

# **Early Entrance Coproduction Plant**

## **Quarterly Report No. 1**

Reporting period:      October 1, 1999 – December 31, 1999

Principal Authors:      Lalit S. Shah (Principal Investigator)  
                                 William K. Davis (Project Manager)

Date Issued:              February, 2000 (Preliminary Issue)  
                                 May, 2000 (Final Issue)

## **DOE Cooperative Agreement No. DE-FC26-99FT40658**

Texaco Energy Systems, Inc.  
1111 Bagby St.  
Houston, Tx. 77007

Disclaimer:

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

**Abstract:**

The overall objective of this project is the three phase development of an Early Entrance Coproduction Plant (EECP) which produces at least one product from at least two of the following three categories: (1) electric power (or heat), (2) fuels, and (3) chemicals. The objective is to have these products produced by technologies capable of using synthesis gas derived from coal or coal in combination with some other carbonaceous feedstock.

The objective of Phase I is to determine the feasibility and define the concept for the EECP located at a specific site and to develop a Research, Development, and Test Plan (RD&T) for implementation in Phase II.

The objective of Phase II is to conduct RD&T as outlined in the Phase I RD&T Plan to enhance the development and commercial acceptance of Coproduction technology that produces high-value products, particularly those that are critical to our domestic fuel and power requirements. The project will resolve critical knowledge and technology gaps on the integration of gasification and downstream processing to coproduce some combination of power, fuels, and chemicals from coal and other feedstocks.

The objective of Phase III is to develop an engineering design package and a financing plan for an EECP located at a specific site.

The project's intended result is to provide the necessary technical, economic, and environmental information that will be needed to move the EECP forward to detailed design, construction, and operation by industry.

## TABLE OF CONTENTS

	<b>Page</b>
I. Executive Summary .....	4
II. Discussion .....	5
III. List of Major Activities for Q4, 1999 .....	7
IV. List of Planned Activities for Q1, 2000 .....	8
V. Graph – Phase I, Planned vs. Actual Total Expenditures .....	9
VI. Graph – Phase I, Planned vs. Actual DOE Expenditures .....	10
VII. Graph – Phase I, Planned vs. Actual Progress .....	11
VIII. Schedule – MS Project Schedule updated through December, 1999.....	12

## **I. Executive Summary**

This is the first of five quarterly reports which will summarize the progress of Phase I of the development of the Early Entrance Coproduction Plant (EECP) concept which is covered under DOE Cooperative Agreement No. DE-FC26-99FT40658. Phase I objective is to determine the feasibility and define the concept for the EECP located at a specific site and to develop a Research, Development, and Testing Plan. Phase I is scheduled for completion by the end of year 2000. Phase II is scheduled for two calendar years (2001 through 2002) and is to conduct the research as outlined in Phase I. Phase III is scheduled for the calendar year 2003 and is to develop an engineering design package and financing plan for the EECP. The overall project's intended result is to provide the necessary technical, economic, and environmental information needed to move the EECP forward to detailed design, construction and operation by industry.

On September 30, 1999, the subject Cooperative Agreement was signed. Efforts began immediately to organize an industrial consortium to undertake this endeavor. As described in the original proposal, this consortium is now comprised of representatives from Texaco, Kellogg-Brown & Root, General Electric, Praxair, and Rentech. Contract development between Texaco Energy Systems Inc. and each of these parties began during this reporting period.

Preparation of the Project Management Plan also began immediately and was submitted to the DOE for review on November 16, 1999. On November 19, 1999 a kick-off meeting was held at the DOE offices in Morgantown, WV and representatives from each company of the consortium gave a presentation which generally described their company's contribution to the overall project.

In early December, the project team developed site selection criteria and visited two potential EECP sites. The Motiva refinery in Port Arthur, Texas was visited on December 2, 1999 and Tampa Electric Company's Polk Power Station near Tampa, Florida on December 7, 1999. Other potential sites were contacted by telephone but not visited during this reporting period.

Certain conceptual process studies were also started during this period which were not site specific. They were:

- Fischer-Tropsch product upgrading options
- Fischer-Tropsch waste water treating options
- Fischer-Tropsch feed gas optimum H<sub>2</sub>:CO ratio.

