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Unconventional Gas Recovery Program Plan

FY 1988

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U.S. Department of Energy
Assistant Secretary for Fossil Energy
Deputy Assistant Secretary for
Oil, Gas, Shale and Special Technologies

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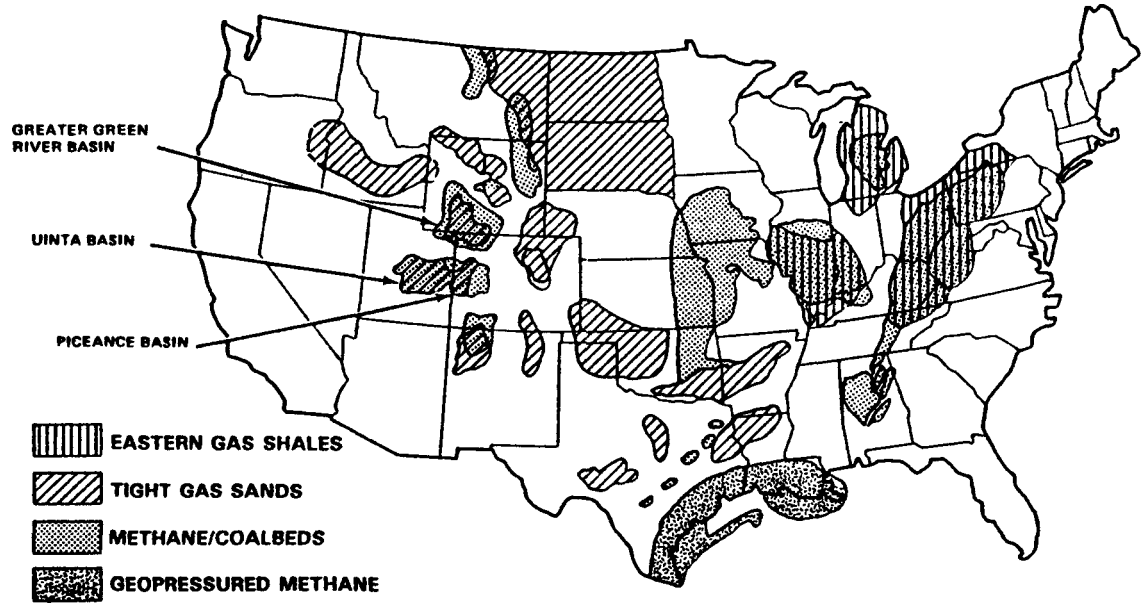
I. Background and Program Goal

Background

Unconventional gas recovery (UGR) includes the development of advanced technologies for the extraction of natural gas from currently unrecoverable gas resources. The resources for UGR include lenticular tight gas sands, eastern Devonian shales, gas hydrates, deep source gas, gas-to-liquids and coalbed methane. Figures 1 and 2 show the location of unconventional gas resources in the United States.

