

Wabash River Coal Gasification Repowering Project

**Topical Report
July 1992 - December 1993**

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**For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
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**By
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EXECUTIVE SUMMARY

The Wabash River Coal Gasification Repowering Project (WRCGRP, or Wabash Project) is a joint venture of Destec Energy, Inc. of Houston, Texas and PSI Energy, Inc. of Plainfield, Indiana, who will jointly repower an existing 1950 vintage coal-fired steam generating plant with coal gasification combined cycle technology. The Project is located in West Terre Haute, Indiana at PSI's existing Wabash River Generating Station. The Project will process locally-mined Indiana high-sulfur coal to produce 262 megawatts of electricity.

PSI and Destec are participating in the Department of Energy Clean Coal Technology Program to demonstrate coal gasification repowering of an existing generating unit affected by the Clean Air Act Amendments. As a Clean Coal Round IV selection, the project will demonstrate integration of an existing PSI steam turbine generator and auxiliaries, a new combustion turbine generator, heat recovery steam generator tandem, and a coal gasification facility to achieve improved efficiency, reduced emissions, and reduced installation costs.

Upon completion in 1995, the Project will not only represent the largest coal gasification combined cycle power plant in the United States, but will also emit lower emissions than other high sulfur coal-fired power plants and will result in a heat rate improvement of approximately 20% over the existing plant configuration.

The Wabash Project achieved several significant milestones since the signing of the Project cooperative agreement with the DOE in July 1992, including:

- preparation and revision of the Project Management Plan and Project Evaluation Plan;
- regulatory approval (certification) for construction by the Indiana Utility Regulatory Commission;
- receipt of a Finding of No Significant Impact statement from the DOE under the National Environmental Policy Act;
- receipt of the Project air permit from the Indiana Department of Environmental Management;
- receipt of a wastewater (NPDES) permit from the Indiana Department of Environmental Management;
- completion of Budget Period 1;
- completion of site preparation work;
- initiation of construction activities;
- completion of two technical progress reviews with the DOE.

As of the end of December 1993, construction work is approximately 20% complete for the gasification portion of the Project and 25% complete for the power generation portion.

Major milestones and activities for 1994 involve procurement and construction. Detailed engineering should be complete by mid-year. Construction activities, initiated in 1993, will continue. The peak construction manpower load, over 400 on site daily will occur during the summer of 1994. Selection and training of operations personnel will also be a key activity in 1994.

To date, the Project is on schedule and within budget for a third quarter 1995 startup date.

INTRODUCTION

In September 1991 the United States Department of Energy (DOE) selected the Wabash River Coal Gasification Repowering Project (WRCGRP) for funding under Round IV of the DOE's Clean Coal Technology Program. This was followed by nine months of negotiations and a congressional review period. The DOE executed a Cooperative Agreement on July 28, 1992. The project's sponsors, PSI Energy, Inc. and Destec Energy, Inc., will demonstrate, in a fully commercial setting, coal gasification repowering of an existing generating unit affected by the Clean Air Act Amendments (CAAA). The project will also demonstrate important advances in Destec's coal gasification process for high sulfur bituminous coal. Subject to the necessary state, local and federal approvals, this project is scheduled to begin Commercial Operations in the third quarter of 1995, with a three-year demonstration period and 22 year operating period (25 years total).

The Wabash River Coal Gasification Repowering Project, a joint venture of Destec and PSI Energy, will develop, design, construct, own, and operate a coal gasification combined-cycle (CGCC) power plant. Coal gasification technology, originally developed by The Dow Chemical Company and owned by Destec, will be used to repower Unit 1 of PSI's Wabash River Generating Station in West Terre Haute, Indiana. The CGCC power plant will produce a nominal 262 net megawatts (MWe) of clean, energy-efficient capacity for PSI's customers. In the repowered configuration, PSI and its customers can additionally benefit because this project can enhance PSI's compliance plan under the CAAA regulations. The project is designed to use locally mined, high sulfur coal. Upon completion, the project will not only represent the largest CGCC power plant in operation in the United States, but will also emit significantly lower emissions than most other high sulfur, coal-fired power plants.

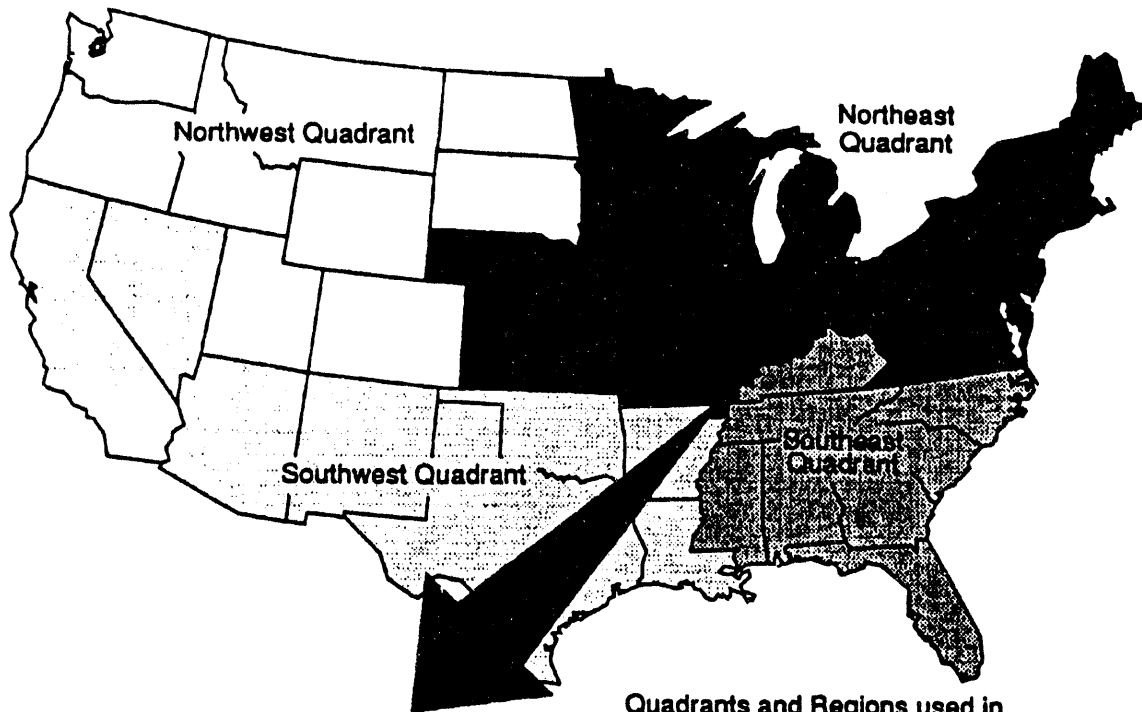
BACKGROUND INFORMATION

Project Inception and Objectives

Public Law 101-121 provided \$600 million to conduct cost-shared Clean Coal Technology (CCT) projects to demonstrate technologies that are capable of replacing, retrofitting, or repowering existing facilities. To that end, a Program Opportunity Notice (PON) was issued by the Department of Energy in January 1991, soliciting proposals to demonstrate innovative energy efficient technologies that were capable of being commercialized in the 1990's. These technologies were to be capable of (1) achieving significant reductions in the emissions of sulfur dioxide and/or nitrogen oxides from existing facilities to minimize environmental impacts such as transboundary and interstate pollution and/or (2) providing for future energy needs in an environmentally acceptable manner.

In response to the PON, 33 proposals were received by DOE in May 1991. After evaluation, nine projects were selected for award. These projects involved both advanced pollution control technologies that can be "retrofitted" to existing facilities and "repowering" technologies that not only reduce air pollution but also increase generating-plant capacity and extend the operating life of the facility.

One of the nine projects selected for funding is the project proposed by the Wabash River Coal Gasification Repowering Project Joint Venture. This proposer, a Joint Venture between PSI Energy Inc. (PSI), of Plainfield, Indiana and Destec Energy, Inc. (Destec), of Houston, Texas requested financial assistance from DOE for the design, construction, and operation of a nominal 2500 ton-per-day (262 MWe) two-stage, oxygen-blown, coal gasification combined-cycle (CGCC) repowering demonstration project. The project, named the Wabash River Coal Gasification Repowering Project, is to be located at PSI's Wabash River Generating Station in West Terre Haute, Indiana. The project location and site are shown in Figures 1 and 2. The demonstration project will utilize advanced coal gasification technology in a commercial repowering setting to repower an existing generating unit affected by the Clean Air Act Amendments of 1990. Emissions from the repowered generating unit will be reduced by greater than 90%, despite an increase in electrical generating capacity of over 150%. In addition, the project, including the demonstration phase, will last 71 months at a total proposed cost of \$396 million. The DOE's share of the project cost will be 50% or \$198 million.



