

**FUNDING OPPORTUNITY  
ANNOUNCEMENT**



**Enabling Turbine Technologies for High-Hydrogen Fuels  
DE-PS26-05NT42380**

**CFDA Number: 81.089 Fossil Energy Research and Development**

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Information regarding this solicitation is available on the Department of Energy, Industry Interactive Procurement System (IIPS) web site at: <http://e-center.doe.gov>

## **NOTE: NEW REQUIREMENTS FOR GRANTS.GOV**

**Registration Requirements:** As part of the Department's implementation of e-Government, we are encouraging the submission of applications through Grants.gov. There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider and register with Grants.gov). You must complete all the one-time actions in "Get Started" at [www.Grants.gov](http://www.Grants.gov) prior to submitting your initial application. Applicants, who are not registered with CCR and Grants.gov, should allow at least 14 days to complete these requirements. It is suggested that the process be started as soon as possible. (See SECTION IV.H OTHER SUBMISSION AND REGISTRATION REQUIREMENTS)

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**Training Demonstration On How To Complete An Application Package** - Grants.gov has a multi-media presentation that guides you through the process of completing an application package. It is recommended that you view this training demonstration prior to submitting your application. This demonstration can be found at: <http://www.grants.gov/CompleteApplication#demo>.

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## PART I - FUNDING OPPORTUNITY DESCRIPTION

### A. SUMMARY

Products and technology improvements under the Turbine Program are being developed to serve the central station power generation markets. The Turbine Program will provide technologies and systems primarily for the development of hydrogen fueled turbines for integrated gasification combined cycle (IGCC) power systems and/or FutureGen type power plants that can lead to the capture and separation of carbon dioxide (CO<sub>2</sub>).

The objective of this solicitation is to establish projects and programs for the research and development of turbines and related systems that can utilize high hydrogen fuels, promote the use of hydrogen derived from coal and be integrated into systems that eliminate the emissions of CO<sub>2</sub>. Ultimately the turbines and turbine based systems developed through this solicitation will be integrated into advanced highly efficient near zero emission power systems that can capture or minimize the emissions of CO<sub>2</sub>. This solicitation is comprised of five topic areas and associated subtopics that are consistent with this objective.

Projects established through this solicitation will be structured in a phased approach with one, two, or three phases. The three phases will consist of: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. The projects / programs will include an R&D Implementation Plan as a major deliverable of Phase I and will provide the basis for establishing Phase II and Phase III work. Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III projects.

Technologies that are already developed beyond the detailed design phase may be submitted as Phase III projects. It is anticipated that work subsequent to Phase III, such as full-scale pre-commercial testing, could be supported through other competitive initiatives and are not included within the scope of this solicitation. Applicants are encouraged to read the sections associated with each topic area entitled “Application Development and Project Implementation” as well as the section entitled “General Guidance for Preparing the Research & Development Implementation Plan.”

### B. BACKGROUND INFORMATION

The Turbine Program addresses key technologies needed to enable the development of advanced turbines and turbine-based systems that will operate cleanly and efficiently when fueled with coal-derived synthesis gas and hydrogen fuels. Developing turbine technology to operate on coal-derived synthesis gas and hydrogen is critical to the development of advanced power generation technologies such as integrated gasification combined cycle and the deployment of FutureGen plants. The Turbine Program is an investment in secure U.S. electric power production that is clean, efficient, affordable and fuel-flexible, and will make possible the continued use of coal, our Nation’s largest domestic fossil energy resource.

The technological challenges associated with the program goals are:

- **Reducing emissions of NO<sub>x</sub> to less than 3 ppm:** Currently turbines in coal based IGCC application operate in a diffusion combustion mode and have reported NO<sub>x</sub> emissions on the order of 20ppm or less. To address these technical challenges stakeholders are pursuing approaches that include Hydrogen premixing, novel combustor designs such as trapped vortex combustion (TVC), and catalytic combustion. Premixing studies will address Hydrogen properties such as flame speed, auto-ignition temperature, and volume based

calorific-value in the context of existing dry low NO<sub>x</sub> (DLN) geometries. The catalytic combustion approach is concerned with catalyst life that needs to be at least 8,000 hrs and preferably 24,000 hrs. designing systems that can be retrofitted into existing class-F and G machines and function on coal derived Hydrogen as well as high-hydrogen syngas fuels while managing combustion air to keep final catalytic exhaust temperatures below 2800 F.

- **Reducing gas turbine capital costs by increasing power output:** Natural gas fuel provides 2% of the flow through the turbine while syngas, which has a much lower heating value than natural gas, provides about 15%-20% flow to achieve the same heat input into the gas turbine. The additional mass-flow in the turbine section results in about 30-40% higher gas turbine output power. However, due to other limitations, such as shaft torque, Mach number, and/or axial compressor surge, the actual peak output power of most IGCC gas turbines is typically limited to values below the theoretically possible syngas maximum output power.
- **Increasing combined cycle efficiency by increasing turbine inlet temperatures and addressing integration:** Turbines fired with syngas are typically operated at turbine inlet temperatures less than the temperature that the same machine would operate at when fueled with natural gas. This is primarily done for two reasons 1) to avoid blade degradation issues and 2) to avoid aerodynamic issues associate with the higher volume of a higher temperature gas stream. At this time the extent of this limitation is not clear. Blade degradation has been reported in some applications. To address these issues material degradation issues will be evaluated and improvements to thermal barrier coatings explored. Opportunities for more fully integrating the turbine with IGCC subsystems will be explored to include the air separation systems and Rankine cycle.
- **Turbines for Zero Emission Systems:** DOE is providing leadership in identifying power systems that minimize or eliminate the emissions of carbon dioxide and other criteria pollutants, increases efficiency and reduces the cost of electricity. For turbine applications these zero emission systems are based on coal gasification technology. One approach for a zero emission system is the FutureGen project which requires the combustion of hydrogen. The issues associated with the combustion of hydrogen are similar but significantly more challenging to those associated with the combustion of coal-derived synthesis gas. The turbine program will be addressing these issues to provide efficient, clean and low cost power systems that can capture CO<sub>2</sub>. Another promising approach is oxy-fuel combustion for ultra high temperature and high pressure steam turbines. In these systems, the oxidant and fuel are combusted to create a working fluid for the turbine composed mostly of water, and CO<sub>2</sub>. The design of these systems would facilitate the capture of 100 % of the CO<sub>2</sub> and all of the Clean Air Act criteria pollutants and other unregulated pollutants. The turbine program will be addressing the design of combustors and turbines for these systems that will offer system efficiencies in the 50 – 60 % (HHV) range in advanced coal based applications.
- **Hydrogen utilization in Megawatt Scale Turbines:** The utilization of hydrogen produced from coal in MW-scale turbines supports the office of Fossil Energy's goals for zero emission systems. This includes the utilization of exported hydrogen from coal based FutureGen type power plants and the potential of coal-based co-production (hydrogen, synthesis gas and electricity) in industrial applications. To support MW-scale turbine development for hydrogen utilization several approaches are being pursued. These include: 1) zero emission and efficient hydrogen combustion in turbines, 2) hydrogen combustion augmentation to minimize NO<sub>x</sub> emissions below 3 ppm and 3) turbines that operate under reducing conditions for integration into coal based co-production systems. MW-scale turbines imply

machines larger than 1 MW and smaller than 100 MW that are typically used for electric power production and mechanical drive applications.

### Benefits from this Solicitation

Turbine technologies developed through this solicitation will provide significant public benefits to U.S. citizens through lower energy consumption and fuel cost savings, electricity cost savings, emissions reduction, system reliability, job creation, conservation of land and water resources, and U.S. gas-turbine power-generation-equipment exports. Because next generation turbines will be fuel flexible, they will expand the options for high-efficiency conversion of domestic fuels into electric power.

In the near term, turbine technologies will be suitable for new capacity, re-powering of older fossil units, combined heat and power applications, and as efficiency enhancement units for existing fossil-fueled steam plants. Additionally, in the long term, next generation turbines will be adapted and integrated into solid-fossil-fueled power plants. Investing in research that applies new fuels such as hydrogen to the full range of MW-scale turbines provides the U.S. additional opportunities for zero emission systems, developing a hydrogen economy and the use of coal our nation's most abundant fossil fuel.

Enabling technologies developed under the program will benefit and support other missions of the U.S. government, such as enhancing defense capability and serving the needs of future military operations. Another large benefit of the program is the creation and maintenance of U.S. jobs directly related to the manufacturing of advanced power systems and those indirectly created and maintained because of the low cost and environmental superiority of next generation turbines. This in turn helps keep U.S. businesses competitive.

## **C. FUNDING OPPORTUNITY OBJECTIVES**

The overall goal (2005 – 2015) of the Turbine Program within NETL is to provide high efficiency, near-zero emissions and lower cost turbines for coal-based stationary power systems. As an evolutionary development, coal-based power systems will be tasked to capture CO<sub>2</sub> and produce hydrogen. In response, the Turbine Program will address hydrogen utilization issues. The Turbine Program will continue to identify and evaluate advanced turbine-based power cycles that offer low cost and efficient systems for the capture of carbon dioxide.

The objective of Phase I efforts is to (1) identify and define the proposed components or systems, (2) establish expected performance of the proposed turbine system and the associated fuel-to-bus-bar power system, (3) identify and provide plans to resolve barrier issues, (4) develop a conceptual design, and (5) develop an R&D Implementation Plan with a cost estimate that takes the proposed component or system through all three phases of the project. The objective of Phase II efforts is to develop a detailed design and conduct validation testing to allow a proof-of-concept prototype to be designed, built and tested in Phase III. The objective of Phase III efforts is to fabricate a pre-commercial prototype component or system and conduct longer-term testing using actual or simulated coal derived synthesis gas or hydrogen as the fuel. Several of the topic areas require applications to include provisions for the development of preliminary test plans for full-scale component or system testing at the DOE's FutureGen Project.

## **D. PROGRAM AREAS OF INTEREST**

This funding opportunity notice contains multiple program areas of interest identified in the funding opportunity description. Applicants are cautioned that this funding opportunity announcement is a master announcement and that each program area of interest has its own program-specific number for submission of applications. For example, Program Area of Interest 1, **Hydrogen Turbines for FutureGen** has a funding opportunity number of DE-PS26-05NT42380-1. If there are subtopics under the topic area, please submit to the proper subtopic. For example, Program Area of Interest 2A, **Coal-Based Oxy-Fuel System Evaluation and Combustor Development** has a funding opportunity number of DE-PS26-05NT42380-2A. Applications cannot be submitted under the master announcement.