Figure 1. Unconventional Gas Resources of the United States

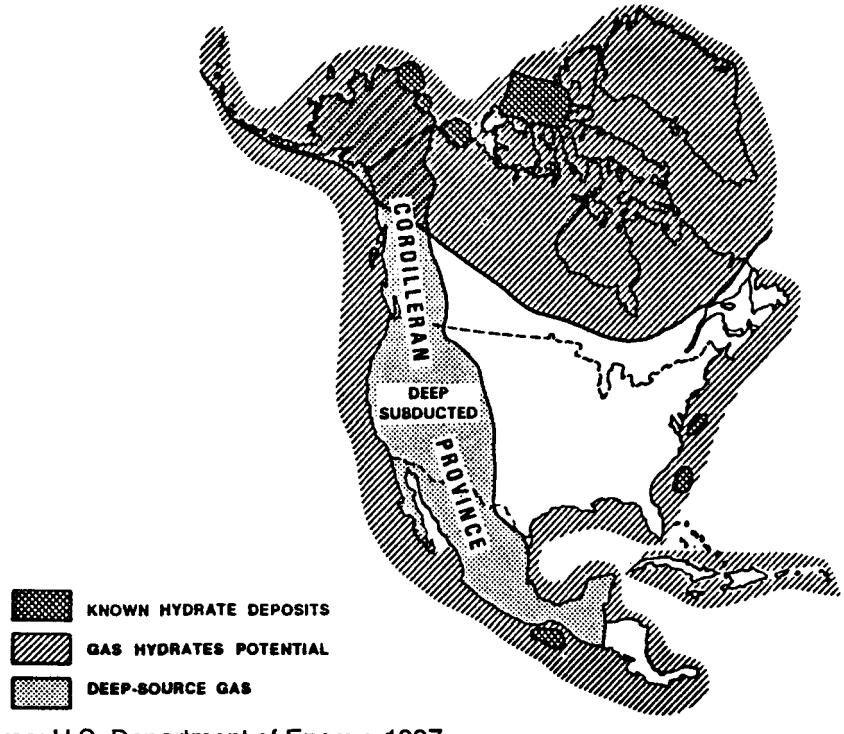


Source: U.S. Department of Energy, 1987.

Lenticular tight gas sand resources are gas bearing formations characterized by low permeability and limited reservoir size. Although tight sands occur throughout the United States, the principal resources are located in western basins. The principal gas-bearing Devonian shales of the United States are contained in the Appalachian Basin, the Michigan Basin and the Illinois Basin. These resources exhibit low permeability and porosity and characteristically have an extensive system of natural fractures. Areas of high natural fracture density tend to offer the greatest potential for economic gas production.

Gas hydrates are solid ice-like compounds in which gas molecules are trapped and bound to water molecules. They occur naturally in sediments directly beneath and within thick permafrost and in the deep ocean areas. Coalbed methane is trapped within the micropores of coal and in natural fractures of coalbeds. Deep-source gas is currently believed to consist of methane originating deep within the earth's crust. There is no current commercial production, and none is expected until more fundamental knowledge is acquired.

Figure 2. Deep-Source Gas and Gas Hydrates of North America



Source: U.S. Department of Energy, 1987.

U.S. gas resources in place, currently recoverable reserves, and potential recoverable reserves are represented in Table 1 below.

Table 1. Gas Resources/Reserve Estimates
(trillion cubic feet)

Gas Resource	Resources In Place	Reserves Currently Recoverable
Unconventional Natural Gas		
Tight Sands	466-5,700	192-907
Eastern Gas Shales	800-1,900	31
Gas Hydrates	2,700	NA
Deep Source Gas	NA	NA
Coalbed Methane	215	48
Conventional Natural Gas	430-900	192

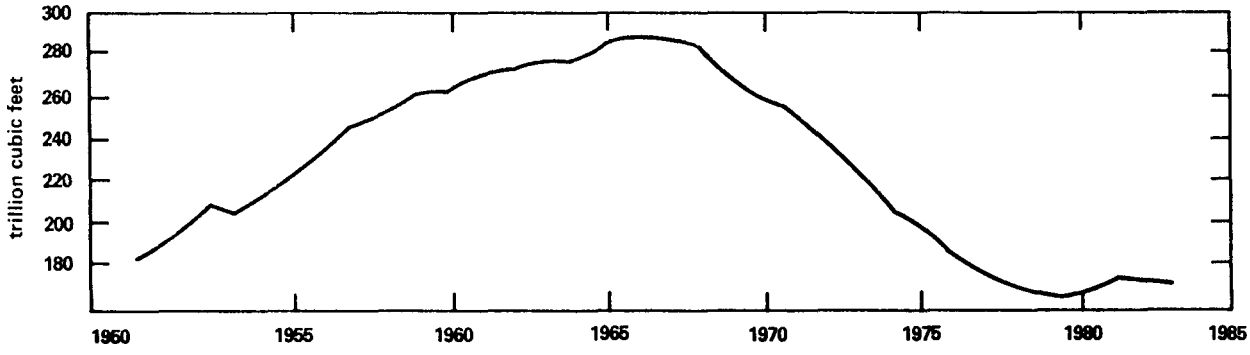
NA = not available

Sources: Argonne National Laboratory, 1988; "World Wide Report," 1987; McIver, 1979; U.S. Geological Survey, 1987, 1988; National Petroleum Council, 1980; U.S. Department of Energy, 1988.

Natural gas is projected to supply approximately 24 percent of total U.S. primary energy needs into the next century (German, et al., 1988). It is a premium fuel relative to oil, coal and nuclear power because it provides a high heating value with comparatively little capital investment, and its extraction, transportation and consumption are relatively environmentally benign. Conventional sources of natural gas declined despite intensive exploration and rising gas prices in the 1970s. (See Figure 3.)