Quadrants and Regions used in Programmatic Environmental Impact Analysis (DOE / PEIA-0002)

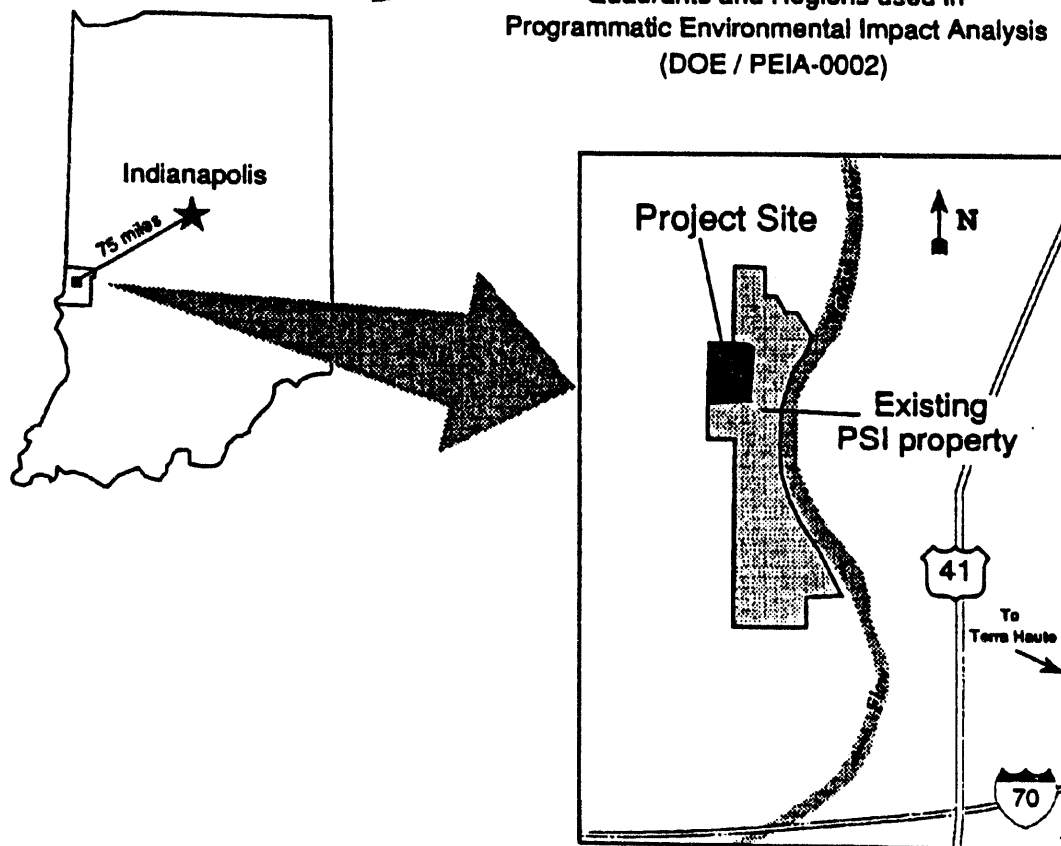


Figure 1. Project Location

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SITE MAP OF WABASH RIVER GENERATING STATION

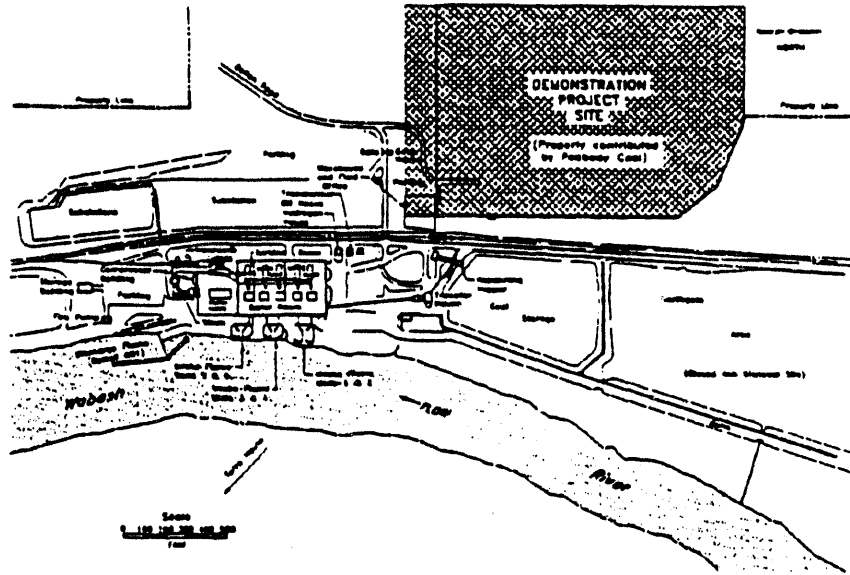


Figure 1A

PLOT PLAN

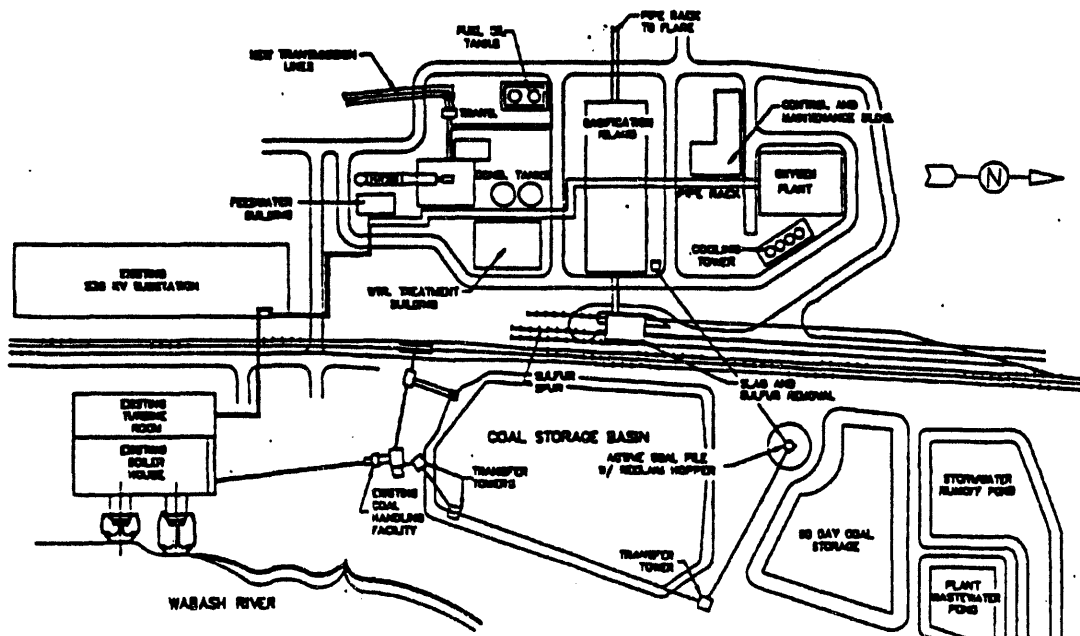


Figure 1B

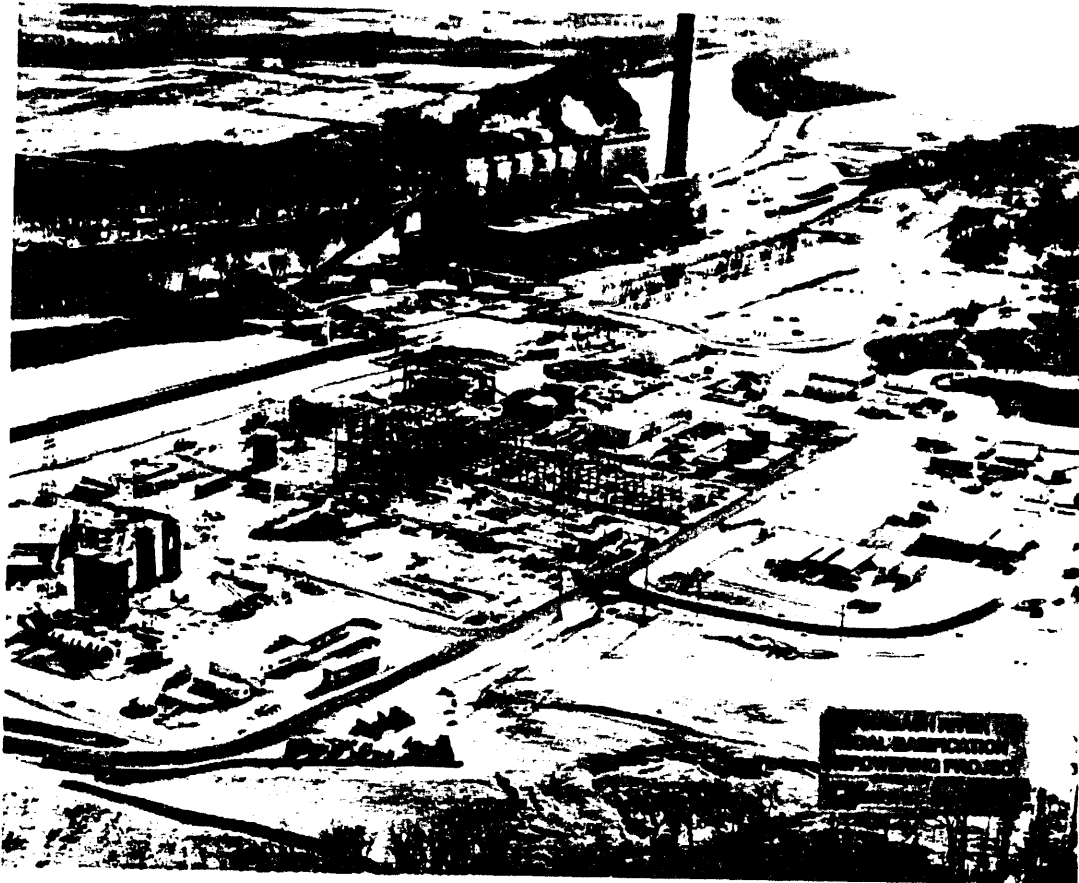


Figure 2

The CGCC system will consist of:

- Destec's oxygen-blown, entrained-flow, two-stage coal gasifier, which is capable of utilizing high sulfur bituminous coal;
- an air separation unit;
- a gas conditioning system for removing sulfur compounds and particulates;
- systems or mechanical devices for improved coal feed and all necessary coal handling equipment;
- a combined-cycle power generation system wherein the gasified coal syngas is combusted in a combustion turbine generator;
- a heat recovery steam generator.

