Sen Talmadge (D-GA) writes that in his opinion "this can best be done by private enterprise, and we have only to look at the present state of the Postal Service for proof."

Sen. Buckley (D-NY) states he supported efforts to deregulate the wellhead price of new natural gas, adding "I believe that this is the single most effective means of encouraging production of additional domestic supplies of this vital fuel."

Concerned about the Trans-Alaska pipeline authorization act and its implementation, Rep. McKinney (R-CT) says "the proper management of precious oil and gas from the newly developed Alaskan fields is crucially important to the security of America's future. To date, that security cannot be insured." He believes that competing interests of various agencies that regulate the industry enable it to play one regulator against another in pursuit of its goals. He fears Alaskan oil and gas will not be distributed in the U.S. but will be exported.

With the practical understanding shown in this statement: "My voting record in Congress demonstrates my commitments toward insuring that our domestic energy industry can earn sufficient profits to underwrite the tremendous capital costs of developing and transporting new and existing forms of energy," it is hard to picture Rep. Hubbard (D-KY) as author. He usually votes so it would be hard for the oil industry to have profits.

Sen. Moss (D-UT) demurred to answering our questions but gallantly did so. He also enclosed a 4-page report of a survey he'd done among his constituents. When he'd asked: "Should the federal government remove price controls from natural gas and old domestic oil?" a majority said no.

Following are questions we sent and answers returned by members of Congress:

1. Do you believe the U.S. is running out of oil and natural gas?

Practically every respondent thought the U.S. was running out of oil and gas. The yeses count 113 or 86% compared with 19 who say "no". Rep. Fountain (D-NE) checks "yes" and adds "but not in the near future. Not before we can develop our alternatives and supplemental sources."

Rep. Jordan (D-TX), who comes from the largest producing state in the U.S., says "Ultimately, yes, immediately no." Her "ultimately" can't be very long because she estimates oil and gas will be major supplies 3 to 10 years.

A "no" comes from Rep. Meyner (D-NJ) who remarks "Ultimately the whole earth will run out of oil and gas. In the immediate future, no." Rep. Poage (D-TX) warns, "We have already run out of surplus supplies; we still have vast reserves."

A reason for "running out" is supplied by Rep. Hansen (R-ID), who says "So-called energy policy and tax reform legislation have discouraged an urgently needed increase in exploration and drilling."

Writes Rep. Van Deerlin (D-CA), "Certainly not in the crisis sense but these non-renewable resources will not last forever and alternatives must be found."

Respondents to 1976 Congressional Survey

Not all the respondents answered the 10 questions; those who did not said it was policy or the questions did not fit "yes" or "no" answers.

House of Representatives

James Abdnor (R-SD)
Carl Albert (D-OK)
Mark Andrews (R-ND)
Bill Archer (R-TX)
William L. Armstrong (R-CO)
Thomas L. Ashley (D-OH)
Alvin Baldus (D-WI)
Max Baucus (D-MT)
Edward P. Beard (D-RI)
Alphonzo Bell (R-CA)
Mrs. Hale Boggs (D-LA)
John B. Breaux (D-LA)
Garry Brown (R-MI)
George E. Brown Jr. (D-CA)
John Buchanan (R-AL)
J. Herbert Burke (R-FL)
Goodloe E. Byron (D-MD)
Tim Lee Carter (R-KY)
Bill Chappell Jr. (D-FL)
Shirley Chisholm (D-NY)
William S. Cohen (R-ME)
James M. Collins (R-TX)
John Conyers Jr. (D-MI)
William R. Cotter (D-CT)
Lawrence Coughlin (R-PA)
Philip M. Crane (R-IL)
Ronald V. Dellums (D-CA)
John H. Dent (D-PA)
Butler Derrick (D-SC)
William L. Dickinson (R-AL)
Thomas N. Downing (D-VA)
John J. Duncan (R-TN)
John D. Early (D-MA)
Bob Eckhardt (D-TX)
Robert W. Edgar (D-PA)
Glenn English (D-OK)
Marvin L. Esch (R-MI)
Edwin D. Eshleman (R-PA)
Frank E. Evans (D-CO)
Joseph L. Fisher (D-VA)
James J. Florio (D-NJ)
Edwin B. Forsythe (R-NJ)
L. H. Fountain (D-NC)
Donald M. Fraser (D-MN)
Bill Frenzel (R-MN)
Robert N. Giaimo (D-CT)
Barry M. Goldwater Jr. (R-CA)
Henry B. Gonzalez (D-TX)
Tennyson Guyer (R-OH)
James A. Haley (D-FL)
John Paul Hammerschmidt (R-AR)
Mark W. Hannaford (D-CA)
George Hansen (R-ID)
Michael Harrington (D-MA)
Margaret M. Heckler (R-MA)
H. John Heinz III (R-PA)
Henry Helstoski (D-NJ)
Jack Hightower (D-TX)
Andrew J. Hinshaw (R-CA)
Kenneth L. Holland (D-SC)
Carroll Hubbard Jr. (D-KY)
William J. Hughes (D-NJ)
Andrew Jacobs Jr. (D-IN)
Albert W. Johnson (R-PA)
James P. (Jim) Johnson (R-CO)
James R. Jones (D-OK)
Barbara Jordan (D-TX)
Robert W. Kasten Jr. (R-WI)
William M. Ketchum (R-CA)
Thomas N. Kindness (R-OH)
Edward I. Koch (D-NY)
Robert J. Lagomarsino (R-CA)
Norman F. Lent (R-NY)
Gillis W. Long (D-LA)
Trent Lott (R-MS)
Manuel Lujan Jr. (R-NM)
Robert McClory (R-IL)
John Y. McCollister (R-NE)
Mike McCormack (D-WA)
Stewart B. McKinney (R-CT)
Torbert H. Macdonald (D-MA)
George H. Mahon (D-TX)
James R. Mann (D-SC)
James G. Martin (R-NC)
Helen S. Meyner (D-NJ)
Robert H. Michel (R-IL)
Parren J. Mitchell (D-MD)
Anthony Toby Moffett (D-CT)
G. V. (Sonny) Montgomery (D-MS)
W. Henson Moore (R-LA)
Carlos J. Moorhead (R-CA)
John M. Murphy (D-NY)
Gary A. Myers (R-PA)
John T. Myers (R-IN)
Richard Nolan (D-MN)
Richard L. Ottinger (D-NY)
J. J. Pickle (D-TX)
W. R. Poage (D-TX)
Albert H. Quie (R-MN)
Thomas M. Rees (D-CA)
John J. Rhodes (R-AZ)
Frederick W. Richmond (D-NY)
Matthew J. Rinaldo (R-NJ)
Ray Roberts (D-TX)
J. Kenneth Robinson (R-VA)
John H. Rousselot (R-CA)
Harold Runnels (D-NM)
Philip E. Ruppe (R-MI)
Leo J. Ryan (D-CA)
Herman T. Schneebeli (R-PA)
Keith G. Sebelius (R-KS)
J. William Stanton (R-OH)
Alan Steelman (R-TX)
Sam Steiger (R-AZ)
Louis Stokes (D-OH)
Steven D. Symms (R-ID)
Olin E. Teague (D-TX)
Charles Thone (R-NE)
Ray Thornton (D-AR)
Paul E. Tsongas (D-MA)
Morris K. Udall (D-AZ)
Lionel Van Deerlin (D-CA)
Guy Vander Jagt (R-MI)
Richard F. Vander Veen (D-MI)
Joe D. Waggonner Jr. (D-LA)
Richard C. White (D-TX)
Charles E. Wiggins (R-CA)
Bob Wilson (R-CA)
Charles Wilson (D-TX)
Larry Winn Jr. (R-KS)
Jim Wright (D-TX)
Leo C. Zeferetti (D-NY)

Senate

Howard H. Baker Jr. (R-TN)
Dewey F. Bartlett (R-OK)
J. Glenn Beall Jr. (R-MD)
Lloyd Bentsen (D-TX)
James L. Buckley (D-NY)
Carl T. Curtis (R-NE)
Pete V. Domenici (R-NM)
Thomas F. Eagleton (D-MO)
James O. Eastland (D-MS)
Paul J. Fannin (R-AZ)
Barry Goldwater (R-AZ)
Mike Gravel (D-AK)
Clifford P. Hansen (R-WY)
Philip A. Hart (D-MI)
Vance Hartke (D-IN)
Floyd K. Haskell (D-CO)
William D. Hathaway (D-ME)
Ernest F. Hollings (D-SC)
Roman L. Hruska (R-NE)
Jacob K. Javits (R-NY)
J. Bennett Johnston Jr. (D-LA)
John L. McClellan (D-AR)
James A. McClure (R-ID)
George McGovern (D-SD)
Thomas J. McIntyre (D-NH)
Robert Morgan (D-NC)
Frank E. Moss (D-UT)
Gaylord Nelson (D-WI)
Sam Nunn (D-GA)
Bob Packwood (R-OR)
Abraham Ribicoff (D-CT)
William V. Roth Jr. (R-DE)
Robert Taft Jr. (R-OH)
Herman E. Talmadge (D-GA)
John Tower (R-TX)
Lowell P. Weicker Jr. (R-CT)
Milton R. Young (R-ND)

Congress Spills Views

2. Do you believe a shortage of domestic energy sources will hamper employment in the U.S.?

To this question nearly every one agrees: 94% checked "yes" with only 6% saying "no." Of these 7 were Democrats and 1 was Republican. He was Sen. Goldwater (R-AZ) who asked "When?" but did not say yes or no. Rep. Long (D-LA) commented there was no reason for shortages.

Rep. Eckhardt (D-TX) says "A domestic energy shortage need not adversely affect employment if (1) imported energy is available, or (2) the U.S. shifts its economy gradually away from energy intensive industries and faithfully practices energy conservation." Strangely enough this M.C. from Texas has never voted in favor of private energy industry.

In the opinion of Rep. Chisholm (D-NY) "A shortage of domestically produced energy will hurt, of course. I wish the industry would not hold back production as it has been and start producing. Also I think there should be a major conservation effort."

From Maine comes this observation of Rep. Macdonald (D-ME), "Certainly our dependence on foreign imports has had a significant impact on our present unemployment problems."

Rep. Myers (R-PA) writes, "Energy is so critical to small business employment and yet Congress is forcing the country into an intolerable time frame for delivering new energy supplies." Rep. Symms (R-ID) goes further, "It could completely disrupt the economy; reduce our standard of living." Sen. McClellan (D-AR) comments, "Of course it will."

This statement comes from Sen. Baker (R-TN): "There's been shown to exist a very close relationship between real economic growth, GNP, employment and energy availability."

Another concurs. "A shortage of energy obviously would hamper employment in the U.S. — that would include energy on the part of individuals to be employed," writes Rep. Jacobs (D-IN) who seldom favors the oil industry.

3. For how many years do you think oil and natural gas must continue to provide the major portion (now 76%) of U.S. energy requirements? 5 years? 10 years? 20 years?

Despite the fact that several respondents reply they had no knowledge of how long oil and gas would have to provide the major portion of U.S. energy requirements and anything they say would be guessing, the 68% who check "20 years or more" show a realistic viewpoint.

Highest guess came from Rep. Wilson (D-TX) who inserts "50 years." Another 91 persons mark 20 years or more and give various time periods. Only one, Rep. Burke (R-FL), selects 5 years. Democrats and Republicans were evenly divided on this question. Perhaps one reason is in Rep. Myers, (R-IN) frank answer, "I have no way of knowing from personal knowledge."

Explaining his answer of "24" years, Sen. Beall (R-MD) states "although some of our reserves are being depleted, we have immense untapped reserves remaining. The primary constraints on their exploration and development at present are burdensome legal and regulatory barriers and resultant lack of exploratory incentives for private industry."

That's not what Rep. Dellums (D-CA) thinks. He says, "At least as long as government policy subsidizes existing large energy companies." Rep. Mahon (D-TX), like many others, thinks "Perhaps more than 20 years."

In the opinion of Rep. Montgomery (D-MS), "Ten years unless available coal resources are greatly increased and roadblocks to nuclear energy are removed." Along the same line Rep. Wright (D-TX) says, "Until we can convert coal in sufficient quantities to liquefaction and gasification."

More specific is Sen. Hart (D-MI): "Extrapolating from Exxon's projections to 1990, it seems clear that our energy requirements by the year 2000 will be in excess of 60 million b/d of oil equivalent. I cannot see how more than half this amount can come from sources other than oil and gas, given the growth rates in alternative supplies which would be needed to replace oil and gas."

4. What sources do you feel can provide U.S. energy (as much as 10%) in the next 10 years? Please rank in order of importance by number: coal; nuclear; geothermal; hydrogen; solar; shale oil; other.

Most respondents chose coal #1 and nuclear #2 and ignored the remainder. As one respondent said it was "too technical."

Rating below was result of counting largest designation for each resource; i.e. 110 marked coal No. 1; 12 checked coal No. 2; 5 called it No. 3; and 3 marked it No. 4. Nobody placed it No. 5 or No. 6

Rank	Resource	Checked by No. persons
1	Coal	110
2	Nuclear	79
3	Solar	26
4	Shale	24
5	Geothermal	22
6	Hydrogen	19

Resources added by respondents are: Wind power, biomass, tidal. Several include oil and gas. Rep Buchanan (R-AL) has another: "Wind, tides, hot air from Congress."

Ranking of solar resources as #3 stems more from hope than expectation. Some are inhibited by the 10-year period and 10% volume limitation. Coal today is the only one with this volume of use after oil and gas (Actually coal now provides 18% energy in the U.S.)

Notes Rep. Harrington (D-MA), "Considering the short, 10-year time span involved, only coal and perhaps nuclear can be realistically expected to provide more than 10% of our energy needs. There is a real possibility, with adequate federal commitment, for solar power to play a predominant role in space and water heating. It is unlikely that geothermal or oil shale will ever be a major source of U.S. energy."

5. In your opinion, is Congress doing enough to encourage development of these energy resources?

This question often turned liberal and conservative respondents into the same channel. As Rep. Albert (D-OK) said, "Congress is doing a lot, but the job is enormous."

Evidently referring to government funding, Rep. Brown (R-MI) replies: "I'm not sure. Effective utilization of funds depends upon progress in the state of art."

In the same groove, Rep. Buchanan (R-AL) observes, "Recent research legislation will help. We need an effort of the magnitude of a space program."

Another facet is added by Rep. Robinson (R-VA): "Financing of research support is substantial but investment incentives should be improved."

Rep. Goldwater (R-CA) writes, "It is doing the exact opposite." Rep. Pickle (D-TX) comments, "Effort is good and getting better but unlimited R&D money does not necessarily mean the job will be done."

One "no" answer is from Rep. McCollister (R-NE). He wrote "Absolutely not. Congress has kept prices artificially depressed thus discouraging development. It has adopted excessive environmental regulations making use of coal and nuclear power very difficult."

Rep. Forsythe (R-NJ) gets down to cases: "Deregulation of price would help." Rep. Moffett (D-CT) suggests, "Devote more resources for coal, solar and geothermal development."

One of the affirmative minority is Rep. Teague (D-TX): "Yes. Committee on Science and Technology has increased the FY Budget Authority funding for solar energy to $229 million, five time that of three years ago, and also made large increases in fossil and geothermal energy research and development."

However, Rep. Thone (R-NE) thinks, "Coal needs more push."

6. Are you aware that USSR oil production may now exceed that of U.S.?

Two-thirds of those who answered this question are aware of this situation. Rep. Roberts (D-TX) says "No, it is not so." And he may be right. Russia generally combines its crude oil and natural gas liquids whereas U.S. keeps separate data. This makes it hard to judge oil production of the two nations.

As Rep. Vander Jagt (R-MI) admits, "I do not have any available statistics to answer this question." Most of us don't have but we have seen headlines recently telling that Russia has gone ahead of the U.S. in oil production.

And Rep. Hinshaw (R-CA) writes, "No one knows but Russia." The same point is made by Rep. Jacobs (D-IN). He states, "Of course I am aware that USSR oil production 'may' exceed that of the U.S. I am also aware that the USSR 'may' be in process of becoming a democracy; I doubt both."

7. Do you believe price controls on oil and natural gas discourage drilling and new discovery programs?

For the first time the liberal vs. conservative viewpoints begin to show up in answers to this question. For the Democrats there are 38 who believe that price controls discourage drilling and exploration and for the Republicans there are 60. Those who believe that controls are not discouraging number 26 Democratic side and 6 on the Republican side.

Rep. Collins (R-TX) indicates his stand with "This is the only industry with price controls."

Sen. Bartlett (R-OK) remarks, "The widening shortages of interstate natural gas are the most obvious illustration of the failure of price controls. Recent price controls on oil show similar results."

Says Rep. Ketchum (R-CA), "I believe present controls on the price of interstate gas are responsible for the shortages of that product and should be removed immediately. Whatever possessed my colleagues in the House to vote for more regulation is beyond me."

According to Rep. Kasten (R-WI), "Natural gas price regulation has failed in its original intent. It has kept prices down, but the unrealistically low prices have undermined incentives for high cost, high risk exploration thus playing a large part in creating the current shortages. Needed capital must be generated. Deregulated prices would encourage producers to (1) commit larger amounts of gas to long term contracts (2) increase drilling in already discovered fields and (3) promote exploration for new gas fields."

Along the same lines, Rep. McClory (R-IL) writes "House Republicans, including myself, are convinced that the only realistic and effective means of dealing with the future oil and natural gas situation is to deregulate market prices. Deregulation, with its resultant higher wellhead prices, would provide the economic incentives needed to stimulate exploration and development in these industries. One clear cut example indicating the incentives provided by deregulation can be found in the intrastate natural gas market in Texas where new gas is selling for $1.80/Mcf and drilling has increased by 100%."

Is this tongue in cheek? Rep. Crane (R-IL) "Maximize profits! Let Meany and Woodcock invest union pension funds in oil stocks and keep plants and cars running." (George Meany, labor leader, wants a government oil company be-

Congress Spills Views

cause it would require more organized workers.)

There is not a lot of comment from the Democrats who say "Controls are not discouraging." One is Rep. Harrington (D-MA) who points out "Price controls may be discouraging oil and gas drilling, but, in my opinion, the failure of the industry to develop new reserves is not justified. Rather it seems the industry is determined to wait for decontrol before making the full commitment to energy production."

Another is skeptical. Rep. Early (D-MA) believes "A great deal of those activities goes on with price controls."

8. Do you believe U.S. oil producers should be paid the same price for crude oil as foreign producers?

This question touched off a lot of remarks indicating the legislators are perfectly aware of the situation. Affirmative answers are given by 27 Democrats and 35 Republicans; negative answers come from 30 Democrats and 16 Republicans. Seven on each side wanted price decided by the market.

