



Project Summary

The Liquid and Gaseous Fuel Distribution System

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The report describes the national liquid and gaseous fuel distribution system. The study was performed as part of an effort to better understand emissions of volatile organic compounds from the fuel distribution system. The primary, secondary, and tertiary segments of the liquid fuels (crude oil and refined liquid petroleum products) distribution system are discussed individually, the quantities of liquid fuels are estimated, and the transportation modes for each system segment are described. The report includes a flow chart of fuel distribution system and its end users. The discussion of the U.S. natural gas distribution system includes estimates of state-specific and total gas production, a flow chart describing the system and its end users, and flow charts describing the natural gas marketing system.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

As part of EPA's program dealing with the control of atmospheric ozone and carbon monoxide (CO), state and local air pollution agencies responsible for areas which do not meet EPA standards for ozone and CO pollution levels must estimate volatile organic compounds (VOCs), oxides of nitrogen (NO_x), and CO emis-

sions from point, area, and mobile sources to serve as a basis for State Implementation Plans (SIPs). EPA provides these agencies with guidance for estimating emissions of these pollutants from these three source categories.

Petroleum distribution activities are a source of evaporative VOC emissions. Gasoline marketing activities accounted for 4.5% of the U.S. VOC emissions as represented in the 1985 NAPAP Emissions Inventory. Current EPA guidance bases emissions estimates on county-level fuel consumption estimates, which are based on a state-to-county allocation scheme rather than on county-specific data. Future improvements in estimating emissions from fuel distribution sources depend on better county-level fuel consumption estimates. The research described here was performed to establish a framework for future emissions study and for future improvements in estimating fuel consumption at the county level. As a first step toward developing improved guidance for estimating emissions from petroleum marketing activities, the liquid and gaseous fuels system distribution system was studied. This report presents the results of that study.

Crude Oil And Refined Liquid Products

The crude oil and refined product distribution system consists of an extensive network of terminals, refineries, dedicated storage facilities, pipelines, tankers, barges, rail cars, and tank trucks. This network initially transports crude oil from wellheads to refineries, where it is pro-



cessed into finished products such as gasoline, jet fuel, and fuel oil. The distribution system then delivers finished products from refineries to large storage and distribution centers, then on to the end users. Table 1 summarizes the inventory and storage capacity of the entire petroleum distribution system.

The liquid fuels distribution system consists of primary, secondary, and tertiary segments. Figure 1 is a schematic diagram of the liquid fuels distribution system. The primary segment includes distribution of crude oil and refined products from wellhead to refineries, from the refin-

Table 1. Estimated 1987 Inventory and Storage Capacity in the Petroleum Distribution System*

	Primary		Secondary		Tertiary		Total	
	Inv.	Cap.	Inv.	Cap.	Inv.	Cap.	Inv.	Cap.
Motor Gasoline	231	451	48	92	63	109	342	652
Kero-Jet Fuel	40	82	—	—	11	22	51	104
Distillate Fuel Oil	89	261	15	37	113	255	217	553
Residual Fuel Oil	44	117	2	4	60	185	106	306
Totals**	404	911	65	133	247	571	716	1615
Crude Oil***	343	508	—	—	—	—	343	508

* Units are in millions of barrels as of March 31, 1988. (1 bbl = 159 L.)