(See Figure 3)

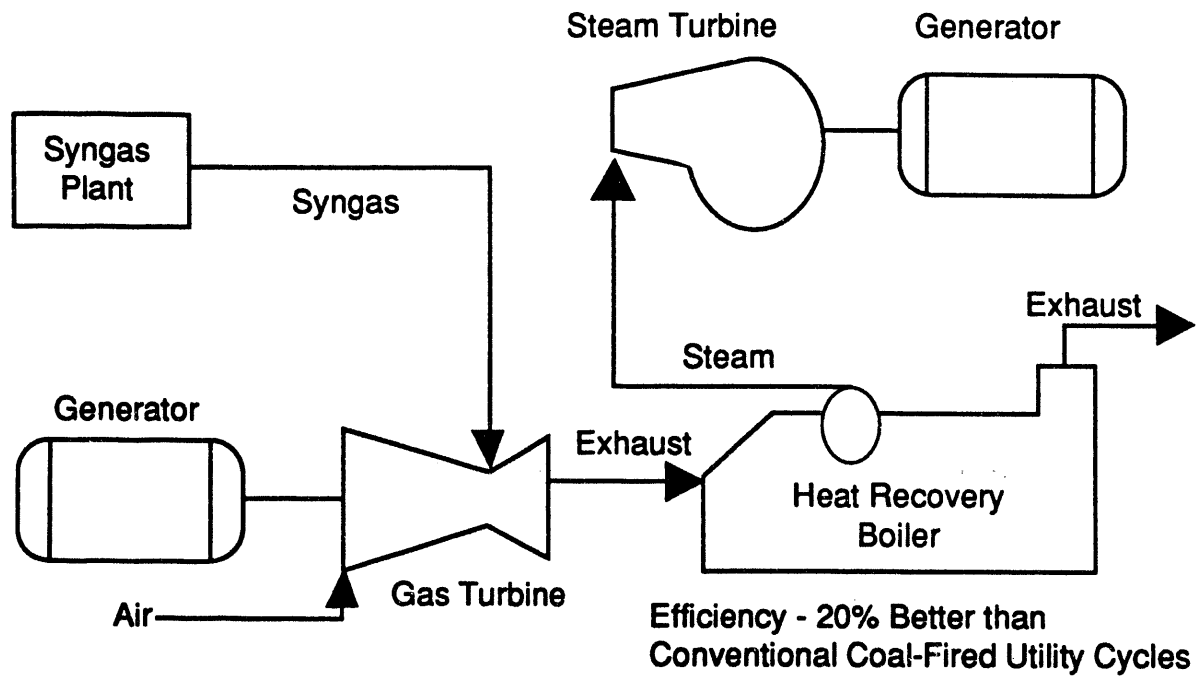
The result of repowering will be a CGCC power plant with low environmental emissions (SO_2 of less than 0.25 lbs/MMBtu and NO_x of less than 0.1 lb/MMBtu) and high net plant efficiency. The repowering will increase unit output, providing a total CGCC capacity of nominal 262 MWe. The Project will demonstrate important technological advancements in processing high sulfur bituminous coal.

In addition to the joint venture members, PSI and Destec, the project team will include Sargent and Lundy, which will provide engineering services to PSI; Destec Engineering Inc., which will provide engineering services to Destec; and Destec Operating Company, which will provide operation and maintenance services for the gasifier.

The potential market for repowering with the demonstrated technology is large and includes many existing utility boilers currently fueled by coal, oil, or natural gas. In addition to greater, more cost-effective reduction of SO_2 and NO_x emissions attainable by using the gasification technology, net plant heat rate will be improved. This improvement is a direct result of the combined-cycle feature of the technology, which integrates a combustion topping cycle with a steam bottoming cycle. This technology is suitable for repowering applications and can be applied to any existing steam cycle located at plants with enough land area to accommodate coal handling and storage.

One of the project objectives is to advance the commercialization of coal gasification technology. The electric utility industry has traditionally been reluctant to accept coal gasification technology and other new technologies as demonstrated in the U.S. and abroad because the industry has no mechanism for differentiating risk/return aspects of new technologies. Utility investments in new technologies may be disallowed from rate-base inclusion if the

COAL GASIFICATION COMBINED CYCLE



Efficiency - 20% Better than
Conventional Coal-Fired Utility Cycles

Figure 3

technologies do not meet performance expectations. Additionally, the rates of return on these are regulated at the same level as established (lower risk) technologies. Therefore, minimal incentives exist for the utility to invest in, or develop, new technologies. Accordingly, most of the risk in new technologies has traditionally been assumed by the supplier.

The factors described above are constraints to the development of, and demand for, clean coal technologies. Constraints to development of new technologies also exist on the supply side. Developers of new technologies typically self-finance or obtain financing for projects through lenders or other equity investors. Lenders will generally not assume performance and operational risks associated with new technology. The majority of funds available from lending agencies for energy producing projects are for technologies with demonstrated histories in reliability, maintenance costs and environmental performance. Equity investors who invest in new energy technologies also seek higher returns to accept risk and often require the developer of the new technology to take performance and operational risks.

Consequently the overall scenario results in minimum incentives for commercial-size developments of new technologies. Yet without the commercial-size test facilities, the majority of the risk issues remain unresolved. Addressing these risk issues through utility-scale demonstration projects is one of the primary objectives of DOE's Clean Coal Technology Program.

The Wabash River Coal Gasification Repowering Project was developed in order to demonstrate the Destec Coal Gasification Technology in an environment and at such a scale as to prove the commercial viability of the technology. Those parties affected by the success of this Project include, the coal industry, electric utilities, ratepayers, and regulators. Also, the financial community, who will provide funds for commercialization, is keenly interested in the success of this project. Without a demonstration satisfying all of these interests, the technology will make little advancement. Factors of relevance to further commercialization are:

- The Project scale (262 net MWe) is compatible with all commercially available advanced gas turbines and thus completely resolves the issue of scale-up risk.
- The operational term of the Project is expected to be approximately 25 years including the DOE demonstration period of the first 3 years. This will alleviate any concerns that the demonstration does not define a fully commercial plant from a cost and operations viewpoint.

- The Project will dispatch on a utility system and be called upon to operate in a manner similar to other utility generating units.
- The Project will operate under a services agreement that defines guarantees of environmental performance, capacity, availability, coal to gas conversion efficiency and maximum auxiliary power consumption. This agreement will serve as a model for future commercialization of the Destec Coal Gasification Technology and define the fully commercial nature of the Project.
- The Project will be designed to accommodate most coals available in Indiana and typical of those available to midwestern utilities, thereby enabling utilities to judge fuel flexibility. The Project will also enable testing of varying coal types on support of future commercialization of the Destec Coal Gasification Technology.

Plant Description

The Wabash River Coal Gasification Repowering Project will develop, design, construct, own, and operate a coal gasification combined cycle (CGCC) power plant. Coal Gasification technology owned by Destec, will be used to repower one of six units at PSI's Wabash River Generating Station in West Terre Haute, Indiana. The Project will be in operation for a minimum of 25 years. In the repowered configuration, PSI and its customers will additionally benefit because of the role this Project will play in PSI's Clean Air Act compliance plan. The CGCC power Plant will produce 262 net MWe of clean, energy efficient, cost effective capacity for PSI's customers. An additional economic benefit to the state of Indiana is that the Project will not only represent the largest CGCC power plant in operation, but will also emit lower emission than other large, high sulfur coal-fired power plants.

The gasification process is as follows (see Figures 4 and 5): coal is ground with water to form a slurry and then pumped into a gasification vessel where oxygen is added to form a hot, raw gas through partial combustion. Most of the non-carbon material in the coal melts and flows out the bottom of the vessel forming slag - a black, glassy, non-leaching, sand-like material. The hot, raw gas is then cooled in a heat exchanger to generate high pressure steam. Particulates, sulfur and other impurities are removed from the gas before combustion to make acceptable fuel for the gas turbine.