As Rep. Kindness (R-OH) states, "Market should be left free to determine price." Rep. Chappell (D-FL) has the same idea, "Supply/demand operating in free market environment should determine."

The view is shared by Rep. Hightower (D-TX): "Prices should reflect only the constraints placed upon them in a market unhindered by government regulation." Rep. Moore (R-LA) wrote "They should be paid world market price which may or may not be the same."

Rep. Mann (D-SC) adds, "Yes, if it is keyed to costs and not an artificial cartelized level." Rep. Johnson (R-PA) writes, "Only a free market and competition can provide price differences." Rep. Steelman (R-TX) says, "Only as market place dictates that price."

Others object. Rep. Abdnor (R-SD) says, "Not at today's unrealistic price. I feel U.S. producers should get a fair price, but not unjustified — 10% to 15% profit is realistic." The Congressman apparently does not know profit margin on sales is presently around 5%.

In agreement, Rep. Edgar (D-PA) writes, "No, unless such foreign price is set by competition instead of a cartel which would be a violation of anti-trust laws if done by domestic companies in the U.S."

Also checking "no", Rep. Hannaford (D-CA) says, "No, not unless the world goes to a free market price."

Sen. Goldwater (R-AZ) puts it simply, "If market calls for it." And Sen. Curtis (R-NE) concludes "Unless U.S. producers can produce it more cheaply, which I believe they can."

Reasons Sen. Hart (D-MI): "Certainly I think that in a free, competitive market, U.S. oil producers should receive world market price for crude. I believe that the gradual decontrol Congress voted is necessary to phase in the impact on the economy of higher crude prices. To insure that the market is a true competitive market, I favor divestiture of crude oil production from other industry functions. And — when I talk about equality in the world market — I would hope those producers who want the world market price when it's $11/bbl would be willing to accept the world price if it should drop to, say, $7 or $8/bbl."

9. Should we continue selling gasoline to Americans in the 58¢/gallon area (since we produce only 62% of our requirements) when prices in other industrialized nations are 2 to 4 times that price?

This question brings 54 "yeses" and 36 "noes" and 17 who suggested the marketplace for pricing. Several mentioned that the high prices in other countries are taxes and they didn't care for more taxation.

Rep. Eshleman (R-PA) points out, "Most of that difference is taxation." And he is right.

Sen. Beall (R-MD) says "We should not control retail price." Opposite him, Rep. Udall (D-AZ) writes, "The price should reflect market conditions but OPEC should not control domestic price." Of course, OPEC only indirectly controls any gasoline price.

Sensibly, Rep. Runnels (D-NM) puts it like this: "Yes, if the companies can make a profit at that price. No, if the companies lose money at that price."

Bluntly, Rep. Sebelius (R-KS) remarks, "This 'we' connotes the government — get the government out of the marketplace." Rep. Michel (R-IL) says, "This answer may be unrealistic but there is no justification for the price in the U.S. being doubled or quadrupled just to match the foreign price."

Writes Rep. Archer (R-TX), "Price of gasoline in this country should be established in competitive market place. Price in other countries is in itself no yardstick for U.S. prices." Rep. Moorhead (R-CA) says, "Price should be set by the market." Rep. Murphy (D-NY) explains, "It depends on the ability to market and produce at that price." In the judgment of Rep. Rousselot (R-CA), "Free market should determine price."

Rep. Wiggins (R-CA) responds, "Prices should reflect costs and competition — ours not theirs — unless the foreign price directly impacts our costs." Rep. Carter (R-KY) says, "Yes, if profit margin is high enough and it seems to be." Rep. Burke (R-FL) comments, "Great problem as I see it is policy of suggesting either raising prices or rationing."

No one mentions the idea that if U.S. crude oil were not under price control it would have to compete in the market place which might bring all oil prices down.

Rep. Fraser (D-MN) answers the question: "I would favor a high price for gasoline, if a large component of that price were a federal refundable tax, which would serve as a means of income re-distribution as well as an energy conserving force. The price of gasoline in European countries is high because of the high government tax."

10. Since the U.S. produces less than two-thirds the energy it requires, do you believe this handicaps our defense capabilities?

An overwhelming majority vote "yes" to this question, but there is a lot of static also. Those who check "no" have plenty of explanations. Here are some:

Rep. Dellums (D-CA): "Nothing handicaps our defense (i.e. military) capabilities."

Rep. Crane (D-IL): "Not necessarily, but overdependence on one part of the world is always a great concern."

Rep. English (D-OK): "Uncertain because of coal potential."

Rep. Gonzalez (D-TX): "It depends on receptions of likely war scenarios; i.e., in a short war industrial stocks make little difference; but in a long war they make the total difference."

Rep. Winn (R-KS): "To the extent that our imports are subject to arbitrary disruptions."

Rep. Zeferetti (D-NY): "Vertical and horizontal energy monopolies that stifle **laissez-faire** competition do not contribute to greater energy supplies for the American people." (It doesn't exactly fit the question.)

Rep. Baucus (D-MT): "Probably to a degree."

Summary

Polling Congressmen is highly interesting and respondents are usually courteous and amiable and answer frankly.

Like Rep. Van Deerlin (D-CA): "You may quote my comments, including the comment that this ia a lamentable questionnaire, containing loaded questions that no intelligent person could answer 'yes' or 'no'." He then answered every one of the 10 questions. Thank you, Mr. Congressman.

P&GJ

CENTURY III

select panel of authorities offer their views on the ascinating new world of pipeline energy and the energy ontiers still available to our nation and our planet.

Next 100 Years Will Be Critical To Survival

by
Frank G. Zarb,
Administrator,
Federal Energy
Administration

A glance at the predictions for America's future energy situation made in the past — even as recently as five years ago — shows the danger of trying to forecast future energy conditions accurately.

Still, some things can be said with a high degree of certainty. We will need more energy — a lot more — to meet the future needs of a growing population and a growing economy. And we do have the resources and the resourcefulness to provide those future energy needs from domestic sources, free from the threat of arbitrary cutoffs of imported energy supplies.

We will need to conserve energy wherever possible, and we will have to develop a new sense of the real value of energy in order to encourage the most efficient feasible use of energy in all new applications. We will need to develop our domestic potential resources of oil and natural gas as rapidly as possible. We will need to make the best possible use of the massive coal resources possessed by this Nation. And we will depend increasingly on nuclear energy to provide our electric power requirements.

But, most importantly, we will need not just one of these actions but *all* of them. Only the complete combination will accomplish the job of allowing us to bridge the gap between our present energy dependence and our future energy invulnerability. And only with the contribution of all of these actions to rebuilding our energy self-reliance can we buy the time necessary to bring promising new energy technologies from the trial-and-error stage to full commercial viability.

Our total energy requirements will continue to grow for the foreseeable future. The rate of growth will be reduced, granted, but those who advocate a total absence of growth are simply ignoring the facts of our economic life.

For the next 10 years, our primary task must be to make the optimum use of our presently available energy sources — conservation and the fossil fuels — to limit our increasing reliance on foreign petroleum. For the years beyond the next decade, our biggest job will be the development of relatively inexhaustible energy resources to meet future energy needs. To be ready to meet the Nation's requirements for energy at the end of this century and in the next century, we will have to begin now to develop advanced energy sources, and at the same time make the most of the energy sources that we can tap quickly, using existing technology.

We need not, we cannot, and we will not have to choose between having adequate energy supplies and having a safe, clean, productive environment. We can have both, now and in the future, if we strike a sensible balance between the need to protect and improve environmental quality and the equally important need for secure energy supplies.

Perhaps the most critical factor in determining whether we will be able to fulfill our future energy needs from domestic sources, rather than from foreign supplies, is public awareness of the need to take action now to prepare for the years to come.

We cannot afford to wait until energy shortages become severe and we cannot afford to gamble on the chance of not having another embargo in the future. If we do, we will find ourselves increasingly unable to act quickly enough to provide energy for industries, businesses, and individuals if and when shortages do occur.

Energy independence is not just a catchy concept. We did have energy independence for many years, and we can have it again during our third century as a Nation.

We have begun the process of regaining our energy invulnerability, but we have barely begun. Much more needs to be accomplished — and soon — if domestic energy self-sufficiency is to be the basis for our economy and standard of living for the next hundred years.

The energy problems faced by the United States are as big a challenge as we have faced in our history. But we have met and mastered challenges in the past, and we can do so now.

III

Major Shifts Ahead In Energy Sources

by
Robert C. Seamans Jr.,
Administrator,
U.S. Energy Research
and Development
Administration

In 1850, the dominant fuel for energy in the United States was firewood. By 1910, 60 years later, coal accounted for about 90% of the Nation's energy supply. And after another 60 years, in 1970, the Nation depended for 77% of its energy on petroleum and natural gas.

1970 was a watershed year in that U.S. production of petroleum peaked at about 10 million b/d and has been declining ever since. Natural gas production hit its peak in 1973 and is now declining even more rapidly. We anticipate that new wells on the Alaska North Slope and possibly on the Outer Continental Shelves will produce only a temporary delay in the inevitable running out of these domestic fuels. Moreover, total world reserves may last only another 30 or 40 years.

Thus very early in the next 100 years, we must see a dramatic worldwide shift away from these two fuels to alternate energy sources now under development. And it will have to be a lot more rapid than past shifts in this country because we do not have the luxury of another 60 years in which to accomplish the change.

The mission of the Energy Research and Development Administration is to develop the necessary alternate energy technologies and also the technologies needed to accomplish the transition to these new energy sources. Two technologies fall into the transition category — energy conservation and enhanced recovery techniques for the remaining oil and gas. With regard to the latter, we believe that enhanced recovery can extend our oil and gas supplies by as much as a decade, and we are accordingly giving these technologies our highest priority for the near term.

Conservation must be far more than a transition technology, however. It is unlikely that energy ever again will be regarded as the cheap, limitless resource it once was in this country. The United States and the rest of the world will have to embrace an "energy conservation ethic" for at least the remainder of our lifetimes if not beyond. To facilitate this vital conservation ethic, ERDA is developing a spectrum of conservation technology in the form of more efficient energy-consuming devices aimed at eliminating the current extensive waste of energy that is now routine.

On the energy supply side, coal and nuclear power are expected to play major roles in the United States at least through the end of this century and almost certainly well into the 21st century. ERDA is developing a number of direct coal utilization technologies so that we can take advantage of this country's vast coal reserves in an environmentally acceptable manner.

Similarly, current light water nuclear reactors are expected to rise sharply in number and capacity through the end of this century. The advent of the nuclear breeder reactor, which we have under intensive development now, could extend our uranium supply into several centuries worth of energy. This technology, however, along with solar electricity and the possibility of nuclear fusion, will require many years of research and development and are most likely to make their impact not much before the turn of the century.

In the nearer term, other new technologies are expected to make growing fractional contributions to our energy economy as they come into more widespread commercial use. These include solar thermal applications, geothermal energy and our emerging synthetic fuel industries. The synthetic fuels are, of course, of special interest to the pipeline and gas industry because these are the fuels that will be flowing through the current pipeline network in the future and will be feeding the vast array of energy consuming devices now fueled by gas and oil.

Processes now are under development and demonstration to convert some of our coal reserves — particularly the environmentally difficult high-sulfur coals — into clean high-Btu and low-Btu gas and liquid coal derivatives. In addition, vast quantities of oil, more in fact than in the known Middle East reserves, now are locked up in domestic deposits of oil shale. An estimated 600 billion barrels is estimated to be contained in the high grade ores alone. With fortuitous technological development, these oil shale deposits can form the foundation of a whole new domestic oil industry for the next century.

Thus it appears that the next 100 years in energy will be characterized by a major shift away from the petroleum and natural gas, replaced initially by coal and conventional nuclear reactors, with the later addition of synthetic fuels, solar and geothermal techniques, and finally the commercialization of one or more of the infinite energy sources of nuclear breeders, fusion, and solar electricity.

III

Century III

Industry, Government Cooperation Essential

The most critical issue with regard to energy that must be resolved during the next 100 years is what will take the place of fossil fuels. The lifetime of the ultimately recoverable resources of all the fossil fuels combined — both in the United States and in the world as a whole — roughly corresponds to this period at a projected energy demand growth in the 2 to 3% per year range, and peak productive capacity would undoubtedly occur much sooner than that.

Even 100 years is not really much lead time because, in the past, it has taken roughly 60 years to change from the predominant use of one energy form to another. From wood and water and wind power to coal took 60 years, and then from coal to oil and natural gas took another 60 years.

Nuclear fission, which was to be the next new energy source, is already way behind schedule because of a whole range of institutional, resource, technical and environmental problems. It cannot reach its full potential in the form of a breeder-reactor economy unless these problems are resolved. If, for some reason, breeders are rejected as a source of long-range energy supply, the available alternatives do not look very promising at this point. Among the major ones, the taming of fusion energy has yet to be demonstrated scientifically, and the many different candidates for high-technology approaches to capturing and utilizing solar energy are in a very early state of development.

We know, of course, what a low-technology solar energy economy looks like. This is what we had from the beginnings of mankind until the early to middle 1800's. During this period, which now looks so enchanting to many of our political and intellectual leaders, the world's population barely reached one billion and only a tiny fraction was adequately fed, clothed and housed, and had the physical, social and economic mobility required for any meaningful exercise of personal and political freedom.

With an expected world population of 7-billion by the year 2000, the urgency of finding energy solutions that will prevent regression of mankind to the general state of misery characteristic of most of its history should be apparent.

The major energy issue with regard to the near- or intermediate-term is the Nation's unwillingness to make the hard policy decisions that will allow speedy development and production of our substantial remaining oil and natural gas resources and the orderly development and utilization of our huge coal and oil shale resources.

Quite clearly, to gain 100 years of lead time to arrive at more permanent solutions to energy supply, the prompt elimination of obstacles in the way of these near- and intermediate-term solutions becomes extremely critical. Continued inaction, in the face of the near-certainty that world crude oil productive capacity will peak around the turn of the century and world natural gas productive capacity not long thereafter, invites disaster.

Developing Long Range Solutions Is Imperative

In the past 250 years, mankind has eaten its way through a big portion of the fossil fuels that it took the sun many millions of years to lay down.

We Americans, of course, have developed the most voracious energy appetite of all. We waste more than most nations use. Our 6% of the world's people account for 30% of the total energy consumption. About 90% of the power we use comes from burning fossil fuels — petroleum, coal, natural gas.

Our standard of living is largely based upon our use of this energy. Today one gallon of gasoline performs the work equivalent of 25 man/days. Without it, or something to take its place, life would be infinitely harder for every one of us.

By the most optimistic projections, the world's total supply of fossil fuels will be exhausted in the next several hundred years. The key word here is "exhausted." There will be no second crop.

In the U.S., we have sufficient coal to last perhaps 300 years. Our known oil reserves, however, are good for *less than 20 years* at our *present* rate of consumption — a rate which, incredible as it may seem, has been *doubling* about every ten years!

There are short-range palliatives and a long-range solution. The first are important, the latter imperative.

The short-range goals include developing Alaska's North Slope, encouraging more natural gas exploration, building off-shore superports for big tankers. Most of these are in the making.

For the decades immediately ahead, we're going to have to hurry the development of interim fuel sources such as the conversion of coal to gas and fuel oil. One highly promising process known as H-COAL has been perfected.

In a coal liquefaction program using commercial conversion plants of sufficient magnitude, it is possible even with today's technology to transform coal into liquid fuel at a price competitive with that of oil. Yet the federal government has been shamefully timid about providing the seed money for such a program.

For the long haul, the most hopeful answer to the world's energy problem is *solar power.*

The energy of the sun is safe, clean and inexhaustible. Its rays cannot explode. They do not produce radioactive wastes. They do not befoul our land or air or water. And they will surely be around as long as mankind is — perhaps a good deal longer.

The true potential of solar power all but boggles the mind. Scientists say the energy which falls on the United States in the form of sunlight each year is equal to 9,000,000,000,000,000 (nine quadrillion) kilowatt hours of electricity . . . almost *500 times* as much energy as we use for *all* purposes in this country each year.

All this development depends, however, on whether we are willing to spend the money necessary to perfect the methods and build the machines to harness solar energy effectively. All the fundamental scientific facts are well known. Solar energy requires no dramatic break-through such as we achieved on nuclear energy with our war-time Manhattan Project. All we really need is the will to get started.

As chairman of the House Democratic Task Force on Energy and Economy, I frankly have been disappointed at the failure of the present Congress to meet the real challenges of the energy crisis.

True, we have initiated a few rather timid conservation measures. We have dabbled in questions of energy pricing. We have enlarged to some extent the scope of our long-range research.

But for all practical purposes we have done nothing — absolutely nothing — to bring on the actual production of alternate sources of energy from technologies presently available to us.

Too often Congress has been simply unwilling to make the hard decisions and to take the difficult steps necessary to start us on the road to energy self-sufficiency.

What are we waiting for? Let us get on with the job. Let us move forward so that 100 years from today historians will not have to lament that our generation was too timid to attack the problem, too quarrelsome to get together, and too petty to act.

by
Congressman
Jim Wright,
Chairman,
House Democratic
Task Force on
Energy and
the Economy

III

olutions To Energy Survival Are Achieved

by
Dr. Henry R. Linden,
President,
Institute of
Gas Technology

The gas industry will have to play a pivotal role in the next 100 years. It not only is still the major supplier of energy from domestic sources in the United States, as well as the most threatened in terms of its ability to continue supplying the demand for its essential commodity, but it is also in the lead position for bringing to market the Nation's huge coal resources in an environmentally acceptable and economically competitive way through the medium of coal gasification.

Only institutional barriers have so far delayed the construction of a substantial number of coal gasification plants based on fully developed and proved commercial technology, the first essential step toward greater energy supply security.

Similarly, only institutional barriers stand in the way of freer international trade in LNG. This is unfortunate inasmuch as the world's natural gas resources are roughly equal to those of crude oil, and the only practical way for the 7-billion people in 2000 to survive until long-term energy solutions are implemented is to freely exchange all essential commodities at fair market value.

In the longer range, the fascination of planners everywhere with total electric solutions has made it difficult to develop new technology designed to ensure an essentially perpetual supply of energy and chemical raw materials in forms which are of the greatest public benefit. It can be demonstrated that gaseous fuels can continue to offer an economical and environmentally desirable alternative to electricity for the foreseeable future, be they derived from unconventional sources of natural gas, or from coal, oil shale, nuclear energy, biomass or direct solar sources.