** Totals include surveyed petroleum products only.

*** Crude oil numbers exclude Strategic Petroleum Reserve and 10.6 million barrels of lease stocks.

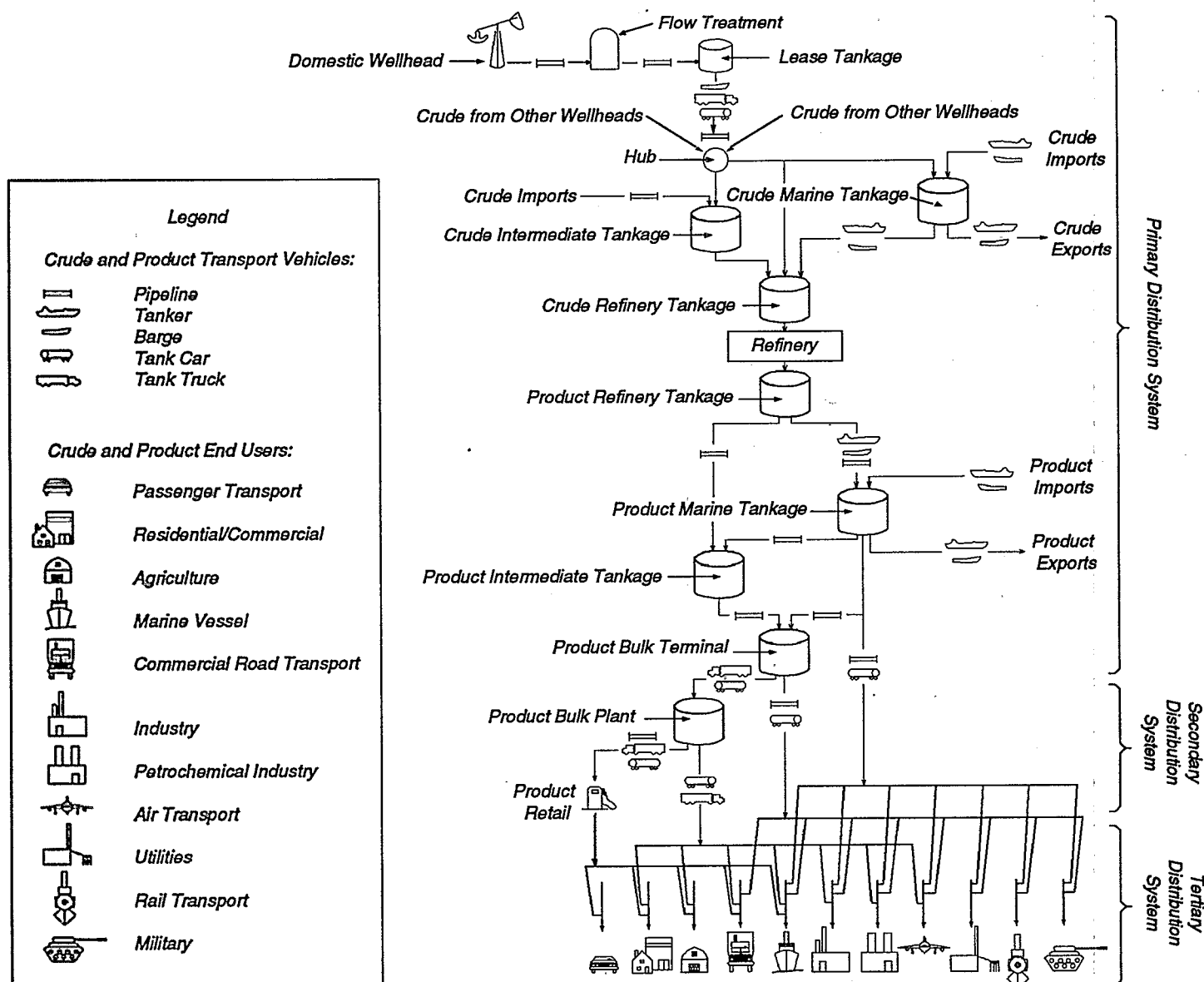


Figure 1. U.S. liquid fuels distribution system. Reproduced, with permission, from Petroleum Storage and Transportation, Volume I, ©1989, by the National Petroleum Council.

eries to their customers, and from bulk and marine fuel terminals to their customers. Bulk fuel plants and retail outlets make up the secondary segment, while the tertiary storage system consists of storage by the end user (in automobiles, homes, factories, etc.). Petroleum liquids are transported by a variety of land and marine systems, including pipelines, rail tank cars, tank trucks, barges, and oceangoing tankers. Pipelines and tankers transport the greatest quantities of fuel, but trucks and rail cars are also integral parts of the sys-

tem. Figures 2 and 3 describe the liquid fuels transportation system.

