

PROJECT DATA

Combustion Resources, LLC - 02GO12061

Clean Production of Coke from Carbonaceous Fines

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PROJECT SCOPE: The objective of this project is to refine material and process requirements to improve economic benefits and expand prior work on the technology through successful prototype testing of both metallurgical and foundry coke products. The initial market study and business plan will be refined based on this work. A 500,000 ton/year plant that utilizes the new process uses almost six times this amount of waste coke fines as feedstock. The process is expected to produce about 10 million tons of coke per year, with potential savings in production costs of 30% or more over traditional metallurgical coke-making methods.

FINANCIAL ASSISTANCE

Approved DOE Budget:	\$200,000	Approved DOE Share:	\$200,000
Obligated DOE Funds:	\$200,000	Cost Share:	\$57,035
Remaining Obligation:	\$0		
Unpaid Balance:	\$43,869	TOTAL PROJECT:	\$257,035

Project Period: 09/01/02 to 08/31/04

TECHNICAL PERFORMANCE
DE-FG36-02GO12061
Combustion Resources, LLC
Clean Production of Coke From Carbonaceous Fines

PROJECT SYNOPSIS

The objective of the project is to refine material and process requirements to achieve improved economic benefits and to expand prior work on the technology through successful prototype testing of both metallurgical and foundry coke products. The initial market study and business plan will be refined based on the studies and prototype testing. The process is projected to be capable of producing about 10 million tons of coke per year. Energy consumption for the proposed unit is 6.43×10^{11} Btu/yr/unit, compared to 3.97×10^{12} Btu/yr/unit for the existing technology. Bench-scale testing has been performed which indicates the process is capable of producing coke at lower cost while meeting the most stringent industrial requirements. Currently, domestic coke prices average around \$110/ton, while bench-scale tests already completed show the new method can produce high quality coke at about \$55/ton.

Economic studies have been completed showing potential savings in production costs of 30% or more over traditional metallurgical coke-making methods. The bench-scale tests also demonstrated the process' ability to produce the coke with minimal by-products and waste. A conventional coke oven plant producing 500,000 ton/yr of usable coke will generate approximately 55,600 ton/yr of waste coke fines. A 500,000 ton/yr plant that utilizes the new fines briquetting process can use almost six times this amount of waste coke fines as feedstock.

SUMMARY OF TECHNICAL PROGRESS

The work toward commercialization of Combustion Resources Clean Coke is progressing with interested potential industrial partners. The main area of focus has been in Task 2, where coal char has been heavily researched as a substitute to the more expensive low-sulfur pet-coke. In order to continue testing for Task 2, more feed materials were obtained from local sources and from potential industrial partners. For Task 3, used equipment that can crush and dry the feed materials has been identified. A possible end user for the demonstration of the product has been identified; an existing furnace, for Task 4, has been identified and required modifications specified. There has also been a new testing furnace constructed, and testing of the Clean Coke product is progressing rapidly. Efforts for Task 5, foundry coke testing, have been diverted to address issues of potential industrial partners whose main focus is metallurgical coke. There is such a large interest in met-coke at this time that all resources and time have been moved from foundry coke testing into met-coke testing. However, foundry coke still plays a minor role in the overall coke market and is still of interest as a subject for future work. The effort of testing prototype briquettes for Task 6 has been accelerated. Task 7, along with Task 8, are well underway. CR has conducted multiple discussions with potential commercialization partners. Development of business plans and work agreements are in progress.

SUMMARY OF PLANNED WORK

Combustion Resources anticipates finishing the work agreement with DOE on time and expects to have a working agreement in place with industrial partners.

PROJECT ANALYSIS

The project has shifted focus from foundry coke to coal char studies with good results. Excellent progress has been made and industrial partners have shown interest in the technology. Spending progress has also been good. Combustion Resources expects to finish the project on time and within budget.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK
DE-FG36-02GO12061
Combustion Resources, LLC
Clean Production of Coke From Carbonaceous Fines

PROJECT GOAL

The objective of Combustion Resources' proposed project is to refine material and process requirements in order to achieve improved economic benefits, and to expand prior work on the proposed technology through successful prototype testing of both metallurgical and foundry coke products. Additionally, the initial market study and business plan will be refined based on the studies and prototype testing.