The challenge to the energy industry and Government in the next 100 years is to cooperate in finding solutions to an energy crisis that need not be a crisis at all as long as all reasonable options are given a chance and means are found to make rational selections, and promptly implement the most promising.

III

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Century III

America's Economic Miracle — Cheap, Abundant Energy — Must Face Up To Its New Problems

by
Dr. John B. McCall,
Consulting Economics Editor

Every society in the world, one way or another, has to decide WHAT it is going to produce in the way of goods and services, HOW it will produce them, and WHO will get the benefit of these goods and services. History seems to pin our success, to date, on a lucky combination of abundant resources (including a labor force willing to work plus cheap, plentiful energy), a fairly isolated location, political stability, and an economic structure that emphasized the promise of profits and the discipline of losses as the major mechanism by which we made the societal decisions as to WHAT, WHY, and FOR WHOM to produce.

The magnitude of the American economic miracle — so far dependent on this lucky combination — is now facing an entirely new problem, the solution of which may well be with us in the entire third century. That problem is the Energy Revolution. It's said that we took 60 years to convert from wood to coal and another 60 years to convert from coal to oil and gas as our major energy source. We are faced now with the plain fact that we don't have 60 years in which to convert to other energy sources. Solution of this problem requires simultaneous attention to both the immediate dimensions of energy supply as well as to the long-term solution.

Our institutions seem ill-equipped to respond to the energy problem. In the short-term dimension (better use of oil and gas), profit and loss signals to the corporate decision process have been dulled by excessive governmental regulation. Long-run response to the energy problem (conversion toward alternative energy sources) has been blunted by the fact that energy corporations have huge investments in existing technology to protect. Politicians plan for the next election and corporate management anticipates the next stockholder's meeting. We all tend to live in the short-run. Solution to the energy problem is long-run in nature.

To continue the American economic miracle into the third century we must accomplish the following:

- Develop increased domestic supplies of oil and gas with the net increase coming mostly from offshore production.
- Increase domestic coal production — mostly from western reserves.
- Implement the available technology to move this coal from mine to market via gasification, slurry pipelines, and generation electric power.
- Proceed without delay in the construction of nuclear power plants and recognize that only breeder reactors will make the nuclear route viable because of limited uranium supplies. Should a nuclear moratorium evolve, the trade-off cost will be the doubling of coal production from our western reserves.
- Commit considerable capital to further research on new energy sources such as geothermal and solar energy.
- Loosen the historical 1-to-1 link between primary energy use and the overall level of economic activity through conservation and more energy-efficient technology.

These accomplishments will have to be pursued simultaneously and their realization requires events such as the following:

- Significant moves toward price deregulation of oil and gas.
- Fairly steady economic growth at a 4 to 7% annual rate in real terms with no more annual inflation than 6%. In this context, the capital needed to finance the energy revolution will be generated, as well as the optimism and stability necessary for the decisions to be made.
- Considerably-expanded offshore leasing activity on the part of the government.
- Eminent-domain capability for new coal slurry pipeline construction, as well as quicker action by the government on requests for new installations and conversion of old facilities.

With the favorable environment described above — and it seems to me that it is all absolutely necessary — the energy dimensions of the U.S. economy in the third century should develop roughly along the following lines:

By the year 2000, coal will have replaced oil and gas as our major primary energy input. In the early years of this conversion, much coal will be hauled by rail but, as the major cost of coal as a fuel is not the coal itself but its transportation, this fuel will be transported increasingly by pipeline (both as a slurry and as a gas). The time-frame of this conversion toward coal will depend upon how lucky we are with new offshore finds of oil. Consumption of remaining oil and gas will become more closely tied to the areas where it is produced.

Assuming nuclear power development continues apace, significant amounts of our electricity will come from this source.

After the turn of the century, although coal will continue to be the "main line" source of primary energy, what are now the more exotic forms of energy would become viable. Onsite liquefaction of coal and extraction of liquids from extensive shale deposits should supply most of our demand for liquid fuels. Where sites are available, geothermal energy will be harnessed. Finally, both direct and indirect (wind, ocean currents, bio-mass) forms of solar energy will evolve toward eventual dominance of our energy supplies as we enter the fourth century.

Such grandiose predictions are, in large measure, anybody's guess, and trends mentioned above seem both logical and obvious. Realization of these trends requires occurrence of some necessary preconditions outlined above plus these final general observations:

1. Into the near future, although we still continue to have general inflation of all prices, we will also continue to have a change in *relative* prices . . . energy prices will take a larger relative share of every individual and business budget.
2. Development of both technology and economic productivity to bring about the energy revolution requires long lead-times; we have to start now.
3. The more exotic forms of energy will become viable

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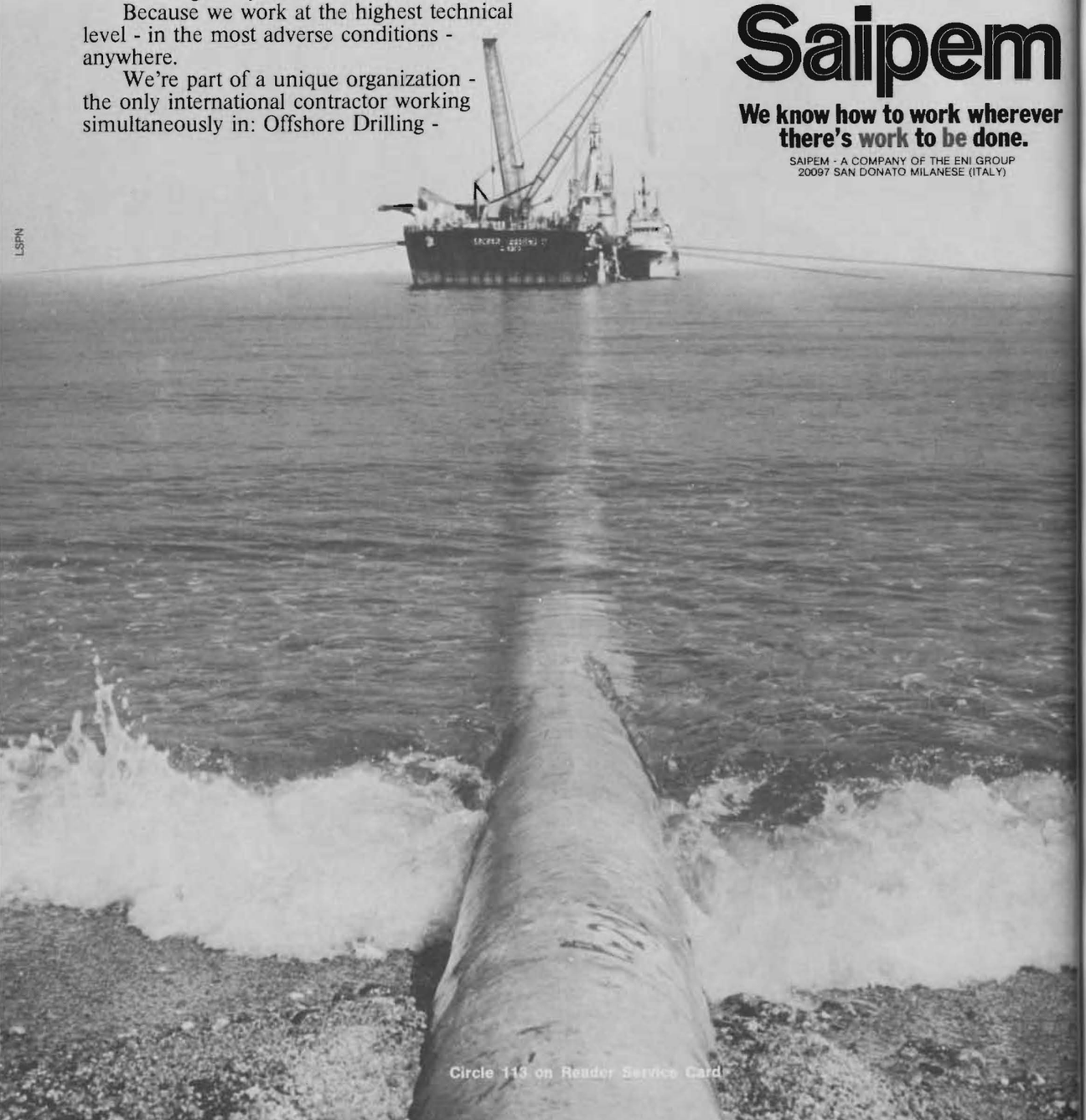

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A centrifugal compressor for installation in the North Sea has been successfully tested at 700 kg/cm² (10,000 psi)

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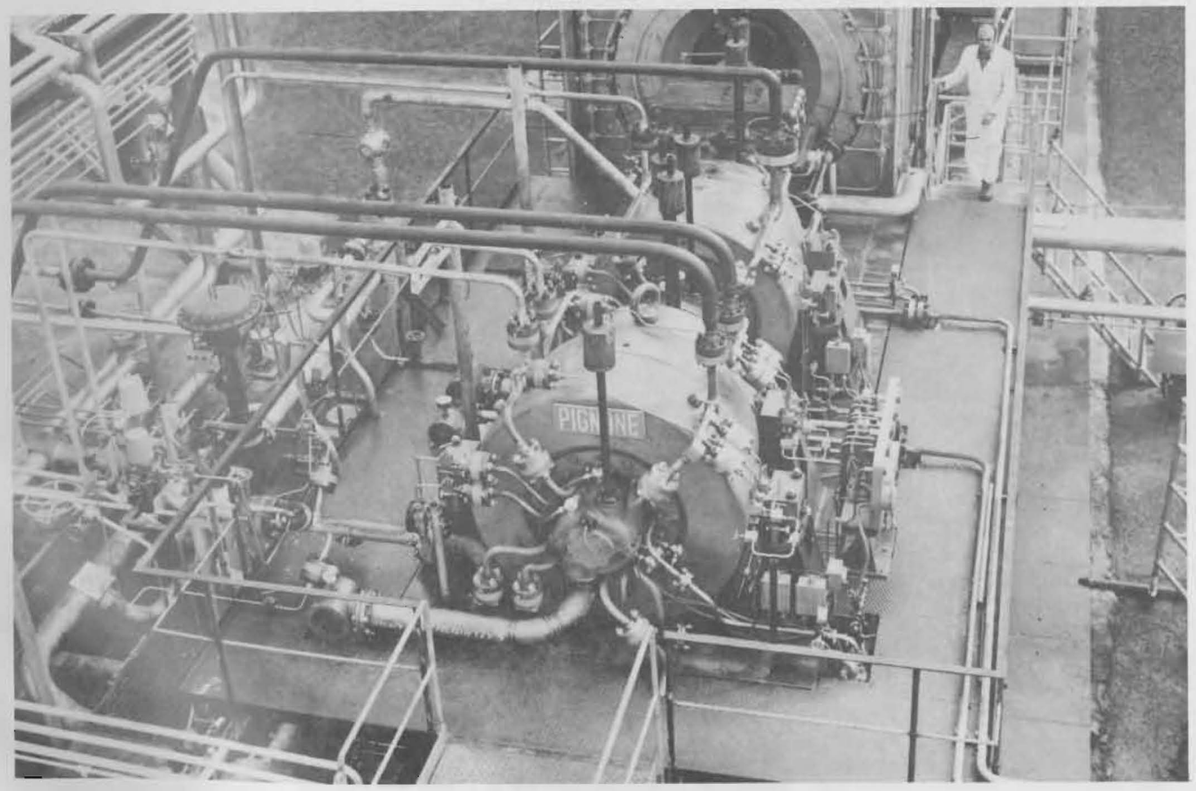

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sooner than is generally expected because prices of more conventional energy will rise faster than we wish to contemplate and because dependability of continued supply will become more important than price as conventional energy sources approach final depletion.

4. As this energy revolution evolves, we will come to view all energy sources in terms of their "net" energy contribution (energy produced minus energy consumed in all aspects of production).
5. Finally, and here we return to the question of HOW we will produce energy . . . will government or private industry produce this energy? Under favorable circumstances, it seems that private capital will be available to finance this revolution (about 30% of total net investment in the economy). The profit motive, however, will not funnel much private capital into the now-exotic possible forms of energy and this indicates that the government will play a role here. Private industry needs to have unrestrained profit and loss signals to do the job intelligently. Private industry needs to act responsibly in exchange. Price and decision regulation by the government, while necessary in degree and concept has gone too far as things now stand. It should be freed-up — and if it isn't I suggest we all get some books on the recent history of England and "read-up".

Lincoln said it: *"The dogmas of the quiet past are inadequate for the stormy present. The occasion is piled high with difficulty and, as the case is new, we must think anew and act anew. We must dis-enthrall ourselves. Then we shall save our country!"*

III

Integrated, Comprehensive Energy Policy Urgently Needed

by
W. L. Naumann,
Chairman of the Board, Caterpillar Tractor Company

There will be three major influences on the energy industry during the next 100 years — availability, politics, and technology. All three must be considered individually, then collectively, if even an uncertain picture of the future is to appear.

Supplies of oil and natural gas in the United States are already insufficient, and reserves are dwindling. As a result there will be a continuing dependence on foreign sources for these fuels. Hydroelectric capacity in the United States is almost fully developed. Nuclear power and energy from the sun, wind, and tides are so closely tied to technology that they must be considered under that topic. That leaves coal, the most abundant energy resource in the U.S. That fact alone means coal will play a major role in meeting U.S. energy needs during the next century.

Politics on both the domestic and international level affect the energy industry. In the United States, political actions influence the way energy resources are recovered, transported and consumed.

These actions have significant impact on costs in every facet of the industry. On the international level, political action can artificially control the supply and price of fuels.

Of the three major influences on the energy industry, technology will probably emerge as the most significant. Before coal resources can be fully utilized, desulphurization and gasification methods must be significantly improved. Before nuclear power can realize its potential, the technical problems of breeder reactors (and, hopefully, fusion reactors) must be overcome. Solar power requires major technological breakthroughs before it will be anything more than a footnote to the U.S. energy story.

Taken together, these three influences mean:

1. Fossil fuels will continue to be the major sources of energy for a considerable period, perhaps for most of the next century;
2. During this period, coal will be the dominant U.S. fuel because of its availability and freedom from foreign control;
3. Other sources of energy, particularly nuclear power, will gain in importance as technology develops;
4. Energy will become more expensive as supplies of easily recovered fossil fuels decline and expensive, sophisticated technology is required to produce power; and
5. By the end of the next century, no one fuel will be dominant. Many different types of fuels and technologies will supply the needs of a more populous and energy-conscious world.

As energy prices rise, industrial consumers will have to develop more energy-efficient production methods and convert increasingly to more readily available sources of space and process heat such as coal and electricity. Factories and offices will be designed to conserve energy.

Earthmoving and construction machinery will also be affected. Machine efficiency and fuel consumption will be stressed, and eventually, new systems for powering machinery will be developed.

The requirements of the future point to one, overriding need — an integrated, comprehensive national energy policy. It must set national energy goals, give direction and financial assistance to technological research, allow financial incentives for business firms to meet the nation's energy needs, and find the needed balance between the desire for a clean environment and the demand for abundant energy. The formation of such a policy should have top national priority.

III

(Continued page 27)

How the American Technical Improvement Program (T.I.P.) helps you get the most from every bit of gas.

What never changes about an American Meter product? The fact that it is constantly changing—for the better.

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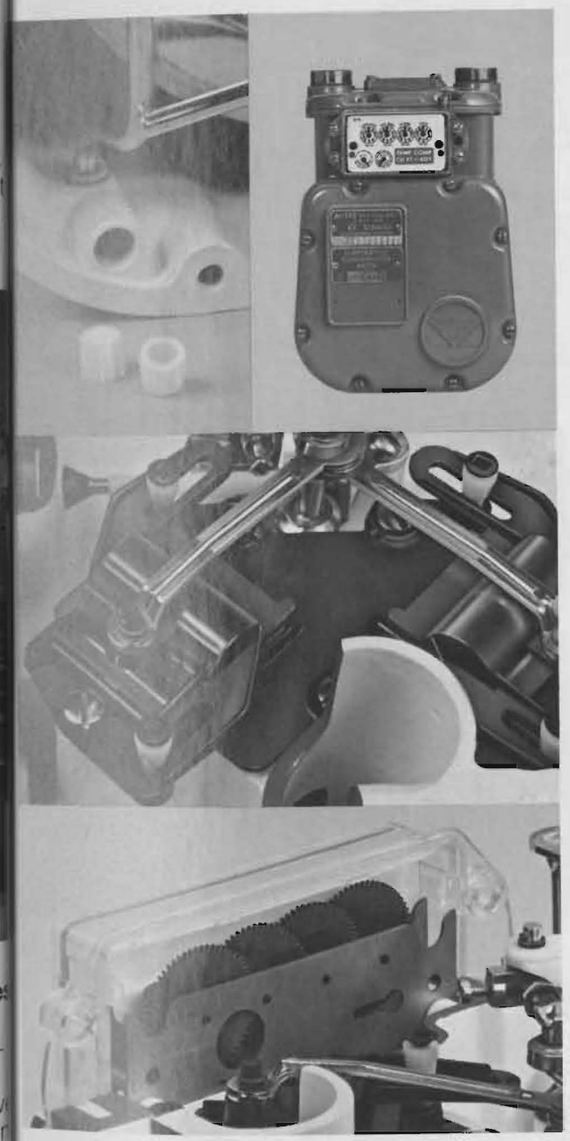

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Century III

New Technology Needed By Tomorrow's Energ

by
Harold C. Price,
President,
The Price
Companies.

Looking toward the future often is aided by a study of the past. My views of the next 100 years are influenced most by our industry's history, and the advanced technologies that are now emerging.

By the end of the next 100 years, we will not be building pipelines as we do today. Energy will probably be transported and distributed by systems that bear little resemblance to our present facilities, and possibly by means of technology totally unknown to us today.

Any predictions are based on an assumption, and a hope, that we will not destroy our civilization, or make the earth uninhabitable for our species. If we are wise enough to survive to have the opportunity to utilize what remains of the earth's hydrocarbons, we are going to have to reach deeper into the oceans, and further into the arctic regions.

Known but undeveloped energy sources, including the sun, the winds, and the tides, will certainly be utilized to supplement the power manufactured from nuclear sources. It has been proposed by others that the electricity generated in this manner be used to separate water into its components, and that extracted hydrogen be transported in pipelines for use as a fuel. As difficult as that may be, it could prove easier than getting along without energy at populated locations distant from the generating point.

In all likelihood, the next 50 years will see a substantial increase in the liquefaction of gases for transport in small diameter pipelines. The low temperatures will require that these small lines be thermally insulated. In the year 2026, it is quite possible that the large diameter steel pipe of today will be used primarily to transport water and other products not suitable to thermal control or compression.