Natural Gas Distribution System

The U.S. consumed 18.0 trillion ft³ of natural gas in 1988. The natural gas distribution system is a three-part system made up by the gathering system, the transmission system, and the market distribution system. Figures 4 and 5 are schematic diagrams of the natural gas distribution and marketing systems.

The gathering segment of the natural gas distribution system includes a network of pipelines that collect gas from production fields, processing plants, and producer-owned pipelines. The gas is conditioned (e.g., dehydrated, sweetened) prior to entering the gathering system. The gathering lines transport natural gas to the main line transmission segment of the system.

The transmission system, consisting of a system of parallel transmission lines, with compressor stations every 40-130 mi (64-208 km), transports gas from the gas production fields, underground storage fields, and liquid natural gas (LNG) import terminals to the market distribution system. Pipelines in the transmission system, unlike the weblike structure of the gathering and market distribution systems, follow a relatively straight line.

The market distribution system distributes gas to gas distribution companies, local utilities, or industrial customers. While residential and other end users purchase gas from the distribution companies, utilities and industrial customers often take delivery from spur lines directly from the main transmission lines.

Conclusions

The report contains a detailed description of the national liquid and gaseous fuel distribution system, and may be used as a framework for future emissions guidance development. Further work in this area, including surveys of state agencies and state governments, is necessary to develop a better predictive model of county-level gasoline consumption.

While quantifying the amount of fuel in each leg of the fuel distribution system (see Figures 1 and 4) was a goal of this project, the data required to develop these estimates are difficult to obtain. Statistics on the production and transportation of crude oil are readily available, and some data on fuel consumption by economic sector are available. Fuel consumption by manufacturing industry subsector and by modes of transportation is also estimated in various government publications. Tracing petroleum products through the distribution system is more difficult. In addition to this study, efforts have been made to develop these estimates by governmental departments including the Internal Revenue Service. These efforts have had limited success.

(*) 1 ft³ = 28.3 L.

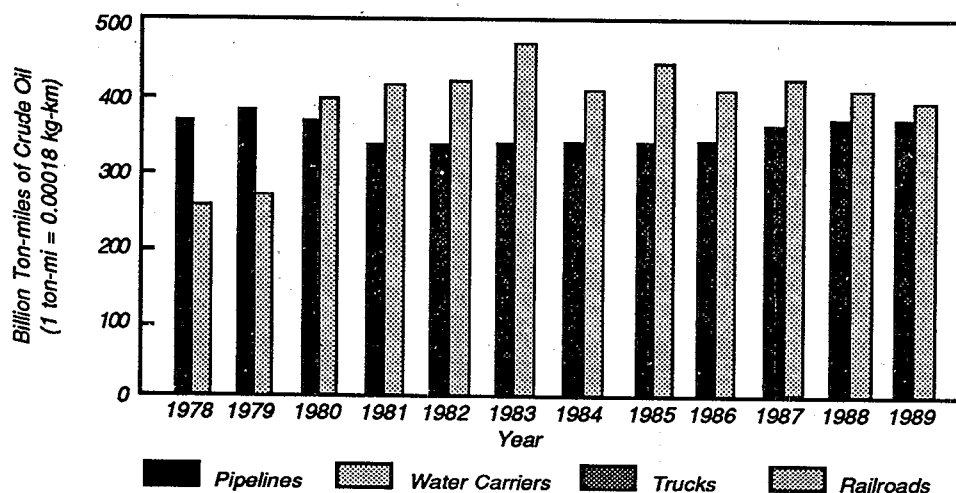


Figure 2. Crude oil transportation.