The proposed study would link previous bench-scale testing to future commercial demonstration. It includes a development stage, where the new coke-making process will be refined, and prototype testing which will prepare the process for industrial commercialization. All parametric studies, coke formation, and associated testing will be completed at Combustion Resources' laboratory in Provo, Utah.

DETAILED TASK DESCRIPTIONS

Task 1. Obtain Raw Materials and Equipment

Adequate supplies of coke breeze, petroleum coke fines, coal fines, pitch, tar, and other raw materials needed will be identified and acquired. Multiple sources of each raw material will be identified, and the raw materials from each of the suppliers will be analyzed using proximate and ultimate analyses. The costs and raw material qualities associated with each supplier will be analyzed for incorporation into the revised business plan (see Task 8).

Task 2. Conduct Studies to Reduce Feed Material Costs

Studies will be conducted to determine the best types of coal and coal/coke ratios needed to minimize raw material costs, while at the same time maintaining acceptable levels of coke quality. Requirements for manufacture of both foundry and metallurgical coke will be formulated. Contingencies for price fluctuations in the raw materials will also be investigated.

Task 3. Conduct Parametric Studies to Reduce Cost-Intensive Processes

Crushing of the coke fines and calcining the coke represent the two most cost-intensive stages of the proposed process. Parametric studies will be conducted to investigate potential cost-saving applications. Studies of the coke fines crushing stage will investigate the effect of crushing the coal and coke fines to various mesh sizes and the effects of different types of crushing equipment in order to determine the most cost-effective crushing technique. Different types of existing furnaces capable of performing the required calcining operation will be researched using a life-cycle-cost approach. The results of the initial calcining studies will then be used as a starting point for the design requirements of the calcining furnace, Task 4. Subsequent studies will be conducted in parallel with the designing of the furnace to ensure the most cost-effective design.

Task 4. Identify a Production Calcining Furnace

The calcining furnace will be one of the key components of the new process. It will represent a large portion of the original capital expenditures in building the coke production facility, and it must be designed to work in the closed-loop process. Currently existing furnace designs will be investigated to determine which furnaces represent the best candidates and modifications, if any, are required. The parametric studies of Task 3 will be used to guide the design process to ensure the most efficient system possible. In addition, basic drawings of the calcining system will be developed.

Task 5. Conduct Prototype Testing of Foundry Coke

Based on the results of Tasks 2 and 3, prototypes of the foundry coke will be produced and tested for coke qualities. The qualities of the produced coke will be compared to other foundry cokes used in the castings and steel industries. Coke tests will examine CSR and CRI values, crush strength, specific gravity, and proximate composition.

Task 6. Conduct Prototype Testing of Metallurgical Coke

Based on the results of Tasks 2 and 3, prototypes of the metallurgical coke will be produced and tested for coke qualities. The qualities of the produced coke will be compared to other metallurgical cokes used in the steel industry. The finished coke product will be tested for CSR and CRI values, crush strength, specific gravity, and proximate composition.

Task 7. Solidify Industrial Partners

In order to market coke from this new process in an expeditious manner, industrial partners are needed. Potential partners include those that would provide required feedstock materials or expertise in briquette and block-forming processes, as well as coke-consuming companies such as steel manufacturers. Some corporations have already expressed interest in forming a partnership, and other companies will be contacted. Partnerships that result in the best economics, provide for an early entrance into the market, and result in long-term stability will be sought.