Equipment we may use in the future can be more accurately projected by others — but I surely would expect that it will last longer, and use less energy manpower.

There will assuredly be new pipeline contractors in the future. We hope that our successors endure to witness the accuracy, or errors, of these predictions. III

ENERGY:
The First Two Hundred Years

by Margaret G. Small, *Assistant Editor*

There was no formal recognition of the concept, and hardly anyone — if anyone — knew it existed or would even occur. A new nation was being formed. It was to be a nation whose growth was inexorably interwoven with its ability to develop and master the use of its abundant natural resources. It was to bring about the most powerful nation in the world, a nation whose people would enjoy the highest standard of living the world had ever known, and who would also enjoy 200 years of continuous democratic government, unequalled previously by civilization.

Historians have not been quick to record the economic phenomenon that helped immeasurably to make this all happen, yet it has been — and must continue to be acknowledged. That phenomenon is cheap and abundant energy.

Symbolic of America's energy future, perhaps, was George Washington's discovery in 1775 of a "burning spring" along the Kanawha River in West Virginia. This discovery by the "father of our country" might have sparked the initial thought that hydrocarbon energy in the form of natural gas and petroleum would someday play an important role in expanding and strengthening our great nation.

For two centuries, man's expanding knowledge of energy and its utilization has proven a boon to the economic, social, and political miracle we know as the United States of America. The relationship has been extremely synergistic.

1780 The nation started early on the road to self sufficiency with its break from England, establishing itself as a separate nation. Although independence allowed the new nation to shape its own direction, to form its own laws, it could no longer depend on England for essential products and raw materials.

Coal supplies from England, for example, were cut off during the revolution. Because coal, needed to heat iron and cast cannon, was vital during the war, Americans began to look for domestic coal resources.

The colonists' fervent independent spirit pressuring them beyond limits to achieve freedom, was evident in the adoption of material symbols of their freedom. The Declaration of Independence, signed in 1776, immortalized the pervading spirit of the time. The adoption of Betsy Ross' flag in 1777 was another symbol of the American pride and fervor.

Americans not only dwelt on idealistic principle but took concrete action to further establish themselves as an independent nation. In 1777 Congress adopted the Articles of Confederation, ratified in 1781. A year after the American army disbanded and the peace treaty was signed Washington D.C. was established as the U.S. capital. The nation's population, according to the first census taken in 1790 was 3,929,214.

The new nation continued to increase its strength by initiating interstate commerce, developing domestic resources, encouraging industrial expansion, and exploring new territories beyond existing state boundaries. Before 1800 the first stationary steam engine completely built in the U.S. appeared; anthracite coal was discovered in Pennsylvania; and Samuel Slater opened America's first factory, a spinning mill at Webster, Mass.

The government, keeping reigns on the growing nation, began to regulate industrial, economical and territorial expansion. In 1786 state representatives met at Annapolis to consider a unified regulation of commerce. A few years later Congress established a mint in Philadelphia. U.S. interest in territorial expansion was evident with the signing of the treaty with Spain in 1795 which allowed the U.S. free navigation of the Mississippi.

1800 The U.S. population had grown to 5,508,483, with only 5% west of the Alleghenies. Exploration west continued, initiating new developments in transportation. In 1804 Louis and Clark began their expedition westward. Congress appropriated $30,000 for a national road, linking settlers across the Alleghenies to the east. In 1805 Fulton's steamship, *Clermont*, made a successful trip up the Hudson, 150 miles in 32 hours, initiating a new era in water transportation.

The need to tap domestic natural resources and expand industry became

even more apparent during the War of 1812 as the British European blockade prompted suspension of foreign trade. New energy innovations developed simultaneously, stimulating the growth of industry. In 1812, David Melville of Newport, R.I. successfully made gas in his home, lighting his house and street in front. A year later, he was granted a patent for his gas-making machine. Soon after he introduced gas lighting in a cotton mill in Watertown, Mass. and in a mill near Providence, R.I. in 1813. The first textile mill to use powered machinery, owned by F. C. Lowell, opened in Waltham, Mass. in 1814.

Gas lighting appeared in Baltimore in 1816. Rembrandt Peale, Baltimore museum owner and portrait painter, attracted great crowds on the eve of June 13, 1816 by lighting his museum with gas lights. Peale's newly organized Gas Light Co. of Baltimore, a month after his museum exhibition, was chartered by the city council to lay pipe in city streets for gas street lighting. A gas plant was soon erected along with gas storage holders, looking like giant beer barrels and on Feb. 7, 1817 the first U.S. street was gas lighted.

At first only manufactured gas was used for illumination, however natural gas came to be used more frequently for this purpose as new discoveries were made. The first natural gas discoveries were accidental, usually resulting from drillings for salt brine. Gas was considered a nuisance by salt miners, in some cases accidentally igniting.

In 1821 at Fredonia, New York, the first natural gas well was drilled specifically to obtain natural gas for lighting purposes. After gas had been discovered on the banks of Canadaway Creek by small boys at play, the townspeople, realizing the value of the "burning spring," drilled a well 27 ft deep and piped gas through small hollowed-out logs to several nearby houses for lighting. These first primitive pipelines were laid end to end while joints were sealed with rags, hide, iron bands or whatever else was at hand.

William A. Hart, the local gunsmith, later replaced the log pipe with a ¾-in. lead line, ran the gas 25 ft into an inverted water-filled vat, called a "gasometer," and ran the line to one of the local inns for illumination. Soon other houses were lit by this same procedure and Fredonia became the "world's most lighted town." In December, 1825 the Fredonia Censor recorded, "We witnessed last evening burning of 66 beautiful gas lights and 150 lights could be supplied by this gasometer, (gas holder). There is now sufficient gas to supply another one as large." Fredonia's gas supply was acclaimed as "unparalleled on the face of the globe." General Lafayette, travelling through Fredonia that same year, stopped by the brilliantly illuminated Taylor House and remarked that he had better get away from a place where gas came from a mysterious underground source as it must be too near Hades!

1825 Gas lighting soon expanded to other American cities even though customer resistance persisted due to the oil lamp business and feared dangers of gas explosions and asphyxiation. Organization of gas companies occurred between 1826 and 1836 chiefly to light streets, for home gas lighting was too expensive.

The New York Gas Light Co. was granted a charter in March 1823 but not

This gas-making apparatus lit William Murdock's cottage.

until 1825 did customers receive gas, sold for $10 per Mcf. In 1828 New York's, "Great White Way," Broadway, was lit by gas lamps. The city of Philadelphia decided to build its own gas works in 1834, establishing the first municipal gas sytem in the U.S. After the proven success of gas lighting, companies across the nation formed to produce and distribute gas: Boston in 1828, Louisville and New Orleans in 1832, Pittsburgh in 1836, Washington in 1848, and Chicago in 1850. The Dayton, Ohio Gas Co., organized in 1848, was the first to make gas from refuse grease obtained from slaughter houses. Gas was distributed through mains of stove pipe coated with 2½-in. of lime mortar.

As gas use increased the need for a publication to serve the gas industry was met. The first issue of THE AMERICAN GAS LIGHT JOURNAL was published July 1, 1859. The first issue showed a table of "Gas-Light Companies," listing 183 in the U.S. The editor suggested that gas lights be used for railroad cars. In this issue the first technical article — on clay retorts — appeared. By October 1859 the Journal had instituted a patents column and published an article on "Gas Lighting by Electricity. It also reported a method for coating wrought iron pipe, internally and externally, with a coal tar mixture. The November issue reported gas works under construction in Honolulu, Hawaii. In December, the editor commented on the high price of gas in the U.S., calling it "the heavy charge of the light brigade."

During the first half of the 19th century the U.S. saw new innovations in other areas that contributed to the nation's self sufficiency. In 1831 American Joseph Henry introduced the first electric motor. Cryus McCormick patented the reaping machine in 1834. Charles Goodyear, in 1839, made possible the commercial use of rubber by inventing the process of vulcanization. In 1846 Elias Howe patented the first sewing machine.

1850 The existence of crude oil in the U.S. was known for many years but it was not until 1852 that it was put to use. Up until this time, dwellings had been lit with whale oil and coal gas but, as sperm whales became more scarce and coal prices increased, the pressing need for another lamp fuel became evident. Crude oil was first valued for this purpose.

Samuel Kier, testing his idea that the crude oil found in nearby Tarentum, Pa. salt wells could be used as an illuminant, decided to distill the oil twice, in an attempt to rid it, when burned, of its unbearable smoke and stench. Kier also invented a four-pronged burner, admitting air to the flame, thus intensifying the light. He was immediately able to market his household illuminant and burner. Now that crude oil was in new demand new methods of obtaining it evolved and America was soon to see the rush for "black gold."

It was Kier's new product that gave Edwin Drake the incentive to drill the first oil well. Drake was hired by James M. Townsend, an officer of the Seneca Oil Co., to supervise the drilling for oil in Titusville, Pa. where a spring, on property which Seneca Oil had acquired, bubbled oil. Townsand supported the idea, as did Drake, that if salt could be found by drilling, why not petroleum. Townsand, before financially supporting the venture, requested respected chemist Benjamin Silliman of Yale to analyze crude oil and report on its worth. Published in 1855, Silliman's report was very encouraging. It described crude oil as "a raw

material, from which, by simple and not very expensive process your company may manufacture very valuable products." Drake arrived in Titusville, Pa. May 15, 1858, at first experiencing constant set backs. He finally secured the services of Billy Smith, a competent salt well driller. Drake, in his drilling efforts, originated the principle of the drive pipe. Lengths of heavy pipe were driven through quicksand and mud to bedrock. After these had been bailed out, drilling could resume through the casing at three ft a day. On August 28 at 69 ft Billy Smith hit oil!

Oil refineries soon began to replace coal distilleries. The price of crude oil at the well was at first erratic, $19.25 per barrel in 1860, 10¢ in 1862, and 11¢ in 1864. Most of the retail price was based on hauling and container costs.

As the population increased with the "Great Immigration" from Europe in 1847, settlers forged westward. Discovery of gold in California brought settlers to the continent's western boundary. By 1849, the California gold rush was at its height. Exploratory trips, such as Fremont's expedition to the Rockies in 1842, opened up new territories to be settled. The expanding nation was held together by new methods facilitating transportation and communication.

In 1825, the Erie Canal was completed, connecting Buffalo and Albany and extending water travel from NYC to the Great Lakes. That same year the Stockton/Darlington railroad carried the first group of railroad passengers. By 1840, the U.S. boasted of 2816 miles of railroad compared to 1331 miles in England. A decade earlier Peter Cooper had secured a patent on the steam locomotive and Morse had patented the magnetic telegraph, a major communication innovation that played a major role in unifying this vast and sparsely populated nation.

The widely variant geographical areas settled in the U.S. shaped differing economic and social structures. These in turn molded various ideologies often conflicting when governmental measures were passed which applied to the nation as a whole. The south, an agricultural society, depended mainly on slave labor, while the north, not as productive agriculturally relied on mining and industry. To iron out differences the Missouri Compromise, dividing slave and free territories, was passed in 1820. Between 1845 and 1861 the North and South conflict intensified until compromises could no longer hold the nation together. Civil War broke out April 12, 1861.

1860 The Civil War prompted increased use of gas appliances and influenced inventions of new labor saving machines due to manpower shortages at home. Gas stoves began to be used. Cincinnati reported 100 families cooking on "gas stoves." The first practical internal combustion engine was constructed. A total of 60 patents related to gas making were listed in the Sept. 16, 1864 issue of THE AMERICAN GAS LIGHT JOURNAL. During the war local and federal governments continued to keep tabs on the gas industry. Congress, to raise money for the war effort, passed a 5¢ per Mcf tax on gas sold by gas companies. Massachusetts passed a law in 1861 establishing the office of "Inspector of Gas meters and of Illuminating Gas."

The oil industry continued to boom during and after the war. These years were ones of rapid expansion and tough competition, for neither government or business had formed policies to guide such fantastic growth. The nation was in the grip of a remarkable economic and social transformation. Pioneering oilmen leapt into the business with neither the funds nor the experience.

Titusville had been transformed almost overnight from a peaceful town into a cauldron of activity. Other towns in Pennsylvania, West Virginia, Kentucky, Ohio, and Indiana, where major oil strikes had been made prior to 1900, continued this same pattern. In 1860 the oil region in Pennsylvania was producing a total of 650,000 bbl per day of oil.

To solve their problem of transporting oil from the backwoods country where it had been discovered to waiting markets, early oil transport pioneers at first used barge transportation. Another alternative was to pay teamsters exhorbitant fees to haul the oil by land to the nearest railroad station. The oilfield was adjacent to Oil Creek but 20 miles from the neares railroad. Barges and rafts were loade with barrels of oil and sent downstrea on the crest of a huge wave made b releasing dams, normally impounde to float logs downstream. The cargoe were floated to Oil City where the were transferred to larger boats for trip down the Allegheny River t Pittsburgh. In a single run 20,000 b could be brought in, but because man boats were destroyed and oil lost in th process, railroads were turned to as second solution.

At the start of the Civil War, th nearest rail outlet was at Corry Penn., some 20 miles north of Ti tusville. Tracks were soon laid t Titusville. Other nearby cities wer connected to the system and by 186 the rail network provided crude oil a outlet to Cleveland and New York Crude oil shipments totalled 32 millio gallons in 1864, despite Confederat attempts to block northern ports. Th first railway tank cars held tw wooden tanks with a capacity of 40 bb on a flat car. By 1869 wooden tank were replaced by the iron boiler tan car. Teamsters were still employed t carry oil from the field to the shi ping point and were paid from $1 to $ per bbl.

Several attempts at crude oil trans portation by pipeline had been mad but failed, due to violent teamster op position and pipeline leakage. Thes first pipelines were made of wood.

It was not until 1864 when Samue Van Syckel tried transporting oi through a 2-in. wrought iron line tha this transportation method becam successful. Van Syckel organized th Oil Transport Association and with a $30,000 loan began laying the line fro a field along Pit Hole Creek, a tribu tary of the Allegheny River, eight mile above Oil City to Miller Farm Railroa Station. When teamsters cut up por tions of the line, Van Syckel hire armed guards. The line, when com pleted on October 7, 1865, consisted o 32,000 ft in 15-ft sections, lap welde and tested to a pressure of 900 psi Three Reed and Cogswell pumps, pro viding a through-put of 81 bbls per hr were installed along the route.

The line was a success and soon second line from Pit Hole to Meredith on the Miller Farm was completed. The two lines moved 2,000 bbls per day fo $1.00 per bbl. This was less than hal the teamsters charge of $2.50 per bbl. The total project cost approximately $3,000 per mile. Competition from other companies, constructing lines i the same region, forced the price down to 50¢ per bbl. Pipeline companies also provided oil storage in wrought iron

tanks capable of holding 15,000 bbls. By 1870 approximately 1 million bbls of oil in storage was available in the oil region.

The first gathering lines, connecting oil at the well to nearby storage tanks were introduced in 1866. Prior to that teamsters had carried the oil from the well across the field to the dump tank, connected to the pipeline. Transporting oil through the gathering lines cost only 25¢ per bbl and soon displaced the teamsters, charging 50¢ to $1 per bbl. As new oilfields were discovered and production spread over a wider area, the success of gathering lines encouraged oil companies to build larger long-distance trunk pipelines, which were in direct competition with railroads.

Railroads at first favored pipeline development and soon formed transportation combines to control shipment of oil. Establishing a transportation monopoly, railroads constructed pipelines of their own or formed a transportation pool with pipelines owned by others. Standard National Transit Co. was the major monopoly, which controlled a majority of the pipe and rail transportation. By early 1870, monpolies were able to dictate prices to producers and shippers. Consequently, many producers operated at a loss as the price refineries could pay for crude oil was limited by market conditions.

Railroads strengthened their monopoly by refusing any privately owned pipeline, other than their own, permission to cross the railroad track. Public sentiment flared and in 1872 Pennsylvania and Ohio Legislatures passed laws granting common carrier pipelines eminent domain in acquisition of rights-of-way. Main trunk lines were now free to connect the field directly to refineries, providing more economical transportation.

In 1872 the Columbia Conduit System built a 3-in., 60-mile line between Millerstown, Penn. and Pittsburgh, yet in spite of the eminent domain privilege, was refused permission by the railroad to pass through a railroad crossing. The company continued the pipeline to Pittsburgh on the other side of the track transporting the oil by wagon from one storage tank to the other, placed on both sides of the track. A legal battle followed and in July 1875 the courts ruled in favor of the pipeline. The 100-ft gap in the line was completed and it began delivering 500 bbl of oil per hr to Pittsburgh refineries at 30¢ per bbl.

The principal scene of oil activity was at first along Oil Creek and its tributaries. In 1865, new oil fields were opened east of Oil Creek along the Allegheny River. In 1875 the greatest field thus far was discovered around Bradford, Pa.

Byron D. Benson, in 1878, began what seemed to be an almost impossible feat in pipelining. He organized the Tidewater Pipe Co. to construct a cast iron line from Bradford, Pa. across the Alleghenies to Williamsport, Pa. where it would reach the Philadelphia and Reading Railroads. The new pipeline pumped 10,000 bbl daily a distance of 110 miles from the Bradford field. By 1881 Bradford field production reached a peak of 80,838 bbl per day. In 1888 the line was extended to Bayonne, New Jersey. The success of these early long distance trunk pipelines awakened the public to the technical and economic possibilities of such a system. The railroad monopolies were consequently broken up and forced to reduce rates.

1875 The years from 1870 to 1900 were especially turbulent and bitter for the oil industry. Railroads fought to continue their dominance of oil transportation, rebates were given to large oil shippers, cities bargained with one another for favorable shipping rates and there was an abundance of oil depressed prices. The South Improvement Co., a secret group of principal railroads and refiners, to stop price cutting, fix freight charges, and eliminate competition, organized a war against producers. At the same time other oil producers and transporters fought Standard Oil's monopoly of pipelines, refining and marketing. State and federal governments were finally called in to regulate railroads and monopolies. The first of these regulations was the Interstate Commerce Act, requiring railroads to charge reasonable rates for passengers and freight in interstate commerce. The Elkins Act, passed in 1903, supplemented the Interstate Commerce Act, preventing the granting of rebates by railroads to certain shippers. In 1906 both acts became applicable to interstate and common carrier pipelines. As monopolies grew and friction increased more government action would become necessary.