Block Flow Diagram

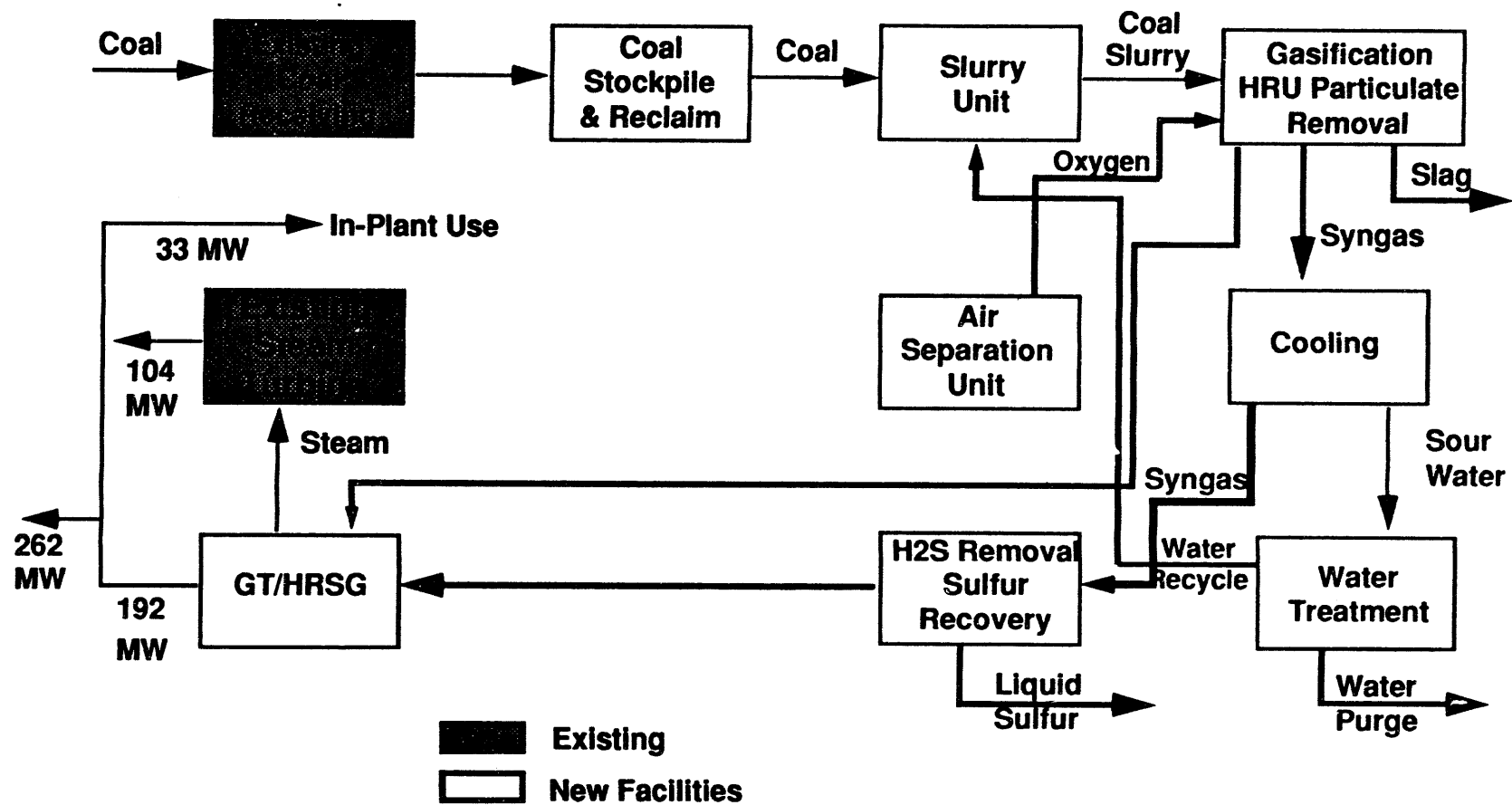
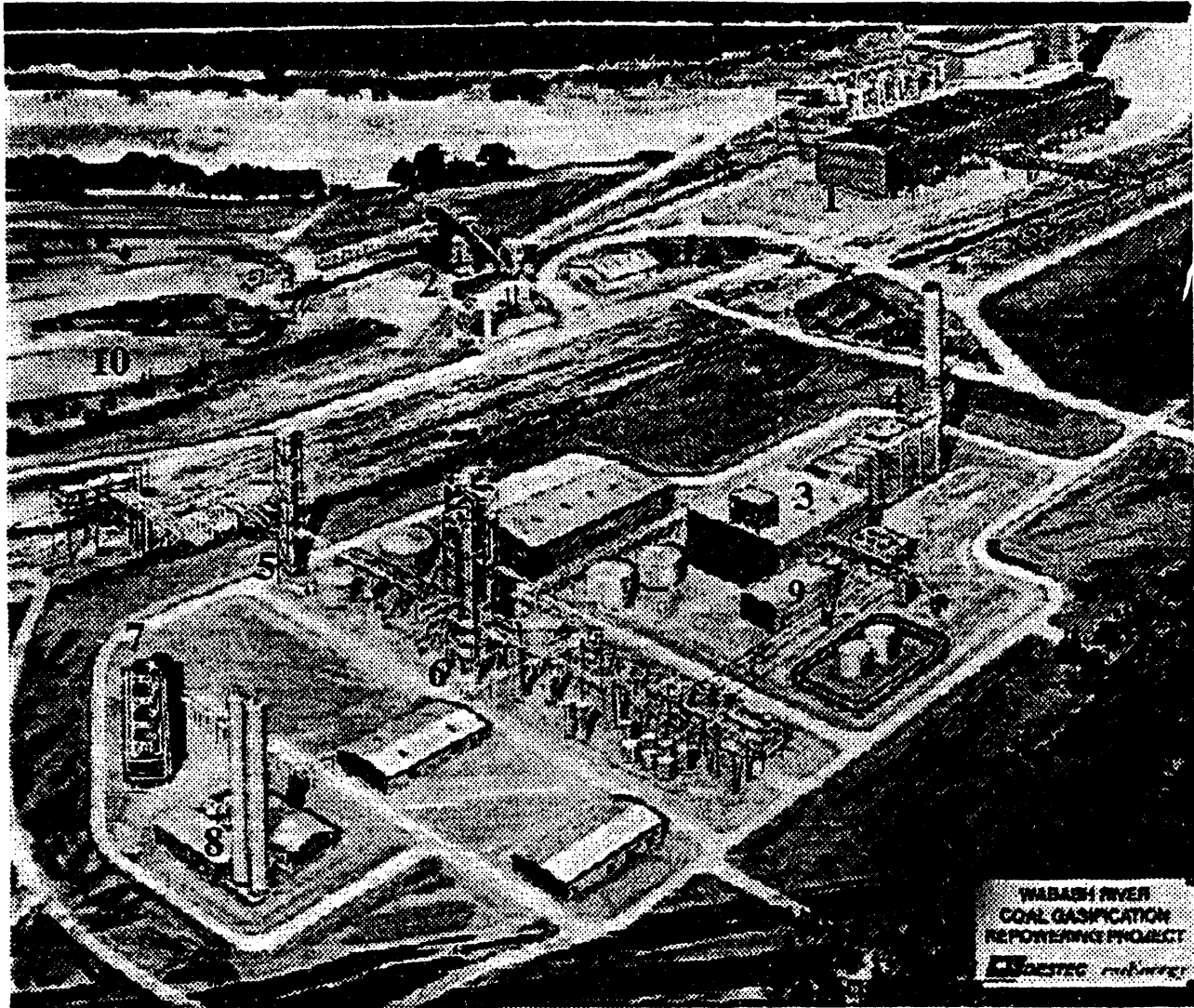


Figure 4



1. Existing Wabash Station
2. Existing coal transfer tower
3. Gas turbine building
4. Heat recovery steam generator stack
5. Coal receiving silo
6. Gasifier
7. Cooling towers
8. Oxygen plant
9. New substation
10. Existing coal pile

Figure 5. Artist Conception of Project

The gasification process byproducts, sulfur and slag, will be sold thus mitigating the waste disposal problems of competing technologies.

The synthetic fuel gas (syngas) is piped to a combustion turbine generator which produces approximately 192 MWe of electricity. A heat recovery steam generator recovers gas turbine exhaust heat to produce high pressure steam. This steam and the steam generator in the gasification process supply an existing steam turbine generator in PSI's plant to produce an additional 104 MWe. The net plant heat rate for the entire new and repowered unit is approximately 9,000 Btu/kWh (HHV), representing an improvement of approximately 20% over the existing unit. The Project heat rate will be among the lowest of commercially operated coal-fired facilities in the United States.

The Destec Coal Gasification process was originally developed by The Dow Chemical Company during the 1970's in order to diversify its fuel base. The technology being used at Wabash is an extension of the experience gained from that time, through pilot plants and up to the Louisiana Gasification Technology, Inc. (LGTI) facility, a commercial-scale facility, which has been operating since April 1987.

In order to generate data necessary for commercialization, the Joint Venture has chosen a very ambitious approach for incorporation of novel technology in the project. This approach is supported by PSI's desire to have another proven technology alternative available for future repowering or new base load units. Destec desires to enhance its competitive position relative to other clean coal technologies by demonstrating new techniques and process enhancements as well as gain information about operating cost and performance expectations. The incorporation of novel technology in the project will enable utilities to make informed commercial decisions concerning the utilization of Destec's technology, especially in a repowering application.

New enhancements, techniques and other improvements included in the novel technology envelope for the project are as follows:

- A novel **application** of integrated coal gasification combined-cycle technology will be demonstrated at the project for the first time - repowering of an existing coal-fired power generating unit.
- The **coal fuel** for the project will be high sulfur bituminous coal, thus demonstrating the environmental performance and energy efficiency of Destec's advanced two-stage coal gasification process. Previous Destec technology development has focused on lower rank, more reactive coals.

- **Hot/Dry particulate removal/recycle** will be demonstrated at full commercial scale by the project. Destec's current plant, LGTI, has utilized a wet scrubber system to remove particulates from the raw syngas.