Task 8. Revise Business Plan

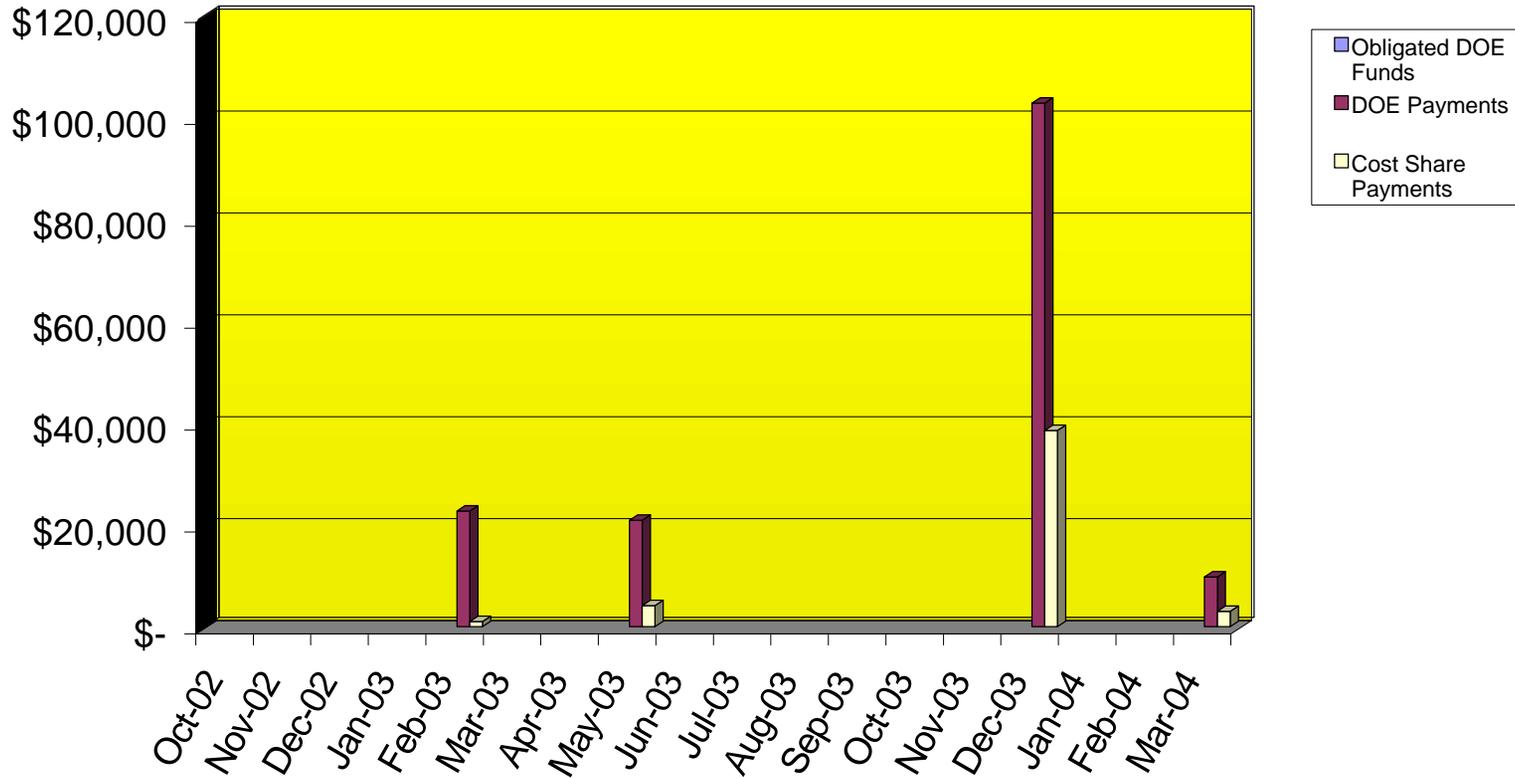
Based on the results of the parametric studies, the prototype tests, and the solidification of industrial partners, the business plan will be revised. This revised business plan will present a proposed schedule, market potential, and economic analysis for bringing this product to market.

Task 9. Project Management and Reporting

Combustion Resources is responsible for submitting both Semi-Annual Progress Reports and a Final Report to DOE. The Semi-Annual Reports are due every April 30 and October 31. The Final Report is due 90 days after the project completion date as specified in the agreement. This task also includes other DOE requirements for market assessments, fact sheets, benefits analyses, workshops, etc.

Project Cost Performance in DOE Dollars for Fiscal Year 2003

DE-FG36-02GO12061 Combustion Resources, LLC
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	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE Payment	\$0	\$0	\$0	\$0	\$22,696	\$0	\$0	\$20,871	\$0	\$0	\$0	\$0
Cost Share Payment	\$0	\$0	\$0	\$0	\$998	\$0	\$0	\$4,117	\$0	\$0	\$0	\$0

	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	PFY*	Cumulative
Obligated DOE Funds	\$0	\$0	\$0	\$0	\$0	\$0	\$200,000	\$200,000
DOE Payment	\$0	\$0	\$102,782	\$0	\$0	\$9,782	\$0	\$156,131
Cost Share Payment	\$0	\$0	\$38,523	\$0	\$0	\$3,032	\$0	\$46,670

Approved DOE Budget:	\$200,000
Approved Cost Share Budget:	\$57,035
Total Project Budget:	\$257,035

* Prior Fiscal Years