The oil industry continued, until the turn of the century, to center around Eastern U.S., mainly Pennsylvania, Ohio, West Virginia, Indiana, although small oil strikes had been made in western states. By 1900 Pennsylvania was still the largest oil producer. It reached its zenith in 1882, producing 30,053,509 bbl.

Smaller oil fields had been discovered in Freemont County, Wyoming in 1883; in 1887, 90 oil wells were discovered and 14.5 miles of 3-in. line were laid near Nacogdoches, Texas; in 1888, Indiana's first "gusher" came from a water well drilled near Terre Haute; in 1889, oil was discovered at California's Midway-Sunset field and near Los Angeles in 1893; in 1890 the first oil in Kansas was found near Neodesha. Oil was discovered in 1896 at Corsicana, Tex. by a Pennsylvania group. Fifty wells had been drilled there producing 66,000 bbl by the year end. In 1898 the first commercial oil refinery was built in Corsicana. Commercial oil production in Oklahoma began in 1897 near Bartlesville.

The majority of the vast amounts of oil discovered in the U.S. until about 1909 were distilled to produce kerosine, used for lighting, heating and cooking purposes in the U.S. and abroad. By 1865 petroleum ranked sixth among U.S. exports, constituting at least a 20th of our export trade. Heavy oil was used to make parafin and candles, to treat roofs, wooden pavements and bridge timbers, and to lubricate and grease locomotives, stationary engines and other heavy machinery. Gasoline was later used for lighting. Oil based pharmaceuticals also proved of real value as vaseline, lotions, etc.

During the years of the oil rush, natural gas had been all but forgotten after Hart's gas discovery in Fredonia, because pressure in pipelines wasn't sufficient to transport gas easily to market. Consequently the gas, often discovered with oil, was piped away from oil wells and burned, or "flared," merely to get rid of it.

In 1870, a 25-mile log gas transmission line was laid between West Bloomfield and Rochester, New York but was

abandoned several years later when sufficient pressure could not be maintained in the system. The porosity of the 12½-in. pine logs, and leakage of joints sealed with surplus Civil War army blankets soaked in pitch, doomed the project from the start.

Gas pipeliners were more successful with iron pipe, first used in 1872. A 5½-mile, 2-in. iron pipeline was laid between Titusville and Newton, delivering 4 million cu ft of gas daily to 250 commercial and residential customers at a pressure of 80 lbs.

As industry grew, gas became more valuable as a manufacturing fuel, especially in rolling mills, steel mills, and gas plants. In 1868, an oil supply firm began using gas in its plant at Erie, Penn. A firm in Leechburg, Penn. used gas for the first time in 1874 as a boiler fuel for puddling and heating furnaces to make iron and steel. In 1883 gas was piped into Pittsburgh glass and steel plants from Murrysville, Penn. In 1873 gas was used in a ceramic plant in East Liverpool, Ohio.

1885 With the success of iron pipelines, gas became more popular for home use in heating, illuminating and cooking. In 1878 gas was distributed in Kansas City, Missouri, from natural gas wells at Wyandotte, Kansas. In Pittsburgh in 1884 one natural gas company alone had 335 miles of pipe within the city supplying 250,000,000 cu ft daily. Natural gas had supplanted 10,000 tons/day of coal. By 1885 over 500 miles of pipe had been laid in and around Pittsburgh, some as large as 24 in. The same year the first "high pressure" manufactured gas transmission line carrying 10 psi was installed under San Francisco Bay between Oakland and Alameda. In 1886 Buffalo, New York was supplied with natural gas by an 87½-mile pipeline from McKean County, Penn.

In 1889 Standard Oil supplied Detroit with natural gas by laying a 92-mile line from Findlay, Ohio. What was considered the "world's longest natural gas pipeline," in 1886, was laid 87 miles from Kane, Penn. to Buffalo, New York. Thirty miles of this original line is still being used. The first high pressure natural gas pipeline was constructed in 1891 between Greentown, Indiana to Chicago. The 120-mile 8-in. line was transported solely by well pressure with initial pressure of 525 psi. The gas cost 50¢ per Mcf in Chicago, lower than manufactured gas, but was not considered good enough for illuminating purposes and was used as a fuel gas.

Until the early 1900's when huge new gas fields were discovered in the south and southwest, pipelines consisted of random lengths of small diameter pipe joined together by screwing one length into another and hammered into place. Unreliable crude ditching machines were used to dig trench for the pipeline and dirt was replaced, after the line was laid, by teams of mules dragging "mormon boards".

1895 Total value of natural gas consumed in the U.S. by 1895 was $13,006,750 according to U.S.G.S. reports. In 1894 total value was $13,954,400 and in 1893 $14,346,250. Natural gas consumed in Texas was $50 in 1893, $50 in 1894 and $20 in 1895. Values of natural gas consumed from 1882 to 1895 rose from $215,000 to $13,006,650, 1888 being the banner year when $22,692,875 was used. At the turn of the century, natural gas had been discovered in 17 states with Pennsylvania the leading producing state. Production was valued at over $23,700,000.

Increase in natural gas demand was partially caused by increased use of improved natural gas appliances in the home. The Welsbach mantle, invented in 1885, which expanded open burner gas lighting from 3 to 20 candle power per cu ft., stimulated gas use for lighting. The development of the double superheater gas apparatus was another boost to the gas industry. Gas stoves, heaters and even refrigerators came into greater use between 1880 to 1900. In 1887 AGA describes the use of the Otto gas engine with a Lightfoot (compressor) refrigerator. "Machines are made in several sizes to deliver from 3000 to 6000 cu ft of dry cold air per hr but smaller and larger combinations can be made if required." Lowe improved heating in 1889 by perfecting the three-cell or "improved double super-heater" type of water gas set. The gas steam radiator was invented by Robert Calef in 1896.

An industry census, published by THE AMERICAN GAS LIGHT JOURNAL March 1, 1886, noted that there were 971 gas-light companies in the U.S. Average price of gas sold was $1.77 per Mcf, the price range per Mcf being 75¢ to $20. A total of 186,901 public lamps were lit by gas and of 888 companies reporting specific information, 592 were selling coal gas and 296 were selling oil-gas or other types of gas. The industry's annual production was 23.5 billion cu ft.

Oil and gas discoveries gradually moving westward helped contribute to the settlement of new lands. The government, encouraging settlement of newly admitted states and acquired territories, passed the Homestead Act in 1862. New states admitted to the union between 1860 and 1900 were Kansas (1861), West Virginia (1863), Nebraska (1867), Colorado (1876), North Dakota (1889) and Utah (1896). Alaska was purchased in 1867 from Russia for $72 million. The Oklahoma territory created in 1890 brought more settlers to the southwest. By 1898, with the signing of the treaty ending the Spanish-American War, the U.S. had gained Guam, Puerto Rico, and the Philippines.

Progress in transportation and communication gradually made these new states and territories accessible. The first continental railroad was completed in 1869 with the junction of Central Pacific and Union Pacific line at Promontory, Utah. By 1900, 200,000 miles of railroad tracks in the U.S. matched the total for all of Europe.

The first automobile, using a gasoline fueled internal combustion engine was built by Karl Benz in Germany in 1887 and improved by Gotlieb Daimler. In 1892, the first gasoline auto in the U.S. was built by C. E. Duryea. By 1900, 4192 passenger cars were built.

Progress in communications also continued. The Pony Express was supplanted by transcontinental telegraph in 1861. The telephone was invented in 1876 by Bell, and the first wireless, invented by Marconi, was patented the same year. Edison invented the phonograph in 1877 and the incandescent light in 1879. In 1882 the Edison Electric Illuminating Co. was formed operating a steam-powered central station. Edison patented his kinetoscope in 1891.

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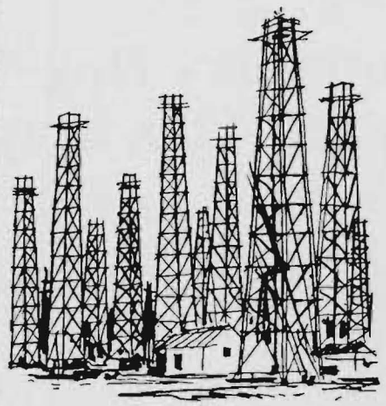
ENERGY: FIRST 200 YEARS



1900 By 1904 crude oil production in eastern fields was declining, causing eastern refineries to seek additional crude supplies from newly discovered fields. Crude lines were constructed from the mid-continent region to connect with eastern lines. By 1911 mid-continent fields supplied 30% of refinery requirements east of the Mississippi and 60% by 1914.

Spindletop was the first large oil discovery in the southwest. It changed the U.S. oil industry, making the southwest the world focal point in oil production. Spindletop, producing the world's first 100,000 bbl per day well, proved that oil could be found in large quantities. Prior to that, the average well produced less than 100 bbl per day. Spindletop was discovered by Pattillo Higgins, a self taught geologist who was convinced that oil lay beneath a dome of ground located four miles from Beaumont.

During the first 10 years the field produced some 42,000,000 bbl of oil. Spindletop's supply diminished after several years but was spectacularly revived in 1925 when deeper oil deposits on the flank of the dome were found. Peak production from this area reached 20,751,000 bbl in 1927. That same year the first gusher in Louisiana was hit at 18,000 ft, six miles north of Jennings.

In 1902 and 1903 prolific fields of gas and oil were discovered in California's San Joaquin Valley and at Ventura. California became the leading oil producing state with 24.27% of national production. In 1905 oil was discovered at Glen Pool, Oklahoma. In 1912 the Cushing field was discovered. The El Dorado field, discovered in Kansas after a wide-scale geological survey, became the basis for the organization of Empire Gas and Fuel Co., one of the nation's pioneer successful experimenters in scientific exploration.

To transform these vast amounts of petroleum into usable products new refineries were constructed, principally along navigable water ways of the Great Lakes, Mississippi River, Texas Gulf and California Coasts. The demand for refined oil was constantly increasing as the automobile became more popular. At the start of WWI there were 3,000,000 autos in the U.S. Introduction of diesel engines also meant a greater market for refined fuel. Airplanes, requiring high octane gasoline, became more popular after Lindberg's flight in 1927. Endless new avenues for refiners were opened with William M. Burton's thermal cracking process. Burton's "cracking" still, built in 1913, doubled the yield of gasoline from a barrel of oil to about 45% of each barrel, greatly reducing the price of gasoline.

Crude oil pipelines were constructed from the oil producing regions to these new refineries and to marine terminals to be shipped to ports in the U.S. and overseas. The Port Authur refinery in Texas exported almost 9-million bbls in 1903. Construction of products pipelines, though, did not begin in earnest until 1930 as the population expanded in Midwest centers.

As the search for oil continued in the southwest, many huge gas fields were discovered. The low cost of gas and introduction of long distance piping increased gas use all over the country. In 1916 the rich Monroe gas field was discovered in Louisiana, having an area of approximately 260,000 acres. The first gas discovery in the renowned Panhandle gas field, the world's largest producing gas reserve (almost 1,600,000 acres), was made in the northern part of Potter Country, Tex. in 1918. Drilling in the Hugoton gas field started in 1919 and continued for three years until gas was discovered at 2755 ft. This was to become the world's largest dry gas field enclosing an estimated 850,000 acres in Kansas, Texas, and Oklahoma.

Because new gas fields discovered in the south and southwest were hundreds of miles from major cities, an effective and inexpensive means of transporting the gas was needed. This gave added incentive to improve methods of laying pipelines that, until this time, had not been laid over 120 miles. Until pipelining methods had been perfected, eastern states closer to areas of demand retained the dominent position in supplying natural gas.

In 1909, Cincinnati received natural gas through a 183-mile 20-in. pipeline

from West Virginia fields. Gas from West Virginia fields was also brought to Cleveland through a 120-mile line. Supply of natural gas to the Buffalo-Pittsburgh-Toledo area, where transportation and marketing facilities were excellent, spurred industrial and economic development.

As more residential consumers as well as industries began to use natural gas, the need for testing and standardization to protect consumers became evident. Various gas associations were formed during this period. In 1906, the Natural Gas Association of America was formed in Kansas City. In Atlanta in 1908, the Southern Gas Association was organized. The American Gas Association, in 1918, was organized through the consolidation of the American Gas Institute and the National Commercial Gas Association.

The government, also concerned with setting standards for the gas industry, formed the Bureau of Standards which in April, 1912 published Circular 32, "State and Municipal Regulations for the Quality, Distribution and Testing of Illuminating Gas."

By 1921, according to an A.G.A. survey, gas furnished the cooking, heat and illumination in homes of over 49,000,000 citizens; 4,600 communities were served with gas, and gas mains totaled 68,300 miles. The survey revealed the use of 7,000,000 gas-burning cooking appliances in American homes, gas water heaters numbering 1,500,000 and gas heaters nearly 1,000,000. Approximately 25% of gas consumed was for industrial purposes. More than 300,000,000,000 cu ft of gas was distributed annually including artificial gas.

Capital invested in the gas industry in 1916, reported the AMERICAN GAS JOURNAL, was approximately $1.1 billion, and annual output was 190-billion cu ft, supplying a total population of 32,000,000 with gas service. West Virginia continued to be the leading natural gas producing state. By 1928 Texas had become the leading producer in natural gas.

Meals prepared on gas stoves were a new luxury

1925 Need for natural gas was not as great in the agricultural centers closest to the enormous gas reserves in the south and southwest. These fields were crying out for markets but first pipelining methods had to be improved. Expansion began in 1925 when Magnolia Gas Co., a subsidiary of Magnolia Petroleum Co. at Dallas, completed a 217-mile line from northeastern and northern Louisiana fields to Beaumont. This was the first long-distance, all-welded pipeline and consisted of 14, 16, and 18-in. pipeline, acetylene welded. Another long distance line was soon constructed from southwestern Texas fields 220 miles to Houston and one of 217 miles was built from northeastern Texas to Houston and Port Arthur. In 1926, a 22-in. 170-mile line was laid from the Monroe fields to Baton Rouge where Standard Oil's giant refinery was located. The line, owned by Interstate Natural Gas Co., was extended to New Orleans the following year for a total length of 260 miles. The first line over 300 miles was built from Texas to Colorado in 1927, a distance of 340 miles, considered a great engineering feat.

Development of gas pipeline systems was gradually revolutionizing the fuel situation. Many industries switched from fuel oil to natural gas, industrial users as well as residential consumers delighted in obtaining such an inexpensive fuel. As new fuel supplies became available in the southwest, this region began to grow in population as well as economically and industrially.

New, improved methods of pipeline construction added to the success of this type of fuel transportation. Gasoline-engine powered trenchers, pipe layers and backfillers, facilitated pipelaying. Soon pipe screwing machines and side-boom tractors were introduced. Although acetylene welding began to be used in the early 1920's coupled pipe was still the popular construction procedure, following screwed pipe.

New techniques in storing gas began to appear between 1915 and 1930. The first liquefied petroleum gas was produced at the Sisterville, West Virginia plant of the Riverside Oil Co. Underground storage of natural gas in depleted or near depleted fields was first used in the U.S. in 1916 in the Zoar field near Concord, New York. The first large-scale underground gas storage field was developed in Kentucky, in the Menifee field, by Central Kentucky Natural Gas Co. In 1925 the spherical storage tank adapted to storage of gas under pressure was developed by Chicago Bridge and Iron Works. The "Hortonsphere," as it was called, was erected at Phoenix, Arizona and had a diameter of 57½ ft.

Several of today's large oil and gas companies got their start during this period. In 1900 Texas Fuel Oil Co. which later became Texaco, was formed with John S. Cullinan as president. Sun Oil Co. was also formed in 1900 in Philadelphia. In 1911, Humble Oil Co. (now part of Exxon) was founded in Texas. Gulf Oil Corp. was incorporated in 1907. Kansas Natural Gas Co., the first main supplier of natural gas to the midcontinent area, was established in 1904.

Columbia Corp., predecessor of Columbia Gas System, was incorporated in West Virginia in 1906. Oklahoma Natural Gas Co. was formed the same year. Phillips Petroleum was established in 1917 by Frank and L. E. Phillips.

Others, however, resulted from government efforts — under anti-trust laws — to break up the major oil monopolies. Biggest of those was the Standard Oil complex.

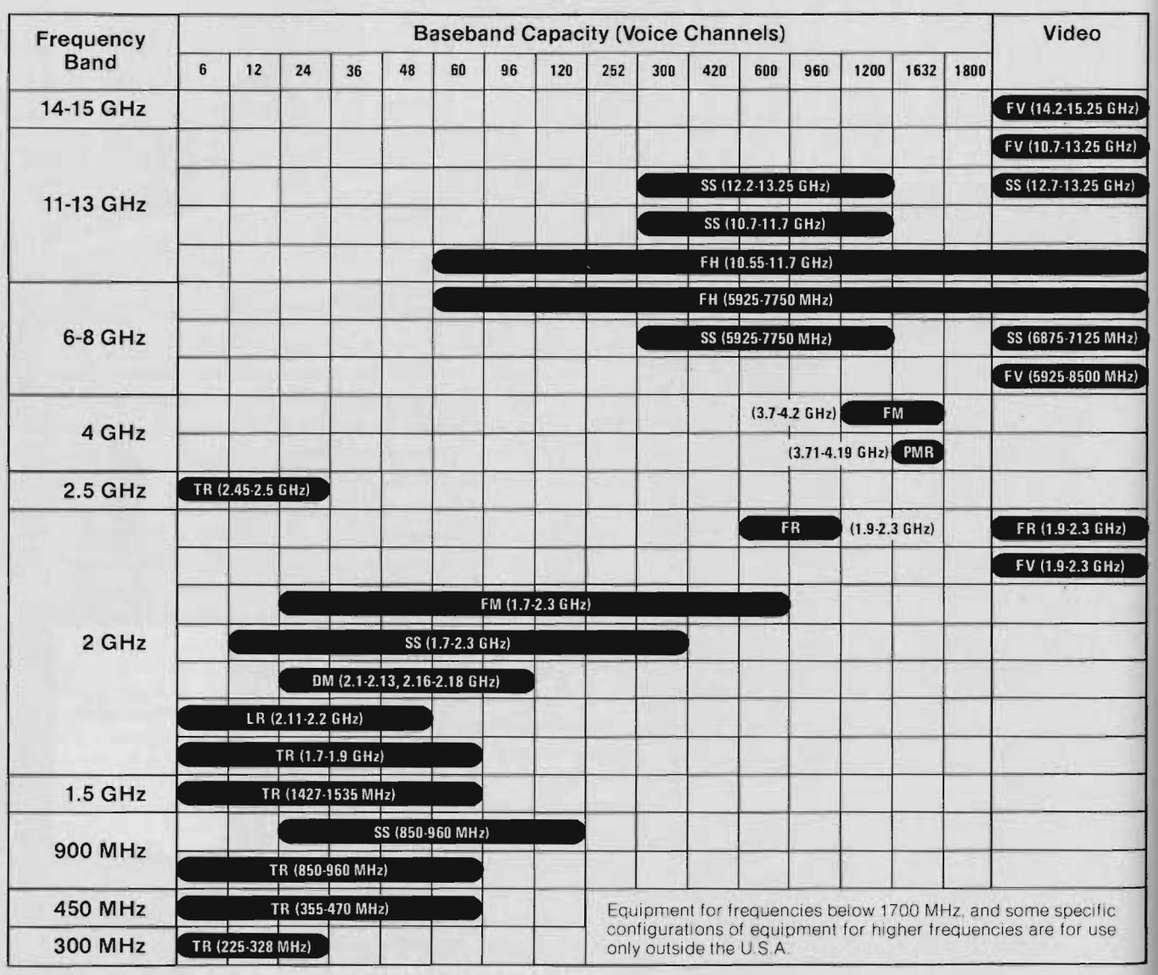
In 1911, after four long drawn-out years of debate, the Supreme Court ruled that Standard Oil constituted a monopoly. Under the court's famous dissolution decree, 33 subsidiaries were separated from the holding company.