Other coal gasification process enhancements included in the project to improve the efficiency and environmental characteristics of the system are as follows:

- **Syngas Recycle** will provide fuel and process flexibility while maintaining high efficiency.
- **A High Pressure Boiler** will cool the hot, raw gas by producing steam at a pressure of 1,600 pounds per square inch absolute (psia). Destec's first unit is currently operating at a pressure of 650 psia in a much less corrosive environment than will be experienced at the project.
- **The Carbonyl Sulfide (COS) Hydrolysis** system to be incorporated at the project will be Destec's first application of this technology. This system is necessary to attain the high percent removal of sulfur at the project.
- **The Slag Fines Recycle** system will recover most of the carbon present in the slag byproducts stream and recycle it back for enhanced carbon conversion. This also results in a high quality slag byproduct.
- **Fuel Gas Moisturization** will be accomplished at the project by the use of low-level heat in a concept different from that used by Destec before. This concept will reduce the steam injection required for nitrous oxide (NO_x) control in the combustion turbine.
- **Sour water**, produced by condensation as the syngas is cooled, will be processed differently from the method used at LGTI. This novel **Sour Water System**, to be used at the project, will allow more complete recycling of this stream, reducing waste water and increasing efficiency.
- **An oxygen plant producing 95 percent pure oxygen** will be used by the project. This will increase the overall efficiency of the project by lowering the power required for production of oxygen.
- **The power generation facilities** included in the project will incorporate the latest advancements in combined-cycle system

design while accommodating design constraints necessary to repower the existing Unit 1 steam turbine.

- The project will incorporate an **Advanced Gas Turbine** with a new design compressor and higher pressure ratios.
- **Integration Between the Heat Recovery Steam Generator (HRSG) and the Gasification Facility** has been optimized at the project to yield higher efficiency and lower operating costs.
- **Repowering of the Existing Steam Turbine** will involve upgrading the unit in order to accept increased steam flows generated by the HRSG. In this manner, the cycle efficiency will be maximized because more of the available energy in the cycle will be utilized.

The Gasification/Repowering approach offers the following advantages as compared to other options:

- This is a viable alternative that will add life to existing older units. The primary assumption, however, is that reasonable life exists in the steam turbine to be repowered. If reasonable life exists in the steam turbine, this approach eliminates the need for refurbishment of much of the high wear component of conventional pulverized coal units. Three such items are the boiler, coal pulverizers and high energy piping systems.
- This approach is an alternative for Clean Air Act compliance compared with the traditional scrubber approach. Although space constraints are similar for the installed facility, waste storage requirements are smaller due to saleable byproducts in lieu of on-site storage of scrubber sludge.
- This approach provides a use for high sulfur coal. This is particularly important in areas such as Indiana where high sulfur coal is abundant and provides a substantial employment base.

Project Management

The WRCGRP Joint Venture has established a Project Office for the execution of the project. The Project Office is located at Destec's corporate offices in Houston, TX. All management, reporting, and projects reviews for the project are carried out as required by the Cooperative Agreement. The Joint Venture partners, through a Joint Venture Agreement, are responsible for the performance of all engineering, design, construction, operation, financial, legal, public affairs, and other administrative and management functions required to execute the project. A Joint Venture Manager has been designated as responsible for the management of the project. A Joint Venture organization chart is shown as Figure 6. The Joint Venture Manager is the official point of interface between the Joint Venture and the DOE for the execution of the Cost Sharing Cooperative Agreement. The Joint Venture Manger is responsible for assuring that the Project is conducted in accordance with the cost, schedule, and technical baseline established in the Project Management Plan (PMP) and subsequent updates.

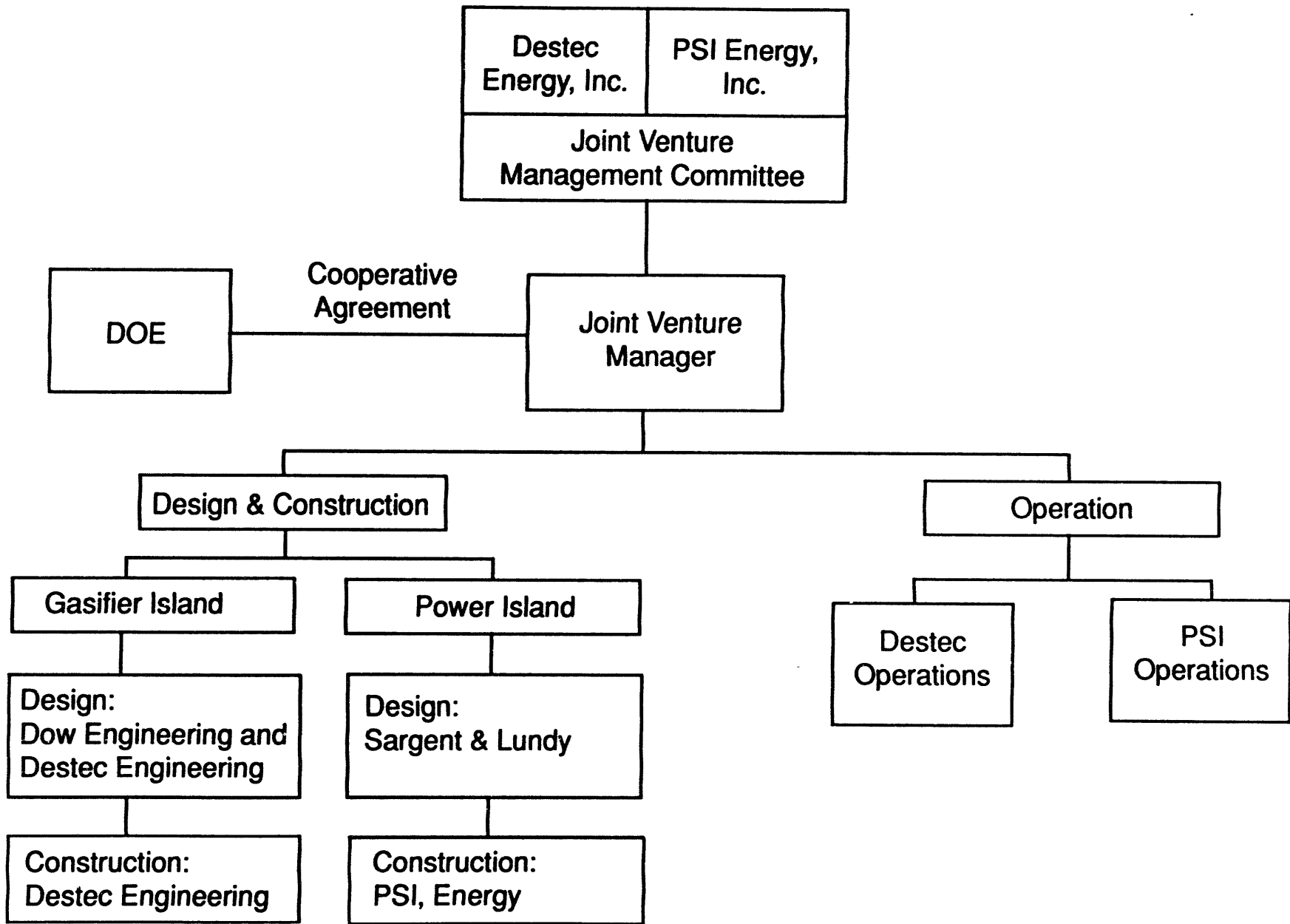


Figure 6 Project Organization

Major Activities and Milestones

The Project Cooperative Agreement was signed on July 28, 1992, with an effective date of August 1, 1992. Under the terms of the Cooperative Agreement, Project activities are divided into three phases:

- Phase I - Engineering and Procurement
- Phase II - Construction and Startup
- Phase III - Demonstration

In addition, for purposes of the Cooperative Agreement, the Project is divided into three sequential Budget Periods. The expected duration of each budget period is as follows:

- Budget Period 1 - 9 months
- Budget Period 2 - 26 months
- Budget Period 3 - 36 months

The Project Milestone Schedule is provided in Figure 7.

Phase I Activities - Engineering and Procurement

Under the provisions of the Cooperative Agreement, the work activity in Phase I (Engineering and Procurement) will focus on detailed engineering of both the syngas and power plant elements of the Project including design drawings, construction specifications and bid packages, solicitation documents for major hardware and the procurement thereof. Site work will be undertaken during this time period to meet the overall construction schedule requirements. The Project Team will include all necessary management, administrative and technical support.

The activities to be completed during this period are those necessary to provide the design basis for construction of the plant, including capital cost estimates sufficient for financing and, all necessary permits for construction and subsequent operation of the facility.

The work during Phase I can be broken down into the following main areas:

- Project Definition Activities
- Plant Design
- Permitting and Environmental Activities

Each of these activities is briefly described below. The status and progress in each area of activity is described later in this report.