Applicants should submit their application under the program area which best fits the majority of the effort to be performed. If an application is submitted under a program area of interest in which the DOE believes fits more appropriately in another program area of interest, the applicant will be directed to resubmit under the appropriate area of interest. Do not submit an identical application under more than one area of interest.

You may submit more than one application. Each application must have its own unique title on the subject line (i.e., project title and principal investigator/project director, if any). Please specify which Subtopic you are applying under on the cover page.

#### Topic Area 1: Hydrogen Turbines for FutureGen

Applications are solicited that apply and advance state-of-the-art (SOTA) large frame natural gas fueled turbine technology to produce turbines designed specifically for hydrogen fuels. Applications should show that large-frame machines (nominal 300 MW combined cycle size) would be available for a commercial offering in a 2015 time frame. The performance goals for this hydrogen fueled machine include: 1) capability of integration with coal based IGCC power plants that are ready for carbon dioxide (CO<sub>2</sub>) sequestration, 2) fuel flexibility for operation on 100% hydrogen and conventional coal derived synthesis gas), 3) emissions of oxides of nitrogen at less than 3 ppm (at 15 % oxygen), and 4) combined cycle efficiency equivalent to that of the SOTA machine fueled with natural gas. Any exceptions or deviations from these goals should be clearly explained and justified.

The DOE goal is advanced coal based power systems with efficiencies in the 45 – 50 % (HHV) range, that cost less than \$1000 /kW, and that are ready for commercial deployment by 2010. The DOE FE Turbine Program plans to contribute to this efficiency goal by demonstrating, by 2010, a 2 – 3 percentage point increase in combined cycle efficiency when compared to the current combined cycle efficiency for large frame machines fueled with coal derived syngas. Applications must address how new turbine subsystems, components, or technology could be tested or validated by 2010 to demonstrate incremental performance improvements towards this efficiency goal in a coal-based IGCC power plant application. The turbine development program should culminate in 2015 with a machine, designed for hydrogen and coal derived syngas fuels, that can attain the equivalent efficiency realized in current F-frame or G-frame machines when fueled with natural gas fuels. It is anticipated that by 2015 this efficiency improvement will amount to 3 – 5 percentage points increase in combined cycle efficiency when compared to the current combined cycle efficiencies for large frame machines when fueled with coal derived syngas. Additionally, successful applicants will show in a preliminary test plan how their advanced subsystems, components or technology could be tested and validated at the DOE's FutureGen project during the 2012 – 2015 operation and test phase. Applications should clearly address the ability to attain these goals.

To facilitate the 10 year development timeline and to minimize cost, it is anticipated that successful applicants will use exiting components of SOTA machines (rotors, compressors and ancillary sub-systems) to the extent possible, including component redesign to optimize combustion and maximize work extraction with hydrogen based fuels. Deviation to this suggested approach will be accepted but must be justified.

Higher risk advanced turbine concepts that minimize emissions or increase efficiency and power output can be proposed in this topic area. However it is required that the applicant propose, plan, and cost these alternate advanced concepts as options and parallel efforts to the main program. It is requested that work to fully integrate the air separation unit with the turbine compressor be addressed and presented as one of the advanced concepts to be investigated. Alternate advanced concepts that are investigated as parallel efforts in Phase I and Phase II will be considered for addition to the main program in Phase III.

DOE recognizes the intrinsic conflict, in certain cases, between attaining goals for efficiency, emissions and cost. It is also acknowledged that there are various ways to attain DOE goals for overall system performance. A relevant example of this conflict is the dilemma between NOx prevention, NOx control and higher efficiency. Other conflicts can exist between efficiency and capital cost. Applicants should demonstrate in the application how these conflicts and trade-offs will be managed to develop an advanced turbine for a coal based system that best meets DOE's overall goals stated above.

#### Application Development and Project Implementation

Applications in Topic Area 1 must include a phased approach showing a logical organization of work and that allows for "go" and "no-go" decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation entitled "General Guidance for Preparing the Research & Development Implementation Plan".

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as full-scale, pre-commercial testing, could be supported through other competitive initiatives.

It is expected that in this Topic Area Phase I efforts will be between 1 and 3 years, Phase II efforts will be between 2 and 4 years, and Phase III efforts will be between 2 and 4 years. These periods of performance are intended to be consistent with the goal of providing a commercial offering in the 2015 time frame.

#### Topic Area 2: Turbines and Combustors for Oxy-Fuel Rankine Cycle Systems.

Studies<sup>1</sup> indicate that advanced power systems that utilize nearly pure oxygen as the oxidant

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<sup>1</sup>“ Advanced Fossil Power Systems Comparison Study,” Final Report; E. Parsons (NETL), W. Shelton and J. Lyons

and gasification-based coal derived gaseous fuels are an attractive approach to highly efficient zero emissions coal-based power systems that capture and sequester carbon dioxide. In these systems, the oxidant and fuel are combusted to create a working fluid for the turbine. The working fluid will be composed mostly of water, CO<sub>2</sub>, and trace constituents. The design of these systems would facilitate the capture of 100 % of the CO<sub>2</sub>, the Clean Air Act criteria pollutants and also other, unregulated pollutants.

The studies have shown that these systems have the potential to reach nominal efficiencies in the 30 % range with today's steam turbines when fueled with natural gas and capturing the CO<sub>2</sub>. With anticipated advances in gasification, oxygen separation, and steam turbine technology these systems are expected to achieve efficiencies in the 50 – 60 % (HHV) range when fueled with coal in the 2015 time frame.

To further pursue this topic area the government is requesting applications that address two sub topic areas. These sub topics areas are:

#### Sub-Topic Area A: Coal-Based Oxy-Fuel System Evaluation and Combustor Development.

Applications are requested that evaluate, through system studies, a suite of coal-based oxy-fuel systems options and then use selected state points (temperature, pressure, species and mass flow) from these studies to design, fabricate and test an appropriately sized oxy-fuel combustor or combustor module. The goal of this sub-topic area is to further develop and test oxy-fuel combustors that can operate in zero emission coal based systems.

This suite of system configurations to be evaluated shall include, but is not limited to, progressively advanced subsystems such as turbine technology, oxygen separation technology, gasification technology and other sub-systems that could be included to enhance performance. Sub system performance parameters used in these models should be based on referenced documents or communications. The alternative configurations shall be sophisticated to the extent that all anticipated cooling and reheat streams are accounted for as well as various degrees of sub system integration to include, if appropriate, but not be limited to turbines and air separation systems. System models are required to show a high degree of detail and integration in their models by using input and performance data from various subsystem vendors (gasifiers, turbines, ASU, etc).

Systems should be evaluated that consider alternate locations for CO<sub>2</sub> extraction (low pressure vs. high pressure) that could minimize the penalty for CO<sub>2</sub> pressurization. System configurations that produce excess hydrogen for export should also be evaluated. System configurations that capture carbon and produce electricity or hydrogen and could be readily deployed, retrofitted into existing fossil fueled power plants, or take advantage of existing commercial / industrial infrastructure are also of interest for study and evaluation.

Successful applicants will be required to follow the quality standards provided in the most current revision of the publication "Quality Guidelines for Energy System Studies" as prepared by NETL's Office of Systems and Policy Support. The January 30, 2005 revision of this document can be found as attachment A. Applicants are highly encouraged to use the appropriate version of Aspen Plus® process simulation software for the government funded system studies.

A major requirement of this topic area is the design, fabrication and testing of an appropriately sized oxy-fuel combustor or combustor module based on the data and results of selected system studies and the evaluations discussed above. It is anticipated that the tested combustor will support the development of oxy-fuel combustors that lead to large scale (300 – 600 MW nominal) power systems for coal based fuels. Applications should include a logical plan to show how state points from the system studies will be used as input data for combustor design and testing. This plan should include, conceptually, what might be expected in terms of hardware design, test plans (independent and dependent parameters, test time and data measurement), and an assessment of anticipated technical issues. It is expected that preliminary planning and design of the combustor could begin in parallel with the system studies, however the final combustor and test plan design would wait to the completion of the system studies and government approval. While it is anticipated that the system studies may suggest a range of combustor sizes only one Government-funded combustor would be built and tested which should be designed to address a range of fuel compositions and operating points.

Combustor design, and the logical testing and development of this component must take into account future turbine integration. Appropriately sized combustors and or combustor modules for testing should be proposed that lead to combustor systems that integrate with large-scale turbines that take into account exhaust temperature and flow rate profiles and distributions. Any reheat combustor design and testing should also be proposed. Combustors developed under this program shall include the capability to utilize fuels with a range of carbon-to-hydrogen ratios and demonstrate the ability to vary that ratio on a load following or varying hydrogen export basis. Combustor testing shall be based on appropriate fuels to include actual coal derived synthesis gas, simulated coal derived synthesis gas, high-hydrogen fuels, and carbon monoxide. Other candidate test fuels will be considered but need to be justified.

Applications must include an option to produce a plan that would allow for the design, fabrication of an appropriately sized combustor for testing at the DOE's FutureGen project. Actual testing would occur in the 2012 – 2015 time frame.

#### Application Development and Project Implementation

Applications in Topic Area 2, Sub-topic Area A must include a phased approach showing a logical organization of work and that allows for "go" and "no-go" decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation titled "General Guidance for Preparing the Research & Development Implementation Plan".

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as full-scale pre-commercial testing, could be supported through other competitive initiatives.

It is expected that in this Sub-topic Area Phase I efforts will be between 12 and 18 months, Phase II efforts will be between 12 and 18 months, and Phase III efforts will be 12 months with an optional 12 to 24 month testing program at DOE's FutureGen project. These periods of performance are intended to be consistent with the goal of enabling a commercial offering in the 2011 time frame.

