

PROGRAM SOLICITATION NUMBER DE-PS26-02NT41430

**SUPPORT OF ADVANCED FOSSIL RESOURCE UTILIZATION RESEARCH
BY
HISTORICALLY BLACK COLLEGES AND UNIVERSITIES
AND
OTHER MINORITY INSTITUTIONS**

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NOTICE

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ANY AMENDMENTS TO THIS PROGRAM SOLICITATION WILL BE ISSUED VIA THE NETL WORLD WIDE WEB INTERNET SYSTEM. APPLICANTS ARE RESPONSIBLE FOR CHECKING THE INTERNET SYSTEM (<http://www.netl.doe.gov/business/solicit>) FOR SOLICITATION AMENDMENTS PRIOR TO SUBMITTING AN APPLICATION.

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CATALOG OF FEDERAL DOMESTIC ASSISTANCE NO. 81.089

1.0 INTRODUCTION

The Department of Energy (DOE) is uniquely charged in the Energy Reorganization Act of 1974 (Public Law 94-438) with the responsibility for helping to ensure an adequate supply of manpower in the U.S. for the accomplishment of energy research and development programs by "sponsoring and assisting in educational and training activities in institutions of higher education."

One means undertaken to comply with this requirement was the implementation of the DOE Office of Fossil Energy's Historically Black Colleges and Universities (HBCU) and Other Minority Institutions (OMI) Research and Development, Education and Training Program. The Program objectives focus on efforts to expand the involvement of HBCUs/OMIs over the full spectrum of DOE/Fossil Energy supported fossil energy research and development programs (i.e., oil, coal, gas, the environment and other related technical and business areas); to assist in bridging between traditional U.S. industry interests and HBCU/OMI objectives and capabilities; and to further strengthen the position of American commerce in the international market. The intent of the Fossil Energy HBCU/OMI Program is, therefore, to establish a mechanism for cooperative HBCU/OMI research and development projects; to provide faculty and student support at the institutions; to foster private sector participation and interaction with HBCU/OMIs in fossil energy research and development; to provide for the exchange of technical information and research hardware; to raise the overall level of competitiveness by the HBCU/OMIs with other institutions in the field of fossil research; and to tap a heretofore under-utilized resource by increasing the number of opportunities in the areas of science, engineering and technical management for HBCU/OMIs.

The collaborative involvement of professors and students from the HBCU/OMI and the commercial sector in the development and execution of fresh new research ideas, and the establishment of linkages between the HBCU/OMI and private sector fossil energy community are essential to the success of this program and equally consistent with the goal of ensuring the U.S. a future supply of technically competent managers, scientists, engineers and technicians from a previously under-utilized resource. It will also serve to maintain and upgrade the educational, training, and research capabilities of our

HBCUs/OMIs in the fields of science, engineering and technical management, and provide the talent for an improved utilization of the nation's fossil fuel resources.

Therefore, the DOE's National Energy Technology Laboratory (NETL) invites HBCUs/OMIs, in collaboration with the private sector, to submit applications for innovative research and development of advanced concepts related to fossil energy utilization and conversion. The overall purpose of this collaborative effort is to improve prospective U.S. commercial capabilities, and to increase scientific and technical understanding of the chemical and physical processes involved in the conversion and utilization of fossil fuels, thereby broadening fossil resource and technology benefits to our commerce and the consumer. Thus, HBCU/OMI faculty members and their institutions, in collaboration with the private sector, are strongly encouraged to undertake fossil energy-related research and development or to continue ongoing work in this area (see Application Requirements/Eligibility, Section 5.1).

Pursuant to 10 CFR 600.6(b), eligibility for award under the subject solicitation is restricted to HBCUs/OMIs (see eligibility requirements specified under Section 5.1). Statutory authority for this Program is provided by Public Law 95-224, as amended by 97-258.

2.0 TECHNICAL TOPICS

Several fundamental changes are underway in the energy industry. Widespread deregulation is changing the nature of the industry. While eventual effects are uncertain, the industry will clearly be far more diverse and complex. These trends lead to a vision of a future economy where power, energy, and manufacturing are closely intertwined in a highly efficient, flexible economic system. This evolution provides the foundation for Vision 21.

The concept of Vision 21 encompasses a fleet of advanced, highly efficient, non-polluting energy plants that will compete effectively in the future energy market. Vision 21 plants are a set of flexible, modular systems that can be integrated and tailored to market demands for high-value, fossil-based commodities, such as clean fuels (chemicals and feedstocks), and/or electricity. Among the unique capabilities of Vision 21 will be its ability to provide these energy products while achieving net zero CO₂ emissions, thereby virtually closing the carbon cycle for fossil energy.

The integrated program path leading to Vision 21 builds on technology being developed and demonstrated today. A key component is the Clean Coal Technology Demonstration Program, which establishes the foundation on which the next generation of technologies will be developed and advanced. Vision 21 will require enhanced versions of the technologies in the existing Coal and Power Systems portfolio as well as some new areas to be developed within these technologies, such as gasifiers, hot gas cleanup systems, fluidized-bed combustion, fuel cells, advanced turbines, hybrid cycles, high-temperature heat exchangers, oxygen separators, hydrogen separators, fuels, and conversion processes. Fossil Energy Product Lines will be strategically

aligned to assist the nation to effectively use and manage natural carbon resources and to achieve the goals of Vision 21.

Product Lines that are currently managed by Fossil Energy include the following: In the Office of Product Management for Fuels & Specialty Markets- Natural Gas Supply and Storage, Natural Gas Processing, Transportation Fuels and Chemicals, Fuels Systems Advanced Research, and New Business Development; in the Office of Power Systems Product Management-Combustion Systems, Environmental, Power Systems Advanced Research/AR&TD, Integrated Gasification Combined Cycle, Fluidized Bed Combustion, Advanced Turbine Systems, and Fuel Cells; and in the Office of Product Management for Environmental Management (no topics in this solicitation)- Industry Programs, Decontamination and Decommissioning, Technology Applications, Nuclear & Strategic Processes, and the Center for Acquisition and Business Excellence.

In order to develop and sustain a national program of university research in advanced technologies and fundamental fossil fuels studies, the DOE/Fossil Energy is interested in providing assistance to develop and maintain a broadly-based research infrastructure to provide educational and research training opportunities for tomorrow's scientists. Grant applications are sought in innovative research and development of advanced concepts pertinent to fossil fuel conversion and utilization in the nine technical topics specified below. Technical Topics 1 through 8 are considered to be in the HBCU/OMI Core Program; education and research training must be a strong component and private sector collaboration is strongly encouraged. Technical Topic No. 9 is considered to be in the Faculty/Student Exploratory Research Training Grant Program.

While all Technical Topics are of importance to Fossil Energy programs and product lines, areas which are emerging as higher priority include the following: problems related to Global Climate Change and Greenhouse gases (especially carbon dioxide), Materials (as related to advanced power system components and advanced separations), Catalysis (for improved reaction chemistry, higher efficiencies, short residence times, etc.), Computer Modeling (especially related to Vision 21 scenarios for fossil energy, and advanced Coal Characterization (related to fossil and biomass carbon as a feedstock, solid fuels, and coprocessing), control and characterization of Mercury and fine particulate (PM_{2.5}), Computer Enhancements and Reservoir Modeling as related to oil and gas recovery), Continued Emphasis on flooding issues and geoscience as related to improved oil and gas recovery technologies, and Optimization for Oil Well Completions and Stimulations.

2.1 TECHNICAL TOPIC 1 - Advanced Environmental Control Technologies for Coal

There are numerous problems related to the use of coal in energy utilization and conversion systems. Coal is a solid fuel and contains components that are precursors of environmental pollutants or materials that are potentially damaging to downstream components. These deleterious materials include nitrogen and sulfur which form undesirable oxides during combustion, as well as hazardous trace elements.

Furthermore, coal contains mineral matter which is converted into ash during combustion that can lead to suspended particulates in air, deposition or erosion of downstream system components, and problems related to air toxic and solid waste disposal. The objectives of this topic are to mitigate the environmental disadvantages of coal utilization through improvements in various aspects of the fuel cycle, from coal extraction and preparation through combustion-related waste utilization or disposal.