These, and other studies, are expected to be complete during the next quarter and preliminary results will be described in that quarterly report.

## II. Discussion

The following describes work performed during this reporting period by task as outlined in the Cooperative Agreement and the Project Management Plan:

### **Task 1 – Project Management Plan**

The Project Management Plan was submitted to the DOE for review on November 16, 1999. It included a Work Breakdown Structure; narrative for each task and sub-task for Phases I, II, and III with most detail for Phase I; project organization chart; Simplified Work Flow Chart; Milestone Log; Detailed Phase I Schedule; and projected Cash Flow curves. The information provided in this Plan will be the basis for monitoring progress of the work through-out Phase I. DOE comments to the Plan will be incorporated and a final issue released in January, 2000.

### **Task 2 – Concept Definition, Development and Technical Assessment**

Three technical studies were started:

#### Task 2.1 – Overall concept definition and development

##### Task 2.1.2.1 – F-T product upgrading options

A consensus for the basis of this study, including F-T products stream characterization, was developed and various upgrading options were identified. Preliminary block flow diagrams for the various options were prepared. KBR began study of the various options in more detail.

##### Task 2.1.2.3 – F-T waste water treating/utilization

A consensus for the basis of this study, including F-T water characterization, was developed and various options identified. KBR began study of the various options in more detail.

##### Task 2.1.3.1 – F-T feed gas optimum H<sub>2</sub>:CO ratio

A consensus for the basis of this study was developed and the following five cases identified:

Case A – Low H<sub>2</sub>:CO ratio (no adjustment to H<sub>2</sub>:CO ratio as it is produced from the gasifier)

Case B – High H<sub>2</sub>:CO ratio (add sour shift section)

Case C – High H<sub>2</sub>:CO ratio (add natural gas Steam Methane Reformer)

Case D – High H<sub>2</sub>:CO ratio (add hydrogen)

Case E – High H<sub>2</sub>:CO ratio (recycle F-T tail gas)

Preliminary block flow diagrams for these cases were developed and a more detailed review of each was initiated.

#### Task 2.2 – Alternatives and options assessment and selection

**Task 2.2.1 – Identify sites for concept development**

An investigation of potential host sites for the EECP was begun.

**Task 2.2.2 – Visit/evaluate two sites**

Members of the project team visited the Motiva refinery in Port Arthur, Texas on December 2, 1999 and Tampa Electric Company's Polk Power Station near Tampa, Florida on December 7, 1999. Both of these sites appear to be viable hosts for the EECP and will continue to be evaluated using preliminary process study results.

**Task 6 – Preliminary Site Analysis**

**Task 6.1 – Site criteria**

Prior to consideration of any specific site, the project team developed a list of site selection criteria for use in evaluating the relative merits of the potential sites. These criteria contain site characteristics including transportation access, market factors, economic factors, and environmental considerations, as well as the host's commitment to the project.

**Task 6.2 – Identify specific sites**

The two sites (reference Task 2.2.2) that have been identified for further EECP concept evaluation are considered representative of a "typical" power plant and a "typical" refinery. Further process study will help weigh the relative merits between these two types of facilities.