Pipeline companies also were visited by the federal "trust busters." In one of the "Pipe Line Cases of 1914" the U.S. Supreme Court upheld the provisions of the Hepburn Act and required that crude oil pipeline companies, although they owned the oil, were common carriers and must make their pipelines available to all shippers, obey the orders of the ICC and file tariffs showing their complete rate structure. In another 1914 case, known as the "Uncle Sam" case, the court held that if a company was engaged solely in transporting its own production from its own wells through its own lines to its own refineries, it was not subject to ICC Jurisdiction. In 1922, an ICC ruling required that a shipper's minimum crude oil tender be 10,000 bbl. Many pipelines had previously required only a minimum crude oil tender of 1000 bbls.

Your 1976 Handy Guide to Farinon Microwave Systems

At-A-Glance

These Channel Capacities at These Frequencies



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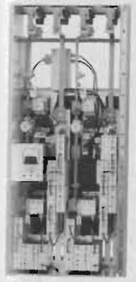
In More Detail



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Circle 127 on Reader Service Card

The U.S. saw great industrial and economic growth as well as population expansion between 1900 and 1930. In 1915 the population was over 100 million. By 1930 it had increased to 122 million. Immigrants to the U.S. were numerous and continued to settle unpopulated western areas.

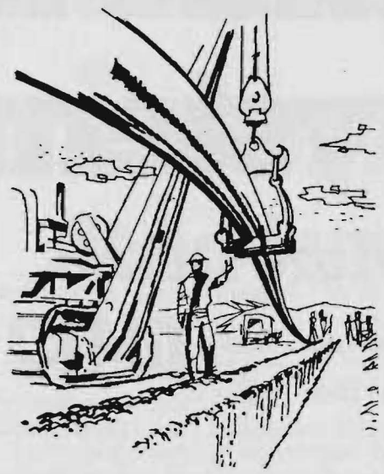
Events during this period had profound effects on the oil and gas industries. In 1906 the San Francisco Earthquake and fire left 452 dead with losses totaling $350,000,000. Reconstruction of gas mains and plants was begun immediately and service was restored within 30 days.

During World War I, wartime government took over rail and communication systems and regulated fuel production and distribution. The first world war, influencing progress in plane, truck and tank transportation, increased the need for fuel and lubricants. Petroleum also supplied merchant ships and men-of-war. In 1918, when the war ended, a foreign statesman remarked, "The allies floated to victory on a sea of oil." During the depression, beginning in 1929 with the stock market crash, the oil and gas industry offered some stabilizing influence to the economy as the demand for oil and natural gas continued. Yet the depression had its adverse effects on the industries. In the gas industry revenues were down 5.1% for 1932, manufactured gas sales fell 4.8% and natural gas sales dropped 16% in 1931.

1930 Despite the depression, 1930 and 1931 were banner years in interstate movement of gas and marked a new era in long distance pipelining. Completion of a 1,000-mile, 24-in. electric-arc-welded steel pipeline, from the Texas Panhandle to Chicago by Natural Gas Pipeline Co. of America, initiated long-distance pipelining.

In 1931 several other important pipelines were completed. Southern Fuel Co. built a 26-in. line from Kettleman Hills to Los Angeles. A year earlier San Francisco was supplied with gas from the same field, Kettleman Hills, and Buttonwillow, through a 250-mile pipeline. Panhandle Eastern Pipe Line Co. completed construction, in 1931, on a line from the Hugoton-Panhandle field starting at Dumas, Texas to the Indiana state border. The same year Atlantic Seaboard Corp. supplied Washington D.C. with gas from east Kentucky and West Virginia fields via a 20-in., 160-mile line.

By 1935, 19 interstate gas transmission systems operated over 13,000 miles of pipeline.



1940 During WWII the industry continued to expand. In 1944, Tennessee Gas & Transmission Co. constructed a 1265-mile 24-in. line from south Texas to West Virginia. This was the first gas line from the southwest to serve the East. At the war's end, in 1945, gas pipelines totaled 82,000 miles.

Texas Eastern Transmission Corp. bought the 20-in. and 24-in. War Emergency Pipe Lines, in 1947, converting them from crude and products service to natural gas transmission lines, supplying natural gas to New Jersey from Texas. The lines had a combined length of more than 2,800 miles.

In 1947, El Paso Natural Gas Co. laid the first 30-in. line to supply California with natural gas. In 1949 construction began on a line linking northern and central California with 1600-mile system carrying gas from Texas and New Mexico, the final segment consisting of 34-in. line. The same year construction was completed by Michigan-Wisconsin Pipeline System on a 1,609-mile project extending from Texas Panhandle to Detroit.

A year later Transcontinental Gas Pipe Line began construction on a 1840-mile 30-in. line from south Texas to New York. This was the longest single project pipeline in the world at the time. In 1951 construction began on a 1300-mile 26-in. and 30-in. Texas-Illinois Natural Gas Pipe Line system from Gulf Coast to Chicago. A 1487-mile Pacific Northwest Pipeline system from the San Juan basin to the Canadian border was built in 1956, bringing natural gas to the Pacific Northwest.

During the 1960's and 70's stronger and larger diameter line has been used with compressor stations powered by aircraft type jet engines. By 1969 gas pipelines stretched from the Gulf Coast to the east and northern states. By 1970 the network of U.S. transmission lines totaled 248,071 miles, supplying 42 million customers all over the U.S.

In 1940 the first LNG was produced at Cleveland, Ohio, climaxing experiments begun in 1937. A plant to serve East Ohio Gas Co. was constructed at a cost of over $1,500,000. During the 1940-41 winter season it supplied the Cleveland area with gas.

In 1959 the first cargo of LNG was carried on *S.S. Methane Pioneer* from Lake Charles, La. to England. Wisconsin Natural Gas and San Diego Gas & Electric, in 1965, put into operation the first LNG plants for peakshaving.

New refineries continued to be built during this period to convert the large crude supply to usable fuel. In 1941 Conoco constructed a refinery at Lake Charles that produced 27 gals of motor fuel from each 42 gal. bbl of oil. As midwest cities began to expand in population, new markets for refined products, produced in the southwest, opened up. Midwest centers were closer than eastern cities, thus the possibililty of pipeline oil tranportation became more feasible. Pipelines were soon constructed to transport many grades of refined products. In 1930-1931, 3000 miles of products pipelines were placed in operation. In some cases older crude lines were cleaned and the direction of flow reversed to move products from the east coast to the midwest.

Supplies of large quantities of crude oil and refined products to the east coast were transported by tankship and barge prior to Pearl Harbor. By June 1940, East coast oil and products shipments averaged 1,472,000 bbl daily. By 1941 the coastal shipments had been reduced to 961,000 bbl daily because tank ships were now needed for the Allied War effort. The U.S. had entered the war after the bombing of Pearl Harbor, Dec. 7, 1941.

The demand for immediate energy supply during the war sparked new innovations in pipeline transportation. Activity of Axis submarines along the gulf and east coasts reduced oil shipment by tanker. Consequently war production was greatly hampered by lack of petroleum supply. Pipelines provided the most sensible solution. While pipelines were under construction, the oil industry's fleet of about 107,000 oil tank cars were organized into fuel trains. More than a million bbl per day were transported by rail to the

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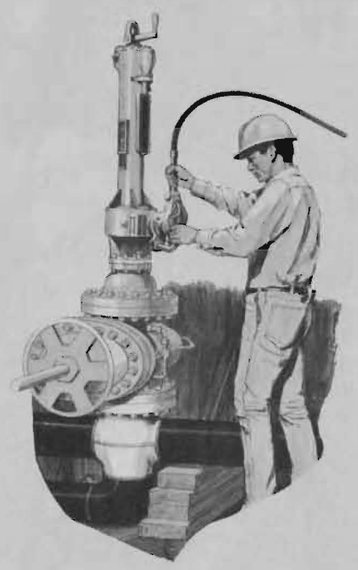
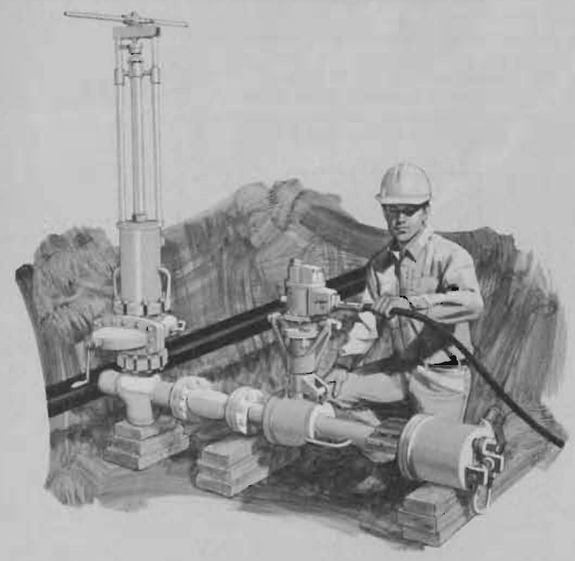
Drilling the main for a service connection using a welding service tee can be done efficiently and economically with the hand or power-operated Mueller D-5 Drilling Machine and a gate valve. The machine will also insert the completion plug into the tee.

For mechanical service connections, the Mueller E-5 Drilling Machine can be hand or power operated to drill the main through a tee and service clamp.



The Mueller C1-36 Drilling Machine drills through a main to be relocated using Mueller No-Blo® line stopping methods. It's power-operated for fast and easy drilling through tapping valves, gate valves, tees, nipples, too.

Drilling the main through a nipple for a temporary or semi-permanent connection is done with a hand or power-operated Mueller EH-1 Drilling Machine and a gate valve. It's the high-pressure counterpart of the E-5 Machine, with capacity from ⅛″ through 1″ and a maximum pressure of 1200 psi.



The safe and sure way to make a lateral connection to a main under pressure is to use the Mueller power-operated CH-6 Drilling Machine. It cuts a hole in the side of the main by drilling through an extension stopper fitting. There's no blowing of gas, no interruption of service.

Circle 129 on Reader Service Card

east and 165,000 bbl per day of crude oil moved across the Rockies to California.

Plans to move large volumes of petroleum to the East by pipeline were soon underway and included reversals or rearrangements of and additions to existing pipelines and construction of new systems. Thirty-five separate projects were planned and developed at a cost of $334,000,000.

The War Emergency Pipeline was the largest of the war projects. The Big Inch, 1400-mile 24-in. line, extended from Longview, Texas to Philadelphia. The Little Big Inch, a 1475-mile, 20-in. line was completed a year later in 1943 and extended from Beaumont to New York. Peak deliveries of the WEP systems were 334,456 bbl of crude oil per day and 239,884 bbl of refined products daily. The Little Big Inch pumped 227,000 bbl daily of 100 octane gasoline. During a two year period the wartime pipeline effort had provided 17,684 miles of system changes, more than 11,000 miles of new trunk gathering lines, 3,000 or more miles of older lines relaid in new locations and more than 3,000 miles of older lines reversed. Daily shipments eastward soared to 754,000 bbl compared to prewar amounts of 50,000 bbl/day. American pipeliners contributed their knowledge to overseas construction of fuel lines as well, to aid in the Allied war effort.

In Alaska, the Canol pipeline, a 972-mile refined products line, extended from the port of Skagway to White Horse and other towns along the highway. A 577-mile, 4 and 6-in. crude oil line connected the Norman Wells oil field to the White Horse refinery. Construction of these lines across the subarctic wastes proved to be an engineering triumph. Many of the pipelines constructed during the war are still being used today.

The war had a profound effect on the pipeline industry with the introduction of the large diameter trunk line that proved to have operating flexibility of smaller diameter lines. In addition the larger trunk lines could transport large volumes of petroleum at considerably less cost per barrel. Such factors marked a turning point in petroleum pipeline construction.

1948 In 1948 a 20-in., 648-mile crude oil line was constructed from central Texas to central Illinois. Soon other large diameter trunk lines began to appear. A 20/22/24-in. crude oil line was completed in 1949 extending from New Mexico, via Cushing, Okla. to

central Illinois. Spanning a distance of over 1000 miles, the Basin and Ozark Systems, as they were called, were the first large oil lines financed entirely by private capital.

In 1950 the 1053-mile, 20/22-in. Mid-Valley line from Texas to Ohio was completed. Numerous large diameter trunk lines used on worldwide pipeline projects today oftentimes have been designed to serve the same areas previously handled by multiple small diameter trunk lines which have been removed or reversed and converted to products pipelines.

In 1948 U.S. pipeline companies were operating 47,036 miles of gathering lines, 63,364 miles of crude oil trunk lines, and 13,692 miles of products lines. By 1965 pipeline companies were operating 46,886 miles of gathering lines, 63,220 miles of crude trunk lines and 49,477 miles of products lines. The most significant factor, however is in line capacity. By 1965, 1,061 billion bbl miles of crude oil were transported, an increase of 200% over 1948's figure of 514 billion bbl miles. Refined products in 1965 totaled 448 billion bbl miles, a 200% increase over the 1948 figure, 85 billion bbl miles.

In 1973 with the Arab oil embargo the U.S. felt the vital need to increase its domestic gas and oil production to partially meet the demand of the trans-Alaska oil pipeline.

Progress in pipeline construction since 1930 can be largely attributed to technological advances in construction methods. The development of high tensile steels has permitted the use of thinner wall pipe allowing diameters up to 48-in. in joint lengths of 68 to 80 ft. Automatic welding machines have become commonplace for field welding pipe joints. Newly developed microwire, carbon dioxide welding process was later employed as an alternate welding method.

Improvements in pipe laying techniques can be attributed to the introduction of tractor-mounted winches, boom hoists, dozers, backhoes, and self-propelled coating machines. Installation of pipelines offshore has required development of special lay barges, special pipe coiled on a reel and new installing techniques in water hundreds of feet deep. Pump station equipment improvements include use of centrifugal pumps. Gas turbines were introduced shortly after WWII as prime movers for the pumps. Permitting more efficient operating techniques, automated control of pump station — as well as control of an entire pipeline system from one central point — has developed rapidly.

ENERGY: FIRST 200 YEARS

Although most of the major oil fields in the U.S. had been discovered prior to WWII oil companies continued exploration at home and abroad. In 1945 a 200 million bbl field was discovered in the Golden Trend in Texas. Offshore oil production continues to increase. Louisiana held its first offshore lease sale in 1945. By 1947 the world's first offshore producing well "out of site of land" began producing. In 1968 the Prudhoe Bay oil field was discovered. Since that time many offshore fields have been tapped. By 1970 domestic oil production peaked at over 10 billion bbl per day.

U.S. oil companies greatly increased their overseas oil interests after 1960. In 1961 Mobil Oil let a drilling contract from Nigeria, a year later Esso obtained a drilling license in the North Sea. Phillips Petroleum invested heavily in 1969 in Norwegian North Sea production. U.S. companies have other foreign oil interests although many countries have nationalized these oil producing systems.

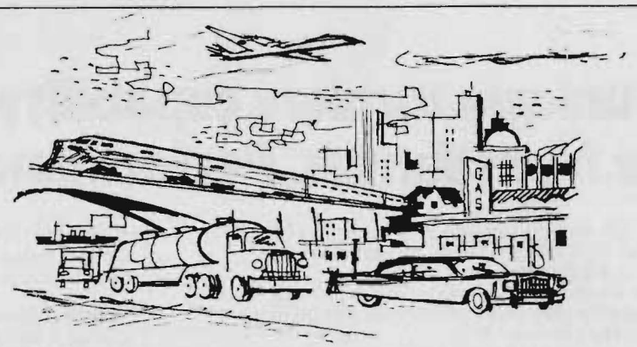
The Arab oil embargo in 1973, made Americans aware of their increasing dependence on fuel and the lack of present readily available energy sources. Gas and oil production plunged during the embargo as prices increased. Motorists who had previously paid 25¢-30¢ a gallon were now paying twice that much. By the beginning of 1975 drilling and producing activities began to pick up.

As pipeline transportation systems expanded and demand for gas and oil increased after 1930, the government continued to set limits for the growing oil and gas industry. The Natural Gas Act, passed in 1938, marked the entrance of the federal government into the field of regulatory control of the natural gas industry. The Act gave the Federal Power Commission the authority to regulate interstate transportation and sale of natural gas. Sections 7(c) and (3) of the Natural Gas Act were broadened in 1942 to provide for issuance of certificates of public convenience and necessity for the extension acquisition, construction, or operation of natural gas pipelines.

The "Phillips Case" hearings, begun in 1948, brought about the 1954 Supreme Court ruling that independent natural gas producers were also under federal regulation. In 1950 FPC's jurisdiction over natural gas production and distribution was extended. In the east Ohio case, the Supreme Court ruled that a natural gas distributor, operating solely within a state, but selling gas that moves interstate is subject to FPC control. The Kerr Bill, designed to exempt independent gas producers from FPC control, was vetoed by President Truman.

In 1954 the Supreme Court ruled that FPC regulate wellhead prices of gas of independent producers and gatherers. That same year the Supreme Court upheld legislation returning the title of offshore lands within historic state boundaries to the states. The "Memphis Case" decision in 1958 by a Circuit Court of Appeals said that a pipeline company could not file for rate increase and collect the increase subject to refund without unanimous consent of all its customers. At the end of the year the decision was reversed when appealed to the Supreme Court. The Tax Reform Act of 1975 almost eliminated percentage depletion tax deduction for the oil and gas industry. Other acts that directly or indirectly affect the oil and gas industry include the Natural Gas Pipeline Safety Act of 1968 that set safety standards for gas utility systems and pipelines. The Federal Water Pollution Control Act was one of many environmental laws effecting the oil and gas industry.