SPECIFIC EXAMPLES (including but not limited to):

- Improved approaches to coal mining technologies to reduce environmental impacts.
- Advances in the following processes for preparation of coal and biomass-based solid fuels and feedstocks: surface or density-based cleaning, especially advanced dewatering/drying, reconstitution/handle ability, and enhanced energy recovery through applications of high-technology instrumentation.
- Optimization programs for preparation of coal and biomass-based solid fuels and feedstocks, including software (i.e., advanced diagnostics and algorithms) that supports artificial intelligence and neural networks in the whole plant or in unit operations within the plant to improve plant process efficiency and product quality.
- The development of technologies for the recovery and processing, into a singular fuel form (e.g., pellets, briquettes, slurry, etc.), of coal fines that are currently impounded or are now being generated as waste products from coal preparation plants.
- Identification of novel approaches (suitable for utility use) to recovering waste coal fines and processing of cleaned coal fines to be combined with other waste materials (e.g., sludge, fibers, biomass, etc.) to provide a uniform, marketable product.
- Developmental studies for producing smokeless solid fuels based on coal for residential use; large international markets exist in Africa, China, India, Korea, etc., for economical and environmentally benign coal-based solid fuels with no significant health effects).
- Development of acceptable industrial monitoring devices or other methods that will allow quantitative detection, at very low concentration, of mercury, trace metals, volatile organic compounds and aerosols for individual samples, continuous emissions monitoring, or remote sensing [especially to determine (measurement and predictive capability) the form/species and fate of mercury (vapor vs particulate-bound) and other significant trace metals from coal utilization].

- Research on the capture of pollutants both internal and external to the combustor, with or without sorbents, and on the regeneration of the spent sorbents.
- Development of techniques for generating salable by-products from waste streams and flue gases in coal utilization processes. Innovative and cost-effective methods for directly converting H₂S and SO₂ to sulfur or other marketable sulfur-based products.
- Novel methods for reducing NO_x such as catalytic reduction with less costly and more environmentally benign reductants, direct catalytic decomposition without the use of reductants, or more efficient non-catalytic reduction.
- Development of technology for minimizing NO_x formation in cyclone-fired boilers or wet-bottom slagging combustors, which would reduce overall plant cost for NO_x emissions control and for waste disposal.
- Estimation of the effect that coal characteristics will have on NO_x emissions resulting from coal combustion using advanced models for rapid coal devolatilization.
- Study of novel methods of CO₂ collection in a relatively pure form, from both conventional and advanced coal-based power systems.
- Research regarding the development of CO₂ disposal methods that are technically, economically, and ecologically feasible. Research (mostly analytical with small scale experiments) is desired that deals with the fate of carbon dioxide in the deep ocean, in abandoned and depleted oil and gas reservoirs, unmineable coal seams, and in deep confined aquifers.
- Study of formation, mitigation and elimination (prevention) of pollutants, and particulates emitted to the atmosphere associated with coal utilization; novel flue gas cleanup and hot gas clean up techniques for high efficiency removal of particulates (especially PM_{2.5}), sulfur and nitrogen compounds (with respect to fine particulates), mercury and halogens, including high temperature membrane separation for trace contaminant removal, and advanced air separation technologies.
- Research on high-temperature effects of sintering, fluidity, coalescence and reactions of coal mineral matter as it relates to techniques for determining high temperature filterability of coal ash from gasification and combustion processes and how the ash filterability relates to its other physical properties.
- Advanced separation techniques for processing waste streams from coal utilization processes (combustion and gasification), such as fly ash, circulating fluidized bed combustion, ash and slag and converting them to useful products (e.g., removing carbon from fly ash and slag). Innovative methods for producing

higher value-added products that use ash and slag as the basic raw ingredient (e.g., ceramic tile production). Demonstrated marketable uses for fly ash containing unburned carbon such as that produced with some low-NO_x burners or from gasifiers.

2.2 TECHNICAL TOPIC 2 - Advanced Coal Utilization

Coal is abundant and inexpensive compared to oil and gas. The efficient use of coal is constrained by the difficulties of using a solid raw material for producing fuel, chemicals and other feedstocks and of managing the by-products of coal utilization (e.g. solid fuel combustion by-products include particulate, ash, and gaseous wastes). The results of innovative research could contribute to coal utilization by enabling users to handle coal with higher levels of confidence approaching that of liquid and gaseous fuels. This topic explores advanced combustion techniques, as well as other systems and materials, that allow coal to be utilized more efficiently and more cleanly than in currently deployed conventional systems.

SPECIFIC EXAMPLES (including but not limited to):

- Research on coal as a feedstock for production of chemicals.
- Research on advanced fuel cell concepts, including analysis of advanced systems, CO₂ separations, electrocatalysts, reactants, purification and gas separation, improved materials (e.g., electrodes, gas seals, sealing materials, interconnects, separator plates, and coatings); and study of the effects of contaminants on the performance of fuel cells. Investigations of innovative methods for cost-effective in-situ removal of deposits including ash, carbon, and trace metals from high-temperature molten carbonate and solid oxide fuel cell surfaces are needed for long-term operation (40,000 hours).
- Development of Innovative Protective Surface Oxide Coatings to permit exploitation of the potential of advanced high-temperature materials designed to significantly improve energy efficiency and reduce deleterious environmental impact (e.g., to achieve the performance goals of the Vision 21 power plants). There is a need to expand the scientific and technological approaches to improving stable surface oxides for corrosion protection in high-temperature oxidizing environments.
- Investigations of new cycles for power generation to increase the efficiency of power plants to well over 45%; studies may include high temperature (~1,000F), high pressure (~2,400 psi), ammonia/water vapor/liquid thermodynamic properties at various volume ratios, validation of efficiency projects, alternative approaches to complex combined cycle evaluations for better matching of conventional and advanced technology processes, economics, and identification of barriers to commercialization (corrosion and new materials investigations, heat transfer coefficients in two liquid mixtures for application in falling film heat exchangers). Novel topping and bottoming cycles may also be offered.

- Development of techniques and instrumentation for in-situ, on-line analysis and control systems for solids flow, high-temperature gasification, temperature measurements, etc. for systems using coal and coal-derived products.
- Characterization and/or demonstration of the carbon in coal as a potential feedstock for advanced clean fuels, chemicals, advanced materials, and other marketable products
- Study of the structure, reactivity, and other chemical and physical properties of activated carbons and carbon molecular sieves derived from coals of various rank, or coal tar pitch and its carbon-based products. Similar characterizations are needed for carbon in fly ash and bulk ash and interactions with flue gas-derived mercury.
- Technology development aimed at the production of new and improved premium carbon structures (e.g., high-strength fibers) for utilization in various industries such as automotive, aerospace, etc.
- Study of the formation and vaporization of alkalis, and determination of their state at specific gasifier and combustor conditions of temperature and pressure; techniques for removing alkalis and chlorine from coal gas or waste streams at high temperature.
- Research on advanced combustion control diagnostics that provide continuous on-line measurement and control of the fuel and air flow rates for each burner, or at specific locations in the boiler or coal combustor.
- Developmental studies for advanced materials, both alloys and ceramics, and components for both directly and indirectly fired coal-based power systems that can withstand the high-temperatures and corrosive environments encountered in coal combustion systems.
- Novel concepts for developing hybrid systems that use both coal/coal-derived fuels and renewable energy sources. Development of technologies for co-feeding coal and other low-cost carbon-based feedstocks (e.g. biomass, municipal waste) to high pressure gasifiers (both dry and slurry-feed systems).

2.3 TECHNICAL TOPIC 3 - Clean Fuels Technology

DOE is soliciting applications for research related to the production of premium fuels and products from coal. These fuels and products, and the precursors required for their production, include diesel, jet fuel, and carbons such as pitches or cokes. In addition, technologies related to the economical production and separation of hydrogen will be required to facilitate the use of coal for many of these fuels and products. The

fuels of the 21st century will have to satisfy the competing demands of environmental acceptance and engine performance. In order to be embraced by the marketplace, engines must deliver the required acceleration, horsepower, reliability, and conformance to specifications. At the same time, cleaner burning fuels will be required to minimize both airborne pollutants and emission of carbon dioxide. Increased emphasis on the control of particulate matter is likely in light of the growing popularity and practicality of diesel engines. A similar set of concerns exists for jet fuels. One type of fuel currently under development and capable of providing such qualities is a next-generation diesel fuel produced via a Fischer-Tropsch (F-T) process. Novel concepts furthering this and/or other approaches to the development of premium fuels and products are sought.