### **III. List of Major Activities for October through December, 1999**

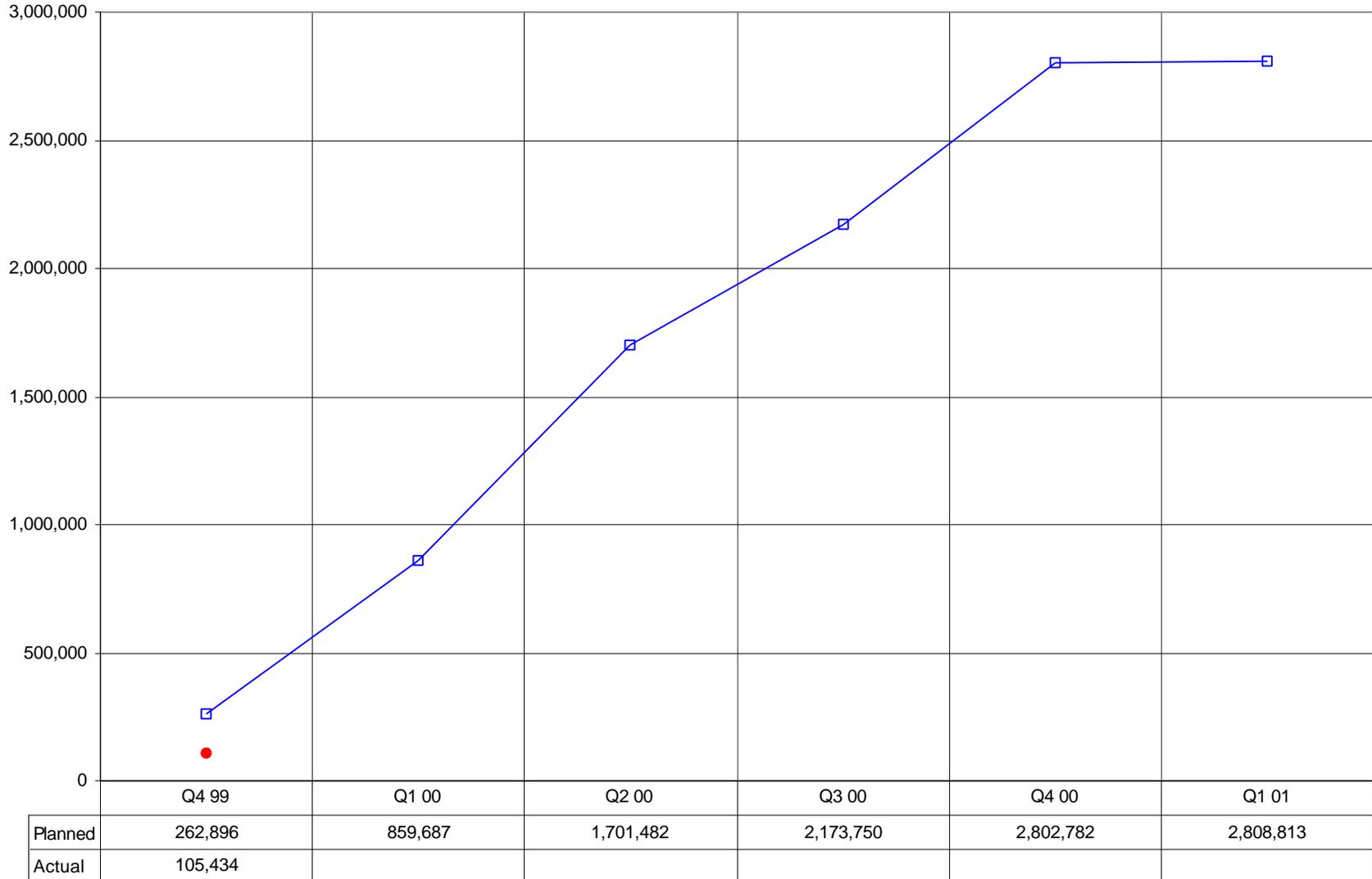
- Signed Cooperative Agreement on September 30, 1999 and immediately began organizing an EECF project team.
- Submitted Project Management Plan to DOE for review on November 16, 1999.
- Held kick-off meeting at DOE offices in Morgantown, WV on November 19, 1999
- Began development of contracts for sub-contractors (GE, Praxair, Brown & Root Services)
- Developed EECF site selection criteria and visited two potential sites on December 2 and December 7, 1999.
- Began developing invoicing procedures
- Began conceptual process studies for:
  - Fischer-Tropsch product upgrading options
  - Fischer-Tropsch waste water treating options
  - Fischer-Tropsch feed gas optimum H<sub>2</sub>:CO ratio

#### **IV. List of planned activities for January through March, 2000**

- Incorporate DOE comments on Project Management Plan and receive approval
- Award contracts to sub-contractors
- Begin periodic meetings for coordination of process work among all parties
- Select a “typical” power plant and a “typical” refinery for further study as EECP site
- Complete the following process studies:
  - Fischer-Tropsch product upgrading options
  - Fischer-Tropsch waste water treating options
  - Fischer-Tropsch feed gas optimum H<sub>2</sub>:CO ratio
- Begin and complete the following process studies:
  - Acid gas removal scheme
  - Fischer-Tropsch tail gas utilization
  - Per cent of CO<sub>2</sub> in Fischer-Tropsch feed gas
- Prepare Block Flow Diagrams and Heat & Material Balances for both sites
- Begin market assessment and product valuations for both sites