#### Sub-Topic Area B: Turbines for Oxy-Fuel Rankine Cycle Coal Based Power Systems.

Applications are solicited to produce advanced turbines for oxy-fuel based power systems. Successful applications will show a logical development of turbine technology culminating with commercially ready machines in a 2015 time frame. It is anticipated that systems that utilize the subject turbine could achieve system efficiencies in the high 50s to high 60s range (depending on fuel: coal or natural gas) and require turbine working fluids in the 3000 – 3200 °F range. Turbines developed through this program should strive to enable large (300 – 600 MW) advanced coal based power systems to achieve overall plant efficiencies in the 50 – 60 % (HHV) range.

Applicants are requested to propose a limited number of system studies to assess likely operating conditions for these machines. These system models should be based on subsystems that are progressively advanced through time to show potential improvements in efficiency and cost of electricity.

It is envisioned that the machines will incorporate high pressure, intermediate pressure and low pressure stages. These turbines are expected to operate on working fluids comprised mostly of H<sub>2</sub>O and CO<sub>2</sub> as a result of the direct combustion of oxygen and gaseous fossil fuels. Depending on the coal based gasification process, gas stream cleanup and combustion process the potential exists for small amounts O<sub>2</sub>, and compounds of nitrogen, sulfur and trace contaminants in the working fluid. Options for working fluid reheat should be considered in the design. Developers should evaluate the effect of various CO<sub>2</sub> / H<sub>2</sub>O compositions on the aerodynamic blade designs. Final turbine exhaust should be conducive to the separation and capture of CO<sub>2</sub> in a way that promotes high overall system efficiencies and minimizes the penalty of CO<sub>2</sub> compression.

It is anticipated that the most challenging aspect of this turbine development effort will be rotating blade materials. Applications must discuss how these and other material issues will be addressed. Synergies between existing material development efforts or existing technology should be leveraged. For instance it is envisioned that the low temperature condition (~1350 – 1500 °F) in the application of oxy-fuel turbine technology would be similar to the high temperature condition in ultra supercritical steam turbines. Consequently it is desirable to leverage possible synergies in materials developed for ultra supercritical steam turbines (reference US DOE FE Solicitation DE-PS26-04NT42249-2B).

#### Application Development and Project Implementation

Applications in Topic Area 2, Sub-topic B must include a phased approach showing a logical organization of work and that allows for “go” and “no-go” decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a

major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation titled “General Guidance for Preparing the Research & Development Implementation Plan”.

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as full-scale pre-commercial testing, could be supported through other competitive initiatives.

It is expected that in this Sub-topic Area Phase I efforts will be between 1 and 3 years, Phase II efforts will be between 2 and 4 years, and Phase III efforts will be between 2 and 4 years. These periods of performance are intended to be consistent with the goal of enabling a U.S. commercial offering in a 2015 time frame.

### Topic Area 3: Mega-Watt Scale Turbines for Hydrogen Utilization.

To support the office of Fossil Energy’s goals for zero emission (carbon and criteria pollutants) coal based power generation and to support hydrogen utilization as a result of potential hydrogen exports from FutureGen type power systems the government is seeking applications that develop: 1) Mega-Watt scale (MW-scale) turbine power systems that can efficiently burn hydrogen with reduced NO<sub>x</sub> (< 3 ppm) while maintaining or extending simple cycle efficiencies, 2) combustion systems that can be retrofitted into existing MW-scale turbines and utilize hydrogen to augment existing fuels and combustion systems to yield NO<sub>x</sub> emission below 3 ppm and 3) MW-scale turbines that operate under reducing conditions for integration into coal based co-production systems. For the purpose of this topic area a MW-scale turbine implies machines larger than 1 MW and smaller than 100 MW that are typically used for electric power production and mechanical drive applications.

#### Sub-Topic Area A: Development of Highly Efficient Zero Emission Hydrogen Combustion Technology for Mega-Watt Scale Turbines.

The government is requesting applications that present a logical plan for the development of combustion systems that can be installed or retrofitted into existing turbines that can utilize hydrogen as a fuel, maintain or extend current levels of efficiency, reduce emissions of oxides of nitrogen to less than 3 ppm (@ 15 % O<sub>2</sub>) and eliminate the emissions of carbon dioxide. It is envisioned that turbines developed through this subtopic area would be applicable to electrical power generation in the less than 100 MW size range and for mechanical power applications. It is requested that machines developed through this topic area be fuel flexible making them reliable and available with their traditional fuels and applications.

Since hydrogen fuel is a significant departure from the conventional fuel (natural gas) typically used in these machines it is requested that the emissions (NO<sub>x</sub> prevention) control approach be presented as a parallel effort to the efficiency improvement approach. The intent here is to potentially allow near term technology (like the prevention of NO<sub>x</sub> formation) to be accelerated and be deployed sooner independent of efficiency improvement efforts. The government recognizes the intrinsic link between NO<sub>x</sub> prevention and efficiency improvements, consequently successful applications would show how these two performance issues (NO<sub>x</sub> prevention and efficiency) will be brought together to produce a machine with low NO<sub>x</sub> emissions and high efficiency.

### Application Development and Project Implementation

Applications in Topic Area 3, Sub-topic Area A must include a phased approach showing a logical organization of work and that allows for “go” and “no-go” decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation titled “General Guidance for Preparing the Research & Development Implementation Plan”.

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as pre-commercial demonstrations, could be supported through other competitive initiatives.

It is expected that in this Sub-topic Area Phase I efforts will be between 12 and 18 months, Phase II efforts will be between 24 and 36 months, and Phase III efforts will be between 12 and 24 months. These periods of performance are intended to be consistent with the goal of providing a commercial offering in the 2010-2011 time frame.

Sub-Topic Area B: Development of Hydrogen Combustion Systems for Fuel Augmentation to Reduce NOx in MW-scale Combustion Turbines.

Applications are requested that develop technology for the use of hydrogen in MW-scale combustion turbines to reduce NOx emissions. Research has suggested that the tactical introduction of hydrogen can bring about mechanisms that reduce the formation of NOx in turbine exhaust. Applications are requested that show how these mechanisms and know-how can be developed and exploited so that the required technology can be implemented in new machines and back fitted or retrofitted into existing turbines.

It is envisioned that this technology could be developed and introduced by original equipment manufacturers or organizations with the skills and expertise to provide combustion system retrofits.

It is expected that the utilization of hydrogen in a fuel augmentation application will provide solutions to technical issue associated with the management and implementation of a hydrogen infrastructure. Developing this knowledge is an essential underpinning to a hydrogen economy.

### Application Development and Project Implementation

Applications in Topic Area 3, Sub-topic Area B must include a phased approach showing a logical organization of work and that allows for “go” and “no-go” decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and

Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation titled “General Guidance for Preparing the Research & Development Implementation Plan”.

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as pre-commercial demonstrations, could be supported through other competitive initiatives.

It is expected that in this Sub-topic Area Phase I efforts will be between 12 and 18 months, Phase II efforts will be between 12 and 24 months, and Phase III efforts will be between 18 and 24 months. These periods of performance are intended to be consistent with the goal of providing a commercial offering in the 2010-2011 time frame.

Sub-Topic Area C: MW-Scale Turbines for Power and Hydrogen Co-Production in Industrial Applications.

Applications are solicited for the evaluation and assessment of turbine-based coal fueled systems to produce co-products (electricity, hydrogen or synthesis gases) in industrial applications. The goal of this topic area is to produce a comprehensive assessment and evaluation of the opportunities and issues associated with the coal based production of electricity and hydrogen in industrial applications. The evaluation and assessment should be done on coal based gasification systems in the 50 – 100 MW<sub>e</sub> (equivalent) size range that show high efficiency, ultra low emissions of criteria pollutants (< 3 ppm NO<sub>x</sub>) and at reduced cost while generating co products. Other size ranges will be considered if appropriately justified. The assessment should include: industrial market applicability, potential market penetration, identification of system configurations for each application with the associated co-products, efficiency for each configuration and application, and emission profiles of criteria and non-regulated pollutants.

The turbines utilized in these configurations are expected to operate under a range of reducing conditions and require significant modifications to achieve higher efficiencies, reduced emissions and operate in a co production mode<sup>2</sup>. Successful application will identify and present multiple turbine suppliers who have potential products applicable to these systems, can identify the technical issues associated with the required modifications for these applications and propose an R&D plan, budget estimate and schedule to produce these turbines.

2) “An Evaluation of a Partial Oxidation Concept for Combustion Turbine Power Systems”, Newby et al, ASME paper 97-AA-24, 1997

It is expected that the industrial processes requirements will determine the most appropriate co product gas stream. Likewise it is anticipated that this co product gas stream will drive the selection and type of the gasification process used in these processes. Successful applications will identify potential gasification technologies that have the most relevance to the industrial processes under evaluation.

Successful applications will show how cost reduction and high efficiency will be achieved by considering all aspects of system integration and technology advances and improvements. This includes, but is not limited to, waste heat recovery, oxygen generation, reheat, overall plant integration, and turbine and air separation unit integration. Expected advances in oxygen separation technology and with turbine integration should be considered were appropriate for advanced embodiments of appropriate concepts.

#### Application Development and Project Implementation

Applications in Topic Area 3 Sub-topic Area C are expected to be system studies to identify research and development requirements and technology opportunities. It is expected that this effort will be between 18 and 24 months.

#### Topic Area 4: Novel Concepts for the Compression of Large Volumes of Carbon Dioxide.

Zero emission power plants that are designed to capture CO<sub>2</sub> have a significant separation and compression penalty. This penalty can range from 8 – 12 % points depending on the exhaust state (temperature, pressure and purity) of the carbon dioxide prior to compression. Final pressures for the compressed CO<sub>2</sub> would typically be on the order of 1,500 psia in a super critical state for pipe line transportation. Typically flow rates are on the order of 600,000 – 700,000 lbm/hr (based on a 400 MW IGCC).

To minimize this penalty the government is seeking novel concepts for the compression of large volumes of CO<sub>2</sub> that would be more efficient and cost less than today's options. Applications must provide a clear technical explanation detailing the cost and efficiency benefits for the proposed approach. Applications must provide an option for the development of a test plan for the testing of their technology at the full- or module-scale at the DOE's FutureGen project in the 2012 – 2015 time frame.