SPECIFIC EXAMPLES (including but not limited to):

- Advanced diagnostics and modeling techniques for three-phase slurry reactors (bubble columns) will be valuable for their design, scale-up, and efficient operation in the conversion of synthesis gas into liquid fuels by the F-T process. To develop such a model, both the hydrodynamic parameters and the complex chemistry of the F-T reaction must be fully understood and well integrated. Applications are sought for investigations of advanced diagnostic techniques for the measurement of hydrodynamic parameters under F-T reaction conditions and for models incorporating the hydrodynamic parameters and reaction kinetics for the three-phase slurry reactor.
- Development of novel catalysts is required for the conversion of synthesis gas into clean-burning diesel fuels or jet fuels. These advanced fuels, particularly those required by the next generation of diesel engines, are characterized by high cetane numbers, low sulfur content, and low (or zero) aromatic content. These fuels or fuel additives may include conventional F-T diesel fuels or oxygenated (ether, acetal) fuels. These novel catalysts should offer significant advantages such as higher selectivity to the diesel boiling range, higher activity under milder operating conditions, or other characteristics that lead to improved economic competitiveness.
- Dimethyl ether is one candidate for a clean burning oxygenated diesel fuel of the future. However, its entry into the market place has been hindered by its low boiling point. An improved fuel would retain its desirable combustion characteristics and possess a suitably low volatility. Development of improved processes to convert dimethyl ether or other low boiling oxygenates into higher molecular weight oxygenated fuels is needed. The process would ideally result in a liquid, oxygenated fuel that could be easily integrated into the current fuel distribution infrastructure.
- Precursors of high value carbon products might be obtained from coal milder versions of direct liquefaction processes originally designed to produce only fuels. Processes that lead to high value carbons and by-product fuels could become economically competitive before fuels only-plants. Process concepts

are of interest that are based on innovative routes to materials (pitches, cokes) that lead to high-value carbons. Such processes could use coal or co-processing schemes for coal plus other heavy liquids, petroleum residues, etc.

- Production of clean fuels from coal ultimately requires significant quantities of hydrogen. Hydrogen production often entails the emission of CO₂. To bring about the production of clean fuels at least cost and lowest emissions of CO₂, novel ideas are needed for the generation of hydrogen from coal by means that allow CO₂ to be captured in an efficient way for subsequent sequestration. Fundamental studies are sought that would lead to improved technologies for integrated hydrogen production/CO₂ capture processes.

2.4 TECHNICAL TOPIC 4 - Heavy Oil Upgrading and Processing

The availability of quality transportation fuels at reasonable costs is vital to the economy and the defense of the U.S. Environmental concerns are forcing the demand for cleaner burning fuels which mean fuels with lower boiling ranges, less sulfur, lower aromatics, and additives to reduce emissions. To reduce the aromatics and sulfur in the heavy fractions, hydrogen must be added since the alternative, i.e., acquiring the hydrogen from molecules by rejecting carbon, consumes far more resource per unit of quality transportation fuel produced while yielding a mass of low-value, high-carbon product. This work will apply to other heavy resources such as shale oil, coal liquids, and tar sands oil when their time comes.

SPECIFIC EXAMPLES (including but not limited to):

- Improved understanding of the chemistry of adding hydrogen to heavy feedstocks.
- Improved understanding of the chemistry of the removal of contaminants, i.e., S, N, O, metals, etc., from heavy feedstocks.
- Development of new and less expensive means for producing hydrogen from feedstocks other than light hydrocarbons, such as natural gas, that are excellent as is.
- Development of new and less expensive contaminant removal processes for heavy oils along with environmentally acceptable means of disposing of the contaminants when removed.
- Development of new knowledge to be used to improve catalytic cracking and hydro cracking catalysts and processes.
- Development of the knowledge, catalysts and processes necessary to reduce the production of petroleum coke.

2.5 TECHNICAL TOPIC 5 - Advanced Recovery, Completion/Stimulation, and Geoscience Technologies for Oil

DOE seeks innovative methods and concepts that will contribute to more efficient, effective, and economical techniques for the recovery of domestic oil in declining fields. After primary (natural forces) and secondary (water flood and gas) pressurization recovery techniques have been used, approximately 2/3 of the original oil remains in place in the known producing fields, an estimated 327 billion barrels. About 100 billion barrels of this potential resource exist as pockets of mobile oil, bypassed because of heterogeneities in the reservoir. Much of this remaining oil can be produced by conventional methods once its location and the cause of its non-recovery are determined.

Residual oil is also susceptible to recovery by enhanced oil recovery techniques (i.e., the injection of heat, gases, or chemicals). Better reservoir understanding and engineering design of all of these operations (primary, secondary, and enhanced oil recovery techniques) is needed to increase domestic oil production. Reservoir characterization is the most important means of understanding the reservoir. Its two main facets - defining the anatomy of the reservoir and determining how that anatomy governs fluid movement - are requisite to any improvements in oil recovery strategy.

GENERAL DESCRIPTION OF RESEARCH INTEREST (Innovative grant applications are sought to improve the recovery of oil. Research in the following areas is limited to):

- Novel Low-cost Surfactant for Oil Recovery- If effective low cost surfactants can be found, the potential for surfactant flooding is great. The main reasons most surfactant floods are uneconomical are because of the high cost of the surfactant and high adsorption. The proposed surfactants need to tolerate a wide range of temperatures and brines of varying salinity and hardness. The proposed surfactants need to be available in sufficient quantities to be well characterized; therefore, surfactants produced in-situ or by in-situ microbes will not be acceptable. The novel surfactants proposed should neither be currently available from any major chemical supplier nor under patent rights to anyone other than the applicant.
- Novel Low-cost Methods for Sweep Improvement in Carbon Dioxide Flooding- Carbon Dioxide flooding is currently producing over 150,000 barrels per day in the U.S. This production could be greatly increased if the injected carbon dioxide could be made to better sweep the reservoir. Several methods have been employed to economically improve the sweep efficiency of the injected carbon dioxide. Methods such as foams, entrainers (chemicals that increase the viscosity of the carbon dioxide), and water-alternate-gas have been applied. The novel low-cost methods proposed may be based on these methods; however, the proposed methods must show promise of significant improvement.

- Recovery of Heavy Oil - Two major problem areas in steam injection processes are excessive wellbore heat losses and low reservoir sweep efficiency. Grant applications are sought on novel techniques to: (1) reduce wellbore heat losses using an effective, inexpensive insulating fluid in the tubing-casing annulus; and (2) improve the effective sweep of the reservoir by a) reducing the effect of overriding gravity segregation; b) improving mobility control; and c) better definition of reservoir heterogeneities. Research in wellbore heat losses should not include insulated tubing or solid materials in the tubing-casing annulus. Multiple injectants, either injected from the surface or created in-situ, may be considered for mobility control.
- Optimization of Oil Well Completions and Stimulations -- A complete understanding of the effects of specific types of completion technology is desirable with an effort to improve/control the processes and accurately monitor the results. Determination of the impacts of various completion or stimulation technology employed downhole in actual field as well as laboratory tests is necessary to improve these processes. The creation of low cost, user friendly software, tailored for local or individualized well locations and having specific operator input, would be extremely beneficial in completion or stimulation decision-making.

New well completion and stimulation technology, utilizing formation sand control and/or consolidation techniques, advanced acidization or well bore treatments, microbial processes, formation fracturing, and real time seismic data acquisition in conjunction with these treatments as a monitoring tool are additional areas of anticipated new technology growth.

- Oil-Field Geoscience -- A more complete understanding of the internal architecture of reservoirs, with an emphasis on the location and prediction of pore-scale to interwell-scale heterogeneities, is the key to determining how that anatomy governs reservoir fluid movement.

Grant applications are sought on novel methods of characterization to quantify reservoir parameters including porosity, permeability, pore structure, capillary pressure, fracture patterns, and facies geometry. Techniques are also sought to interpret dispositional, diagenetic, or structural features of reservoirs for prediction of the spatial distribution of heterogeneities and their influence on fluid flow within known oil reservoirs.

Novel improvements are sought in instrumentation for use in characterization of known hydrocarbon reservoirs such as wellbore logging, seismic tomography, electromagnetic tomography, three-dimensional seismic profiling, and innovative techniques for computer modeling of reservoir heterogeneities and reservoir/fluid interactions.

2.6 TECHNICAL TOPIC 6 - Natural Gas Supply, Storage, and Processing

DOE seeks innovative methods and concepts that will allow more efficient, economical, and environmentally acceptable recovery of natural gas. Novel improvements in recovery techniques could lead to lower production costs and/or greater recovery efficiencies. The DOE's interest in drilling, completion, and stimulation is to lower capital investment, improve recovery, and minimize formation damage. Collectively, these objectives are expected to reduce the unit cost of accessing and producing natural gas. The technology focus for low-permeability formations emphasizes improvements in the detection, mapping and analysis of naturally fractured gas reservoirs so that economical recovery methods may be realized. Program activity in gas delivery and storage is focused on assisting the storage industry in the development of new or existing storage system capacity and deliverability. Research in natural gas upgrading emphasizes converting methane to liquids or chemicals in a simple one- or two-step process under moderate operating conditions of pressure and temperature, and advancing processing technologies for raising low-quality raw natural gas to pipeline quality. Finally, environmental aspects of producing gas wells emphasize methods to reduce the costs of achieving environmental compliance in the various production regions within the states.