**WABASH RIVER
COAL GASIFICATION REPOWERING PROJECT**

**LIST OF PROJECT MILESTONES
AS OF DECEMBER 31, 1993**

WBS		BASE LINE DATE	REVISED BASELINE	COMPLETION DATE
1.1.04	Signing of Gasification Services Agreement	06/24/92	06/24/92	06/24/92
1.1.05	Completion of Funding	03/15/93	11/19/92	11/19/92
1.1.06	Receipt of Air Permits	01/01/93	05/28/93	05/28/92
	Receipt of NPDES Permit Modifications	12/01/92	12/06/93	12/06/93
1.1.07	NEPA Completion	10/01/92	05/28/93	05/28/93
1.1.08	Receipt of IURC Certificate of Need	01/01/93	05/26/93	05/26/93
1.1.10	<u>Project Management</u>			
	Project Management Plan	10/31/92	12/04/92	12/04/92
	Financing Plan & Licensing Agreements	02/28/93	04/30/93	04/30/93
	Project Definition & Preliminary Plant Design	02/28/93	03/15/93	03/15/93
	Continuation Application	02/28/93	05/05/93	05/05/93
	Formal Project Review	01/15/93	03/30/93	03/30/93
	Draft Environmental Monitoring Plan	04/30/93	03/31/93	03/31/93
1.1.13	DOE Award	07/27/92	07/27/92	07/27/92
1.1.30	Award of EPC Subcontract for Oxygen Plant	11/15/92	12/15/92	12/15/92
1.2.01	<u>Project Management</u>			
	Environmental Monitoring Plan	06/30/93	06/30/93	06/30/93

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PROJECT MILESTONES (Con't)

19

		BASE LINE DATE	REVISED DATE	COMPLETION DATE
	Detailed Design Documents	11/01/94	09/15/94	
	Preliminary Public Design Reports	11/01/94	09/15/94	
	40% Completion Formal Project Review	06/30/94	04/15/94	
	90% Completion Formal Project Review	04/30/95	03/15/95	
	Final Public Design Report	01/31/95	12/15/94	
	Performance Test Plan	05/25/95	04/01/95	
	Plant Startup Plan	07/31/95	06/15/95	
	Continuation Application	01/31/95	12/15/94	
1.2.04	Start of On-Site Dirtwork	12/01/92	12/02/92	12/02/92
	Release of Gasification Plant Site	07/01/93	09/17/93	09/17/93
1.2.05	Mobilization to Site	09/01/93	09/17/93	09/17/93
1.2.20	Award of High Temperature Heat Recovery Unit	11/01/92	11/03/92	11/03/92
	Award of Gasifier Vessels	01/10/93	01/21/93	01/21/93
	Jobsite Receipt of HTHRU	09/01/94	07/15/94	
	Jobsite Receipt of Gasifier	07/01/94	05/15/94	
1.2.22	Start of Foundation Work	09/15/93	10/08/93	10/08/93
	Setting of First Gasifier	09/01/94	07/15/94	
	Setting of Second Gasifier	11/01/94	08/15/94	
	Start of Refractory Installation	09/15/94	08/01/94	
	Initial Firing with Coal	08/15/95	07/01/95	
	Initial Delivery of Syngas	08/15/95	07/01/95	
1.2.29	Completion of 100 Hour Test	10/01/95	08/15/95	
1.2.30	Jobsite Receipt of Main Air Compressor	09/01/94	07/15/94	

PROJECT MILESTONES (Con't)

20

		BASE LINE DATE	REVISED BASE LINE	COMPLETION DATE
	Setting of Column	08/01/94	06/15/94	
	Delivery of Oxygen	07/15/95	06/01/95	
1.2.43	Construction Power/Water Available	09/01/93	10/20/93	10/20/93
1.2.50	Award of Coal Handling Subcontract	04/01/93	05/03/93	05/03/93
	Delivery of Coal to Syngas Facility	01/15/95	12/01/94	
1.2.60	Award of STG Modification Subcontract	01/01/93	06/04/93	06/04/93
1.2.70	Award of Gas Turbine Generator (GTG)	01/31/92	01/31/92	01/31/92
	Award of Heat Recovery Steam Generator (HRSG)	10/15/92	10/15/92	10/15/92
	Jobsite Delivery of GTG	01/01/94	04/01/94	
1.2.75	Hydrotest of HRSG	04/15/95	03/01/95	
	Synchronization of GTG	01/15/95	12/01/95	
1.2.81	GTG Operation on Oil	01/01/95	11/15/94	
	GTG Operation on Syngas	08/15/95	07/01/95	
1.3.01	<u>Project Management</u>			
	Startup and Modification Report	12/01/95	12/01/95	
	Formal Project Reviews	Annual		
	Draft Final Technical Report	07/31/98	07/31/98	
	Technology Performance & Economic Evaluation	11/30/98	11/30/98	
	Final Technical Report	12/31/98	12/31/98	

NOTE: The Revised Baseline dates are by agreement between PSI and Destec in November 1993

Project Definition Activities

This work includes the conceptual engineering to establish the project size, installation configuration, operating rates and parameters. Definition of required support services, all necessary permits, fuel supply, and waste disposal arrangements are also developed as part of the Project Definitions activities. From this information the cost parameters and projects economics are established (including capital costs, project development costs and operation and maintenance costs).

Additionally, all project agreements necessary for construction of the plant will be concluded. Those will include the Co-operative Agreement and the Gasification Services Agreement.

Plant Design

This activity includes preparation of design and major equipment specifications along with plant piping and instrumentation diagrams (P&ID), process control releases, process descriptions, and performance criteria. These will be prepared in order to obtain firm equipment specifications for major plant components and hence establish the basis for detailed plant engineering and design.

Permitting and Environmental Activities

During Phase I, application will be made for the permits and environmental activities necessary for the construction and subsequent operation of the project. The major project permits include:

Indiana Utility Regulatory Commission - This state authority will review the project (under a petition from PSI for a Certificate of Necessity) to ensure the project will be beneficial to the state and PSI ratepayers. The technical and commercial terms of the project will be reviewed in this process.

Air Permit - This permit details the allowable emission levels for air pollutants from the project. It will be issued under standards established by the Indiana Department of Environmental Management (IDEM) and the Environmental Protection Agency (EPA) Region V. This permit also includes within it the authority to commence construction.

NPDES Permit - This permit details and controls the quality of waste water discharge from the project. It is reviewed and issued by the Indiana Department of Environmental Management. For this project it will be a modification of the existing permit for PSI's Wabash River Generating Station.

NEPA Review - The National Environmental Policy Act review will be carried out by the DOE based on project information provided by the participants. The scope of this review is comprehensive in addressing all environmental issues associated with the project impacts including air, water, terrestrial, health and safety and socioeconomic impacts.

There are several miscellaneous approvals and other documents which may be necessary for construction and subsequent operation of the project. These are listed below and will be applied for as required and as appropriate to meet the schedule.

- **FAA Stack Height/Location Approval**
Controlling Authority: Federal Aviation Administration
- **Industrial Waste Hauler**
Controlling Authority: Indiana Department of Environmental Management
- **Solid Waste**
- **FCC Radio License**
- **Spill Prevention Plan**
- **Wastewater Pollution Control Device Permit**
Controlling Authority: IDEM

Phase II Activities - Construction

Construction activities will occur in Phase II and will include the necessary construction planning and integration with the engineering and procurement effort. Planning the construction of the project will begin early in Phase I. Separate on-site construction staff for both Destec and PSI will be provided to focus on their respective work for each element of the Project. Construction personnel will coordinate the site geotechnical surveys, equipment delivery, storage and lay-down space requirements. The construction activities include scheduling, equipment delivery, erection, contractors, security and control.

The detail design phase of the project includes engineering, drawings, equipment lists, plant layouts, detail equipment specifications, construction specification, bid packages and all activities necessary for construction, installation, and start-up of the project.

Performance and progress during this period will be monitored in accordance with previously established baseline plans.

Phase III Activities - Demonstration Period

Phase III will consist of the 25-year project operation period. The operation effort for the Project will begin with the development of an operating plan including integration with the early engineering and design work of the Project. Plant operation input to engineering is vital to assure optimum considerations for plant operations and maintenance and to assure high reliability of the facilities. The operating effort will continue with the selection and training of the operating staffs, development of the plant operations manuals, the coordination of the start-up with the construction crew, planning and execution of plant commissioning, the conduct and documentation of the plant acceptance test and continued operation and maintenance of the facility throughout the demonstration period.

Phase III activities are intended to establish the operational aspects of the project in order to prove the design, operability and longevity of the plant in a fully commercial utility environment.

Budget Periods

For ease of administration, the Project is divided into three sequential budget periods with expected durations of:

- Budget Period 1 - 9 months
- Budget Period 2 - 26 months
- Budget Period 3 - 36 months.

Budget Period 1 activities include pre-DOE award and project definition tasks, preliminary engineering work, and permitting activities. Budget Period 2 activities include detailed engineering, procurement, construction, pre-operations training tasks, and startup. Budget Period 3 activities include the three year demonstration period. The budget period costs were originally projected to occur as follows:

Budget Period 1 -	
DOE Share =	\$ 43,175,801
Budget Period 2 -	
DOE Share =	\$102,523,632
Budget Period 3 -	
DOE Share =	\$ 52,300,567
Total DOE =	\$198,000,000

ACTIVITIES THROUGH DECEMBER 1993

A current Project schedule, indicating milestone dates and current status, is provided as Figure 8.

Phase I Activities - Engineering and Procurement

Phase I activities commenced with signing of the Project Cooperative Agreement in July 1992 and have continued through the end of 1993. Phase I activities are expected to end in 1994. Work activities in Phase I have focused on project definition activities, plant design, and permitting and environmental activities.

Project Definition Activities

Conceptual engineering and other project definition activities were completed for both the gasification and power portions of the plant in 1992. Once conceptual and project definition activities were completed detailed design and engineering commenced.