#### Application Development and Project Implementation

Applications in Topic Area 4 must include a phased approach showing a logical organization of work and that allows for “go” and “no-go” decisions at the conclusion of each phase. The following phases are required: Phase I–Conceptual Design and R&D Implementation Plan: Concept to Commercial Deployment; Phase II–Detailed Design and Validation Test Program; and Phase III– System Fabrication and Testing. It is expected that applications will have more details regarding Phase I work. Since Phases II and III are contingent on Phase I results specific details are not expected. However Phases II and III must provide an anticipated scope, level of effort, and approach. The R&D Implementation Plan, a major deliverable of Phase I, will provide the basis for negotiating and authorizing Phase II work and anticipating the magnitude of the Phase III effort. Offers are encouraged to read the section of the solicitation titled “General Guidance for Preparing the Research & Development Implementation Plan”.

Technologies that are developed beyond the conceptual phase may be submitted as Phase II and Phase III applications. Technologies that are already developed beyond the detailed design phase may be submitted as Phase III applications. It is anticipated that work subsequent to Phase III, such as full-scale pre-commercial testing, could be supported through other competitive initiatives.

It is expected that in this Topic Area Phase I efforts will be between 12 and 18 months, Phase II efforts will be between 18 and 24 months, and Phase III efforts will be between 12 and 24

months. These periods of performance are intended to be consistent with the goal of providing a commercial offering in the 2010-2011 time frame.

#### Topic Area 5: Advanced Brayton Cycles for Highly Efficient Zero Emission Systems.

The government seeks applications that present a plan for the development of advanced Brayton cycle turbine concepts. The application must present concept(s) or approach(s) that will take the state of the art Brayton Cycle (in a combined cycle application) from today's 58 – 60 combined cycle (LHV) efficiency to 65 – 67 equivalent efficiency or higher. The proposed machine(s) must consider integration into advanced coal based and natural gas based zero emission systems with the ability to attain a 60 % (HHV) efficiency and 75 % (LHV) efficiency respectively (prior to carbon separation and capture). Both systems must consider options for zero CO<sub>2</sub> emissions and show how this would affect the turbine design, and operation and overall system performance. The progressive development of other subsystems (gasifiers, air separation unit, membrane separation, fuel cells, and etc.) will effect and should be accounted for in the performance of these advance systems when integrated with and advanced Brayton Cycle. Since the purpose of this topic area is to promote the development of advanced Brayton cycles the system performance and advancement attributed to the Brayton cycle must be clearly delineated. The concept(s) should show how the machine would be optimized at the initial design stage for individual fossil fuels (coal synthesis gas, H<sub>2</sub> derived from coal, and natural gas) or made fuel flexible. It is expected that these machines, and associated variations, will be fully integrated depending on the application.

The reduction of NO<sub>x</sub> emissions is an important goal for the advanced Brayton cycle evaluated under this topic area. The base line goal for NO<sub>x</sub> emissions is less than 3 ppm (at 15 % O<sub>2</sub>). Brayton cycles and systems that can efficiently surpass this limit while maintaining reasonable values of other constraints will be considered favorably. DOE recognizes the intrinsic conflict, in certain cases, between attaining goals for efficiency, emissions and cost. It is also acknowledged that there are various ways to attain DOE goals for overall system performance. A relevant example of this conflict is the dilemma between NO<sub>x</sub> prevention, NO<sub>x</sub> control and higher efficiency. Other conflicts can exist between efficiency and capital cost. Successful applications will demonstrate how these conflicts and trade-offs will be managed to develop an advanced Brayton cycle turbine for a coal based system that meets DOE's overall goals stated above. Applications should consider carefully the trade-off between NO<sub>x</sub> prevention in the turbine combustor and NO<sub>x</sub> control from the system and all associated penalties. These trade-offs should be managed to produce advanced clean and low cost systems with high efficiencies.

Approaches that are expected to bring about these advances may include but are not limited to: increasing the turbine rotor inlet temperature to 3100 °F or higher, increasing pressure ratio to 35 or higher, augmentation of the working fluid, pressure gain combustion, inter-stage reheat, inter-cooling, recuperation, air separation integration and / or CO<sub>2</sub> compression integration, and etc.

Work awarded as a result of successful applications will conduct system studies with proposed advanced Brayton cycles, identify state points (mass flow, composition, temperature and pressure) at key stages in the advanced Brayton cycle, assess technology issues for: feasibility, R&D requirements and cost, and provide knowledgeable input on developmental feasibility from original equipment manufactures and / or consultants.

#### Application Development and Project Implementation

Applications in Topic Area 5 are expected to be system studies to identify research and

development requirements. It is expected this effort will be between 18 and 24 months.

#### General Guidance for Preparing the Research & Development Implementation Plan

A Research & Development Implementation Plan is a required deliverable in all Phase I efforts and shall be submitted to DOE for approval within six months of project award. This plan shall outline the project plan from Concept to Commercial Deployment. This plan shall document alternative concepts and configurations to be examined; proposed testing and validation test plans, trade-off analyses and evaluation methods, criteria for decision making processes, project milestones, go/no go decision points, task interdependencies, critical path for product development, and other relevant project activities. The R&D Implementation Plan must include a budget estimate for completing Phase II and III work. (this budget is an estimate and will not represent the final negotiated cost estimate for Phase II and III work). Although this R&D Implementation Plan is required in Phase I, the plan shall detail activities in Phase II and Phase III in addition to Phase I. This plan shall be prepared using commercially available project management software such as Microsoft Project.

#### General Guidance for preparing System Studies

Successful applicants will be required to follow the quality standards provided in the most current revision of the publication "Quality Guidelines for Energy System Studies" as prepared by NETL's Office of Systems and Policy Support. The January 30, 2005 revision of this document can be found as attachment A. Applicants are highly encouraged to use the appropriate version of Aspen Plus® process simulation software for the government funded system studies.

## **PART II - AWARD INFORMATION**

### **A. TYPE OF AWARD INSTRUMENT (NOV 2004)**

DOE anticipates awarding cooperative agreements under this Program Announcement.

DOE will negotiate a Statement of Substantial Involvement prior to the award of any cooperative agreement. This statement will describe the Government's substantial involvement.

### **B. ESTIMATED FUNDING (NOV 2004)**

The Administration has requested approximately \$3,735,000 in FY 2005 for this program. The actual level of funding, if any, depends on the appropriations for this program. Total federal funding for this solicitation is estimated to be between \$11,835,000 and \$84,735,000 based on the FY05 budget and the planned FY06-FY15 budget requests.

### **C. MAXIMUM AND MINIMUM AWARD SIZE (NOV 2004)**

The maximum total estimated award value (including cost share) for this solicitation is \$100,000,000. There is no minimum award value for this solicitation

### **D. EXPECTED NUMBER OF AWARDS (NOV 2004)**

DOE anticipates making approximately 9 - 13 awards under this announcement. However, the Government reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this announcement and will award that number of financial assistance instruments which serves the public purpose and is in the best interest of the Government.

It is anticipated that there will be two awards in Topic Area 1, between one and three in Topic Area 2, between three and five awards in Topic Area 3, one award in Topic Area 4, and two awards in Topic Area 5.

### **E. ANTICIPATED AWARD SIZE (NOV 2004)**

Individual awards could range from several hundred thousand dollars to several million dollars (i.e. 300-500K up to 5-50M.)

\* The following is the anticipated individual award size for:  
Topic Area 1 - \$50,000,000.

\* The following is the anticipated individual award size for:  
Topic Area 2  
Sub-Topic Area A - \$4,100,000  
Sub-Topic Area B - \$50,000,000

\* The following is the anticipated individual award size for:  
Topic Area 3  
Sub-Topic Area A - \$7,000,000  
Sub-Topic Area B - \$3,500,000  
Sub-Topic Area C - \$1,000,000

\*The following is the anticipated individual award size for:

Topic Area 4 - \$8,000,000

\* The following is the anticipated individual award size for:

Topic Area 5 - \$750,000

**F. PERIOD OF PERFORMANCE (NOV 2004)**

Multiple awards are anticipated. These will range in duration from 1 to 10 years. The 2 and 3 year awards may consist of 2-3 budget periods and/or phases (each 1 year in duration) with go/no go decision points at the end of each budget period and/or phase. The 4 and 5 year awards will consist of 3-5 budget periods and/or phases with go/no go decision points at the end of each budget period and/or phase.

The 5-10 year awards will consist of 5-10 budget periods and/or phases with go/no go decision points at the end of each budget period and/or phase. The budget periods and phases will be tailored to meet the technical stages of development of the technology. It is anticipated that there will be projects with various durations. For instance, Phase I – Conceptual Design and/or system study type projects could last from 1 – 3 years, Phase II – Detail Design and Validation Testing of component and equipment development projects could potentially last for 3 to 5 years, and Phase III – Component Fabrication and Testing projects could last 3-5 years. The maximum period of performance is anticipated to be Oct. 1, 2005 through Sept. 30, 2015 to coincide with the attainment some of the program goals. Applicants proposing component development projects will be encouraged to submit full three phase applications to carry the proposed component development through component level testing.

### **PART III - ELIGIBILITY INFORMATION**

#### **A. ELIGIBLE APPLICANTS (NOV 2004)**

All types of applicants are eligible to apply, except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engage in lobbying activities after December 31, 1995.

#### **B. COST SHARING - EPACT (NOV 2004)**

The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) for Phase I efforts in all Topic Areas and must come from non-Federal sources. (See 10 CFR part 600 for the applicable cost sharing requirements.)

The cost share must be at least 30% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) for Phase II efforts in all Topic Areas and must come from non-Federal sources. (See 10 CFR part 600 for the applicable cost sharing requirements.)

The cost share must be at least 50% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) for Phase III efforts in all Topic Areas and must come from non-Federal sources. (See 10 CFR part 600 for the applicable cost sharing requirements.)

#### **C. OTHER ELIGIBILITY REQUIREMENTS (NOV 2004)**

##### Energy Policy Act Eligibility Requirements.

Awards under this solicitation also are subject to the eligibility requirements stated in Section 2306 of the Energy Policy Act of 1992 (EPAAct). An applicant private sector firm shall be eligible to receive financial assistance under this section only if it is a United States-owned company, or the firm is incorporated in the United States and has a parent company which is incorporated in a country which affords to United States-owned companies: (1) opportunities comparable to those afforded to any other company to participate in any joint venture similar to the one described in this solicitation; and (2) adequate and effective protection for United States companies intellectual property rights.