This trend was slightly reversed by a so-called gas bubble. Much of this surplus gas is thought to be due to consumer conservation and a movement to electrifying new homes even where natural gas hookups are available. Many industry ex-

Figure 3. U.S. Natural Gas Reserves



Source: Office of Technolgy Assessment, 1985.

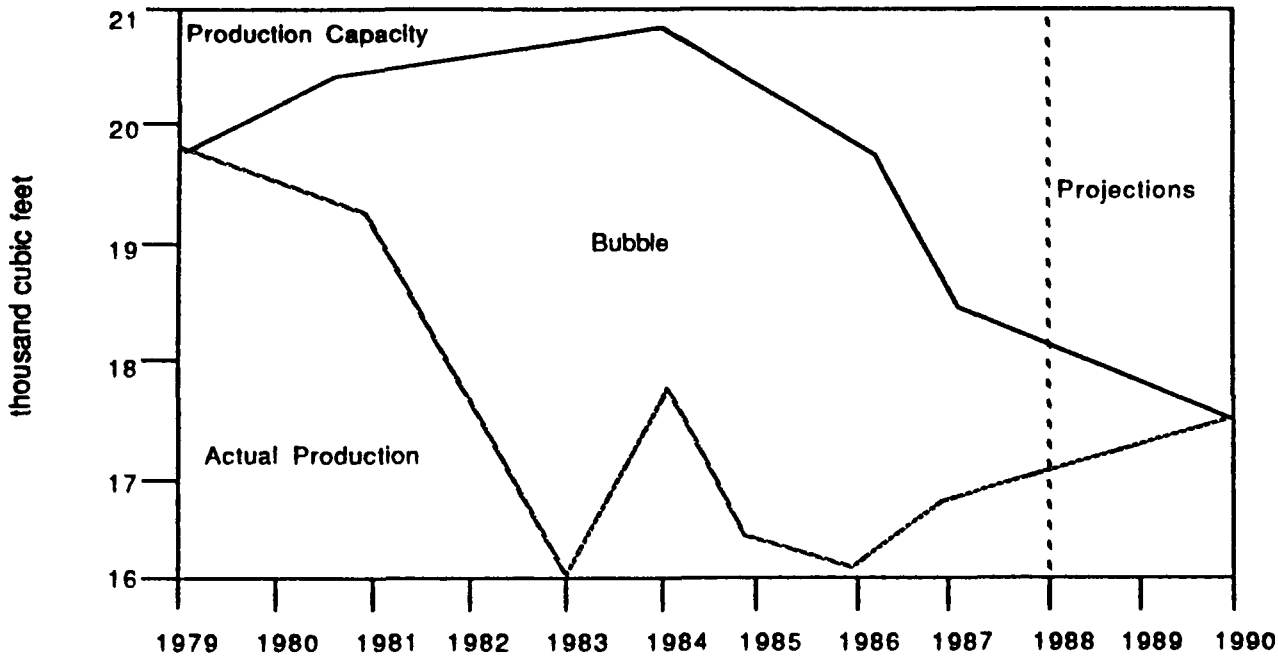
perts expect this oversupply of gas to dissipate in the early 1990s; Figure 4 illustrates the point. However, the situation may be substantially changed by the extent and duration of the economic recovery, gas imports, competition with alternative fuels and gas industry and consumer response to partial natural gas pricing deregulation. By contrast, most unconventional gas resources have not begun to make their potential contribution to the nation's domestic energy needs.

Studies indicate that the full potential of domestic gas resources may be two to three times above current proven conventional reserves when unconventional gas resources are included. Commercial development totals about 1 trillion cubic feet (Tcf) (about 5 percent of total annual gas production). However, significant technological barriers hinder development of these resources.

Program Goal

The UGR program is directed toward the development of advanced technologies for recovering gas from large, currently uneconomically recoverable gas resources. These resources can fill the gap between now and when the nation will likely rely more extensively on synthetic fuels. The overall goal is to

Figure 4. U.S. Natural Gas Capacity versus Production



Source: Kalish, 1987.

foster industry development by the year 2000 of environmentally acceptable extraction technologies which can economically recover a substantial portion of the U.S. unconventional gas resource. Primary targets for investigation are:

- Western gas sands,
- Eastern gas shales,
- Coalbed methane,
- Liquids from methane and
- Novel gas resources.