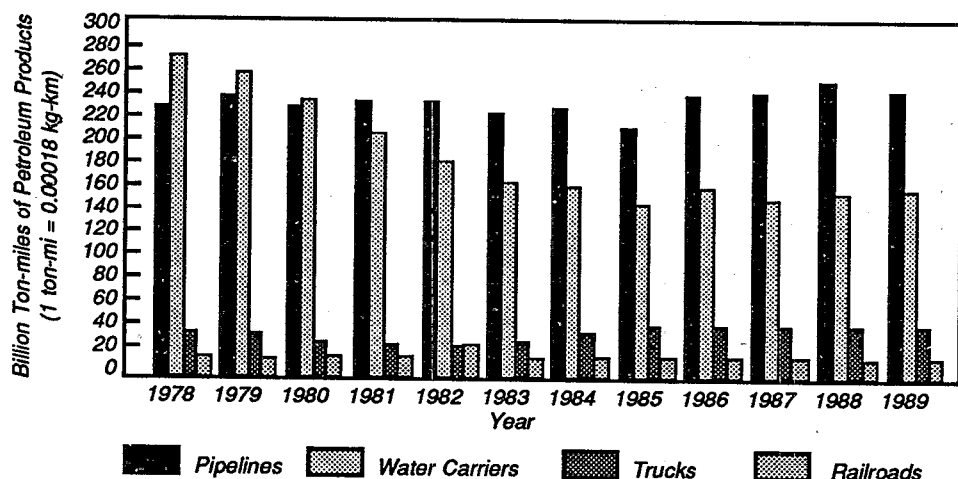


Figure 3. Petroleum products transportation.