In addition, the applicant must show that the project, as a whole, is in the economic interest of the United States. To fulfill this requirement, the applicant must consider the contributions of all participants in the project, including any contractors or suppliers that the applicant has named and relied upon in its application. This can be evidenced by: (1) investment in the United States in research, development, and manufacturing, such as the manufacture of major components or subassemblies in the United States; (2)

significant contributions to employment in the United States; (3) agreement with respect to any technology arising from assistance provided under this solicitation to promote the manufacture within the United States of products resulting from that technology, taking into account the goals of promoting the competitiveness of United States industry, and to procure parts and materials from competitive suppliers.

All applicants shall complete documentation providing a certification of eligibility under Section 2306 of the EAct. Based on the information received, a determination by DOE that the EAct eligibility requirements are met should be made prior to award of an agreement.

Reference: 10 CFR 600.500 – 600.505, Eligibility Determination for Certain Financial Assistance Programs--General Statement of Policy

In accordance with 10 CFR 600.30, the DOE has determined that the minimum cost share for this project is 20%. Cost sharing must meet the requirements of 10 CFR 600.123 and 10 CFR 600.224. Allowable costs for cost sharing shall be in accordance with 10 CFR 600.127 and 10 CFR 600.222.

#### Federally Funded Research and Development Center (FFRDC) Contractors.

FFRDC applicants are not eligible for an award. A list of the FFRDC contractors is available at <http://www.nsf.gov/sbe/srs/ffrdc/start.htm>. However, an application that includes performance of a portion of the work by a FFRDC contractor will be evaluated and considered for award. (See Section VIII).

Applications submitted by, or on behalf of: (1) another Federal agency; (2) a Federally Funded Research and Development Center sponsored by another Federal agency; or (3) a Department of Energy (DOE) Management and Operating (M&O) contractor will not be eligible for an award under this solicitation. An application may include performance of work by a DOE M&O contractor but that work must not exceed 15% of the total contract value. The labs will be funded through separate Field Work Applications (FWPs).

#### Other Considerations

Successful applicants of multi-year multi-phase projects will be required to prepare and submit for approval a Research Management Plan within 6 months of award. This plan will outline the work to be performed, technologies to be explored, down-selection processes, go / no go decision points, etc. for all phases of the project. This plan shall also include an Implementation Plan that details the technology development from concept to commercial deployment.

Applicants of system study type projects will be required to conform to the NETL guidelines for system studies. All system modeling efforts must use the latest version of ASPEN software and show all mass flows, stream compositions, temperatures, and pressure state points

## PART IV - APPLICATION AND SUBMISSION INFORMATION

### A. ADDRESS TO REQUEST APPLICATION PACKAGE (NOV 2004)

#### **APPLICATIONS TO BE SUBMITTED THROUGH GRANTS.GOV.**

Application forms and instructions are available at Grants.gov. To access these materials, go to <http://www.grants.gov>, select "Apply for Grants," and then select "Download Application Package." Enter the CFDA and/or the funding opportunity number located on the cover of this announcement. Select "Download Application Package," and then follow the prompts to download the application package. To download the instructions, go to "Download Application Package" and select "Instructions." **NOTE:** You will not be able to download the Application Package unless you have installed PureEdge Viewer.

### B. LETTER OF INTENT AND PREAPPLICATION (NOV 2004)

#### 1. Letter of Intent.

Applicants are requested to submit a letter of intent by April 21, 2005. This letter should include the name of the applicant, the title of the project, the name of the Project Director/Principal Investigator(s), the amount of funds requested, and a one-page abstract. Letters of intent will be used to organize and expedite the merit review process. Failure to submit such letters will not negatively effect a responsive application submitted in a timely fashion. The letter of intent should be sent by E-mail to Angela.Harshman@netl.doe.gov.

#### 2. Pre-application

Pre-applications are not required.

### C. CONTENT AND FORM OF APPLICATION – 424 (NOV 2004)

#### C1. CONTENT AND FORM OF APPLICATION IF SUBMITTED THROUGH GRANTS.GOV (NOV 2004)

You must complete the mandatory forms for this Announcement which include the **SF 424** and **Attachments** in accordance with the application instructions on Grants.gov and the additional instructions below.

#### MANDATORY FILES

#### 1. SF 424 - APPLICATION FOR FEDERAL ASSISTANCE

Applicants must complete a SF 424 application form. This form may be completed while on the Grants.gov website or it can be completed offline in its entirety. **IT IS IMPORTANT TO NOTE: Applications being submitted through Grants.gov must use the SF 424 provided by Grants.gov NOT the SF 424 provided on the NETL homepage (that would be used for an application submitted through IIPS).** The SF 424 application form can only be viewed and downloaded once PureEdge Viewer has been installed. The SF 424 application form is in a fillable format on Grants.gov so Applicants simply need to complete

all of the required fields which are indicated with an asterisk (\*) and color coded in yellow then close the document (you will then be prompted to save changes or not).

## 2. ATTACHMENTS

The following files must be completed and attached to the "Attachments" form under the Mandatory Documents section of this Announcement.

<u>ATTACHMENT NAME</u>	<u>FILENAME</u>
Attachment 1 - Budget	BUDGET.---
Attachment 2 - Budget Justification	BUDGET JUSTIFICATION.--
Attachment 3 - Project Summary/Abstract	PROJECT SUMMARY.doc
Attachment 4 - Project Narrative	PROJECT NARRATIVE.---
Attachment 5 - Certifications/ Assurances/Representations	CERTIFICATIONS-ASSURANCES.doc
Attachment 6 - Biographical Sketch	BIO.---
Attachment 7- Commitment Letters from Third Parties Contributing to Cost Share	CLTP.---
Attachment 8 – Disclosure of Lobbying Activities	SF-LLL

### ATTACHMENT 1 BUDGET FILE

SF 424A - Applicants must complete a budget for each budget year and a cumulative budget for the total project period.

You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work and are not precluded by the cost principles or program funding restrictions (See Section IV).

### ATTACHMENT 2 BUDGET NARRATIVE FILE(S)

Submit the following budget narrative files with your application and attach them to the Budget Narrative File(s) form. Attach your Budget file in the Mandatory block and any subaward budgets in the Optional block.

Budget Justification File.

Justify proposed direct labor, travel, consultants, large subawards, large or unique "other direct costs", equipment, etc. Provide an explanation of the source, nature, amount and availability of any proposed cost sharing. Save this information in a Word or PDF file, named "**BUDGET JUSTIFICATION.xxx**".

The following budget detail is required. Failure to provide the detailed cost information as described in the instructions will result in an incomplete application. If a minimum cost share is required by this funding opportunity

announcement, the applicant shall stipulate in the application the source and amount of cost sharing and the value of third party in-kind contributions proposed to meet the requirement.

**Subaward File.**

You must provide a separate budget (i.e., budget for each budget year and a cumulative budget) for each subawardee that is expected to perform work estimated to be more than \$100,000 or 50% of the total work effort (whichever is less). The subawardee budget should include the same Object Class Categories/Cost Classification, if applicable, listed on your budget form. Save each Subaward budget in a separate file. Use the subawardee's organizational name (up to 10 letters) as the file name.

**PERSONNEL** -- In support of the proposed personnel costs, provide a supplemental schedule that identifies the labor hours, labor rates, and cost by labor classification for each budget year. Also indicate the basis of the labor classification, number of hours, and labor rates. An example of the basis for the labor classification and number of hours could be past experience, engineering estimate, etc. An example of the basis for the labor rates could be actual rates for the individuals who will perform the work or an average labor rate for the labor classification or a departmental average rate.

**FRINGE BENEFITS** -- Provide the method used to calculate the proposed rate amount. If a fringe benefit has been negotiated with, or approved by, a Federal Government agency, provide a copy of the agreement. If no rate agreement exists, provide a detailed list of the fringe benefit expenses (e.g., payroll taxes, insurances, holiday and vacation pay, bonuses) and their associated costs. Identify the base for allocating these fringe benefit expenses.

**TRAVEL** -- For each proposed trip, provide the purpose, number of travelers, travel origin and destination, number of days, and a breakdown of costs for airfare, lodging, meals, car rental, and incidentals. The basis for the airfare, lodging, meals, car rental, and incidentals must be provided, such as past trips, current quotations, Federal Travel Regulations, etc.

**EQUIPMENT** -- Provide an itemized list of each piece of equipment, its unit costs, and the basis for estimating the cost, for example, vendor quotes, catalog prices, prior invoices, etc.

**SUPPLIES** -- Provide an itemized list of supplies; identify the quantity of each item, its unit cost, and the basis for estimating the cost, for example, vendor quotes, catalog prices, prior invoices, etc.

**CONTRACTUAL** -- Identify proposed subaward/consultant work and the cost of each subaward/consultant. Provide a detailed budget for each subawardee that is expected to perform work estimated to be \$100,000 or more, or 50% of the total work effort, whichever is less. The subawardee budget should the same level of detail as that of the applicant (i.e., by Object Class Category/Cost Classification). In addition, the following information must be provided:

**Consultants** -- Provide the hourly or daily rate along with the basis for the rate. Furnish resumes or similar information regarding qualifications or

experience. Provide a statement signed by the consultant certifying his or her availability and that the rate proposed represents its 'most favored customer' rate. If travel or incidental expenses are to be charged, give the basis for these costs.

Subcontractors -- Identify each planned subcontractor and its total proposed budget. Each subcontractor's budget and supporting detail should be included as part of the Applicant's budget narrative. In addition, the Applicant shall provide the following information for each planned subcontract: a brief description of the work to be subcontracted; the number of quotes solicited and received; the cost or price analysis performed by the Applicant; names and addresses of the subcontractors tentatively selected and the basis for their selection; i.e. low bidder, delivery schedule, technical competence; type of contract and estimated cost and fee or profit; and, affiliation with the Applicant, if any.

CONSTRUCTION -- Provide detail of construction costs, if applicable.

OTHER DIRECT COSTS -- Provide an itemized list with costs for any other item proposed as a direct cost and state the basis for each proposed item.

INDIRECT COSTS -- If indirect rates have been negotiated with or approved by a Federal Government agency, please provide a copy of the latest rate agreement. If you do not have a current rate agreement, submit an indirect cost rate application which includes the major base and pool expense groupings by line item and dollar amount. In either case, provide a breakdown of the proposed indirect costs for each of your accounting periods included in the application. Identify the rate and allocation base for each indirect cost, such as Overhead, General and Administrative, Facilities Capital Cost of Money, etc.