Geopressured methane, though an unconventional gas resource, is not a target of this program. Geopressured methane research is conducted by DOE's Office of Conservation and Renewable Energy. Further, coalbed methane research has not been funded by the program since 1981.

For achievement of the program goal, a series of interrelated technology development steps must be taken, sponsored by the Department of Energy (DOE), other government agen-

cies, other governments and industry. They include basic and applied R&D, proof-of-concept activities, first-of-a-kind field tests and associated commercial-scale activity. UGR program activies are designed to:

- Increase fundamental geological understanding of the resource,
- Expand the technically recoverable resource base,
- Maximize recovery efficiency,
- Enhance environmental acceptability and/or
- Reduce capital and operating costs.

DOE's specific technical objectives for the UGR program are presented in Section IV, Program Strategy.

II. Technology Description

Unconventional gas resources include tight lenticular sand formations of the west, fractured shales of the east, coalbed methane of the east and west and the novel gas resources of hydrates and deep sources.

The key to gas production from these resources is understanding the reservoir geology, which is more complex than that of conventional reservoirs. Each unconventional resource poses unique technical challenges to economically viable gas production rates. For development of any of these resources, improved understanding of the reservoir geology, diagnostic technology and reservoir extraction and stimulation technology is needed.

Reservoir conditions vary from source to source and reservoir to reservoir. Although fundamental geological understanding of the resource is necessary, knowing the detailed site-specific characteristics of individual reservoirs is basic to evaluating their potential and developing technologies to produce the gas.

Economic production of unconventional gas resources requires a means of stimulation to increase permeability of the formation in contact with the wellbore. In general, stimulation is the creation of artificial fractures extending outward from the wellbore to increase the surface area for gas flow. Lenses and fracture systems that would otherwise be inaccessible within a formation can potentially be connected using stimulation methods. If so, both the production rate and ultimate recovery over the well's producing lifetime would increase.

Significant advances in extraction technology are essential for substantial portions of the resource to become technically and economically productive, and each of the resources has its own technical challenges. The UGR resources are characterized below:

- **Tight Gas:** The critical parameters in determining the gas flow rate and recovery from tight gas reservoirs are formation permeability (capability of the rock to transmit gas) and the length of the induced fracture that is effectively held open by an injected proppant (e.g., sand) in the stimulated reservoir. Because the formation permeability can be measured, although with some difficulty, the research focus is on the propped fracture length, which is critical to tight gas reservoir development.
- **Devonian Shale:** Here the critical need is to induce fractures to link the wellbore with as much of the natural fracture system as possible. Wells stimulated in this fashion have higher gas recovery. Proppants are essential in deeper stimulated formations where the pressure exceeds 1,000 pounds per square inch. Although DOE has tested many novel stimulations (i.e., propellants, explosives, various fracturing fluids), reaching economical gas production rates in the thinner and less fractured areas of the Devonian shale is a major technological challenge.
- **Hydrates and Deep-Source Gas:** Comparatively little is known about these resources, but early estimates of gas in place are on the order of quadrillions of cubic feet. Producing gas from a hydrate reservoir will depend on the effects of the dissociation of hydrates on reservoir structure, porosity and permeability. As the hydrates dissociate into water (or ice), the reservoir may change drastically. The applicability of conventional stimulation and production techniques will need to be examined in light of the anticipated unusual behavior of the hydrate reservoir. In addition to conventional onshore and offshore production technology,

unconventional concepts and techniques need to be examined.

The nature of the deep-source gas resource is not known. The primary need is to establish the existence of natural gas originating at depths in excess of 30,000 feet.

- **Gas to Liquids:** Natural gas-to-liquids research is focused on the development of an economic one-step process that will convert natural gas to higher-value liquids. Process technology is needed. One of the most promising options is to convert the gas to liquid fuels such as methanol or gasoline.

III. Technology Status and Research Needs

Technology Status

Substantial R&D has focused on unconventional gas resources since the mid-1970s. Although much is still not known about their geology and how best to extract them, significant strides have been made:

- Geological and engineering studies have improved estimates of in-place gas resources,
- Advances in reservoir simulation have improved the capability to estimate the annual and ultimate gas recovery from a given deposit,
- Improved instrumentation, analysis and interpretation have enabled producers to identify more accurately the geologically favorable areas and pay zones,
- Experimental wells and a multiple well test have defined current capability and the improvements needed for well completion and stimulation,
- Detailed engineering studies combined with field experience have improved the basis for determining capital and operating costs and
- Economic and risk analysis studies, particularly those linked to improved gas production and investment estimates, have begun to define the expected risks,

returns and economic feasibility of pursuing these gas resources.