SPECIFIC EXAMPLES (including but not limited to):

- Innovative methods for technologies, systems, and methods which increase rate-of-penetration, provide real time information on drilling, develop new tools for cutting medium-to-hard formations, enhance horizontal well drilling, minimize stimulation concepts, and/or develop new or improved completion hardware.
- Development of high resolution seismic techniques for locating subsurface fracture systems in low permeability formations and for mapping and analyzing the extent of the fractured reservoir so that the orientation of horizontal or inclined boreholes can be designed for optimal recovery.
- Cost effective methods to revitalize deliverability from existing natural gas storage wells and for locating new wells to control gas migration in the reservoir and/or for optimizing storage field development.
- Innovative techniques for upgrading natural gas to liquid fuels and for raising low-quality raw natural gas to pipeline quality.
- Technology for the measurement, treatment, minimization and disposal of naturally occurring radioactive materials in drilling and production operations.
- Development of guidelines for gas drilling operators to lower the costs for environmental compliance in various locations.
- Methodologies for controlling methane emissions from gas producing sources to achieve environmental compliance.

2.7 TECHNICAL TOPIC 7 - Infrastructure Reliability for Natural Gas

It is estimated that there is about 1.3 million miles of natural gas transmission and distribution pipelines serving over 75 million customers in the United States. Maintaining the integrity and operational reliability of the natural gas transmission and distribution systems across the United States is essential to ensure the availability of clean, affordable energy for homes, businesses and industries. A number of factors, including an aging natural gas infrastructure, increased energy demand, utility deregulation and restructuring, and intense competition requires additional technology development to ensure the continued high level of integrity and reliability. The infrastructure reliability effort is administered by NETL's Natural Gas Infrastructure Reliability Product line through the Strategic Center for Natural Gas. NETL has sponsored visioning and road mapping sessions to clearly identify technology needs for the natural gas infrastructure. The final report is entitled "Pathways for Enhanced Integrity, Reliability and Deliverability." The DOE encourages proposers to address the needs identified in that report. The report can be found at: <http://www.netl.doe.gov/sng/publications/naturalg.pdf>.

2.8 TECHNICAL TOPIC 8 - Fuel Cells

Fuel Cell technology development seeks to dramatically reduce the cost of fuel cell stacks or increase the efficiency of fuel cell systems. New advances offer to potentially lower fuel system costs, shorten development time, take advantage of economy of scale and mass customization, expand the fuel cell market, exploit the synergy between fuel cells and turbines, and simplify the fuel cell balance of plant (BOP).

Fuel cell concepts capable of approaching \$100/kilowatt stack costs and fuel cell system efficiencies approaching 70-80% are desired to meet the Vision 21 goals. The Solid State Energy Conversion Alliance (SECA) Program goals will require a fuel cell system that can be manufactured for \$400/kilowatt by 2010. The Fuel Cell program has focused on fuel cell stacks, cell systems, and fuel cell hybrid system concepts. Some of the barrier issues in order to reach these goals include:

- Advanced fuel cell materials and manufacturing processes
- Improved fuel cell designs
- Improved modeling methods
- Advanced low-cost BOP components
- Technology for advanced system operation and life-cycle cost reduction

The DOE encourages proposals that address these barrier issues.

2.9 TECHNICAL TOPIC 9 - Faculty/Student Exploratory Research Training Grants

Over the long term, all parties will benefit (HBCU/OMI and DOE) if the overall HBCU-OMI research infrastructure can be developed and maintained. If expanded beyond the typical research institution, science and engineering interests can be encouraged at an earlier stage of educational development, improved research training can lead to better prepared graduate students entering the major universities, primarily teaching faculty can continue to pursue limited research interests, and a highly-qualified pool of potential employees may be developed for the fossil fuels industry. "The Faculty/Student Exploratory Research Training Grant" is envisioned as an opportunity to maximize the participation of students and faculty among all of the qualifying institutions.

These grants for research/ research training to be conducted over a one-year period have a maximum value of \$20,000. The proposed work can take the form of a novel idea or concept to be tested at a preliminary stage, or the work can address a small unique aspect of a larger problem, or the work can continue or expand on previous work (e.g. sorbent formulations, catalyst conditions, etc.), or some other concept; but, the topic must fall within fossil energy research needs (Technical Topics 1-6). Note from the evaluation criteria, that there is a much greater burden (compared to the Core Grant) for the proposer to demonstrate enhancements to the research infrastructure that will accrue to the institution if they receive the award.

Since grants to be awarded under this topic are small and of short duration, the technical applications are easier to prepare (15 pages) and they are evaluated against fewer criteria compared to applications submitted under the Core Program. The expected outcome is that many of the smaller institutions, to include Master's Degree granting institutions and undergraduate degree granting institutions (primarily teaching institutions), will find this opportunity to be more palatable/ compatible with the goals of their science and engineering Departments and professional faculty.

This is the only Topic nine (9) under this Program Solicitation that does not have private sector collaboration as a goal in consideration of an application.

3.0 TYPE OF AWARD INSTRUMENT

In accordance with Public Law 95-91, the DOE Organization Act, and Public Law 97-258, the Federal Grant and Cooperative Agreement Act, DOE plans to issue Financial Assistance Grants as the award instrument for applications selected for support. The Code of Federal Regulations (CFR) at 10 CFR, Part 600, contains detailed information concerning the DOE "Assistance Regulations."

4.0 LIMITATIONS ON FUNDING AND PROJECT PERIODS

DOE reserves the right to support or not to support, in whole or in part, any or all applications received, and to determine the number of awards to be made through the solicitation subject to funds available in this fiscal year.

The maximum DOE funding for each financial assistance award under this Program Solicitation is as follows:

<u>Topics (1) - (8)</u>	<u>Maximum DOE Funding</u>
To 12 month project period	\$ 85,000
13-24 month project period	\$150,000
25-36 month project period	\$200,000
 <u>Topic (9)</u>	
To 12 month project period	\$ 20,000

Grants will be awarded to the successful HBCU/OMI for a time period of up to thirty-six months for the HBCU/OMI Core Program--i.e., Technical Topics 1 through 8--and up to twelve months for the Faculty/Student Exploratory Research Training Grant Program--i.e., Technical Topic No. 9.

Applications must specify a project period and include a detailed budget for the proposed project period consistent with the instructions provided in Section 5.2.3.2.

Approximately \$900,000 is available for the grant awards resulting from this Program Solicitation. The total should provide support for approximately four to six research and development application selections (Topics 1 to 8) and approximately four to eight Faculty/Student Exploratory Research Training application selections (Topic 9).

DOE anticipates selection to be made in May 2002, with awards granted thereafter. Unsuccessful applications will be retained by DOE for three years, then destroyed.

5.0 ELIGIBILITY REQUIREMENTS AND INSTRUCTIONS FOR PREPARATION OF APPLICATIONS FOR FEDERAL ASSISTANCE

5.1 ELIGIBILITY REQUIREMENTS

Pursuant to 10 CFR 600.6(b), eligibility for participation in this Program Solicitation is restricted to HBCUs/OMIs recognized by the OCR, U.S. Department of Education, and identified on the OCR's Department of Education U.S. Accredited Postsecondary Minority Institutions list in effect on the closing date of the program solicitation. The website address for the OCR list is <http://ed.gov/offices/OCR/minorityinst.pdf>. Applications submitted by any institution not on OCR's aforementioned list are ineligible for technical evaluation and award. For information regarding the qualification criteria and process of becoming recognized by the Education Department's OCR as a "Minority Institution", institutions should contact the Education Department directly at

the following address: Mr. Peter A. McCabe, Office for Civil Rights, U.S. Department of Education, Washington, DC 20202, Telephone (202) 205-9567. Note: The Education Department should only be contacted on matters related to Institutional status; questions regarding the Program Solicitation should be directed to Ms. Mitchell at DOE.

Participation by Federally Funded Research and Development Centers (FFRDC) and DOE Management and Operations (M&O) Contractors

Proposed Use of a DOE M&O Contractor

Applications submitted by, or substantially relying upon the technical expertise of, FFRDCs and DOE M&O contractors are not desired, will not be evaluated, and will not be eligible for an award under this solicitation. However, an application that includes performance by an FFRDC or DOE M&O contractor(s) as a subcontractor will be evaluated and may be considered for award, provided that: (1) the proposed use of any such entities is specifically authorized by the cognizant agency for the FFRDC or DOE for DOE M&O contractors, in accordance with the procedures established for the FFRDC or the M&O contractor; (2) the work is not otherwise available from the private sector; and (3) the estimated cost of the FFRDC or M&O contractor work does not exceed 25 percent of the total estimated project cost. DOE reserves the right to fund the work through a DOE field work proposal or an interagency agreement.