COST SHARING -- Identify the percentage level and source of cost sharing for the proposed project. Firm funding commitments are expected and documentation of those commitments must be included in the application. Additionally, the impact of DOE's cost share to the viability of the project must be addressed, to include justification for the need for Federal Funds.

**NOTE: The total project cost (i.e. sum of Applicant and other participants plus DOE cost shares) must be reflected in each budget form.**

A detailed estimate of the cash value (basis of and the nature, e.g., equipment, labor, facilities, cash, etc.) of all contributions to the project by each participant must be provided. Note that "cost-sharing" is not limited to cash investment. In-kind contributions (e.g., contribution of services or property; donated equipment, buildings, or land; donated supplies; or unrecovered indirect costs) incurred as part of the project may be considered as all or part of the cost share. The "cost-sharing" definition is contained in 10 CFR 600.30, 600.101, 600.123, 600.224, 600.302, 600.313 and OMB Circular A-110.

Fee or profit will not be paid to the recipients of financial assistance awards.

Additionally, foregone fee or profit by the Applicant shall not be considered cost sharing under any resulting award.

Reimbursement of actual costs will only include those costs that are allowable and allocable to the project as determined in accordance with the applicable cost principles prescribed in 10 CFR 600.127, 10 CFR 600.312 or 10 CFR 600.318.

### **ATTACHMENT 3 PROJECT SUMMARY/ABSTRACT**

The project summary/abstract must contain a summary of the proposed activity suitable for publication. It should be a self-contained document that identifies the name of the applicant, the principal investigator/project director, the project title, the objectives of the project, methods to be employed, the potential impact of the project (i.e., benefits, out comes), and participants (for collaborative projects). It should be informative to other persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate lay reader. This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary abstract must not exceed 1 page when printed using standard 8.5" by 11 paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. Save this information in an MS Word file, named "PROJECT SUMMARY.doc."

### **ATTACHMENT 4 PROJECT NARRATIVE**

This file shall include a **cover page** indicating the funding opportunity notice number, name and address of the Applicant, point of contact, telephone/FAX number/E-Mail address, title of project, and date of application.

The project narrative file must be formatted to separately address each of the sections listed below.

It is requested that the project narrative not exceed **25-50 [see table below] pages (excluding cover page, table of contents, statement of project objectives, resumes, etc.) double** spaced, 1" margins (top, bottom, left, right), and when printed will fit on size 8 1/2" by 11" paper. The type must be legible and not smaller than **12** point. Evaluators will review only the number of pages specified. Applications that contain a narrative in excess of the above page limit shall, without compelling justification, receive a significant weakness under the technical evaluation criteria.

Topic Area & Sub-Topic Area	Page Limit
1	50
2A	30
2B	50
3A	40
3B	30
3C	25
4	40
5	25

Save this information in a Word or PDF file named "**PROJECT NARRATIVE.xxx**"

Unnecessarily elaborate applications are not desired. Elaborate art work,

graphics and pictures will increase the document file size. If the project narrative file size is over 5MB, we request that you use a "Zip" file compression software, such as WinZip software, to reduce the time needed to download the file.

This file should provide a clear description of the work to be undertaken and how you plan to accomplish it. To help facilitate the review process and to insure maximum consideration of the application's merit, the applicant should review the following criteria when preparing the project narrative and must provide ALL of the specified information listed below. **This format relates to the technical evaluation criteria found in Section V.** Provide sufficient information so that the reviewers will be able to evaluate the application in accordance with these merit review criteria.

DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION.

**RELEVANCE AND JUSTIFICATION:** This section should explain the relevance of the effort to the objectives in the funding opportunity announcement. The justification for the proposed project should include a clear statement of the importance of the project in terms of the utility of the outcomes and the target community of beneficiaries

**ROLES OF PARTICIPANTS:** For multi-organizational or multi-investigator projects, describe the roles and the work to be performed by each participant/investigator, business agreements between the applicant and participants, and how the various efforts will be integrated and managed.

**PROJECT ACTIVITIES AND SCHEDULE:** This section should identify the activities/tasks to be performed and provide a time for the accomplishment of the activities/tasks and the expected dates for the release of outcomes. This section should identify any decision points and go/no-go decision criteria. Successful applicants must use this project schedule to report progress.

**EVALUATION PHASE:** This section must include a plan and metrics to be used to assess the success of the project.

**FACILITIES AND OTHER RESOURCES:** Identify the facilities (e.g., office, laboratory, computer, etc.) to be used at each performance site listed and, if appropriate, indicate their capacities, pertinent capabilities, relative proximity and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Provide any information describing the other resources available to the project such as machine and electronics shops.

**EQUIPMENT:** List important items of equipment already available for this project and, if appropriate, note the location and pertinent capabilities of each. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used.

**BIBLIOGRAPHY AND REFERENCES, IF APPLICABLE:** Provide a bibliography for any references cited in the Project Narrative section. This section must include only bibliographic citations

## STATEMENT OF PROJECT OBJECTIVES (SOPO)

The Department of Energy's, National Energy Technology Laboratory uses a specific format for Statement of Project Objectives in its awards. In announcements such as this one, where the Government does not provide a Statement of Project Objectives, the Applicant is to provide one, which the DOE will then use to generate the Statement of Project Objectives to be included in the award.

The project narrative must contain a single, detailed Statement of Project Objectives that addresses how the project objectives will be met. The Statement of Project Objectives must contain a clear, concise description of all activities to be completed during project performance and follow the structure discussed below. The Statement of Project Objectives may be released to the public by DOE in whole or in part at any time. It is therefore required that it shall not contain proprietary or confidential business information.

The Statement of Project Objectives is generally less than 10 pages in total for the proposed work. Applicants shall prepare the Statement of Project Objectives in the following format:

### TITLE OF WORK TO BE PERFORMED

(Insert the title of work to be performed. Be concise and descriptive.)

#### A. OBJECTIVES

Include one paragraph on the overall objective(s) of the work. Also, include objective(s) for each phase of the work.

#### B. SCOPE OF WORK

This section should not exceed one-half page and should summarize the effort and approach to achieve the objective(s) of the work for each Phase.

#### C. TASKS TO BE PERFORMED

Tasks, concisely written, should be provided in a logical sequence and should be divided into the phases of the project. This section provides a brief summary of the planned approach to this project.

#### PHASE I

Task 1.0 - (Title)

(Description)

Subtask 1.1 (Optional)

(Description)

Task 2.0 - (Title)

## PHASE II (Optional)

### Task 3.0 - (Title)

#### D. DELIVERABLES

The periodic, topical, and final reports shall be submitted in accordance with the attached "Federal Assistance Reporting Checklist" and the instructions accompanying the checklist.

[Note: The Recipient shall provide a list of deliverables other than those identified on the "Federal Assistance Reporting Checklist" that will be delivered. These reports shall also be identified within the text of the Statement of Project Objectives. See the following examples:

1. Task 1.1 - (Report Description)
2. Task 2.2 - (Report Description)]

#### E. BRIEFINGS/TECHNICAL PRESENTATIONS (If applicable)

The Recipient shall prepare detailed briefings for presentation to the COR at the COR's facility located in Pittsburgh, PA or Morgantown, WV. Briefings shall be given by the Recipient to explain the plans, progress, and results of the technical effort per deliverable instructions.

The Recipient shall provide and present a technical paper(s) at the DOE/NETL Annual Contractor's Review Meeting to be held at the NETL facility located in Pittsburgh, PA or Morgantown, WV.

## **ATTACHMENT 5 CERTIFICATIONS/ASSURANCES/REPRESENTATIONS FILE**

Applicants must complete the DOE certifications/assurances/representations information. Save this information in a single Word file named "**CERTIFICATIONS-ASSURANCES.doc**".

This program is covered under Title XX through XXIII of the Energy Policy Act (EPACT) of 1992. If an applicant is a business entity other than an organization of the type described in 501(c)(3) of the Internal Revenue Code of 1954, the applicant must complete the form set with the EPACT Representation and provide the appropriate EPACT Representation, (i.e., EPACT Representation for Awards Under \$100,000 or EPACT Representation for Awards of \$100,000 or more). These form sets can be found at <http://grants.pr.doe.gov>.

## **ATTACHMENT 6 BIOGRAPHICAL SKETCH**

Provide a biographical sketch for the project director/principal investigator, and co-project directors/principal investigators. Save this information in a single Word or PDF file, named "**BIO.xxx**". The biographical information must not exceed 3 pages for each person when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must

include:

Education. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Positions: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. A list of up to three publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically.

Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than 5 professional and scholarly activities related to the effort proposed.

#### **ATTACHMENT 7 COMMITMENT LETTERS FROM THIRD PARTIES CONTRIBUTING TO COST SHARING**

The applicant must have firm funding commitment letters from third parties expected to contribute to cost sharing. At the time the application is submitted, the applicant must identify for each participant providing cost sharing: 1) the name of the organization; 2) the proposed dollar amount to be provided; 3) the amount as a percentage of the total project cost; and 4) the proposed cost sharing - cash, services, or property. For projects with multiple cost sharing partners, summarize the information in a table format. Provide the information in a Word file named "CLTP.doc". By submission of the application, the applicant is providing assurance that it has signed letters of commitment. Successful applicants must submit the signed letters of commitments within 15 calendar days of notification of selection (See Section IV Submissions from Successful Applicants).

#### **ATTACHMENT 8 DISCLOSURE OF LOBBYING ACTIVITIES (SF-LLL)**

If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

#### **C2. CONTENT AND FORM OF APPLICATION IF SUBMITTED THROUGH IIPS (NOV 2004)**

If you are unable to submit your application through Grants.gov, you may submit your application through the DOE Industry Interactive Procurement System (IIPS) at <http://e->

[center.doe.gov](http://center.doe.gov) . Instructions on how to submit an application or an application amendment and how to register, submit questions, and view questions and answers are located on the web site at <http://e-center.doe.gov>, click on the “Help” button and click on “Frequently Asked Questions”.

**Applicants must complete the files as identified in Article C1 above with the exception of the SF 424 which must be downloaded from the IIPS web site at:**

[Click here for application form.](#)

Prepare all the required files in accordance with the instructions in C1 in this announcement prior to starting the transmission process. Submit the entire application package in one IIPS session (i.e., do not logoff before all the files are submitted).