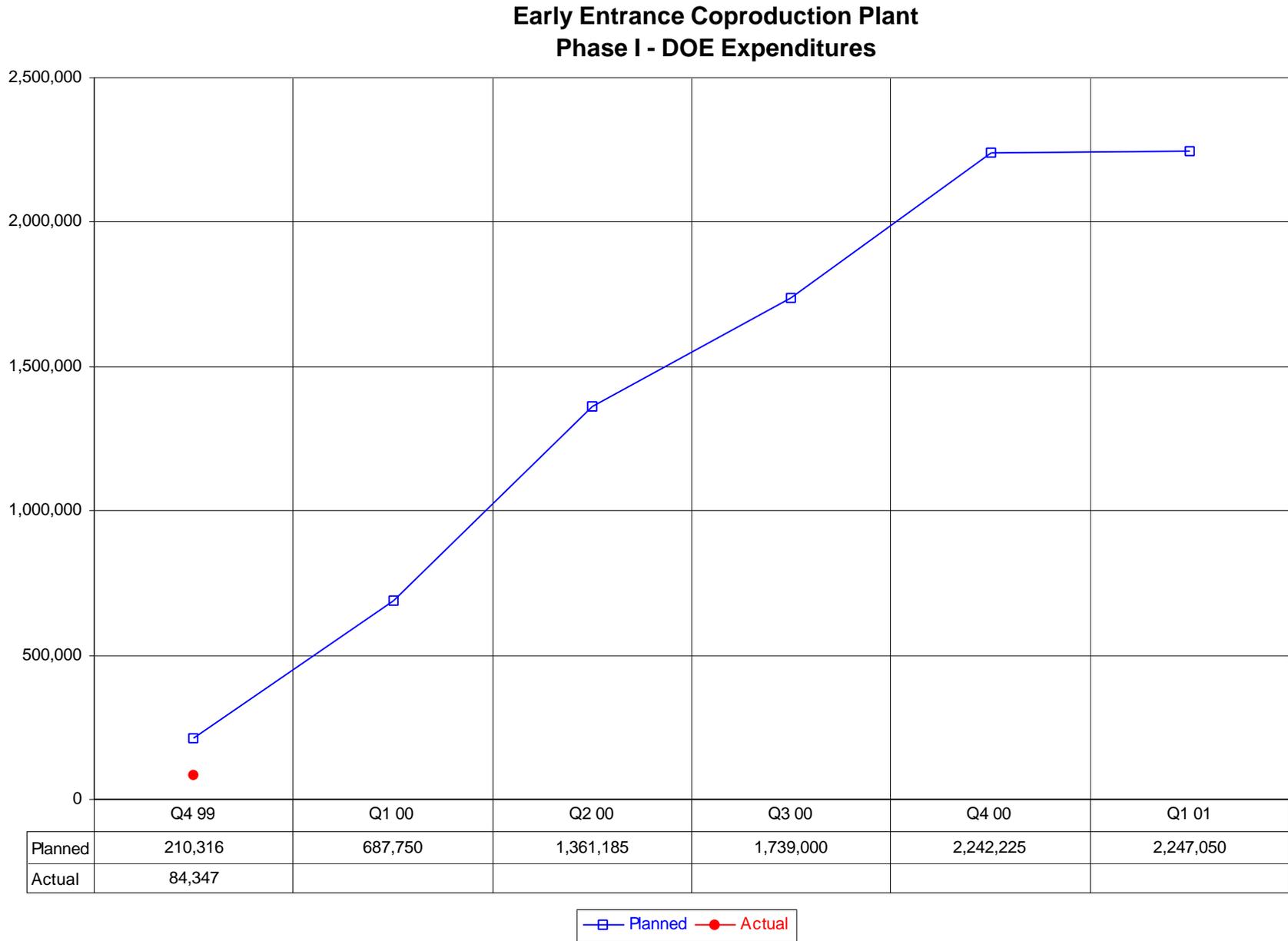
**V. Graph – Phase I, Planned vs. Actual Total Expenditures**