Application Submission Requirements

In addition to the application information to be provided by the applicant, the following requirements apply:

1. Justification.
The offeror shall submit a letter with its application (Volume I) which states that to the best of its knowledge, the work requested will not place the FFRDC or the DOE M&O contractor in direct competition with the domestic private sector, and that the proposed scope of work cannot be performed by any private entity.
2. Work Scope.
The offeror shall submit a detailed scope of work which clearly identifies that portion of the proposed effort for which the expertise and ability to perform lie solely with the DOE M&O contractor. This detailed scope of work shall be provided as an appendix to the Volume I, Technical Application.
3. Cost Information.
The offeror shall provide cost information for that portion of the proposed work scope (see 2, above) to be performed by the DOE M&O contractor. The cost information shall be furnished in the same format and level of detail as prescribed for subcontractors. The estimated cost of the effort shall be clearly identified in the Volume II, Business and Financial Application.

Applications from HBCU/OMI-affiliated research institutes must be submitted through the college or university with which they are affiliated. The university

(not the university-affiliated research institute) will be the recipient of any resultant DOE grant award.

5.1.1 **QUALIFICATIONS CRITERIA**

Grants awarded under this Program Solicitation are intended to maintain and upgrade educational, training and research capabilities of our HBCUs/OMIs in the fields of science and technology related to fossil energy resources. **The involvement of professors, students, and the commercial sector** in the development and execution of fresh new research ideas, and the establishment of linkages between the HBCU/OMI and private sector fossil energy community are critical to the success of this program; and are equally consistent with our goal of ensuring the U.S. a future supply of fossil fuel scientists and engineers from a previously under-utilized resource.

To ensure the continued achievement of these goals, faculty members from HBCUs/OMIs and their affiliated research institutions are encouraged to submit applications which must satisfy all of the following criteria:

- (a) The application (Attachment 2) is submitted by a qualified (see Section 5.1, above) HBCU/OMI and signed by the authorized representative of the HBCU/OMI; applications from HBCU/OMI-Affiliated Research Institutions must be submitted through the HBCU/OMI with which they are affiliated;
- (b) The Principal Investigator or Co-Principal Investigator listed on the application is a teaching professor at the submitting HBCU/OMI and a minimum of 30% of personnel time invoiced under the grant is to pay for student assistance for each year of the grant, as certified by executing the Teaching Professor/Student Employment Certification (Attachment 4). The Teaching Professor/Student Certification shall be certified by the Principal Investigator or Co-Principal Investigator and an authorized representative of the HBCU/OMI.

NOTE: As long as this criterion is met, other participants, Co-Principal Investigators or research staff who do not hold teaching or student positions may be included as part of the research team.

- (c) The application is submitted timely, in accordance with Section 6.1;

Failure by the applicant to satisfy any of the above criteria will result in rejection of the application.

5.1.2 **PRIVATE SECTOR COLLABORATION**

Although it is not required as a qualification criterion, collaboration with the private sector is encouraged, and applications proposing private sector collaboration may be evaluated more favorably (See Section 7.2.2 for a

description of the technical evaluation factors and relative importance of each factor).

Collaboration by the private sector with the HBCU/OMI may be in the form of cash cost sharing, consultation, HBCU/OMI access to industrial facilities or equipment, experimental data and/or equipment not available at the university, or as a subgrantee/subcontractor to the HBCU/OMI.

Qualified Collaborators

- (a) A small or major business enterprise will qualify as a "private" collaborator; however, the following are specifically excluded from recognition as private sector collaborators --Federal, State or local government agencies (because they are considered to be in the "Public Sector"), Federally Funded Research and Development Centers, and colleges or universities or their affiliated research institutions.
- (b) Each applicant must clearly delineate the relationship of the HBCU/OMI and the private sector entity -- the HBCU/OMI must be identified as the "prime recipient" in the application. The private sector entity is ineligible to propose on its own behalf.
- (c) Private sector collaboration of any of the following types, or any combination thereof, will be considered appropriate for this solicitation:
 - (i) *Cash cost sharing* received by the HBCU/OMI awardee from private sector participant(s).
 - (ii) *No-cost collaboration* over some defined frequency of occurrences with the private sector participant(s) that agree(s) to consult with the Principal Investigator and to share information which will assist in improving the experimental plan and/or assist in analyzing data obtained by the Principal Investigator. *Free use of industrial experimental facilities and instrumentation not available at the university is included* in this category of collaboration.
 - (iii) *Subcontracting* by the HBCU/OMI awardee to the **private sector participant(s)** as described in Section 5.1.3(a) below.
- (d) Full information on the details of the collaboration, cash cost sharing, subcontracting, the qualifications of the consultant personnel, and/or the experimental facilities made available to the university must be included in the Business and Financial Application (Volume II).

5.1.3 SUBCONTRACTING LIMITATIONS

- (a) *Subcontracting* by the HBCU/OMI awardee to the **private sector participant(s)** is limited to providing consultation, experimental data and/or equipment not available at the university. DOE funding which can be used for subcontracting is limited to a maximum of 25% of DOE support for the project; there is no limitation on the amount of HBCU/OMI or third-party funding which can be used for subcontracting.
- (b) *Subcontracting* by the HBCU/OMI awardee to **State or local government agencies, and colleges or universities** is also limited to providing consultation, experimental data and/or equipment not available at the university. DOE funding which can be used for subcontracting is limited to a maximum of 25% of DOE support for the project; there is no limitation on the amount of HBCU/OMI or third-party funding which can be used for subcontracting.
- (c) *Federal Government Facility*. Applicants may propose the use of federal facilities only if the facility provides unique services or equipment not otherwise available from commercial sources. In the event that an application is selected that includes performance by a **Federal Government Facility other than a DOE Fossil Energy Facility**, DOE will fund the effort directly. Federal Government Facility costs may not exceed 25% of the DOE support for the project. Federal Government Facility costs will be included in the total project cost subject to the limitations set forth in Section 4.0.

NOTE: Applications which include performance, at any level, by a Fossil Energy facility and/or employee are inappropriate for this competition and shall be determined ineligible for award.

- (d) *Total DOE funding which can be used for subcontracting and Federal Facility Performance* (Items 5.1.3 (a) + (b) + (c)) is limited to a maximum of 49% of DOE support for the project.

5.2 GUIDELINES FOR PREPARING APPLICATIONS

5.2.1 GENERAL

The following general format should be used in preparing all documents:

- (a) Minimum margins (top, bottom, left and right) of one (1) inch on 8 1/2 x 11-inch paper;
- (b) Font size shall be a minimum of 12 points;
- (c) Each volume shall be appropriately paginated.

Applications shall be submitted in two (2) separate volumes and in the quantities designated below:

VOLUME I: Technical	Original + 5 copies
VOLUME II: Business/Financial	Original + 5 copies

Five (5) additional copies of the "Abstract" are requested for reviewer Conflict of Interest screening.

The "original" of Volumes I and II must be clearly marked "ORIGINAL" and must contain the original signatures required.

Following the prescribed format of each volume (see Sections 5.2.3.1 through 5.2.3.2) will significantly assist the DOE in the processing of applications.

5.2.2 FEDERAL COST PRINCIPLES/COST-SHARING/IN-KIND CONTRIBUTIONS (10 CFR 600.123 and .127)

The **Federal Cost Principles** applicable to specific types of grantees, subrecipients, and contractors under grants and subawards are as follows:

(a) Institutions of Higher Education

Office of Management and Budget (OMB) Circular A-21, "Cost Principles Applicable to Grants, Contracts and Other Agreements with Institutions of Higher Education," is applicable to both public and private colleges and universities.

(b) State and Local Governments and Indian Tribal Governments

OMB Circular A-87, "Cost Principles Applicable to Grants, Contracts and Other Agreements with State and Local Governments," is applicable to State, Local and Indian tribal governments and shall also be used to the extent appropriate for foreign governments.

(c) Nonprofit Organizations and Individuals

OMB Circular A-122 "Cost Principles Applicable to Grants, Contracts and other Agreements with Nonprofit Organizations", applies to nonprofit organizations other than a non-profit institution of higher education or hospital. However, a few nonprofit organizations, as specifically listed in OMB Circular A-122, are subject to the commercial cost principles specified in subparagraph (d), below. OMB Circular A-122 shall also apply to grants to individuals.

(d) Commercial Firms and Certain Nonprofit Organizations

Title 48 CFR Subpart 31.2 (Federal Acquisition Regulations) "Contracts with Commercial Organizations," as supplemented by 45 CFR Subpart 931.2 (DOE Acquisition Regulations), applies to for-profit organizations (other than for-profit hospitals), including corporations, partnerships and sole proprietorships.

Copies of OMB publications listed in subparagraphs (a)-(d) above may be obtained from the Office of Management and Budget, Office of Administration, Publications Unit, Washington, DC 20503.