When you are ready to submit your application, go to <http://e-center.doe.gov> and complete the IIPS cover page. Enter the project title and the principal investigator/project director, if any, in the “Subject” block. Then attach each file in the corresponding block in accordance with the following:

**MANDATORY FILES**

**FILENAME**

Attachment 1 - Application (SF 424)	APPLICATION.pdf
Attachment 2 - Budget	BUDGET.pdf
Attachment 3 - Budget Justification	BUDGET JUSTIFICATION.doc
Attachment 4 - Project Summary/Abstract	PROJECT SUMMARY.doc
Attachment 5 - Project Narrative	PROJECT NARRATIVE.doc
Attachment 6 - Certifications/Assurances/ Representations	CERTIFICATIONS-ASSURANCES.doc

**ADDITIONAL FILES**

Attachment 7 - Biographical Sketch	BIO.---
Attachment 8 - Commitment Letters from Third Parties Contributing to Cost Share	CLTP.---
Attachment 9 – Disclosure of Lobbying Activities	SF-LLL

**Electronic Signature** - Applications submitted through IIPS constitute submission of electronically signed applications. The name of the authorized organizational representative (i.e., the administrative official, who, on behalf of the proposing organization, is authorized to make certifications and assurances or to commit the applicant to the conduct of a project) must be typed in the signature block on the form to be accepted as an electronic signature. Do not submit a scanned copy of the signed document.

**D. SUBMISSION DATES AND TIMES (NOV 2004)**

**1. Pre-application Due Date**

Pre-applications are not required.

**2. Application Due Date**

Applications must be received by May 13, 2005, not later than 8:00 PM Eastern Time. You are encouraged to transmit your application well before the deadline. **APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

**E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS - NONE (NOV 2004)**

The Department anticipates that no additional submissions will be required. However, it reserves the right to request additional or clarifying information for any reason deemed necessary.

**E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS (NOV 2004)**

Successful applicants must submit the information listed below not later than 14 calendars days after notification of selection. Applicants who fail to provide the information within the required time period may be eliminated from further consideration.

<b>What to submit</b>	<b>Required Form or Format</b>
<p><b><u>Budget for DOE Federally Funded Research and Development Center (FFRDC) Contractor, if applicable.</u></b></p> <p>If a DOE FFRDC contractor is to perform a portion of the work, provide a DOE Field Work Application in accordance with the requirements in DOE Order 412.1 Work Authorization System (See <a href="http://grants.pr.doe.gov">http://grants.pr.doe.gov</a>).</p>	<p>DOE Field Work Application form at <a href="http://grants.pr.doe.gov">http://grants.pr.doe.gov</a>.</p>
<p><b><u>Commitment Letters from Third Parties Contributing to Cost Sharing</u></b></p> <p>If a third party is to provide all or part of the required cost sharing, provide a signed letter of commitment.</p>	<p>No special format.</p> <p>See Section IV.C, Commitment Letters from Third Parties Contributing to Cost Sharing.</p>
<p><b><u>Environmental Questionnaire</u></b></p> <p>You must complete and submit an environmental questionnaire.</p>	<p>This form is available at:</p> <p><a href="http://www.netl.doe.gov/business/forms/451_1-1-3.doc">http://www.netl.doe.gov/business/forms/451_1-1-3.doc</a></p>
<p><b><u>Civil Rights Compliance</u></b></p>	<p>This required information is available at:</p>

<p>Successful applications may be requested to submit Civil Rights Compliance information.</p>	<p><a href="http://www.netl.doe.gov/business/forms/civil_rights_compliance_documentation.doc">http://www.netl.doe.gov/business/forms/civil_rights_compliance_documentation.doc</a></p>
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**F. INTERGOVERNMENTAL REVIEW - NONE (NOV 2004)**

This program is not subject to Executive Order 12372, "Intergovernmental Review of Federal Programs".

**G. FUNDING RESTRICTIONS (NOV 2004)**

Cost Principles. Costs must be allowable in accordance with the applicable cost principles referenced in 10 CFR part 600.

Pre-award Costs. Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if such costs would be reimbursable under the agreement if incurred after the agreement is awarded. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

**H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS (NOV 2004)**

**1. Where to Submit.**

**APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV OR IIPS TO BE CONSIDERED FOR AWARD.**

**Preferred Submission Method:** Submit electronic applications through the "Apply for Grants" function at [www.Grants.gov](http://www.Grants.gov). If you have problems submitting your application, send an email to [support@grants.gov](mailto:support@grants.gov) or call 1-800-518-4726. (See **Article C.1** for instructions on the required content and format of an application for submission through [www.Grants.gov](http://www.Grants.gov)).

**Alternate Submission Method:** If you are unable to submit your electronic application through Grants.gov, you may submit it through the DOE Industry Interactive Procurement System (IIPS) at <http://e-center.doe.gov>. If you have problems submitting your application, send an email to [HelpDesk@pr.doe.gov](mailto:HelpDesk@pr.doe.gov) or contact the Help Desk at 1-800-683-0751 and select option 1.

**2. Grants.gov Registration Process.**

You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov (See [www.grants.gov/GetStarted](http://www.grants.gov/GetStarted)). We

recommend that you start this process as soon as possible. It may take at least 14 days to complete the entire process. Use the Grants.gov Organization Registration Checklist at <http://www.grants.gov/assets/OrganizationReqCheck.doc> to guide you through the process. We strongly recommend that you download and complete the checklist for each registration step, particularly the Central Contractor Registry (CCR) checklist, before contacting the registering entity. These checklists are found at <http://www.grants.gov/RegistrationChecklist#ccr>.

### **3. IIPS Registration Process.**

In order to submit an application through IIPS, you must be authorized by the applicant (i.e., institution or business entity) to submit an application on its behalf and you must register in IIPS. You are encouraged to register as soon as possible. You only have to register once to apply for any DOE award. To register go to <http://e-center.doe.gov>, select the IIPS System, and follow the registration instructions.

## PART V - APPLICATION REVIEW INFORMATION

### A. CRITERIA (NOV 2004)

#### 1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for an award; (2) the information required by the announcement has been submitted; (3) all mandatory requirements are satisfied; and (4) the proposed project is responsive to the objectives of the funding opportunity announcement.

#### 2. Merit Review Criteria

Applications submitted in response to this funding opportunity will be evaluated and scored in accordance with the criteria and weights listed below:

Proposed criteria and weights for technical (merit) review of applications shall be:

##### Criterion 1. Scientific and Technical Merit (50%)

Degree to which the proposed technology or methodology represents an important advancement toward achieving the "Research Objectives for this Solicitation" in the targeted Area of Interest. The degree to which the proposed work identifies and/or makes progress on new concepts, thereby increasing the likelihood of a new successful technology. The degree to which the proposed work is based on sound scientific and engineering principles. Anticipated benefits of the proposed work. Feasibility of the proposed concept.

##### Criterion 2. Technical Approach and Understanding (30%)

Adequacy and feasibility of the applicant's technical approach. Appropriateness, rationale, and completeness of the proposed Statement of Project Objectives. Adequacy of the proposed technical approach with respect to the design, manufacture and testing of proposed components and systems. Adequacy of the proposed project schedule, staffing plan and planned travel.

##### Criterion 3. Technical and Management Capabilities (20%)

Credentials, capabilities and experience of key personnel. Demonstrated corporate experience of the applicant and participating organizations in managing similar projects. Clarity, logic and likely effectiveness of project organization including subcontractors to successfully complete the project. The adequacy of the facilities and equipment to perform project tasks.

#### Budget Review Criteria

The budget evaluation, which is not point scored, is conducted to determine the completeness of the cost estimate, appropriateness and reasonableness of the cost, and to assess the applicant's understanding of the Statement of Project Objectives.

#### Environmental Review Criteria

The Environmental, Health, Safety, and Security (EHSS) Evaluation, which is not point scored, is conducted to determine the completeness of the Environmental Questionnaire, and to assess the applicant's awareness of EHSS requirements for mitigating project related EHSS risks and impacts.

### **3. Other Selection Factors**

These factors, while not indicators of the Application's merit, e.g., technical excellence, cost, Applicant's ability, etc., may be essential to the process of selecting the application(s) that, individually or collectively, will best achieve the program objectives. Such factors are often beyond the control of the Applicant. Applicants should recognize that some very good applications may not receive an award because they do not fit within a mix of projects which maximizes the probability of achieving the DOE's overall research and development objectives. Therefore, the following Program Policy Factors may be used by the Selection Official to assist in determining which of the ranked application(s) shall receive DOE funding support.

1. Desirability to select a project(s) for award of less technical merit than another project(s), if such a selection will optimize use of available funds by allowing more projects to be supported while not being detrimental to the overall objectives of the program.
2. Desirability to select a project(s) for award that represents a diversity of technology concepts and applications, as well as technical approaches.
3. Desirability to select projects that collectively represent a diversity of types of products.

The above factors will be independently considered by the Selection Official in determining the optimum mix of applications that will be selected for support. These policy factors will provide the Selection Official with the capability of developing, from the competitive funding opportunity, a broad involvement of organizations and organizational ideas, which both enhance the overall technology research effort and upgrade the program content to meet the goals of the DOE.

## **B. REVIEW AND SELECTION PROCESS (NOV 2004)**

### **1. Merit Review**

Applications that pass the initial review will be subjected to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance and Unsolicited Applications". This guide is available under Financial Assistance, Regulations and Guidance at <http://professionals.pr.doe.gov/ma5/ma-5web.nsf/?Open>

### **2. Selection**

The Selection Official will consider the merit review recommendation, program policy factors, and the amount of funds available.

### **3. Discussions and Award**

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to, (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

**C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES (NOV 2004)**

DOE anticipates notifying applicants selected for award by July 1, 2005 and making awards by Sept. 30, 2005.

## PART VI - AWARD ADMINISTRATION INFORMATION

### A. AWARD NOTICES (NOV 2004)

#### 1. Notice of Selection

DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Section IV.G with respect to the allowability of pre-award costs.)

Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

#### 2. Notice of Award

A Notice of Financial Assistance Award issued by the contracting officer is the authorizing award document. It includes, either as an attachment or by reference: 1. Special Terms and Conditions; 2. applicable program regulations, if any; 3 the application as approved by DOE/NNSA.; 4. DOE assistance regulations at 10 CFR Part 600, or, for Federal Demonstration Partnership (FDP) institutions, the FDP terms and conditions; 5. National Policy Assurances To Be Incorporated As Award Terms; and 6. a reporting checklist, which identifies the reporting requirements.

### B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS (NOV 2004)

#### 1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: <http://ecfr.gpoaccess.gov>), except for grants made to Federal Demonstration Partnership (FDP) institutions. The FDP terms and conditions and DOE FDP agency specific terms and conditions are located on the National Science Foundation web site at [www.nsf.gov](http://www.nsf.gov).

#### 2. Special Terms and Conditions and National Policy Requirements

Special Terms and Conditions and National Policy Requirements. The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements and National Policy Assurances To Be Incorporated As Award Terms are located at <http://grants.pr.doe.gov>.

Intellectual Property Provisions. The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at [http://www.gc.doe.gov/techtrans/sipp\\_matrix.html](http://www.gc.doe.gov/techtrans/sipp_matrix.html).

#### Statement of Substantial Involvement.

The awards will be cost shared financial assistance cooperative agreements with substantial DOE involvement. DOE's substantial involvement will include:

- Involvement in either the technical or business management aspects of the

project or both;

- desire to have a greater control over budget;
- option to immediately halt an activity; and
- review and approval during the project period of one stage/phase before work can begin on a subsequent stage/phase.

### **C. REPORTING**

The Reporting Requirements are identified on the Federal Assistance Reporting Checklist attached to the award agreement. See Attachment A to this funding opportunity for the proposed Checklist for this program.

## **PART VII - AGENCY CONTACTS**

### **A. CONTACTS (NOV 2004)**

Questions regarding the Funding Opportunity Announcement should be directed to Angela Harshman, (412) 386-5038, [angela.harshman@netl.doe.gov](mailto:angela.harshman@netl.doe.gov).

Questions relating to the Grants.gov system or on how to submit an application should be directed to [support@grants.gov](mailto:support@grants.gov) or 1-800-518-4726.

Questions regarding how to submit an application through IIPS can be e-mailed to the IIPS HELP Desk at [helpdesk@pr.doe.gov](mailto:helpdesk@pr.doe.gov) or by calling 1 (800) 683-0751.

### **B. ELECTRONIC QUESTIONS (NOV 2004)**

Questions regarding the content of the announcement should be submitted through the "Submit Question" feature of the DOE Industry Interactive Procurement System (IIPS) at <http://e-center.doe.gov>. Locate the announcement on IIPS and then click on the "Submit Question" button. Enter required information. You will receive an electronic notification that your question has been answered. DOE will try to respond to a question within 3 days, unless a similar question and answer have already been posted on the website.

Responses to questions may be viewed through the "View Questions" feature, button. If no questions have been answered, a statement to that effect will appear. You should periodically check "View Questions" for new questions and answers.

Questions regarding how to submit questions or view responses can be e-mailed to the IIPS HELP Desk at [helpdesk@pr.doe.gov](mailto:helpdesk@pr.doe.gov) or by calling 1 (800) 683-0751.

## **PART VIII - OTHER INFORMATION**

### **A. MODIFICATIONS (NOV 2004)**

Notices of any modifications to this announcement will be posted on Grants.gov and the DOE Industry Interactive Procurement System (IIPS). You can receive an email when a modification or an announcement message is posted by joining the mailing list for this announcement through the link in IIPS. When you download the application at Grants.gov, you can also register to receive notifications of changes through Grants.gov.

### **B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE (NOV 2004)**

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

### **C. COMMITMENT OF PUBLIC FUNDS (NOV 2004)**

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

### **D. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL (NOV 2004)**

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

### **E. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM (NOV 2004)**

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph F below, if applicable.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

Special Protected Data Statutes. This program is covered by a special protected data statute. The provisions of the statute provide for the protection from public disclosure, for a period of up to 5 years from the development of the information, of data that would

be trade secret, or commercial or financial information that is privileged or confidential, if the information had been obtained from a non-Federal party. Generally, the provision entitled, Rights in Data – Programs Covered Under Special Protected Data Statutes, (10 CFR 600 Appendix A to Subpart D), would apply to an award made under this announcement. This provision will identify data or categories of data first produced in the performance of the award that will be made available to the public, notwithstanding the statutory authority to withhold data from public dissemination, and will also identify data that will be recognized by the parties as protected data.

Intellectual Property Provisions The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at <http://www.gc.doe.gov/gcmain.html>.

#### **F. NOTICE OF RIGHT TO REQUEST PATENT WAIVER (NOV 2004)**

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver

#### **G. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES (NOV 2004)**

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

#### **H. PARTICIPATION BY FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER (FFRDC) CONTRACTORS (NOV 2004)**

Federally Funded Research and Development Center (FFRDC) contractors are not eligible for an award under this announcement, but they may be proposed as a team member subject to the following guidelines:

Authorization for non-DOE/NNSA FFRDCs. The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's authority under its award and must not place the FFRDC contractor in direct competition with the private sector.

Authorization for DOE/NNSA FFRDCs. The cognizant contracting officer must authorize in writing the use of a DOE/NNSA FFRDC contractor on the proposed project and this

authorization must be submitted with the application. The following wording is acceptable for this authorization.

“Authorization is granted for the \_\_\_\_\_ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complimentary to the missions of the laboratory, will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory, and will not place the laboratory in direct competition with the domestic private sector.”

Value/Funding. The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE/NNSA will fund a DOE/NNSA FFRDC contractor through the DOE field work application system and other FFRDC contractors through an interagency agreement with the sponsoring agency.

Cost Share. The applicant’s cost share requirement will be based on the total cost of the project, including the applicant’s and the FFRDC contractor’s portions of the effort.

The FFRDC contractor effort, in aggregate, shall not exceed 15% of the total estimated cost of the project, including the applicant’s and the FFRDC contractor’s portions of the effort.

Responsibility. The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

## **I. PROPRIETARY APPLICATION INFORMATION (NOV 2004)**

An application may include data, including trade secrets and/or privileged or confidential commercial or financial information which the applicant does not want disclosed to the public or used for any purpose other than evaluation of the application (See 10 CFR 600.15). The use and disclosure of such data may be restricted, provided the applicant marks the cover sheet of the application with the following legend and specifies the pages of the application which are to be restricted:

“The data contained in pages [ ] of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government’s right to use or disclose data obtained without restriction from any source, including the applicant.”

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

“Use or disclosure of the data set forth above is subject to the restriction on the cover page of this application.”

DOE F 4600.2  
(12/2004)  
(All Other Editions are Obsolete)

**U.S. Department of Energy  
FEDERAL ASSISTANCE REPORTING CHECKLIST**

1. Identification Number:		2. Program/Project Title:																
3. Recipient:																		
4. Reporting Requirements:	Frequency	No. of Copies	Addresses															
	<p><b>A. MANAGEMENT REPORTING</b></p> <p><input checked="" type="checkbox"/> Progress Report <input checked="" type="checkbox"/> Special Status Report</p> <p><b>B. SCIENTIFIC/TECHNICAL REPORTING *</b> (Reports/Products must be submitted with appropriate DOE F 241. The 241 forms are available at <a href="http://www.osti.gov/elink">www.osti.gov/elink</a>.)</p> <table border="0"> <thead> <tr> <th align="left">Report/Product</th> <th align="left">Form</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/> Final Scientific/Technical Report</td> <td>DOE F 241.3</td> <td rowspan="2">FG A</td> <td rowspan="2">Electronic Version to E-link&gt;</td> </tr> <tr> <td><input checked="" type="checkbox"/> Conference papers/proceedings/etc.*</td> <td>DOE F 241.3</td> </tr> <tr> <td><input type="checkbox"/> Software/Manual</td> <td>DOE F 241.4</td> <td rowspan="2">A</td> <td rowspan="2">Electronic Version to NETL&gt;</td> </tr> <tr> <td><input checked="" type="checkbox"/> Other Topical</td> <td>DOE F 241.3</td> </tr> </tbody> </table> <p>* Scientific/technical conferences only</p> <p><b>C. FINANCIAL REPORTING</b></p> <p><input checked="" type="checkbox"/> SF-269, Financial Status Report <input type="checkbox"/> SF-269A, Financial Status Report (Short Form) <input type="checkbox"/> SF-272, Federal Cash Transactions Report</p> <p><b>D. CLOSEOUT REPORTING</b></p> <p><input checked="" type="checkbox"/> Patent Certification <input checked="" type="checkbox"/> Property Certificate <input type="checkbox"/> Other</p> <p><b>E. OTHER REPORTING</b></p> <p><input type="checkbox"/> Other</p>			Report/Product	Form			<input checked="" type="checkbox"/> Final Scientific/Technical Report	DOE F 241.3	FG A	Electronic Version to E-link>	<input checked="" type="checkbox"/> Conference papers/proceedings/etc.*	DOE F 241.3	<input type="checkbox"/> Software/Manual	DOE F 241.4	A	Electronic Version to NETL>	<input checked="" type="checkbox"/> Other Topical
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<input checked="" type="checkbox"/> Other Topical	DOE F 241.3																	
<p><b>FREQUENCY CODES AND DUE DATES:</b></p> <p>A - As required; see attached text for applicability. FG - Final; within ninety (90) calendar days after the project period ends. FC - Final - End of Effort. Q - Quarterly; within thirty (30) calendar days after end of the calendar quarter or portion thereof. S - Semiannually; within thirty (30) calendar days after end of project year and project half-year. YF - Yearly; 90 calendar days after the end of project year. YP - Yearly Property - due 15 days after period ending 9/30.</p>																		
<p><b>5. SPECIAL INSTRUCTIONS:</b></p> <ul style="list-style-type: none"> <li>The forms identified in the checklist are available at <a href="http://www.netl.doe.gov/business/Financial Assistance/forms-fa.html">www.netl.doe.gov/business/Financial Assistance/forms-fa.html</a>. Alternate formats are acceptable provided the contents remain consistent with the form.</li> <li>See General Instructions for the Preparation and Submission of Reports (Jan 2005) on the following page.</li> </ul>																		