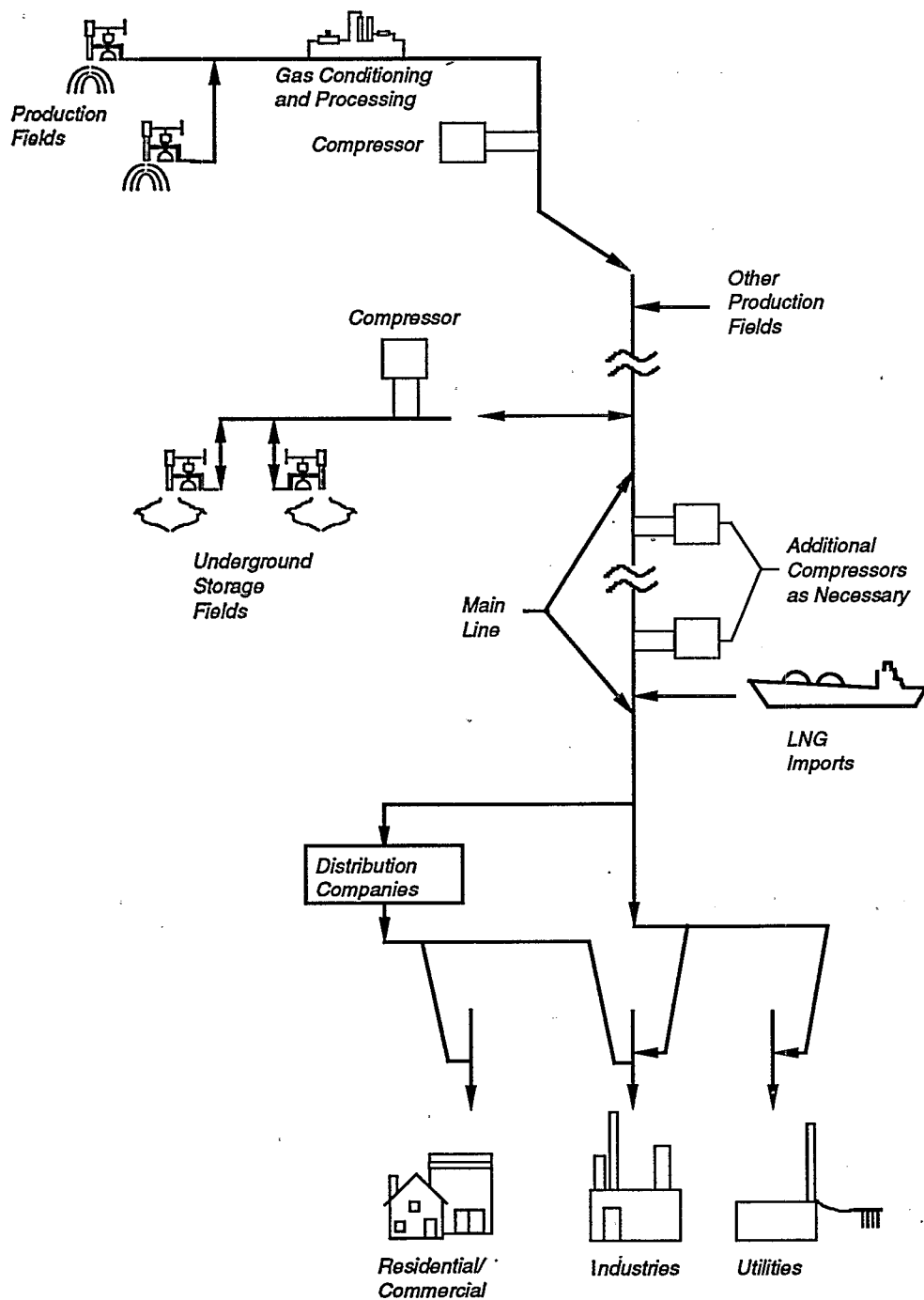
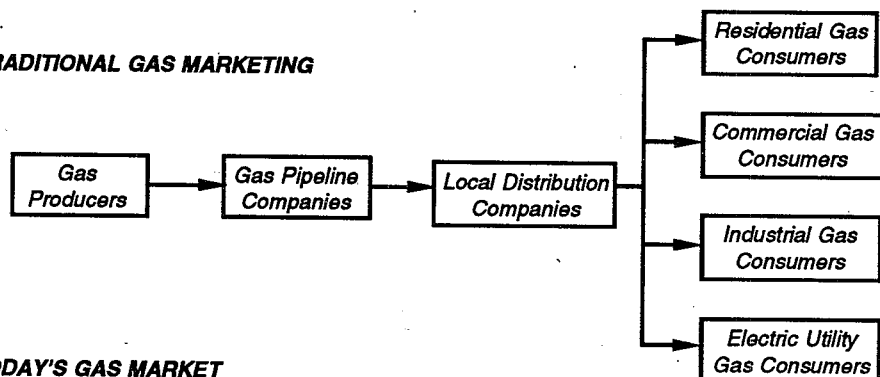