The first step in the development of unconventional gas resources is to identify the most favorable areas, particularly for gas content and permeability. Resource definition and appraisal detailing the geology and lenticular gas resources are nearly complete for eastern gas shales and for one of the three western gas sands priority basins. Similarly, these types of studies are required for gas hydrates and deep source gas.

Research Needs

Generally, the need exists for accurate geologic characterization of the unconventional gas resource, for designation of favorable areas warranting development and for development of stimulation and extraction technologies. Development of a more extensive information base is important to increasing production.

Evaluation begins with defining the geology and determining where at any particular site the gas is. In Devonian shales, for example, some intervals with a high carbon content deliver gas and others do not. Some have all the requisite geochemical characteristics yet have limited natural fracturing. Research must be directed to predicting where the natural fractures and producible gas are.

UGR development requires resource/reservoir research, support technology and field verification activities, including laboratory research, reservoir and stimulation tests and analytical/numerical model development. The laboratory and field efforts provide characterization data on the resource and the reservoir. Such tests are fundamental to understanding gas storage and release mechanisms unique to each of the lenticular sands, eastern shales, hydrates and deep sources. Resource/reservoir data acquisition is integrated with reservoir and stimulation modeling, diagnostics and data base development for assessing formation characteristics and production processes. This information increases the

reliability of recoverable resources estimates, recovery efficiency and extraction economics. Specific research needs are discussed below.

- **Western Tight Gas Sands:** Specific to tight gas reservoirs, the technological needs may be divided into three categories:

  - Fundamental geological understanding: Reservoir conditions seriously affect the profitability and effectiveness of extraction technology. The geology associated with tight gas is poorly understood, especially for lenticular basins, where drilling data are limited. This understanding of the resource is essential to improving technology.

  - Reservoir diagnostic technology: Detailed site-specific characteristics of individual reservoirs must also be known to evaluate their potential and design stimulations. Current tools and methods have limited reliability when applied to tight gas reservoirs. Improved reservoir diagnostic tools and procedures are necessary to the development of cost-effective extraction technology.

  - Reservoir stimulation technology: Induced fractures have demonstrably increased gas production from tight reservoirs, but the performance of fracture technology is unpredictable. The unpredictability results from poor definition of reservoir properties; inadequate understanding of the physics controlling fracture propagation and proppant transport; limited ability to measure, describe and evaluate the created fracture; and uncertainties about the relationship of stimulation design variables (i.e., fluids, proppants, pumping rates) and the resulting fracture. In lenticular formations, these difficulties are compounded by uncertainty about whether multiple lenses, some remote from the borehole, can be stimulated by a common treatment. Improved understanding, evaluation and prediction of stimulation technology are needed for development of tight lenticular gas reservoirs.

These technological needs create the high technical and financial risks that limit tight gas production. For blanket-like gas formations, many of these problems can be solved by systematic trial and error. Fracturing lenticular formations remains extremely unpredictable, with production ranging from large amounts of gas to large volumes of water. DOE is focusing primarily on the tight lenticular gas sands, and the Gas Research Institute (GRI) has a major research effort in tight blanket sands.

- **Eastern Gas Shales:** Specific to eastern gas shales, the technological needs may be divided into three categories:

  — Fundamental geological understanding: In areas of established production, basement faulting is postulated to have contributed to the formation of fractures or fracture facies that release producible amounts of shale gas. Little is known about the location of fracture facies or zones for possible exploration.

  — Reservoir diagnostic technology: To evaluate production potential, diagnostic and modeling capability need to be developed. There is a need to examine and evaluate the factors controlling hydraulic fracturing and to predict fracture geometry. With these capabilities, developing extraction technologies can be evaluated.

  — Reservoir stimulation technology: The ability to predict performance of stimulation techniques remains a key research need. It is important to identify and develop recovery strategies in light of geology and stimulation type. Field efforts are needed in areas of limited production where the geology and geochemistry indicate gas potential. A better understanding of reservoir flow behavior from selected intervals is needed along with the acquisition of data on fundamental reservoir properties.

These areas are basic technological needs for production from eastern gas shales.