ENERGY: FIRST 200 YEARS



The FPC set up the Natural Gas Advisory Council in 1962, made up of members of industry, regulatory and consumer groups to advise the FPC on regulatory matters concerning the Natural gas industry.

New transportation innovations as well as industrial expansion since 1930 has added to the nation's need for fuel. As air transportation progressed new improved techniques were introduced. The first jet engine was built in 1937 by Frank Whittle. In 1939 Sikorsky built the first helicopter with only one main rotor. The Pennsylvania turnpike opened in 1939 heralding the era of a modern interstate highway system. By 1958 jet airline passenger service became available. The U.S., with 6% of the world population, owns 60% of the world's automobiles and a 1972 census reported that "over 100 million vehicles go over 1-trillion miles each year in the U.S."

1976 As the United States of America celebrates its bicentennial, it becomes obvious that the exhilaration of celebrating a glorious past must give way to the exhilaration of a challenging future. Over its 200-year history, the nation has shown a remarkable resiliency and determination to grow and become stronger. What happens in the future depends strongly on our ability to adapt to new technologies, new concepts, new goals. Energy — its development and its intelligent utilization — may indeed play the dominant role. Whatever the human and natural resources available, they are useful only to the extent that they can be universally utilized. Energy makes it possible.

On America's "birthday," the U.S. is, hopefully, again moving toward energy "independence." The wheels are in motion to tap and recover oil and gas resources in the Arctic regions and Alaska oil and gas are destined to play an important role. The trans-Alaska oil pipeline, a first step, is well underway. Natural gas from the North Slope, hopefully, will move to market in a few short years. Greater utilization of the nation's huge coal resources is anticipated — making it possible for the nation to be energy self-sufficient for another 300 years.

For, without energy, there cannot be much in the way of transportation, communication, industry . . . or, for that matter, civilization as we know it.

The future depends on how wisely we plan and develop our resources.

P&GJ

PEOPLE on the MOVE

J. D. Tolliver

C. H. Dietrich

J. D. Reid

J. Brooks

J. D. Tolliver has been named vice president, marketing, for Chemtron Corp.'s Tube Turns division. He succeeds **Tom H. Pike Jr.**, recently retired. **C. H. Dietrich**, former field sales manager, succeeds Tolliver as manager of fitting sales.

Joe D. Reid, president and general manager of West Ohio Gas Co., since 1955 has recently retired. In 1947 Reid began work at West Ohio Gas Co. as vice president in charge of operations. He also served as a director of A. G. A.

Sir Kirby Laing has relinquished the chairmanship of the Laing Group of companies to **Sir Maurice Laing**, formerly deputy chairman. Sir Kirby Laing continues as a full time board member and assumes the responsibilities of deputy chairman.

W. D. Noel, president of El Paso Products Co., has been elected director of The El Paso Co.

J. Curtis Fee has been appointed executive director of FPC. Fee previously served as associate director of presidential personnel at the White House.

Also at FPC, **Jerome E. Hass** has been appointed acting chief, Division of Economic Studies, Office of Economics. Hass succeeds **Robert G. Uhler**, recently resigned.

S. William Yost has been appointed chief of FPC's Bureau of Natural Gas. He succeeds **Francis C. Allen**, named a technical assistant to Commissioner James G. Watt.

Arvonne C. Linder has been promoted to administrator of gas supply statistics for Kansas-Nebraska Natural Gas Co.

Wayne Sellers has been named manager of marketing, far east, for Williamson International Corp. Sellers was formerly marketing manager for TDW's Western Hemisphere Division.

Robert C. Sloan has been elected treasurer of Columbia Coal Gasification Corp. Sloan, previously assistant treasurer, succeeds John P. Cornell. **Robert M. Brown**, Columbia Distribution Company's previous director of service operations, and **Eugene J. Walsh**, a former member of CDC's legal staff, have retired. Brown served the company for nearly 42 years starting as a serviceman in 1934. Walsh joined the company in 1954.

Edwin F. Hardy has joined Jensen Associates, Inc., consultants in energy planning, economics, and logistics. Hardy was formerly A.G.A.'s director of planning division.

Martin R. Engler Jr. has been elected vice president of El Paso LNG. He was formerly executive vice president of San Diego Gas & Electric.

Morris Sievert, president of the Solar Division of International Harvester, has been elected a director of San Diego Gas & Electric Co. Sievert, also a vice president of International Harvester, is the first Solar executive ever elected an IH corporate officer.

Hugh F. Rech has been named vice president, marketing for Aitken Inc. Rech was previously associated with WKM as marketing manager, oilfield pipeline.

Fred Overgaard has been appointed Aitken's sales manager after having been with C-E Natco for five years.

Frank T. Wendt has been named central area sales manager for Rockwell International's Flow Control Division. Also at Flow Control, **Albert Cooper** has been named Philadelphia branch manager.

Wendt, in his new position, is responsible for division sales activity in Indiana, Michigan, Minnesota, Wisconsin, Illinois and Iowa. Cooper was previously major account senior salesman in Philadelphia.

John M. Brooks has been appointed general manager of Process Engineering Inc.'s new 56,000 sq. ft manufacturing facility. Brooks has been involved in research, engineering and sales activities in cryogenics, LNG, Natural gas and associated fields.

Frank Cargould has been appointed general sales manager for Kent Air Tool Co. Cargould was previously regional sales manager. In his new capacity, Cargould will supervise the marketing of Kent's products on an international basis through a network of salesmen and distributors.

R. E. Horine has joined Tejas Gas as director of alternative fuel supply services. He recently retired as executive vice president of Central Power and Light.

Henry B. Sargent has been elected to Arizona Public Service Co.'s board of directors. He presently holds the position of financial vice president and treasurer of the company.

William B. Ashby, president of The American Meter Division of The Singer Co. has been elected corporate vice president. Ashby has been president of American Meter since 1971. Before his appointment as vice president and general manager in 1970, he served in various executive capacities, including vice president, research and engineering.

A. James McCollum has been elected vice president-public relations, Pacific Gas and Electric. He succeeds **Robert R. Gros** who has taken early retirement. McCollum was previously manager of advertising and publicity.

John Van Dyke has been named manager of facilities for receiving and gasification of LNG for Columbia LNG Corp. The facility, now being constructed and expected to be in operation in 1977, is the largest in the U.S., capable of handling more than one billion cu ft of gas per day.

Van Dyke has been manager of operational research at Columbia Gas System Service Corp.

Peter J. King has been elected executive vice president of Colorado Interstate Gas Co. King replaces **Walter W. Sapp**, recently resigned. King also succeeds Sapp on the executive committee of the CIG board of directors.

people

L. D. Garret has been promoted to vice president of project engineering for Gulf Interstate Engineering Co. He previously served as manager of projects and temporarily as manager of engineering services.

M. J. Blevins replaces Garret as manager of engineering services. **Walter C. Green** has been promoted to asst. project manager of the company's Alaska project, and **Robert B. Jacques** has been promoted to senior consultant to the company's Coal Development and Consulting Group.

John W. Morton has been elected president of Cities Service Gas Co. He succeeds **Robert H. Chitwood,** recently promoted to an executive vice president post with the parent Cities Service Co.

John W. Welch has been named senior staff consultant for Crest Engineering. He was formerly chief engineer and director of projects in CE's Tehran office. **Rex A. Vicars,** formerly senior staff engineer, has been appointed manager of operations. He is responsible for engineering operations in the Houston office.

Howard Grekel has been appointed president and chief executive officer of ChemDesign, Inc. Grekel formerly supervised process development and engineering programs for Amoco production.

Michael Urbas has been promoted to a sales position with Harco's Medina region. He was previously project coordinator in the construction department. **John R. Kleppe** has joined the company's Chicago area sales group.

W. L. Lee has been elected chairman of Atlanta Gas Light Co.'s board of directors. He is succeeded as president by **Joe T. LaBoon,** formerly senior vice president-operations.

G. E. "Ted" Creber has been named president and chief executive officer of Consumers' Gas Co. Creber succeeds **J. C. McCarthy,** who has moved up to the position of vice chairman of the board of directors.

James W. Suggs has been elected general manager of G.E.'s Gas Turbine Division's Marketing Department. Suggs replaces **Edward W. Springer,** named general manager of GE's Large Steam Turbine-Generator Department.

Donald A. Cowser has been named senior vice president of Alaska Constructors, Inc, subsidiary of Halliburton Co. Other appointments include **Lee F. Rathbun** as vice president, operations; **Robert L. Carnahan,** vice president, administration; **Jim F. Chandler,** vice president, engineering; and **Walter H. Bauerschlag,** vice president-business development.

Joe H. Rogers has been promoted to account manager, tubular sales, National Supply Co., a division of Armco Steel Corp. He is responsible for tubular accounts in the Dallas area.

Leon Winters, director of government marketing for Dames & Moore, has gained additional responsibility as managing principal in charge of the firm's San Francisco office.

Raymond R. Ernest has been named East Ohio Gas Co.'s vice president, marketing. He was formerly vice president, administration. **David P. Hunt,** formerly assistant vice president was named vice president, planning. **Charles L. Scott,** previously employee relations director, has been named vice president employee relations. **George E. Reid** has been named director of public affairs. He had been general utilization manager.

people


D. J. Taw


F. G. Hansen


N. G. Sprock


R. M. Strickland


P. Tomatis


R. E. Shank

Dudley J. Taw has been named director of Consolidated Natural Gas Co. Taw, president of East Ohio Gas Co., Consolidated's largest distribution subsidiary, replaces Francis H. Wright as director. Taw has also been elected director of Consolidated Natural Gas Service Co., Inc., as has **Arthur W. Foster,** previously manager of gas control. **John J. Hibbs** has been promoted to assistant vice president of CNG Service Co. Hibbs was previously assistant to vice president, gas supply.

Fred G. Hansen has joined Gulf Interstate Engineering Co. as executive consultant to the president. He was previously president of Navajo Refining Co., a member of the New Mexico State Senate and a director of the Holly Corp.

Norman G. Sprock has been appointed vice president of American Natural Gas System's engineering activity. In his new job, Sprock is responsible for overall engineering planning and coordination for the company.

R. Michael Strickland has been appointed manager of sales and service of Solar gas turbine machinery in Alaska. Strickland has been senior sales engineer for Solar in the Anchorage office.

Paolo Tomatis has been appointed to represent Solar's gas turbine machinery in western Europe. Tomatis was previously project coordinator for Ansaldo Meccanico Nucleare S.P.A. in Genova.

Robert E. Shank has rejoined Solar as senior sales engineer in the Tulsa district office. Shank was a solar sales engineer before joining Williams Brothers Engineering Co. in 1974.

Jerome H. Marten has been named director, process engineering, in the Lakeland, Fla. offices of Davy Powergas Inc. He was formerly director, process engineering, petrochemicals.

T. E. "Gene" Byrne has been promoted to regional sales manager for Daniel Industries, Inc. He is in charge of the Southwest Region located in Midland, Texas.

John Bridal has been named manager, special accounts, of Ditch Witch, a division of Charles Machine Works. Bridal in his new position coordinates matters of market development product needs, production and research and development between the special accounts and the appropriate Ditch Witch departments.

people


D. P. Bauer

David P. Bauer has been named president of Harco Offshore, Inc. Bauer, who continues as vice president of the parent company, Harco Corp., was previously regional manager for the Southwest region. **John Piazza,** vice president and formerly southeastern regional manager, has been appointed southern area manager, responsible for Atlanta and Houston regions. **Allen Canady,** previously sales manager for the Atlanta region, has been named Southeastern regional manager.


J. Piazza

Stuart S. Gold has joined Energy Products Group's corporate staff as marketing analyst. He was previously dealer market analyst for A.B. Dick Co.

John C. Crusco has been named sales manager for EPG International Operations. Crusco is responsible for the sale of all EPG products and services throughout Latin America.


A. Canady

Donald W. McCarthy has been elected president and chief operating officer of Northern States Power Co. He was previously the company's executive vice president.

Donald M. Murray has been appointed general manager of CU Engineering Ltd, subsidiary of Canadian Utilities Ltd. CU Engineering specializes in design engineering, project management, and system and capacity evaluation for natural gas distribution and transmission systems.

C. Paul Page has been elected an assistant treasurer of Columbia Gulf Transmission Co. **Gary N. Espey** has been named manager of general accounting to succeed Page and **Myron L. Stewart** succeeds Espey as manager of internal and administrative controls.

Ray G. Keearns has been appointed manager, environmental affairs and pipeline safety, for Williams Pipe Line Co. and **Ken V. Tiffany** has been named manager, engineering and construction.

C. H. Young Jr. has been named general manager of New Orleans division of United Gas Pipe Line Co. Young, previously assistant general manager of the division, succeeds O. D. Jackson, recently retired.

Eugene P. Mink, senior vice president, sales, Wisconsin Southern Gas Co., recently retired after 46 years with the company.

Paul J. Petry has been elected controller of Wisconsin Gas Co. Petry has been assistant controller for corporate accounting activities.

Peter B. Hamilton has been appointed regional director, public affairs, Gulf Oil Co., London. He succeeds **Brian Raggett** who has transferred to Gulf Oil Corp. as assistant coordinator, foreign public relations.

James H. McDonald, formerly executive vice president for Gulf Oil Co., Asia, has been named vice president—supply and transportation for Gulf Oil Co. — U.S.

Ronald R. Scholl has been named eastern region manager of J. I. Case Co.'s Construction Equipment Division. He replaces **Robert A. Johannsen,** recently transferred to the company's International Division.

Guy J. Allouchery has joined Kellog France in a sales position. He was previously sales representative in Paris and New York for Technip.

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meetings

July

18-24 Intersociety Conference on Transportation, Los Angeles Hilton, Los Angeles, Calif.

August

1-6 Welding R&D — Problems and Opportunities, New England College, Henniker, New Hampshire

2-5 BOSS '76, International conference on behavior of offshore structures, Norwegian Institute of Technology, Trondheim, Norway

3-5 Third Annual Conference on Coal Gasification and Liquefaction, University of Pittsburgh, Pittsburgh

4-6 MGA Gas Operations School, Memorial Union, Ames, Iowa

9-11 ASME Heat Transfer Conference, St. Louis

10-11 Appalachian Gas Measurement Short Course, Robert Morris College, Pittsburgh, Penn.

10-12 2nd Annual Underground Coal Gasification Symposium, Lakeview Inn and Country Club, Morgantown, W. Va.

12-14 Second International Symposium on Cold Regions Engineering, University of Alaska, Fairbanks, Alaska.

17-19 ASME Gas Piping Standards Committee, Radisson South Hotel, Minneapolis, MN

23-27 Radial Flow Turbomachinery Course, Fluid Dynamics Institute, Thayer School of Engineering, Dartmouth College, Hanover, N.H.

September

8-10 Pacific Coast Gas Association's 83rd Annual Meeting, Sheraton Hotel, Spokane, Wash.

9 MGA Public Relations & Advertising Meeting, Holiday Inn, Denver

14-16 14th Annual Liberty Bell Corrosion Course, Penn Center Holiday Inn, Philadelphia

18-20 A.G.A. Eighth Synthetic Pipeline Gas Symposium, O'Hare Inn, Des Plaines, IL

19-23 ASME Petroleum Mechanical Engineering Conference, Mexico City

19-23 ASME Pressure Vessels and Piping Conference, Mexico City

Comment...

Where does the money go?

All that money oil and gas companies collect for products has to go somewhere, but where?

Consumers believe what politicians tell them — it goes to oil companies and they don't show much smart in using it or we'd have cheap and plentiful oil and gas again.

So the politicians take over.

In some countries the oil/gas industry is nationalized or the nation takes majority participation. The governments of all OPEC members own their oil operations. The governments of all Communist nations own and manage their oil/gas industry and apparently buy their technology from others.

Industrialized countries are following the same path. National governments on the North Sea own the

So that's where the big money goes. Not to the 31 companies, which sold some $200 billion of products to consumers (that's 2.3% profit margin), not to a million shareholders who invest their savings, not to thousands of employees who worked and planned and sweated to get supplies to users. The big money goes to political entities — the governments, local and national — that flail the oil industry.

Although some of our 31 companies are international in scope, the taxes and income are generally proportionate. They now pay for most oil they buy and import to U.S. and that is expense — not included in this table. Actually dividends are expense, too, but in the U.S. the company must pay a tax on dividends before they are distributed, and the shareholder then pays another tax on dividends he receives.

You can see where the oil money goes and it doesn't end up with the "rich" oil companies. But we are a beguiled nation. Who's going to tell the irritated consumer? And who's going to put the bell on the Big Cat? A bunch of smart mice could. — *Ernestine Adams*

Course, Fluid Dynamics Institute, Thayer School of Engineering, Dartmouth College, Hanover, N.H.

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Comment...

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In some countries the oil/gas industry is nationalized or the nation takes majority participation. The governments of all OPEC members own their oil operations. The governments of all Communist nations own and manage their oil/gas industry and apparently buy their technology from others.

Industrialized countries are following the same path. National governments on the North Sea own the majority of rights directly or through state-owned companies. The Japanese government is involved in energy ventures abroad and at home.

Canada and the United States still put up a front. It's a private investors' industry but political powers are taxing so heavily and regulating so minutely that government take-over is inevitable unless consumers (the voters) find out where the money is going.

U.S. oil companies have been getting hit by U.S. political leaders harder than ever in recent years. They are blamed for energy shortages, for energy price increases, for taking too much money for their own use and failing to compete in the market place.

So Congress practically deleted the depletion tax allowance which always worked down to consumers' benefit in competitive selling. Congress and the Administration placed price controls on oil at the wellhead as it had on natural gas for 22 years.

They set up a new federal agency to carry out a mass of rules and regulations that is a boon to lawyers, a new burden for courts and a labyrinth for operators to wind through if they expect to plan a new venture in finding and developing energy supplies. (It's insurmountable for many.)

Companies say, with less money and too many exotic rules, operations are stymied.

Less money? Where does all that money — billions of dollars from consumers — go?

You get a clue in a table in this issue — Beneficiaries of Integrated Oil Companies' Operations. The first round of income divided up this way:

Our 31 companies came out with 7.8% on the bottom line in profits; shareholders got 5.2%; employees gained 12.9% and governments took a whopping 74.1% in taxes.

