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"RESEARCH AND EVALUATION OF BIOMASS RESOUCES/ CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL)"

QUARTERLY TECHNICAL PROGRESS REPORT

FOR THE PERIOD

February 1, 1980 to April 30, 1980

WORK PERFORMED UNDER

DOE CONTRACT DE-AC0278ET20611
(Formerly Contract No. ET 78-C-02-5022)

Yong K. Ahn
Yung C. Chen
Herbert T. Chen
Richard W. Helm
Eric T. Nelson
Kevin J. Shields
Richard P. Stringer (Project Manager)

of

Gilbert Associates, Inc.
Reading, Pennsylvania 19603

and

Richard C. Bailie

of

Environmental Energy Engineering, Inc. &
West Virginia University
Morgantown, West Virginia 27505

DISCLAIMER

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TABLE OF CONTENTS

I. SUMMARY

Project Description

The project will result in two distinct products.

1. A biomass allocation model which will serve as a tool for the energy planner. With the computer assisted modeling tool the energy planner can select the most profitable combination of biomass feedstocks and the thermochemical conversion processes required to satisfy specific fuel needs under given market conditions. Two data bases are required for this model; a market analyses data base, and a thermochemical processing data base. The market analyses data base includes regional and seasonal biomass cost and availability information and selling prices and demand information for the biomass derived fuels. The thermochemical process data base includes process efficiency information as well as manufacturing costs for the biomass derived fuels.

2. The experimental data is being generated to help compare and contrast the behavior of a large number of biomass material in thermochemical environments. Equipment used to generate the data will include:

   - o Process Development Units
   - o Thermal Gravimetric Analyzers
   - o Pyrogaschromatographs
   - o Effluent Gas Analyzers

The Industrial Energy Research Division of Gilbert Associates, Inc. has performed the biomass allocation modeling portions of the project. Gilbert has been responsible for project management, market analyses, process modeling, and linear programming portions of the project.

The experimental portion of the project has been carried out by West Virginia University and Environmental Energy Engineering, Inc. in Morgantown, West Virginia under the direction of Dr. Richard Bailie.

The original scope of the project is described in the "Clarification Proposal" which was sent to DOE on March 29, 1978. Since then, there has been a need to change some aspects of the scope. These changes are described in this report.

Technical man-hours began to be charged to the project in October of 1978 when the signed contract was received by DOE, one month after the project period began.

The contract extends to October 1, 1980 at which time the final report is due. A continuation proposal is currently being prepared for funds to continue the work for 18 months after October 1st.

Progress To Date

Task 1 (Market Analysis)
Based on information in the literature, values have been developed for regional biomass costs and availabilities and for fuel costs and demands. This data is now stored in data banks and may be updated as better data become available.

Task 2 (Fuel Characterization)
Seventeen biomass materials have been run on the small TGA and the results partially analyzed. Ash analysis has been performed on 60 biomass materials. The Effluent Gas Analyzer with its associated gas chromatographs has been made operational and some runs have been carried out.

Task 5 (Evaluation of Effect of Biomass Particle Size on Fluidized Bed Runs)
This task has been completed.

Task 12 (Process Economics)
Using a computerized program for developing product costs, parametric studies on all but 1 of the 14 process configurations being considered have been performed. Background economic data for all the configuration have been developed.

Task 7 (Develop Process Models)
Models to simulate biomass gasifications in an entrained and fixed bed have been developed using models previously used for coal gasification.

Task 9 (Two Hour Steady State PDU Tests)
Runs have been carried out in the fludiized and fixed bed reactor modes using a variety of biomass materials in atmospheres of steam, O_2 and air.

Task 6 (Creation of a Biomass Feedstock Data Bank);
Task 13 (Creations of a Biomass System Data Bank);
Task 14 (Develop biomass Analysis Program);
Check out of the system continues using fabricated manufacturing cost and efficiency data. A users manual has been written.

II. MAJOR PROBLEMS AND CONSTRAINTS

Production of the biomass characterization data has been behind schedule but is now being generated at an accelerated rate.

The original intent of the project was to have experimental data available in time so that the process models could be developed and for efficiencies and manufacturing costs to be generated from this information. An alternative approach has been followed in the project. Process models available from existing coal conversion reactor models have been used to simulate biomass gasification processes.