- **Gas to Liquids:** In the conversion of gas to liquids, both catalytic and non-catalytic methods are being explored. Processes with a high selectivity to gasoline and/or distillate fuels are of particular interest. Other unique methods, such as biological approaches, might be possible. Some high potential catalytic methods are in the conceptual stage and need further exploration.
- **Hydrates and Deep-Source Gas:** Workshops held during FY 1982 to review research on gas hydrates and deep-source gas helped formulate a program for DOE-sponsored research. From the workshops, it was clear that little is known about either gas resource and that little research is being carried out.

  Recommendations from the workshop on gas hydrates include:

  — Contact oil/gas companies early to establish cooperative agreements for wells of opportunity in Alaska and

  — Develop plans for collection of cores and logging information in the Arctic and on oceanic wells of opportunity.

  Recommendations from the workshop on deep-source gas include:

  — Improve the method for differentiating gas origins,

  — Expand thermodynamic modeling of rock/gas systems and

  — Include the western Cordilleran region of North America, with its relatively large unexplored area, abundant deep fault systems, allochthonous terranes and adjacent convergent margin, in field geology studies.

IV. Program Strategy

The focus of the UGR program is on obtaining a clearer understanding of the geology of the resources and identifying and developing potential extraction technologies. The program brings together geoscience research; supporting modeling, diagnostics and data base development; and field verification of extraction concepts. Each resource, apart from hydrates and deep sources, has produced gas in selected regions, but production rates are often too low for economic exploitation. High costs, high risks and unpredictable production prohibit much expansion beyond areas of known or established gas fields. Accordingly, industry needs a technical and economic data base for tight sand formations and eastern gas shales. The higher-risk gas hydrates and gas from deep sources require basic and limited applied research studies to determine whether development is feasible. Gas to liquids research is directed toward developing process technology to convert natural gas to higher-value products.

Program Elements

Recognizing that each resource has its own unique characteristics and problems, the UGR program has three elements: western gas sands, eastern gas shales and environmental and advanced research. In the latter are gas hydrates, deep-source gas and gas to liquids.

The tight lenticular sands receive top priority because estimates of technically recoverable reserves are as high as 907 Tcf from basins in the western and southwestern states. The

western gas sands focus has been on the multi-well field experiment (MWX). With drilling of the third well in FY 1983, the field laboratory installation was complete. The reservoir and stimulation testing program was completed in late FY 1987. FY 1988 efforts focus on the analysis and documentation of the 5-year testing program.

The fractured shales of the eastern states are the second priority. Their potential as a ready reserve for an area that is highly industrial and populated is unique. This area covers seven states whose annual demand for natural gas is 2 Tcf. Production of just a small part of the 800-1,900 Tcf of gas (DOE, 1988) could assure the gas supply for the northeastern states. Eastern gas shale research will cover areas where commercial production essentially does not exist and the geology and geochemistry show gas potential. Basic reservoir data and better identification of potentially productive intervals are needed. The second offset well test was recently completed in the Appalachian Basin to determine the source of gas, the extent of drainage in the reservoir and the intensity of the fracture system. Analysis of shale gas production mechanisms indicates that increased surface area connected to the wellbore may result in more of the matrix gas being released and produced. A horizontal well was drilled in Wayne County, West Virginia, to cross natural fractures and test this concept. Stimulation and testing of the well will be completed during FY 1988.

The third priority is studying how hydrates and deep-source gas are likely to occur, leading to estimates of their location and extent. Geologic models describing their nature can then be developed. Simulations of extraction processes that might apply to their physical and chemical characteristics will in turn suggest additional R&D.

Natural gas-to-liquids conversion research is a multi-disciplinary effort focused on developing an economic one-step process that will convert natural gas to liquids or distillates.

The current program elements and their broad objectives are defined below:

- **Western Tight Gas Sands:** The United States has a large and mostly uneconomically recoverable potential source of fossil energy held in low permeability tight gas formations. A 1980 National Petroleum Council study identified a natural gas resource of 924 Tcf for these sands and shales. More recent estimates (USGS, 1987, 1988) have identified more than 5,400 Tcf in place in only two basins.. Of this resource, more than 5,000 Tcf are contained in tight and mostly lenticular gas sands of the Rocky Mountain geologic basins. DOE research focuses on these formations.