Cost Sharing (10 CFR 600.123) is a generic term denoting any situation where the Government does not fully reimburse the applicant for all allowable costs necessary to accomplish the project or effort. Cost-sharing may be in various forms or combinations, which includes but is not limited to cash outlays, real property (or interest therein) needed for the project, personal property (equipment) or services, cost matching, or other in-kind sharing. Cost sharing may be accomplished by a contribution of either direct or indirect costs provided such costs are otherwise allowable in accordance with the applicable cost principles.

Foregone fee/profit is excluded from consideration as cost-sharing.

Allowable costs which are absorbed by the applicant as part of its cost share may not be charged directly or indirectly to the Federal Government under other contracts, agreements or grants. The applicant's cost sharing may be provided by the applicant, or other companies/associations with which it has contracts, subgrants or other binding arrangements to perform the project. Cost sharing may include the value of contributions of other non-Federal sources, provided the contributions were not previously obtained free of charge from Federal sources.

In-Kind Contributions represent noncash contributions which are directly beneficial, specifically identifiable and necessary to the performance of the project. In-kind contributions must be verifiable from the applicant's or third party's books and records. The value of any noncash contribution shall be established by the DOE after consultation with the applicant and/or third party donor; **however, adequate supporting documentation must be provided in the application for the estimated value of any noncash contribution (applicant or third party).**

5.2.3 CONTENT OF APPLICATIONS

5.2.3.1 VOLUME I - TECHNICAL

A. CORE GRANT PROGRAM

Elements comprising Volume I - Technical (in the order in which they must be presented) for applications submitted under the Core Program (i.e., Technical Topics 1 - 8) are as follows:

- (a) Application Cover Sheet signed by the Principal Investigator.
- (b) Proprietary Information Disclosure Statement (if applicable).
- (c) Table of Contents.
- (d) Public Abstract - The abstract shall be no more than one (1) single-spaced page. It is suggested that key words be highlighted or underscored to assist in placing the application in the proper group for evaluation.
- * (e) Introduction (**Must be double-spaced** and identified as Page 1).
- * (f) Scientific discussion (**Must be double-spaced**). Provide a detailed description of the program objectives toward which the application is addressed and a detailed presentation of the research work and procedures that will be conducted to achieve these objectives. Provide all necessary information to satisfy each of the technical evaluation requirements specified in Section 7.2.2 of this solicitation.
- * (g) Concise Statement of Project Objectives proposed (**Must be double-spaced**).
- * (h) Research Infrastructure, Research Training, and Education (**Must be double-spaced**). Describe what additional capabilities will accrue to your institution as a result of being awarded a grant to conduct the proposed research.
- * (i) Project Management Plan (**Must be double-spaced**). The plan should provide at a minimum a well defined milestone chart and schedule and plan for communications among the partners and subcontractors if applicable.
- * (j) Literature references (**May be single or double-spaced**, but total pages are subject to the limitation specified below).
- * (k) Qualifications of Proposing Team (**May be single or double-spaced**, but total pages are subject to the limitation specified below):
 - (1) Vitae. Provide a brief vitae for the Principal Investigator and the Co-Principal Investigator(s), if applicable and include a

list of publications pertinent to the proposed research. The Vitae should also identify any past, current or pending support related to the proposed work.

- (2) Facilities. Identify existing facilities, including private sector and/or specialized equipment, available for use in the proposed research.
- (3) Collaboration. Include letters of commitment from the private sector which clearly detail their specific involvement in the performance of the proposed Statement of Project Objectives; resumes of proposed "consultants"; and other relevant qualifications of any proposed private sector collaborators.

***The combined length of asterisked (*) items e, f, g, h, i, j and k must not exceed thirty-five (35) pages, including figures, tables, etc. for applications submitted under the Core Program(Technical Topics 1 through 8).**

B. FACULTY/STUDENT EXPLORATORY RESEARCH TRAINING GRANT PROGRAM

Elements comprising Volume I - Technical (in the order in which they must be presented) for applications submitted under the Faculty/Student Exploratory Research Training Grant Program (i.e., Technical Topics 9) are as follows:

- (a) Application Cover Sheet signed by the Principal Investigator.
- (b) Proprietary Information Disclosure Statement (if applicable).
- (c) Table of Contents.
- (d) Public Abstract - The abstract shall be no more than one (1) single-spaced page. It is suggested that key words be highlighted or underscored to assist in placing the application in the proper group for evaluation.
- * (e) Introduction (**Must be double-spaced** and identified as Page 1).
- * (f) Scientific discussion (**Must be double-spaced**). Provide a detailed description of the program objectives toward which the application is addressed and a detailed presentation of the research work and procedures that will be conducted to achieve these objectives. Provide all necessary information to satisfy each

of the technical evaluation requirements specified in Section 7.2.2 of this solicitation.

- * (g) Concise Statement of Project Objectives proposed (**Must be double-spaced**).
- * (h) Research Infrastructure, Research Training, and Education (**Must be double-spaced**). Describe what additional capabilities will accrue to your institution as a result of being awarded a grant to conduct the proposed research.
- * (i) Literature references (**May be single or double-spaced**, but total pages are subject to the limitation specified below).

The combined length of asterisked () items e, f, g, h, and i must not exceed fifteen (15) pages, including figures, tables, etc. for applications submitted under the Faculty/Student Exploratory Research Training Grant Program (Technical Topics No. 9).

C. GENERAL

Figures and/or tables may be reduced and combined with text, provided that the figures/tables retain their legibility.

Applicants are cautioned that if the combined length of the asterisked items exceed the page limitations specified, **only the first 35 pages for applications submitted under the Core Program (Technical Topics 1 through 8) or the first 15 pages for applications submitted under the Faculty/Student Exploratory Research Training Grant Program (Technical Topic No. 9)** will be given to the reviewer(s), which would be detrimental to the comprehensive evaluation of the application. Therefore, applicants should strictly follow the preceding instructions, keeping in mind that pages containing only partial information will be counted as a complete page. In addition, if an applicant single-spaces the information required to be double-spaced, then each single-spaced page shall be counted as two pages.

No materials shall be incorporated by reference. Any such material will not be considered in the evaluation process.

NO COST INFORMATION IS TO BE INCLUDED IN THE TECHNICAL APPLICATION. Where estimated man-hours will provide clarity, they shall be quoted in man-hour figures only, with no indication as to the cost of these man-hours.

The Technical Application evaluation is conducted to determine the relative merits of an application in accordance with the weighted

evaluation criteria. **The factors evaluated will be as indicated in Section 7.2.2, Technical Application Evaluation Criteria.** The Technical Application evaluation results in a numerical score.

5.2.3.2 VOLUME II - BUSINESS/FINANCIAL

Content. The elements comprising Volume II - Business/Financial (in the order in which they must be presented), are as follows:

- (a) Application Cover Sheet: (Attachment 1) Volume II - Business/Financial, signed by the Principal Investigator.
- (b) SF 424, Application for Assistance (Attachment 2) - **Must be signed by an authorized representative of the submitting college or university.** An authorized representative is an official who is authorized to bind the college or university.
- (c) Proprietary Information Disclosure Statement (if applicable).
- (d) Teaching Professor/Student Employment Certification (Attachment 4) for the Principal Investigator or a Co-Principal Investigator of the submitting HBCU/OMI.
- (e) Certification of Intent to Comply with DOE Budget Limitations (Attachment 5).
- (f) Budget Request for Total Project. The Budget Request shall include (1) a Budget Page for the Total Project (form DOE F 4620.1 contained at Attachment 3), and (2) a "budget explanation" showing how costs are derived for each major cost element.