III. TECHNICAL STATUS REPORT

Task 1 - Market Analysis

Technical Status:

During the past reporting period the level of effort in the market analysis area has been limited to answering questions pertaining to the assumptions used to arrive at the initial data base. Some documentation work has been carried out, but the bulk of this work will be deferred until such time that the documentation for the project must be generated in final form.

Schedule Status:

This task is on schedule.

Next Month:

No new market analyses work is planned.

Scope Changes:

A minor scope change has been made in Task 1. The original statement of work for Task 1 was presented in the clarificaton proposal sent to DOE on March 29, 1978.

In the classification proposal it was stated that the same biomass species being characterized in the experimental laboratory phase of the project (Task 3) would be used in Task 1. The market analysis has been restricted to 61 biomass species, many of which are different than those examined in Task 3. The rationale for selecting the biomass species on which a market analysis was performed is based on the availability of the required data.

Task 2 - Fuel Characterization By Atmospheric TGA Runs

Technical Status:

Major activities included:

- Refurbishing the drop-down mechanism of large TGA - Task accomplished.
- Repair of the two Beckman TGA's - Task accomplished.
- Continuation of ash analysis - 60 materials run.
- Initial EGA runs performed.
- Operations on the small TGA routine.

Discussion of data obtained on small TGA:

A small sample of biomass (less than 20 mg) was heated and the weight of sample remaining and the rate of sample weight loss recorded continuously. The procedure followed was:

- Weight sample
- Heat sample at a rate of 80°F/min. to 960°C in He atmosphere.
- Admit oxygen and burn remaining solid at 960°C.

The chart outputs are provided with this report.

It should be evident from viewing these outputs that the behavior of biomass species under thermal stress is not the same. A few observations from the charts show:

- Sample results are reproducible -- Look at Blackjack Oak analysis

  312-5
  312-6
  312-7
  312-8
  313-4

- Wood species differ -- Compare Blackjack Oak and Balsam Fir. The Oak shows an inflection point prior to maximum. Fir does not.
- Some species are quite different -- Note that Sorghum exhibits three maximums.
- Kelp is an extremely unique material.
- Peat is far different than biomass.

In addition to the raw data points taken at 10° intervals, figures of these are provided on work-sheets. Some characteristic points of these work sheets are summarized in the attached data. The summary table contains:

- Sample specie and identification number.
- Sample weight (for some samples).
- Temperature maximum weight loss occured.
- Fraction of sample pyrolyzed at time maximum weight loss occured.
- Percent volatile taken as the fractional weight loss at 900°F.

SUMMARY TABLE

Identification Material No.		Sample Wt. Mg	Temp. @ Max. Wt. Loss	% Loss @ Max. Wt. Loss	Percent Volatile
Hardwood Pellet	0213-4	3.45	370	32	80
	0222-5	4.77	370	29	82
Cellulose	0224-4	5.56	410	51	95
Black-Jack Oak	0311-8	12.0	400	46	79
	0312-5	15.2	400	44	79
	0312-6	17.85	390	44	78
	0312-7	12.41	390	46	78
	0312-8	15.12	385	45	78
	313-4	11.86	390	46	78
Sorghum	313-6	13.5	390	55	80
	313-7	13.08	390	55	80
Sorghum Rinds	314-5		390	54	80
	317-2	15.14	390	53	80
Hybrid Pop.	325-3		400	53	84
	325-4		400	50	86
	325-5		400	50	85
Wooden Pellets	326-1		410	47	80
	326-2		410	47	79
Corn Pellets	327-2		380	45	77
	327-3		370	40	76
	327-4		365	39	77
Peat Pellets	327-5		370	13	53
	327-6		370	13	53
	331-12		410	20	54
Cellulose	0224-4		410	51	
Peanut Shells	0317-4		390	41	
Balsam Fir	0317-12		390	45	82
	0318-3		400	40	84
Peanut Shells	0318-5		380	42	75
Corn	0318-5		380	41	
	0319-1		380	44	85
Hardwood Pellets	0320-2		390	41	77
Woodex Pellets	320-4		420	52	80
Hardwood Pellets			390	43	78