  The western gas sands program initiated a series of individual massive hydraulic fracturing (MHF) field experiments in FY 1975. Geological engineering and laboratory research on field test instrumentation and stimulation processes were added. With the addition of predictive modeling and diagnostic tool development, emphasis shifted from single-well MHF tests to field testing that supported the geology and R&D elements. The multi-well experiment is investigating the production characteristics of tight lenticular sands and their extraction. Three closely spaced wells were drilled through a series of thick lenticular and blanket-like sands near Rifle, Colorado. The wells, thoroughly cored and geophysically logged during the drilling phase, were tested for formation properties and gas production potential in two discrete blanket formations at the well bottoms. With completion of the third well and stress/flow testing of the Paludal zone in FY 1983, the field laboratory was ready for reservoir and stimulation testing. Five tight lenticular reservoirs have been stimulated and tested since 1984. Results from work at the MWX site will be applied to other wells, first in the Piceance Basin of Colorado, where the MWX took place, and later in the Uinta Basin in Utah.

  In FY 1988, geologic research is concentrated on completing a comprehensive analysis of the Greater Green River Basin, one of three priority basins selected for their potential. The resource/reserve

estimates for the priority basins initiated in FY 1987 will continue during FY 1988.

Generic research, instrumentation and modeling focus on predictive capability development and application. During FY 1988, laboratory fracturing materials/effects R&D, remote lens studies and core analyses will continue.

Production research will focus on the Piceance Basin. The last in a series of lenticular reservoir stimulations has been completed at the MWX site. During FY 1988, MWX results will be analyzed and documented. Field efforts in predictive model verification and new stimulation process testing will begin at other sites in the Piceance Basin. This testing will be done at wells of opportunity. They are drilled by the gas industry for commercial purposes and later made available to DOE at relatively low costs for piggyback field tests.

State-of-the-art stimulation technology met with limited success in the MWX. For this reason, and the fractured nature of the lenticular reservoirs, DOE will study the feasibility of slant hole and/or horizontal well technology as an alternative to stimulation.

- **Eastern Gas Shales:** Prior year efforts were successful in characterizing the geology, geochemistry and resource magnitude within the Appalachian Basin and in defining the gas-producing mechanism and drainage pattern in an established area of production near the center of the basin.

  One concept for recovery of gas from eastern shales is a stimulated horizontal borehole. Experience in West Virginia indicates that a multi-fold increase in gas recovery can be expected over conventionally stimulated vertical wells where typically only 10-25 percent of the gas-in-place is recovered. This concept takes advantage of the natural fracture pattern by directional drilling of a horizontal wellbore perpendicular to the fracture planes and extending several hundred feet; it subsequently stimulates the reservoir at selected intervals. A major field effort applying these concepts

was initiated late in FY 1986. Results are encouraging, and testing will continue in FY 1988. FY 1988 efforts will also include site selection for a second horizontal well. It will be in a different area geologically, where studies indicate production potential.

Studies of eastern tight sands that have been marginally productive will continue at a modest level to determine where dual completion (shale/sands) practices are worthwhile. How advanced technology developed for western sands can contribute to selecting stimulations to reduce payout time in areas of marginal or no production will also be examined.

- **Environmental and Advanced Research:** Three areas are included in this major activity:

  – Gas Hydrates: To evaluate the potential of hydrates as a gas supply. The goal is to estimate recovery potential and develop exploration and production technology to the proof-of-concept level. Project activities initiated in 1982 were designed to characterize gas hydrates. The results, expected in FY 1988, should help in identifying diagnostic criteria.

  Laboratory experimentation on natural and synthetic gas hydrates provided basic data for developing reservoir and production models. Data from analyses of onshore well logs and offshore seismic records provided geological information for further refinement of the reservoir and production models. Reservoir simulations have helped to develop feasible extraction/production models and to identify remaining gaps in the data. Basin studies initiated in FY 1985 will continue during FY 1988 to determine factors responsible for formation of various hydrates.

  Gathering geochemical and geophysical data from North Slope wells began during FY 1986. These data can be integrated with industry data to provide a framework for DOE-sponsored tests.

Canada is interested in gas hydrates because they are a potential safety hazard relative to drilling operations but also because they are a potential energy resource. A Memorandum of Understanding between Canada and DOE was signed by both parties.

In addition, a 3-year cooperative effort with the University of Alaska initiated in FY 1986 will expand on efforts to evaluate the gas hydrate potential on the North Slope.