Plant Design

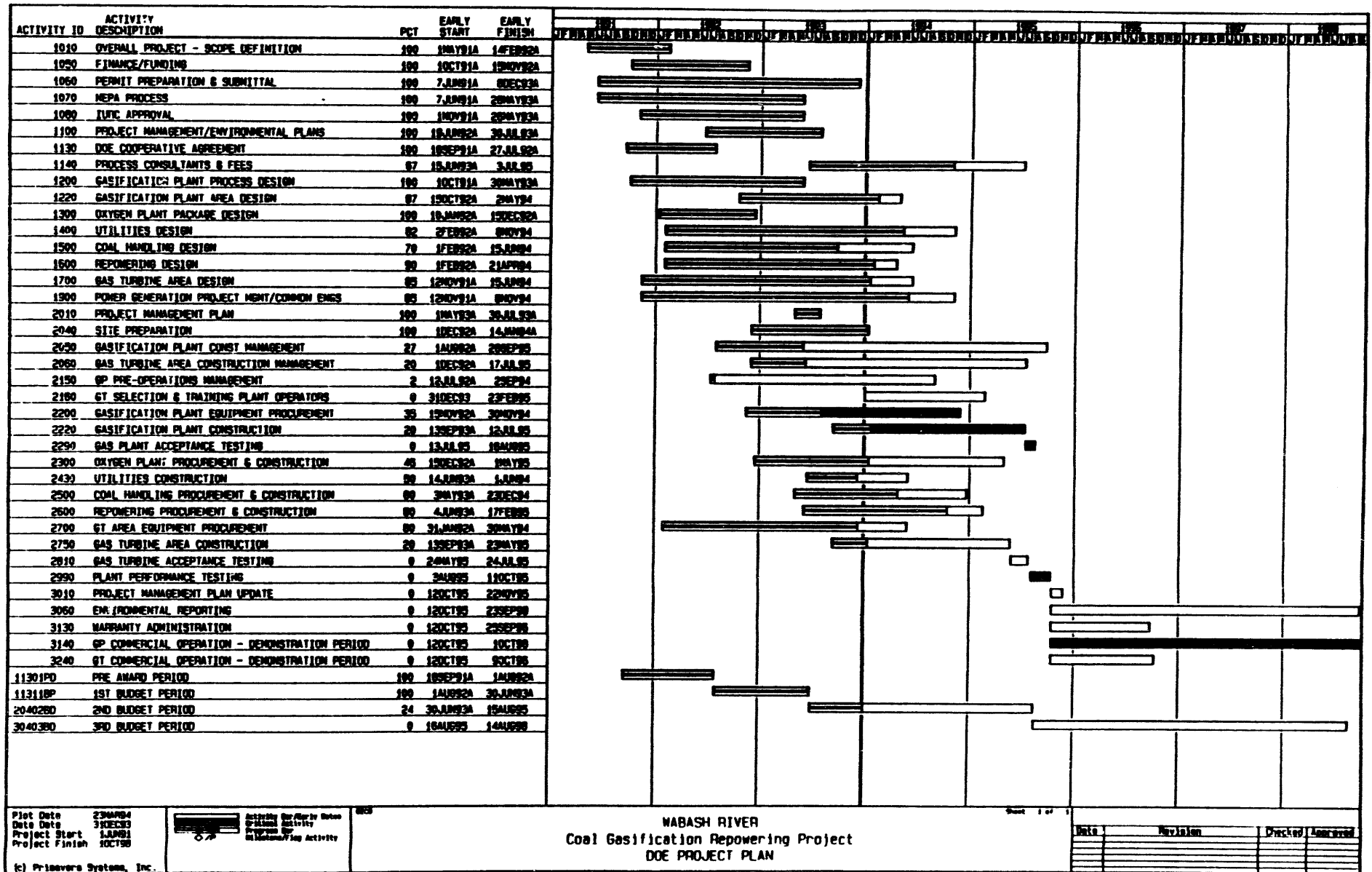
Plant Design activities involve both preliminary and detailed design tasks. As preliminary design packages for various portions of the Project were completed detailed engineering of both the syngas and power plant elements of the Project commenced. Design drawings, construction specifications and bid packages, and solicitation documents for major equipment have been prepared. As of the end of 1993 detailed engineering work is approximately 87% complete for the gasification plant portion of the Project and 85% complete for the power plant portion.

Through the end of 1993 procurement activities (inquiry through purchase order) are approximately 92% complete for the gasification portion of the Project and 99% for the power portion.

Permitting and Environmental Activities

During Phase I, application was made for the permits and environmental activities necessary for the construction and subsequent operation of the project. The major project permits include:

Indiana Utility Regulatory Commission - Approval, in the form of a Certificate of Need, was received on May 26, 1993. Routine construction updates are now being provided to the Indiana Utility Regulatory Commission.



Air Permit - The Project air permit was issued under standards established by the Indiana Department of Environmental Protection Agency (IDEM) and the Environmental Protection Agency (EPA) Region V on May 27, 1993.

NPDES Permit - This permit which details and controls the quality of waste water discharge from the project was issued by the Indiana Department of Environmental Management was received on December 6, 1993.

NEPA Review - The National Environmental Policy Act review, carried out by the DOE, was completed in early 1993 and a Finding of No Significant Impact was issued on May 28, 1993.

Several miscellaneous approvals and other documents which are necessary for construction and subsequent operation of the project were received or applied for. These are listed below and will be applied for as required and as appropriate to meet the schedule.

**FAA Stack Height/Location Approval
Controlling Authority: Federal Aviation Administration
Received: March 9, 1993**

**Spill Prevention Plan
Update existing PSI Energy Plan
Scheduled: 1994**

**Wastewater Pollution Control Device Permit
Controlling Authority: IDEM
Received: December 18, 1992**

In addition, a plan to account for sulfur emission reductions that result from use of the Destec gasification process was developed and submitted the U.S. EPA. Although the Sulfur Accountability Protocol submitted by PSI is not required for operation of the Project, the Project does not fall within the normal technologies covered by the monitoring protocols of the U.S. EPA. In recognition of this fact, and in order to ensure that PSI Energy receives appropriate regulatory credit for SO₂ emissions reductions, Destec and PSI developed a system through which sulfur emission reductions can be reliably quantified. Such a quantification system is important to advancement of the gasification technology.

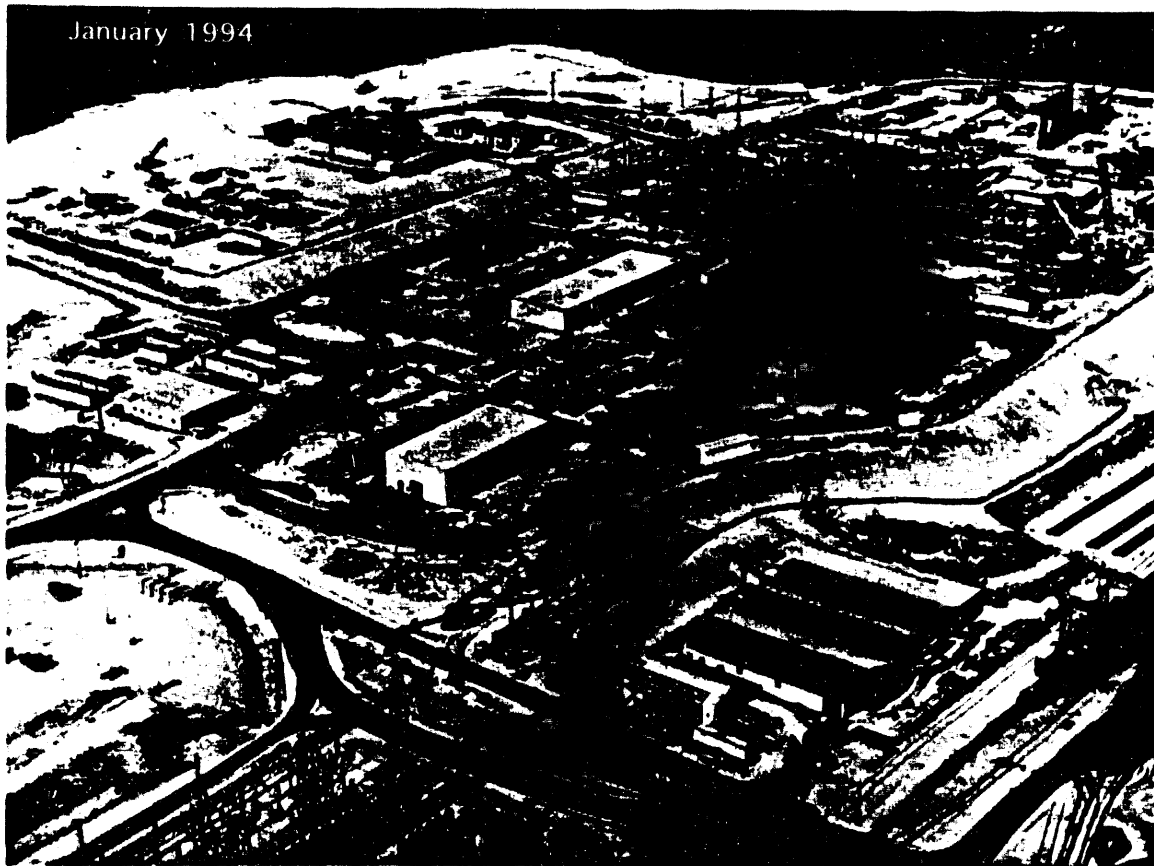


Figure 9
Construction Photos

Phase II Activities - Construction

Construction activities were initiated in 1993.