A budget explanation to support the proposed costs presented on the F 4620.1 must include, at a minimum, the following level of detail:

1. **Labor.** Identify individual labor categories and man-hours or percentages of time/individual, including wage-rate or salary used in the computation of cost and any applicable escalation factor(s);
2. **Fringe Benefits.** Provide the estimated cost of fringe benefits if calculated separately from Labor. If applicable, provide "Current Rate Agreement -- Colleges and Universities", which supports the proposed fringe benefit rate, or explain how the rate was computed;
3. **Travel.** Itemize each trip as to destination, number of travelers and duration. Rates used to estimate airfare, lodging, meals and

incidental expenses, and ground transportation costs should be provided. Include travel costs for attendance by the Principal Investigator to each Annual HBCU/OMI Technology Transfer Symposium (See Section 9.0, Annual HBCU/OMI Technology Transfer Symposium/Travel). In addition to the Annual Technology Transfer Symposium, award funds may be used for domestic travel to one (1) technical meeting per year, during each year of the prospective award;

4. **Contracts, Subgrants and/or Consultants.** Identify proposed contracts/subgrants to other organizations and their relative cost, providing the same level of cost detail as that required of the applicant (i.e., labor, benefits, supplies, etc.). If a consultant is proposed, provide the hourly/daily rate and its basis, and certify whether or not the proposed rate is the consultant's "most favored customer" rate. Furnish resumes or similar information regarding qualifications or experience. **Profit or fee is NOT permitted** to be paid to contractors or subgrantees under this Program Solicitation;

5. **Equipment, Materials and Supplies.** Elements of cost should be itemized to the extent possible and the basis of the proposed prices substantiated as to written/verbal vendor quotes, catalog pricing, etc. Copies of written quotes and/or the vendor catalog pages should be provided to substantiate costs;

6. **Other Direct Costs (ODC's).** The amount and basis for proposed costs not otherwise shown should be included here;

7. **Indirect Costs.** Provide "Current Rate Agreement -- Colleges and Universities", which substantiates proposed indirect rates with the Federal Government. This may be obtained from the college/university business office (photocopy acceptable). If no such Rate Agreement exists, explain how the rates were derived;

8. **Cost Participation**, if any, is considered contributions (cash or in-kind) by the applicant, private sector or other third-party co-funder. The Budget Request and the detailed budget breakdown must be consistent and supportable as to source and type of cost-participation (reference Section 5.2.2);

9. **Total Amount Requested from DOE**, should not exceed maximum funding limits as set forth in Section 4.0;

10. **Total Project Costs.** Total allowable project costs include both costs to be reimbursed by DOE and costs to be shared by the applicant or third parties; thus, **total project costs must reflect all costs to be incurred in the performance of the proposed**

project. The total costs (as well as individual elements of cost) should include the costs to be reimbursed by the DOE as well as any cost participation by the proposing organization or a third party;

- (g) Assurances - Non Construction Programs (SF 424B)(Attachment 7) signed by an authorized representative of the submitting HBCU/OMI. Assurances must also be provided by any other collaborators participating in the proposed effort;
- (h) NEPA Compliance - Environmental Certification (Attachment 6) Assurance that the Environmental Questionnaire will be submitted within thirty (30) calendar days of receiving a grant award, or within thirty (30) calendar days of the notice of selection.
- (i) Identify past, current, and pending support related to the work proposed. Include other DOE Program Offices or Government agencies to which the proposed work has been submitted;
- (j) Discussion of private sector collaboration in the proposed research effort (Technical Topics 1 through 8), as previously set forth in Section 5.1.2;
- (k) Acknowledgment of Amendments (if any). Receipt of any Amendments to the Program Solicitation should be acknowledged by listing the amendment number and date of issuance;
- (l) Letters of Commitment from Private Sector Collaborators. Commitment letters should provide evidence of any proposed 3rd party financial contributions.

5.3 PROPRIETARY INFORMATION

Applications submitted under this solicitation are subject to technical review and evaluation (per Section 7.2, Comprehensive Evaluation and Final Ranking); therefore, applicants should submit only that proprietary information which they determine is essential for a clear and comprehensive presentation of their application. Applications containing proprietary information will be evaluated with due consideration for protection of this information, to the extent permitted by law, and provided such information is clearly identified by inclusion of the Proprietary Information Disclosure Statement, below:

Proprietary Information Disclosure Statement

"The data submitted on pages ____ of this application have been submitted in confidence and contain trade secrets and/or privileged or confidential commercial or financial information and such data shall be used or disclosed only for evaluation purposes, provided that if an award

is made to this applicant as a result of or in connection with the submission of this application, the Government shall have the right to use or disclose the data herein to the extent provided in the award document. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the applicant."

In addition, **each page** of the application **containing proprietary data** which the applicant wishes to restrict **must be marked** with the following legend:

"Use or disclosure of the application data on lines specifically identified by asterisk () are subject to the restriction of the cover page of this application".*

Arbitrary and unwarranted use of this restriction is discouraged.

The Government assumes no liability for disclosure or use of unmarked data and may use or disclose such data for any purpose.

In the event properly marked data contained in an application in response to this solicitation is requested pursuant to the Freedom of Information Act, 5 USC 552, the applicant will be advised of such request, in accordance with 10 CFR 1004. Prior to release of such information the applicant will be requested to expeditiously submit to DOE a detailed listing of all information in his application which he believes to be exempt from disclosure under the Act. Such action and cooperation on the part of the applicant will ensure that any information released by DOE pursuant to the Act is properly determined.

5.4 APPLICATION PREPARATION COSTS

DOE assumes no responsibility for any costs associated with application preparation, including, for example, any costs associated with the preparation and submission of an Environmental Questionnaire. Application costs will be treated in accordance with OMB Circular A-21.

5.5 PATENTS, DATA, AND COPYRIGHTS

Policies and procedures for patents, data, and copyrights are in accordance with Public Law 96-517. The grantee may retain the entire right, title and interest to each invention, subject to the provisions of 10 CFR 600.27.

6.0 SUBMISSION OF APPLICATIONS

6.1 DELIVERY ADDRESS AND APPLICATION DEADLINE

REGARDLESS OF THE DELIVERY METHOD UTILIZED FOR SUBMITTING AN APPLICATION (INCLUDING THE U.S. POSTAL SERVICE OR PRIVATE

CARRIER), APPLICATIONS MUST BE RECEIVED BY 5:00 P.M. EASTERN STANDARD TIME on March 12, 2002, AT THE FOLLOWING ADDRESS ONLY:

**US Department of Energy
Federal Energy Technology Laboratory
Attn: Cynthia Y. Mitchell
Wallace Road, Building 921, Room 107
South Park Township (Allegheny County), PA 15236**

If utilizing the U. S. Postal Service for submission of applications, use the following address for mailing purposes:

**Attn: Cynthia Y. Mitchell MS 921-107
National Energy Technology Laboratory
US Department of Energy
PO Box 10940
626 Cochran Mill Road
Pittsburgh PA 15236**

Code: HBCU Application DE-PS26-02NT41430

If utilizing a Private Carrier for submission of applications, applications will be received, Monday through Friday, except Federal holidays, from 8:00 a.m. to 5:00 p.m. and the following address should be used for delivery purposes:

**US Department of Energy
Federal Energy Technology Laboratory
Attn: Cynthia Y. Mitchell
Wallace Road, Building 921, Room 107
South Park Township (Allegheny County), PA 15236**

Code: HBCU Application DE-PS26-02NT41430

Any modification of an application is subject to the same conditions outlined above. Nevertheless, a late modification of an otherwise successful application which makes its terms more favorable to the government will be considered at any time it is received and may be accepted.

Applications may be withdrawn by written notice received at any time prior to award. Applications may be withdrawn in person by an applicant or his/her authorized representative, provided his/her identity is made known and he/she signs a receipt for withdrawal of the application prior to award.

6.2 INQUIRIES RELATIVE TO SUBMISSION

A proposal conference will not be held. All applicants will receive an e-mail confirming receipt of their application.

7.0 SCREENING AND EVALUATION CRITERIA

7.1 QUALIFICATION REVIEW

Applications submitted in response to this solicitation will be prescreened for compliance with the provisions set forth in Section 5.1.1.

In the event an application is determined to be materially noncompliant, a notice will be sent to the applicant stating the reason(s) that the application will not be considered for financial assistance under this solicitation.

7.2 COMPREHENSIVE EVALUATION AND FINAL RANKING

7.2.1 GENERAL

Each application which clears qualification review will be comprehensively evaluated separately according to the criteria listed in this section.

The applicant's budget (Volume II - Business/Financial) will be evaluated by DOE only to assess realism and determine reasonableness of proposed costs. The applicant's budget will not be point scored nor adjectively rated.

NOTE: Final selection decisions for the Faculty/Student Exploratory Research Training Grant Program and Core Program will be made by DOE based upon the Technical Evaluation Criteria listed in Section 7.2.2, with consideration given to those Program Policy Factors listed in Section 8.0.

7.2.2 TECHNICAL APPLICATION EVALUATION CRITERIA

Technical Applications submitted in response to this Program Solicitation will be evaluated and point-scored in accordance with criterion (1) through (9), below. The relative importance of each criterion is indicated by the maximum point score (as noted in parentheses) allocated to each criterion. The necessary information to be submitted to satisfy the evaluation requirements for each criterion is specified below for each criterion.

NOTE: Only criteria (1) through (5) will be applied to applications responding to Topic 9, Faculty/Student Exploratory Research Training Grant Program, of the solicitation.