- Deep-Source Gas: To investigate theories on deep-source gas formation: abiogenic gas, sub- ducted organic origin gas and deep sedimentary basin gas.

  Research on the deep-source gas--gas originating from depths in excess of 30,000 feet--will quantify the resource, determine its significance to the nation's reserves and allow construction of conceptual models.

  During FY 1988, geophysical studies will continue in a fossil subduction zone in western Washington. Thermal history modeling of selected subduction zones will also continue.

- Gas to Liquids: In catalytic research, to assess simplified catalytic conversion methods for production of ethylene and/or other intermediates that might be converted to gasoline and other fuels.

  In non-catalytic research, the fundamental chemistry necessary to effect the partial oxidation of methane to methanol was examined using a plasma source to initiate the chemical reaction. Now, however, the focus is on a supersonic nozzle reactor to quench the reaction rapidly and provide the needed control.

Program Objectives

Specific objectives and milestones in support of the unconventional gas recovery program elements are as follows:

- **Western Tight Gas Sands** (FY 1988 funding: $3,345K, 10 projects)
  - To delineate and characterize the lenticular tight gas sand reservoirs of the Piceance, Greater Green River and Uinta Basins and to provide the geologic data base for effective transfer of MWX-developed strategies and technologies (4th quarter FY 1990),
  - To develop basic understanding of hydraulic fracturing and the capability to predict reservoir response and stimulation effectiveness as a function of geologic parameters for lenticular tight gas reservoirs (4th quarter FY 1990) and
  - To develop cost-effective production technologies for gas production from tight lenticular sand reservoirs (4th quarter FY 1990).
- **Eastern Gas Shales** (FY 1988 funding: $2,345K, 7 projects)
  - To complete basin analyses for conditions favoring shale gas accumulation and to estimate resource potential for the Appalachian, Illinois and Michigan Basins (1st quarter FY 1988),
  - To develop diagnostic and modeling capabilities that will enable users to evaluate and forecast production potential of eastern Devonian shales (4th quarter FY 1988) and
  - To develop recovery methods as a function of stimulation design and geologic parameters for eastern gas shales using highly instrumented test wells in areas of production potential (4th quarter FY 1989).

- **Environmental and Advanced Research** (FY 1988 funding: $4,844K, 12 projects)

  - To determine the chemical and physical properties for both natural and synthetic gas hydrates under laboratory conditions (4th quarter FY 1990),

  - To complete the geologic characterization, develop geologic models for the formation of both onshore and offshore gas hydrates and develop resource estimates for them (4th quarter FY 1990),

  - To develop diagnostic techniques for measuring in-place characteristics of both onshore and offshore gas hydrates (4th quarter FY 1990),

  - To develop reservoir and stimulation models and preliminary economics for gas hydrates production (4th quarter FY 1990),

  - To characterize the physical and chemical properties of deep subduction zones and their in-place size, gas generating capability and reservoir potential (4th quarter FY 1989),

  - To perform fundamental studies on the conversion of natural gas to higher-value hydrocarbons (4th quarter FY 1990) and

  - To develop technology through bench-scale experiments for economical processes based on catalytic, non-catalytic and/or biological conversion, including separation processes for byproducts, to proof of concept (4th quarter FY 1992).

Table 2 summarizes the UGR budget for fical years 1987 and 1988.

Table 2. Unconventional Gas Recovery Budget
(thousand dollars)

Activity	FY 1987 Appropriation	FY 1988 Appropriation
Eastern Gas Shales	$ 847	$ 2,345
Western Tight Gas Sands	5,399	3,345
Environmental and Advanced Research	1,725	4,844
Total	$7,971	$10,534

V. Program Management

Organization

Management of the UGR program is shared by Fossil Energy headquarters and DOE's Morgantown Energy Technology Center (METC). At headquarters, the Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies is responsible for overall long-range program planning and establishment of program goals and objectives, for status information and for evaluation of program accomplishments. METC is responsible for developing strategies to achieve these goals and objectives and for managing program implementation.

External Relations

When possible, DOE consults with industry, academia and other government agencies. Industry assists in assessing progress and evaluating project direction. Cooperation with industry minimizes unnecessary expenditures for obtaining core, log and field sample data.

GRI maintains a gas supply R&D program similar to the unconventional gas recovery program. DOE coordinates with GRI to avoid unnecessary duplication. GRI focuses on the near term, whereas DOE is longer term. A coordination agreement has been signed between the two parties.

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