Site preparation work began after all necessary permits and approvals were received and construction move-in occurred in September of 1993. By the end of 1993, approximately 70% of the foundations in the gasification area and 90% of the foundations in the power generation area had been poured. Steel erection and vessel placement was in progress. See Figure 9.

In preparation for startup activities, preliminary pre-operations management activities were also initiated in 1993. These activities included identification of operating personnel needs and development of training programs. The operating staff for the Project will be hired/assigned during the construction phase and will work with the construction management personnel to ensure a successful plant startup.

Phase III Activities - Construction

No Phase III activities occurred during this reporting period.

Budget Period 1 Activities

Budget Period 1 commenced on July 28, 1992 and concluded on May 28, 1993. The original duration of Budget Period 1 was estimated to be 9 months (Co-operative Agreement Article VII). Spending for Budget Period 1 was as follows:

	<u>Original Estimate</u>	<u>Actual</u>
Participant Share	\$43,175,801	\$12,349,369
DOE Share	<u>\$43,175,801</u>	<u>\$12,349,380</u>
Total Spending	\$86,351,602	\$24,698,749

Unused Budget Period 1 funds will be used in subsequent periods. The primary reasons that spending for Budget Period 1 was below original projections include delay of site preparation work and delayed release of major equipment. Delay of the NEPA review required rescheduling of some work into Budget Period 2.

Design and Permitting

All Project Definition Activities and Preliminary Plant Design activities were completed during Budget Period 1.

DOE Reporting and Deliverables

Spending and budget reports were submitted on both a monthly and quarterly basis according to the requirements of the Cooperative Agreement. Project reviews and Joint Venture quarterly reports were provided to the DOE. In addition, a project technical review was held with DOE and DOE contractors in April 1993.

DOE Deliverables were provided according to the schedule shown in Figure 10.

Budget Period 2 Activities

Budget Period 2 began on May 29, 1993 and is expected to conclude in August 1995. Procurement, construction, pre-operations personnel and training are among the Budget Period 2 activities performed in 1993.

Design and Permitting

All Project Definition Activities and Preliminary Plant Design activities were completed during Budget Period 1.

DOE Reporting and Deliverables

Spending and budget reports were submitted on both a monthly and quarterly basis according to the requirements of the Cooperative Agreement. Project reviews and Joint Venture quarterly reports were provided to the DOE. A detailed design review was held with the DOE and DOE contractors in December 1993. Topics discussed during the detailed design review included process design changes/modifications, design criteria, process control philosophy and methods, procurement practices, construction schedule, and Project budget.

Other Activities

Several public relations and education activities were carried out in 1992 and 1993. Appendix C provides a list of selected public information and trade and technical papers presented by Destec or PSI personnel related to the WRCGRP.

On July 7, 1993, the DOE, PSI, and Destec jointly sponsored a media event at the Project site. Over 400 people attended the event. Speakers included John Meyers (U.S. Congress), Lowell Miller (DOE), James Rodgers (PSI), and Charles Goff (Destec). The event also included panel discussions.

The event received notice in local, state, and regional print, radio, and television media.

Figure 10
Wabash River Coal Gasification Repowering Project
DOE Deliverable Schedule

	<u>Original Schedule</u>	<u>Actual</u>
<u>Project Management</u>		
Federal Assistance Budget Information Form	08/30/92	
Project Evaluation Plan	09/15/92	09/15/92
	Revised	11/30/93
Project Management Plan	10/31/92	10/31/92
	Revised	07/01/93
<u>Financial</u>		
Financing Plan & Licensing Agreements	02/28/93	05/05/93
	Revised	08/25/93
Project Evaluation Report	02/28/93	05/28/93
Continuation Application Budget Period 1	02/28/93	05/28/93
Formal Project Review Budget Period 1	03/15/93	03/30/93
<u>Environmental</u>		
Environmental Information Volume	02/14/92	02/14/92
	Revised	08/03/92
	Revised	06/02/93
Environmental Monitoring Plan Outline	01/31/93	03/31/93
Environmental Monitoring Plan Draft	04/30/93	07/31/93

1994 ACTIVITIES AND MILESTONES

Activities in 1994 will focus primarily on construction tasks. Major activities for 1994 will include the following:

Engineering, Procurement, and Construction

Detailed engineering activities will be completed and engineering activities will continue in a field-support mode. Construction highlights will include completion of the water treatment building and hydrotesting of the heat recovery steam generator. Major procurement milestones will include receipt of the gasifier vessels, the gas turbine and HRSG packages, and oxygen plant compressors.

Permitting and Environmental

All permits necessary for construction of the Project, as well as major operating permits, have been received. The major focus for environmental activities for 1994 will be finalization of the sulfur accountability plan submitted to the EPA in 1993.

DOE Reporting and Deliverables

Monthly and quarterly reports will continue to be delivered to the DOE in accordance with the terms of the Cooperative Agreement. Phase I activities will be formally completed and a Detailed Public Design Report will be submitted to the DOE.

Other Activities

Other activities of significance include selection and training of operations personnel, and coordination of construction and startup tasks. During 1994 a community relations and education program will be initiated.

APPENDIX A
Glossary of Acronyms

CAAA -	Clean Air Act Amendments of 1990
CCT -	Clean Coal Technology
CGCC -	Coal Gasification Combined Cycle
COS -	Carbonyl Sulfide
DOE -	United States Department of Energy
EPA -	United States Environmental Protection Agency
HHV -	Higher Heating Value
HRSG -	Heat Recovery Steam Generator
IDEM -	Indiana Department of Environmental Management
LGTI -	Louisiana Gasification Technology, Inc.
NEPA -	National Environmental Policy Act
NPDES -	National Pollutant Discharge Elimination System
P&ID -	Piping and Instrument Diagram
PMP-	Project Management Plan
PON -	Program Opportunity Notice
WRCGRP -	Wabash River Coal Gasification Repowering Project

APPENDIX B
List of Figures

- Figure 1 - Site Location Map
- Figure 1a - Site Map
- Figure 1b - Plot Plan
- Figure 2 - Site Picture
- Figure 3 - Process Schematic
- Figure 4 - Process Block Flow Diagram
- Figure 5 - Artist's Drawing (Plant Sections Highlighted)
- Figure 6 - WRCGRP Joint Venture Organization Chart
- Figure 7 - Project Milestone Schedule
- Figure 8 - Project Schedule
- Figure 9 - Construction Photos
- Figure 10 - Budget Period 1 DOE Deliverable Schedule

APPENDIX C
List of Technical and Trade Publications Concerning the WRCGRP

COAL GASIFICATION

LISTING OF TECHNICAL PUBLICATIONS (PUBLIC INFORMATION)

DATE	TITLE/SOURCE	AUTHOR(S)
09/23/92	The Wabash River Coal Gasification Repowering Project/U.S. Department of Energy First Annual Clean Coal Technology Conference, Cleveland OH	Sundstrom
10/92	The Destec Coal Gasification Process: A Progress Update/EPRI Conference, San Francisco CA	Strickland; Payonk
10/92	Coal Gasification and Repowering - A Utility Perspective/EPRI Conference, San Francisco CA	J. U. Bott (PSI)
11/92	The Repowering of Wabash River Station Unit No. 1 with Destec Energy Coal Gasification/Power-Gen '92, Orlando FL	Sundstrom
11/92	The Destec Coal Gasification Process: A Progress Update/Power-Gen '92, Orlando FL	Strickland; Payonk
1/93	Power Engineering Magazine "Destec Coal Gasification"	Janaway, Maurer, Roll
2/93	New Power Generation Technologies Conference "Project Update of LGTI and Wabash River Repowering Project"	Roll
3/17/93	Pacific Coast Generation "The Wabash River Repowering Project"	Maurer
4/12/93	American Power Conference "Integration of Coal Gasification and Combined-Cycle Facilities of the Wabash River Repowering Project" "Environmental Considerations of Coal Gasification Technology and the Wabash River Repowering Project"	Amick, Herbster, Zupan Lessig, Hoffman
5/19/93	EPRI 2nd Annual Repowering Conference "Repowering Wabash Unit No. 1 with Destec Coal Gasification"	Sundstrom, Bott
6/93	Wabash River Repowering Project	Les Bocker
9/9/93	2nd Annual Clean Coal Conference "The Wabash River Coal Gasification Repowering Project Program Update"	Phil Amick, Jim Cook
9/24/93	The Pittsburgh Coal Conference "Destec Coal Gasification Process at LGTI and its Application at Wabash River"	Roll

COAL GASIFICATION

LISTING OF TECHNICAL PUBLICATIONS (PUBLIC INFORMATION)

DATE	TITLE/SOURCE	AUTHOR(S)
10/26/93	5th International Conference on Utilization of High Sulfur Coals "Commercialization of the Destec Coal Gasification Process"	Roll
10/28/93	12th Annual EPRI Coal Gasification Conference "Project Update on Wabash River Coal Gasification Project" "LGTI Process & Performance Update"	Bob Fisackerly Gretchen LeBlanc
11/93	Power-Gen Conference "Environmental Considerations of Coal Gasification Technology and the Wabash River Repowering Project"	Wendy Lessig, Jesse Frederick