Figure 4. Natural gas distribution system. Reproduced, with permission, from *Petroleum Storage and Transportation, Volume I*, © 1989, by the National Petroleum Council.

TRADITIONAL GAS MARKETING



TODAY'S GAS MARKET

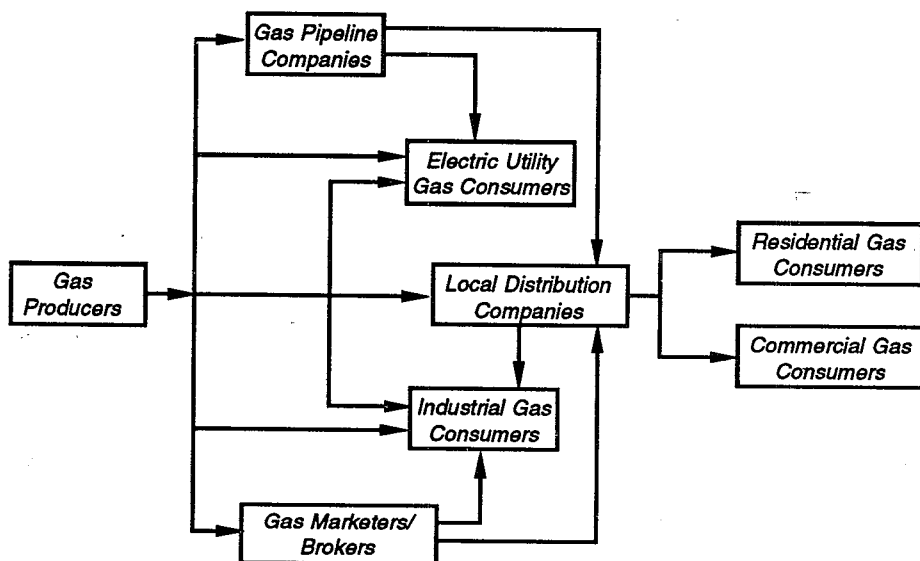
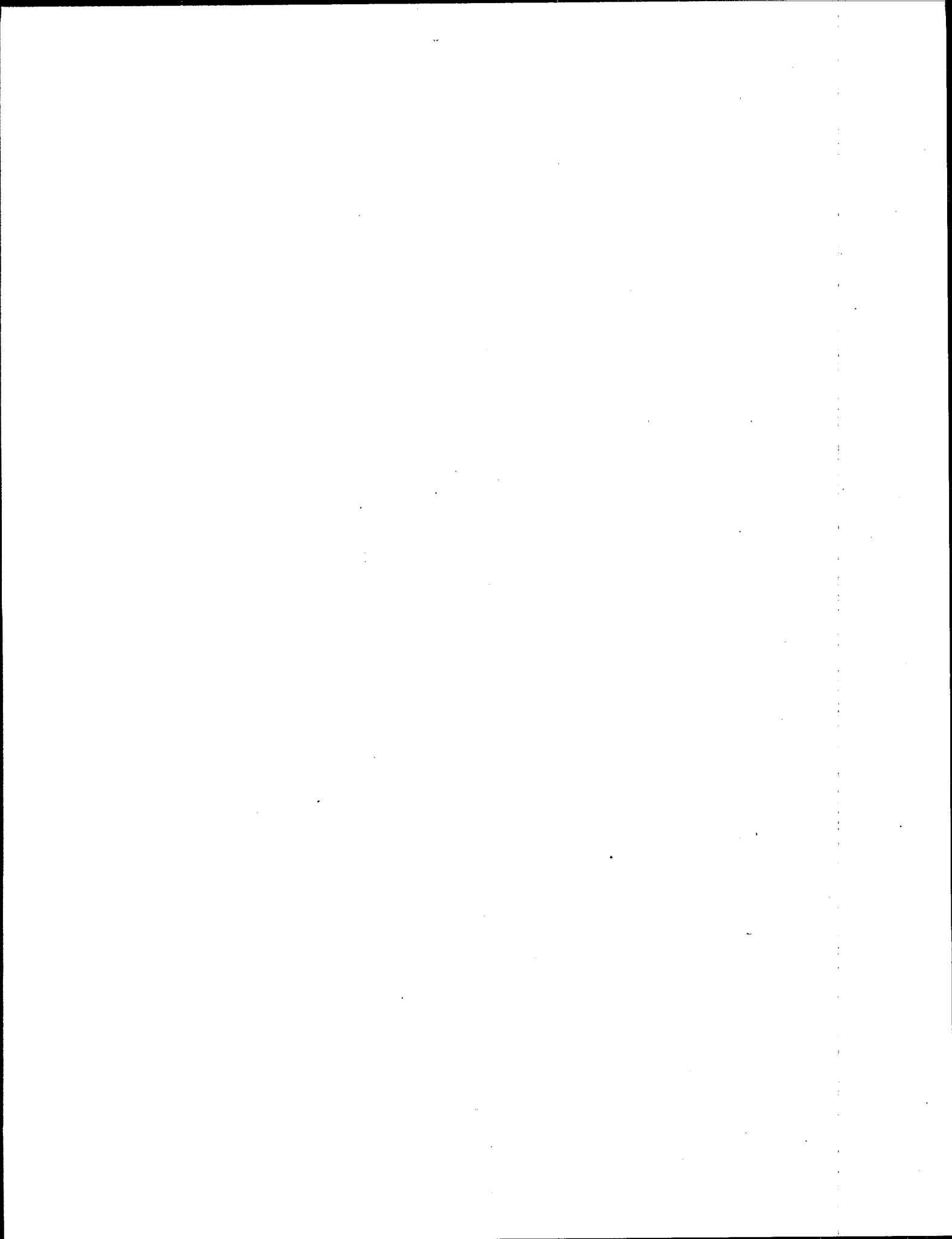
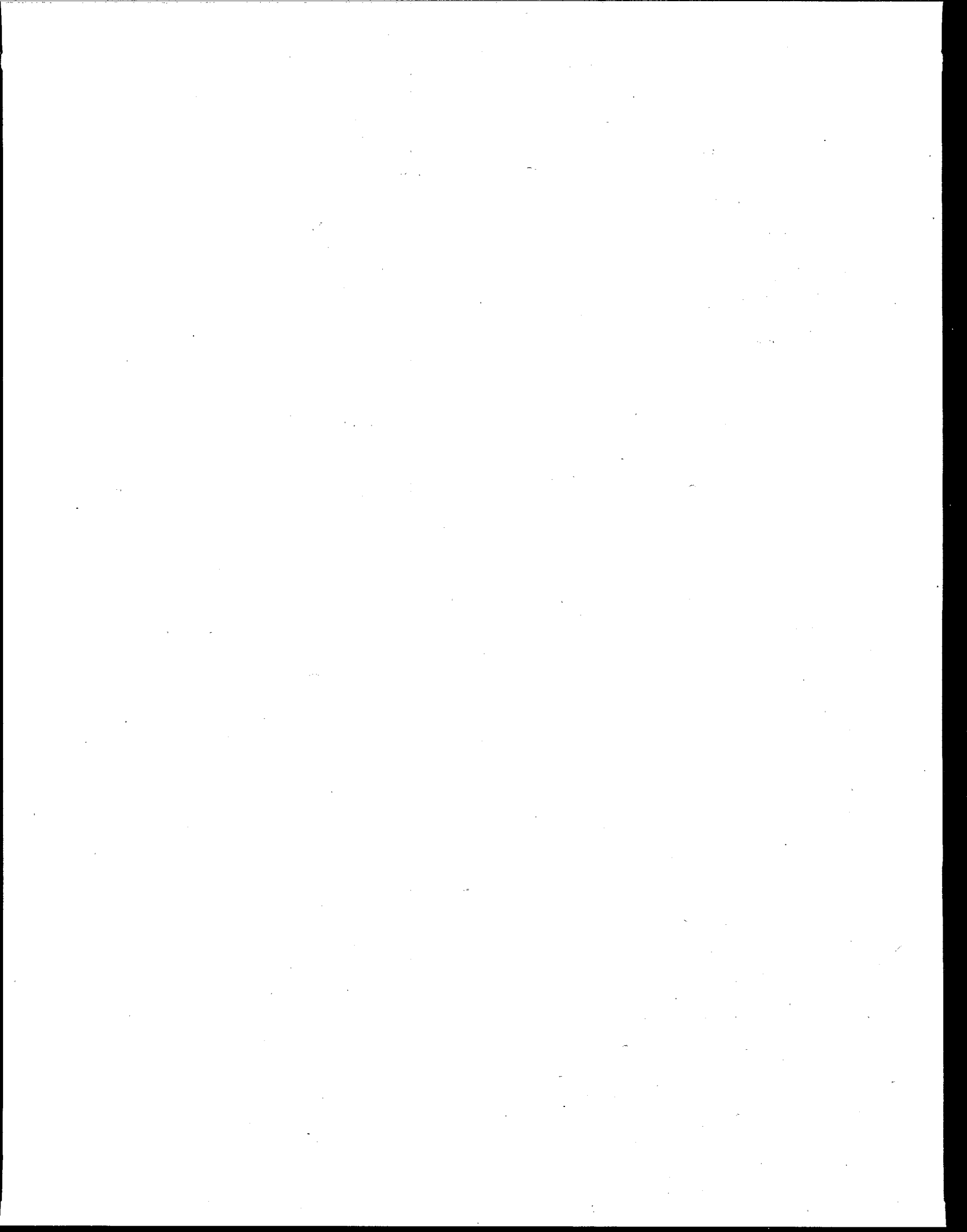


Figure 5. Natural gas marketing system. Reproduced, with permission, from *Petroleum Storage and Transportation, Volume III*, © 1989, by the National Petroleum Council.





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The complete report, entitled "The Liquid and Gaseous Fuel Distribution System," (Order No. PB92-115 203/AS; Cost: \$17.00, subject to change) will be available only from:

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The EPA Project Officer can be contacted at:

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