CRITERION 1. TECHNICAL MERIT

(Maximum 25 points for both the Faculty/Student Exploratory Research Training Grant Program--i.e., Technical Topic No. 9, and 25 points for the HBCU/OMI Core Program--i.e., Technical Topics 1 through 8)

- Demonstrate a clear understanding of the objectives, technology issues, and intended Fossil Energy expectations of this solicitation.
- Demonstrate that the objectives of the proposed research have significant technical merit and address a promising and reasonable approach to specific research issues affecting fossil energy development and applications.

The Reviewer will expect the following:

- high interest (FE), well justified, and expands current knowledge

CRITERION 2. PROBLEM DEFINITION

(Maximum 15 points for the Faculty/Student Exploratory Research Training Grant Program or 10 points for the HBCU/OMI Core Program)

- Clearly define an important problem, concept, or question to be investigated; this may include addressing existing gaps in the knowledge and technology bases and existing technical barriers.

The Reviewer will expect the following:

- clearly defined problem, concept, or question is demonstrated to be of major importance to future utilization of fossil energy resources

CRITERION 3. INNOVATION

(Maximum 20 points for the Faculty/Student Exploratory Research Training Grant Program or 20 points for the HBCU/OMI Core Program)

- Demonstrate an awareness of current and historical developments in the proposed area of research and related studies.
- Distinguish the offeror's work from other similar third-party work in this technology area (historically or ongoing) and show that the idea is unique, well thought out in its development, and offers significant benefits over other efforts.

The Reviewer will expect the following:

- idea is worthy and is clearly innovative
- references and scientific discussion strongly support the investigation proposed and clearly demonstrate awareness, direct relevance, and importance to FE

CRITERION 4. RESEARCH APPROACH AND STATEMENT OF PROJECT OBJECTIVES

(Maximum 20 points for the Faculty/Student Exploratory Research Training Grant Program or 20 points for the HBCU/OMI Core Program)

- The applicant may have one or more alternative methods for achieving the stated objectives. The applicant should, at a minimum, provide a detailed description of the research approach that was chosen and describe why other approaches were discounted.
- Provide a Statement of Project Objectives that clearly describes the proposed work and outlines the project tasks according to a logical sequence of activities to complete the research effort proposed.

The Reviewer will expect the following:

- approach is focused, hypothesis/assumptions are well founded, and successful results are expected.
- exceptionally well planned to match stated objectives; tasks by all participants coordinated; and organized to assure successful completion of the project within the grant period

CRITERION 5. RESEARCH INFRASTRUCTURE, RESEARCH TRAINING, AND EDUCATION

(Maximum 20 points for the Faculty/Student Exploratory Research Training Grant Program or 5 points for the HBCU/OMI Core Program)

- The applicant describes expected enhancements to the research infrastructure, research training, and education programs that will accrue to the institution, staff, and students as a direct result of the proposed work.

The Reviewer will expect the following:

- applicant provides convincing discussion that assistance for the proposed work and proposed equipment purchases will provide enhancements to the research infrastructure, research training, and education programs at the HBCU/OMI institution

CRITERION 6. PROJECT MANAGEMENT

(Maximum 5 points for the HBCU/OMI Core Program)

- The applicant must submit a detailed project management plan including a project milestone schedule and plan for communication among its partners and subcontractors (if applicable).

The Reviewer will expect the following:

- plan is well defined, indicates a strong possibility for meeting the objectives of the project, and conveys adequate organizational structure for 1) coordination of internal and team member/subcontractor activities, 2) oversight for managing project schedule slippages, and 3) controls to ensure reporting requirements are fulfilled.

CRITERION 7. QUALIFICATIONS OF THE PI AND OTHER KEY PERSONNEL

(Maximum 5 points for the HBCU/OMI Core Program)

- Provide resumes for all key personnel who are considered to be critical to the achievement of the proposed project's objectives (including any post-graduate researchers). Resumes for undergraduate and graduate students are not required to be submitted with the application but will be required when the selected projects begin.

The Reviewer will expect the following:

- specialized education/training in this field, published as key author or corresponding author of articles in well recognized or peer-reviewed journals

CRITERION 8. FACILITIES, EQUIPMENT, TECHNIQUES

(Maximum 5 points for the HBCU/OMI Core Program)

- Describe the specific organizational resources and project facilities available to complete the proposed work. This should include the resources of all key participants if applicable.
- Provide an overall description of pertinent test facilities, laboratories, experimental and analytical equipment, as well as the adequacy and availability of the facilities. The description must distinguish between existing facilities and facilities that must be constructed or purchased to execute the work.
- Describe how proposed equipment purchases will advance the proposed work and compliment and enhance existing capabilities.

The Reviewer will expect the following:

- based on the description provided, reviewer can conclude that the quality of the proposed work will not suffer from lack of equipment, techniques, and facilities brought to bear on the problem; various participants offer complimentary resources to assure a synergistic partnership

CRITERION 9. COLLABORATION

(Maximum 5 points for the HBCU/OMI Core Program)

- Discuss the interaction of the collaborators in the project and describe the collaborator's function in the project (i.e., cash contributor, subcontractor, consultant, furnishing facilities, etc.). Letters of Commitment for each collaborator must be submitted within the technical application. Letters of Recommendation (for support) of the proposed researcher or project and/or letters stating interest or intent from a collaborator without specifying any details of the collaborator's commitment will not be considered as valid collaboration.

The Reviewer will expect the following:

- synergistic collaboration established; various participants contribute expertise and other resources to the project team that are complimentary and support the goals of the HBCU/OMI program and the project objectives

8.0 PROGRAM POLICY FACTORS

Program Policy Factors are those which, while not indicative of the application's technical merit, may be essential to the process of selection of the application(s) that individually or collectively represent a range of projects that would best serve DOE program objectives.

In the HBCU/OMI Research and Development Program, DOE seeks to encourage broad participation from within the diverse HBCU/OMI community and private sector fossil energy community. In addition, DOE seeks a balanced program in fossil resource utilization research and development in furtherance of the nation's energy objectives. Accordingly, in determining which of the applications shall receive DOE funding support, the following Program Policy Factors will be considered by the Source Selection Official (SSO):

- a. Geographical Regional Balance
- b. Broad University Participation
- c. Fossil Fuel Category (i.e., Coal, Oil, and Gas) Balance
- d. Programmatic Balance

The Source Selection Official will select a mix of applications for award from the findings established by the Evaluation Panel. The Source Selection Official will consider the relative technical ranking as well as applicable program policy factors in determining which application(s) will best satisfy program objectives.

9.0 ANNUAL HBCU/OMI TECHNOLOGY TRANSFER SYMPOSIUM/TRAVEL

Principal Investigators will be required to attend an annual, three (3) day, HBCU/OMI Technology Transfer Symposium at locations yet to be determined. For costing purposes only, applicants should use the following hypothetical meeting locations:

- 2002 - Pittsburgh, PA
- 2003 - Albuquerque, NM
- 2003 - Atlanta, GA

Additionally, award funds may be used for domestic travel to one (1) technical meeting per year, each year of the respective grant. NOTE: Award funds may not be used for foreign travel. Included in each budget with regard to travel must be detailed information on travel type (i.e. surface, air), hotel/motel accommodations, and per diem.

10.0 TRANSFER OF GRANTS

Financial assistance awards are made to educational institutions not individuals. Should the Principal Investigator leave the employment of the university at any time before expiration of the grant, the university will be required to provide a substitute Principal Investigator of acceptable qualifications to DOE, in order to continue research with grant monies.

11.0 REVIEWER COMMENTS

Requests for comments should be made within one (1) month following notification of an application's selection/ rejection for award. **Requests should directed to the addressee shown in Section 6.1.**

12.0 REPORTING REQUIREMENTS

Reporting Requirements for grant awards resulting from this program solicitation are contained in Part II - Section II of the Model Grant Document at Attachment 8.

13.0 APPLICATIONS OUTSIDE THE SCOPE OF THIS PROGRAM SOLICITATION

Response to this Program Solicitation does not limit the right of the applicant to submit other project applications to DOE. DOE considers applications in all areas of energy and energy related development submitted by any individual or organization.

Additional specific information on application preparation may be found in "Guide for the Submission of Unsolicited Proposals" (DOE/PR-0014). For copies of this guide or for information about submitting applications **outside** the scope of this Program Solicitation, contact either:

For other than Fossil Energy related topics:

U. S. Department of Energy
Unsolicited Proposal Branch
Procurement and Assistance Management Directorate
Washington, DC 20585
Telephone: 202-586-4920

For Fossil Energy related topics:

U. S. Department of Energy
Attn: John N. Augustine, Unsolicited Proposal Coordinator
National Energy Technology Laboratory
P.O. Box 10940
Pittsburgh, PA 15236-0940
Telephone: 412-386-4524

For further information regarding the Unsolicited Proposal Program, view the following World Wide Web site:

<http://www.netl.doe.gov/business/unsol.html>