So that's where the big money goes. Not to the 31 companies, which sold some $200 billion of products to consumers (that's 2.3% profit margin), not to a million shareholders who invest their savings, not to thousands of employees who worked and planned and sweated to get supplies to users. The big money goes to political entities — the governments, local and national — that flail the oil industry.

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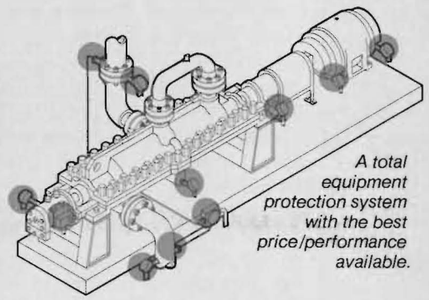

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THE BOTTOM LINE TELLS ALL

by Ernestine Adams, *Editor, Energy Management Report*

Who benefits from oil industry operations? A substantial number of consumers, political leaders, intelligensia, economists will answer, "The fat cats — the giant oil companies."

This is oft-repeated, especially in Washington, D.C., but we couldn't see exactly how it could be since we have reviewed and analyzed more than 100 oil companies' annual reports for 30 consecutive good and bad years.

Even though annual reports always try to look good for those voluntary investors — the stock owners — we know profit margins have narrowed in those 30 years and more capital had to be bought in the money market for exploration and development of resources and expansion of processing and transportation facilities.

What was the true answer?

We took the first line of direct beneficiaries of oil industry operations, using 31 companies with integrated organizations, including the "Giants." (See Table 1.) One company doesn't market directly and another only in a minor way.

Some have foreign operations which can't be broken out in detail for income or for investors, employees and taxes but they are all U.S. companies and a high majority of each share can be allotted to the United States.

If a company has operations abroad, earnings as well as taxes are reflected in shares of companies, investors, employees and governments. Some of these 31 companies have no foreign operations; others are minor.

All data are confined to the 31 companies. Employees take pay and benefits from industry operations, companies earn a net return, investors collect dividends on stock and all of them together get only a fraction of what governments — local and national — claim and receive as their share.

Our 31 companies reported earnings before dividends because dividends are taxed twice — first the companies pay taxes on them as part of earnings and later stockholders pay another tax on the same money unless the owner is a non-profit organization (i.e. church groups.)

After dividends these 31 oil companies had $5.647 billion in 1975 for their year's operations. These same companies spent $24.77 billion for capital and exploration investments the same year. They bought the extra funds needed in the money market.

The interest on these borrowed funds adds to product prices. And that same interest is taxed when it is received as income.

If you say investment wasn't all in the oil industry, you're right, but the expenditure outside was minor and offsetting that are oil companies of substance that are enveloped in bigger corporations.

Champlin Petroleum Co. is now a subsidiary of Union Pacific and you can't break out the financial data along with operations. Champlin produces 42,000 b/d oil, refines 150,000 b/d and markets through some 1,200 branded retail outlets. International Paper bought General Crude and Georgia Pacific acquired Exchange Oil and Gas, both producing concerns, within the last year.

Employees of the 31 companies received $13.89 billion in pay and benefits but after income taxes of approximately one-third (Tax Foundation estimate of average paid by U.S. employed individuals) they came out with $9.26 billion as their share of 1975 operations, (and paid more taxes on family expenditures).

Investors were paid $4.522 billion for their capital funding. We estimate only half the taxes of working people — one-sixth — because many investors are retired and pay less tax and non-profit organizations hold stock on which no tax is paid. After taxes, the investors gained $3.768 billion. (And those who spent that paid more tax.)

Then we came to the big beneficiary — governments — local and national. That was where the money spent for oil/gas products concentrated.

Oil industry operations turn out to be the biggest collection agency that governments have. In 1975 government entities collected $53.274 billion from the operations of 31 U.S. integrated companies, their investors, employees and consumers. That is 74.1% of all direct benefits.

Excise taxes in the U.S. average 12¢/gal. on gasoline: 4¢/gal. federal tax and an average 8¢/gal. state tax. No estimate is made in costs for collecting but companies pay in time, personnel and money to collect from customers, keep accounts and transfer to governments, making up any discrepancies.

Other taxes include all direct levies: Income taxes before dividends (add investors' share to companies share to get income taxed directly), ad valorem taxes, school taxes, severance taxes on oil and natural gas production, import duties, etc.

What U.S. consumers haven't found out, it seems, is that they actually pay all the taxes. The depletion tax allowances which consumer advocates (like Ralph Nader) and unaware Congressmen fought to eliminate — and did — were consumer benefits that permitted cheaper gasoline and fuel oil. Now the heavier tax goes to governments and the oil/gas industry has to collect more taxes from consumers.

If a company doesn't collect enough to pay all the taxes, it's out of business and investors and needs no employees.

It's a puzzlement, wouldn't you say, why U.S. political leaders run re-election campaigns against their biggest tax collector? Are they telling us they want less taxes?

Table 1. Income Shares Generated by 31 Oil Companies' Operations in 1975

Company	COMPANY'S SHARE Net income after dividends ($000)	INVESTORS' SHARE Dividends ($000)	EMPLOYEES' SHARE Employees' payroll & benefits ($000)	GOVERNMENTS' SHARE Taxes on dividends[1] ($000)	Taxes on Employees' share[2] ($000)	Excise taxes on oil products[3] ($000)	Other taxes[4] ($000)	Total taxes ($000)
Amerada Hess	$ 97,919	$ 30,484	$ 92,175[e]	$ 5,080	$ 30,725[e]	$400,880[e]	$221,281	$657,966
American Petrofina	18,853	21,333	53,258	3,556	17,753	65,279	23,554	110,142
Ashland	73,801	45,566	384,917	7,594	128,305	245,000	165,180	546,079
Atlantic Richfield	193,600	156,800	482,900	26,133	160,967	483,700	709,100	1,379,900
Cities Service	73,200	64,500	317,300	10,750	105,767	157,700	183,300	457,517
Clark O&R	1,683	3,554	44,500	592	14,833	123,011	2,935	141,371
Conoco	229,700	101,200	715,300	16,867	238,433	246,500	1,281,000	1,782,800
Exxon	1,118,000	1,385,000	2,694,000	230,833	898,000	2,930,653	12,395,145	16,454,631
Getty	208,800	47,880	225,793	7,980	75,264	141,537	465,976	690,757
Gulf	369,000	331,000	963,000	55,167	321,000	1,570,000	2,656,000	4,602,167
Husky	29,129	6,889	45,025	1,147	15,008	38,616	31,500	86,271
Kerr-McGee	106,665	25,415	151,575[e]	4,236	50,525[e]	141,382	115,104	311,247
Kewanee	27,719	4,408	48,902	735	16,301	0	27,949	44,985
Mapco	36,232	13,082	36,089	2,180	12,030	1,840	47,126	63,176
Marathon	74,267	53,850	194,900	8,975	64,967	282,962	396,025	752,929
Mobil	463,600	346,300	1,216,000	57,717	405,333	1,514,900	4,906,400	6,884,350
Murphy	32,539	7,596	63,180	1,266	21,060	151,461	96,372	270,159
Northeast Petr.	5,764	702	13,000	117	4,333	12,610	5,476	22,536
Occidental	103,860	79,380	439,550	13,230	146,517	12,019	441,375	613,141
Oil Shale (Lion Oil)	(3,633)	0	20,978	0	6,993	41,442	3,718	52,153
Pennzoil	51,264	55,558	146,118	9,260	48,706	35,000	98,262	191,228
Phillips	220,734	121,834	528,800	20,306	176,267	267,000	503,200	966,773
Quaker State	13,376	9,809	35,655	1,635	11,885	14,906	26,093	54,519
Shell Oil	293,800	221,000	763,000	36,833	254,333	732,761	706,500	1,730,427
Standard California	433,188	339,312	821,000	56,552	273,667	701,500	1,654,000	2,686,319
Standard Indiana	493,218	293,769	940,186	48,962	313,395	1,078,906	1,748,048	3,189,311
Standard Ohio	76,092	50,454	273,565	8,411	91,188	212,580	199,793	511,972
Sun	142,385	77,669s	556,738	12,945	185,579	482,539	837,189	1,518,252
Tesoro	38,560	4,366	15,857	728	5,286	1,500[e]	22,079	29,593
Texaco	287,611	542,972	1,267,200	90,495	422,400	2,303,405	2,686,544	5,502,844
Union California	152,201	80,553	340,800	13,426	113,600	350,909	490,082	968,017
TOTAL	$5,463,127	$4,522,245	$13,891,261	$753,708	$4,630,420	$14,742,498	$33,146,906	$53,273,532

[1]Taxes on dividends ar 1/6, a low income tax rate because many shares are owned by retired persons with small incomes and by non-profit organizations which pay no tax. [2]Employees taxes are estimated at 1/3, calculated by Taxpayers' Foundation as the average rate for employed persons. [3]U.S. federal excise tax is 4¢/gal.; state taxes average about 8¢/gal. Other products have lower excise tax. [4]Taxes levied directly on companies: income taxes (before dividends), property taxes, severance taxes on oil/gas production, sales tax. [s]Stock. [e]Our estimate.

Table 2. Beneficiaries of Integrated Oil Companies' Operations

Earnings of 31 companies after dividends	$ 5.648 billion	COMPANIES' SHARE	**7.8%**
Dividends after taxes paid by stockholders (1/6)	$ 3.768 billion	INVESTORS' SHARE	**5.2%**
Employees pay & benefits after taxes (1/3)	$ 9.261 billion	EMPLOYEES' SHARE	**12.9%**
Taxes paid by companies, investors, employees and collected from consumers	$53.274 billion	GOVERNMENTS' SHARE	**74.1%**
BOTTOM LINE	$71.951 billion		**100.0%**

FINANCIAL NOTEBOOK

Money Market, Mergers, Acquisitions, Executive Changes, Capital Expenditures,

Some large mergers are in the making. Atlantic Richfield sold its Canadian unit for $335 million to Petro-Canada, national oil company. Atlantic Richfield-Canada had oil producing properties and ⅛ interest in tar sands project.

R. J. Reynolds Industries, the tobacco company, purchased Burmah Oil & Gas Co. and Burmah Oil Development in the U.S. for $520 million in cash from Burmah Oil Ltd. It had hoped to realize $550 for the property. Burmah ran into bad times with tanker losses.

Santa Fe Industries purchased oil and gas properties of Westates Petroleum Co. for approximately $74.5 million. Shareholders and regulatory authorities must approve the transaction . . . An understanding has been reached for Mobil Oil Corp. to acquire Irvine Co., land development firm, for about $200 million in stock.

Kerr-McGee offered to purchase common shares of Sunningdale Oils Ltd. for $17.35/share. Kerr-McGee already has 952,000 shares . . . Tesoro Petroleum acquired Nikishi Alaska Pipeline Co. and right to complete an oil pipeline Nikiski is building in Alaska, from Gulf Interstate Co . . . Crystal Oil Co. agreed to buy producing and gas properties and gas processing facilities of Charter Exploration and Production Co. for $16 million.

Terra Resources acquired a 17% interest in 17 oil and gas wells in Louisiana for $29 million from private individuals . . . Barber Oil has enlarged its interest in the Jay Field in Florida and Little Escambia Creek Fields in Alabama. Purchases were from private individuals for $17.5 million . . . Total Petroleum completed acquisition of Hanover Petroleum.

Aquitaine Co. of Canada plans to acquire Elf Oil Exploration and Production Canada .Ltd. for its common shares valued at about $20 million. Atlantic Richfield completed sale of its East Chicago Indiana refinery to CF Petroleum for some $80 million.

McAlester Fuel Co. was merged into Alaska Interstate for cash and notes totalling about $40 million . . . Quaker State completed acquisition of Valley Camp Coal Co. on an exchange of stock valued at about $51 million . . . Houston Natural Gas said all of Empire Energy Corp.'s common shares were tendered when it made an offer of $9/share.

Marathon acquired Pan Ocean Oil which has a 32% interest in the Brae oilfield in the U.K. sector of the North Sea and is operator . . . Ashland Oil paid $15 million for half of Bow Valley Exploration Ltd.'s 28% interest in the field and will finance Bow Valley's share of development costs.

At its annual meeting Apco Oil Corp. said the board had authorized management to begin preparation of a plan of liquidation . . . Edgington Oil Co. said it agreed in principle to sell substantially all assets for about $47 million to Buckeye Pipeline Co. (Penn Central).

A state production company to operate on state-owned inland water and in Louisiana offshore territory is being studied by Louisiana state officials. At this time intrastate gas is produced in surplus, but interstate prices do not attract Louisiana gas producers.

Governor Edwin Edwards said he thought the idea holds great promise in that the state would have a better handle on use of oil and gas for Louisiana industries including farming not to speak of Louisiana householders. Governor Edwards has been highly critical of northeast attitude toward offshore drilling.

Some investment houses have a good word for oil companies. Fishbeck & Sons did a study on Tipperary Corp. It gives appraised value at $14.28/share . . . Texas American Oil Corp. is reviewed by Rotan & Mossle which says it is selling at a discount.

A study of oil industry bonds by Paine, Webber, Jackson & Curtis, Inc. recommends "buy" for debt securities for Getty, Shell, Standard Indiana, Marathon, Atlantic Richfield, Ashland, Kewanee, Sohio and Pennzoil.

The money market doesn't seem to be overloaded with customers. Most of what the oil companies obtained came from straight loans. Tenneco completed a private sale of $120 million in promissory notes to 22 institutional purchasers . . . Occidental offered $30 million international 7-year notes through Kidder Peabody International.

Maynard Oil Co. secured a $5 million 7-year loan from Texas Bank & Trust Co. of Dallas . . . Coquina Oil completed a loan of $20 million with a group of banks headed by First National Bank of Midland, Texas . . . Marline Oil Corp., New York, sold 400,000 shares of its class A common for $1 million in cash . . . Sonatrach, Algeria's national oil company, obtained a $430 million loan with a syndicate of 52 international banks.

Kerr-McGee is offering $125 million of new 30-year sinking fund debentures through Lehman Brothers . . . National Fuel Gas Co. offers 1.2 million shares of $2.30 dividend preferred stock at a price of $25 each, to return 9.2%. Underwriters managed by Loeb, Rhoades & Co . . . American Quasar Petroleum is selling $17.5 million convertible subordinated debentures through Dean Witter & Co. and Eppler, Guerin & Turner.

Basic Resources International S.A., a Luxembourg company, placed 500,000 common shares at $9/share with a consortium of European financial institutions . . . Pacific Resources, Honolulu, is offering 700,000 shares of common stock. The company has an oil refinery and the gas utility in Hawaii.

Briefs. Texaco just paid its 295th consecutive dividend . . . Mobil will move its U.S. marketing and refining division from New York City to offices near Falls Church, VA . . . Oil prices in Canada will rise in two stages to $9.75/bbl by

next January 1 . . . New president and general manager of Frank W. Murphy Mfr. Inc., Tulsa, is Frank W. "Mike" Murphy Jr.

Exxon will split its stock 2-for-1. Conoco stock was split 2-for-1 . . . Who's Who in Engineering, a directory prepared by Engineers' Joint Council, will be published in December . . . U.S. Bureau of Labor Statistics says from now till 1985 there will be more jobs for engineers than applicants.

Nefta Gaz II will be held in Moscow, October 13-21, 1977. This is a direct U.S.-to-Russia market exhibit. In the first one, held in 1973, 189 companies participated, exhibiting their equipment and supplies for oil, gas and petrochemicals. The second one will be set up along the same lines.

The exposition will be handled by Martin C. Dwyer International, which has formed an advisory board whose members are: chairman, Michael C. Enright, sec.-treas., International Petroleum Exposition; Leslie Brooks, president, Advertising Engineers; Dr. Weldon B. Gibson, ex. v.p., Stanford Research Institute; Robert W. Johnson, v.p. of UOP; Carl M. Longley, v.p. of Satra Consultant Corp.; R. J. McMenamin, v.p., International Harvester, Overseas Div.; William D. Manly, v.p. of Cabot Corp.; John D. O'Connell of O'Connell & Co., Wallace N. Seward, assistant to president, API, and Abbott Sparks, president, Petroleum Engineer Publishing Co.

Drilling programs are still being carried out. Flynn Energy Corp. closed its drilling program with subscriptions that brought the total to $4.56 million in fiscal 1976 compared to $3.415 million the previous year.

A $3 million offering is being made by Dyco Petroleum comprised of 600 partnership units at $5000 each.

An offer will be made to purchase outstanding limited partnership interests by Cotton Petroleum Corp. for its 1971-1974 oil and gas programs. Total purchase price of some $13 million will be paid if all participants accept the offer.

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12	32	52	72	92	112	132	152	172	192	212	232	252	272	292	312
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16	36	56	76	96	116	136	156	176	196	216	236	256	275	296	316
17	37	57	77	97	117	137	157	177	197	217	237	257	277	297	317
18	38	58	78	98	118	138	158	178	198	218	238	258	278	298	318
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18	38	58	78	98	118	138	158	178	198	218	238	258	278	298	318
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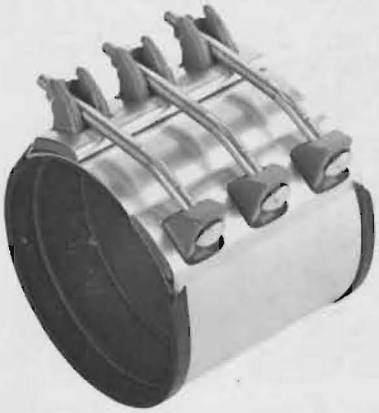

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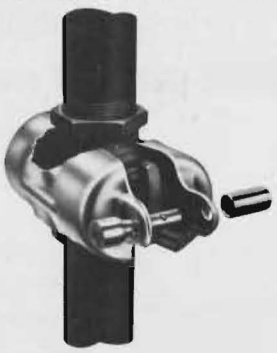

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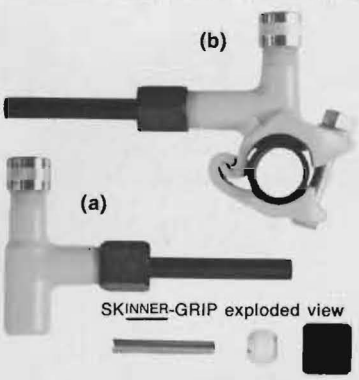

Skinner Punch-It® Tee Saddle with new SKINNER-GRIP for plastic service (a); SKINNER-SEAL® Punch-It® Tee with new SKINNER-GRIP for plastic service, tee welded to main (b). Punch-It® Tee Saddle with coupon retaining punch. Other Skinner products: Service Saddle, Saddle Tee and Drilling Devices.

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