**Early Entrance Coproduction Plant  
Phase I - Total Expenditures**



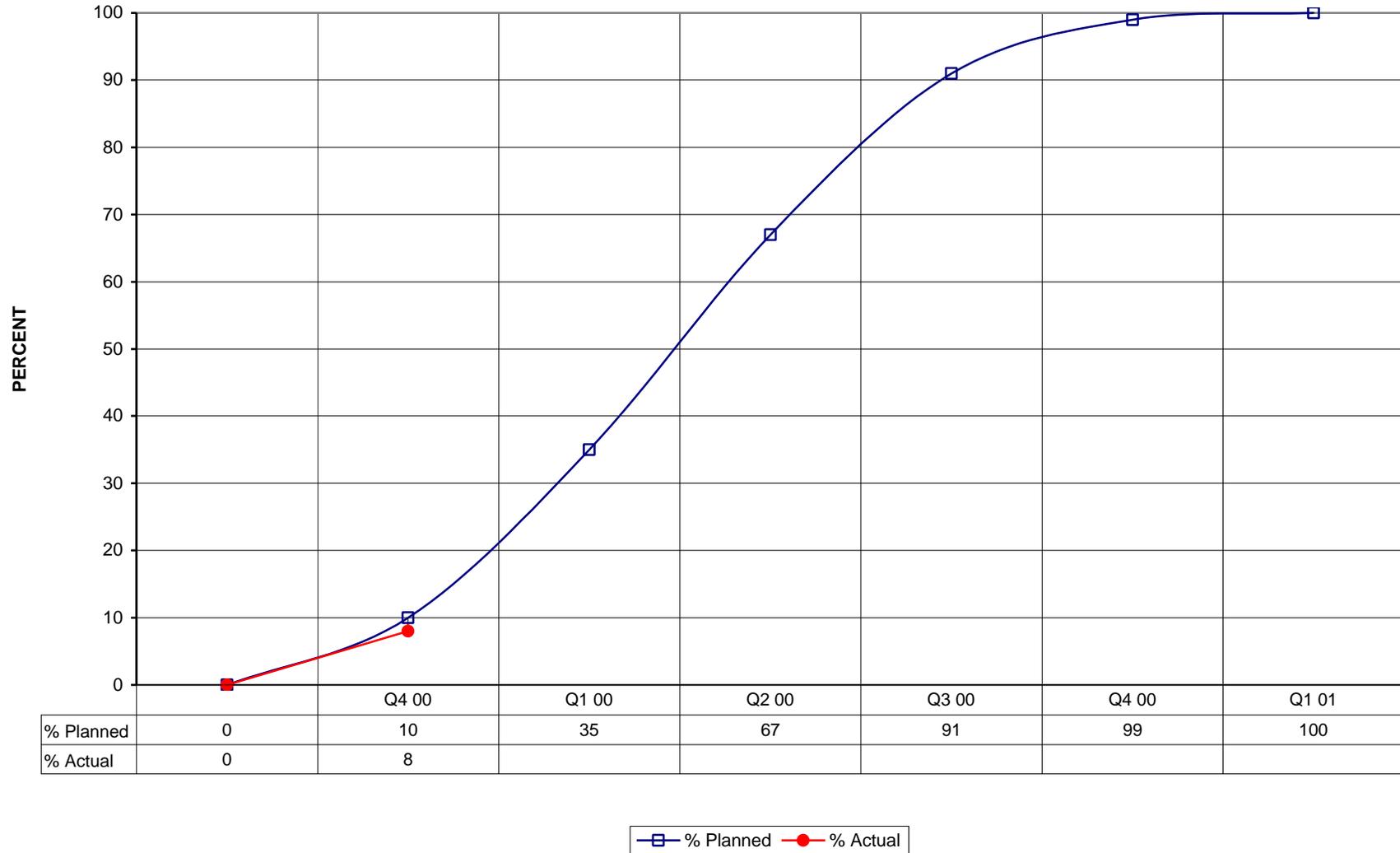
—□— Planned —●— Actual

**VI. Graph – Phase I, Planned vs. Actual DOE Expenditures**



**VII. Graph – Phase I, Planned vs. Actual Progress**

**Early Entrance Coproduction Plant  
Phase I - Total Project % Complete**



### VIII. Schedule