ANALYSIS OF ASH OF BIOMASS SAMPLES

	Fe_2O_3	K2O	Na2O	MnO	ZnO	TiO2	SrO	SiO2	A1203	MgO	CaO	Cu µg/ml in 250 ml	Cu wt. %
Kelp	ND	16.8	11.2	ND	ND	ND	0.20	ND	ND	3.0	3.8	ND	ND
Balsam Fir	0.6	21.7	ND	3.6	0.10	ND	0.13	1.0	0.2	4.9	42.4	0.2	0.05
Barley Straw	0.4	21.0	0.8	0.03	ND	ND	0.03	46.0	ND	2.2	6.1	0.1	0.025
M-Nut Hickory	0.3	3.3	ND	1.2	0.15	ND	0.46	1.0	0.1	2.8	67.2	ND	ND
Black Gum	0.2	12.0	0.3	1.25	0.05	ND	0.32	2.0	0.4	9.5	58.8	ND	ND
Walnut	0.2	7.8	ND	0.03	ND	ND	0.12	1.0	0.2	8.3	71.4	0.1	0.025
Er Cedar	0.5	5.9	0.3	0.23	0.03	ND	0.05	1.0	0.4	3.4	73.5	0.2	0.05
Slash Pine	1.8	15.0	0.4	2.6	0.20	0.1	0.17	3.0	5.8	10.0	34.8	0.45	0.1125
Cottonwood	0.6	21.6	0.3	0.67	0.55	0.1	0.19	2.0	0.2	6.4	37.8	0.2	0.05
Post Oak	0.4	9.8	ND	1.14	0.01	ND	0.23	ND	ND	3.0	32.5	0.1	0.025
Tamarak	0.5	18.0	0.6	8.4	0.24	0.1	0.23	ND	0.2	9.0	34.1	0.2	0.05
Corn Pellets	2.4	13.2	0.7	0.16	0.28	0.2	0.05	42.0	2.7	7.9	18.5	0.4	0.10
Hybrid Poplar	0.4	16.5	ND	0.13	0.12	ND	0.06	ND	0.1	2.7	52.5	0.2	0.05
Hardwood Pellets	1.6	12.8	0.3	0.11	0.06	ND	0.10	24.0	2.2	3.9	38.5	0.1	0.025
Sycamore	0.3	16.0	0.1	0.19	0.04	ND	0.18	1.0	ND	12.4	42.9	0.1	0.025
Woodex Pellets	6.4	6.1	0.2	0.7	0.03	0.4	0.12	32.0	5.5	3.5	38.5	0.1	0.025
Rind	0.6	17.2	1.3	0.13	0.09	ND	ND	53.0	0.1	6.4	4.7	ND	ND
Tops	0.9	20.5	0.8	0.1	0.04	0.1	ND	56.0	1.2	3.6	3.5	ND	ND
Peanut Pellets	2.2	22.0	0.5	0.12	0.06	0.85	0.07	43.0	4.7	3.9	11.4	0.6	0.15
Black Jack Oak	0.3	20.0	ND	1.6	ND	ND	0.27	2.0	0.3	3.9	52.8	ND	ND
Sorghum Leaves	0.3	16.0	0.7	0.07	0.02	ND	0.01	44.0	0.5	7.9	8.4	ND	ND

ANALYSIS OF ASH OF BIOMASS SAMPLES (Cont'd)

	Fe_2O_3	K_2O	Na_2O	MnO	ZnO	TiO_2	SrO	SiO_2	Al_2O_3	MgO	CaO	Cu µg/ml in 250 ml	Cu wt. %
Black Oak	0.3	12.0	0.1	2.95	0.01	ND	0.25	1.0	0.2	2.8	58.3	0.1	0.025
Walnut Shell	17.5	19.2	1.8	0.30	130.0	0.3	0.08	7.0	1.3	6.3	28.00	1.18	
B. Locust	0.9	3.7	0.6	0.11	180.0	0.1	0.29	3.0	2.0	4.5	72.05	0.30	0.075
Sassy	3.5	15.6	0.8	1.42	470.0	0.3	0.44	12.0	3.4	3.9	43.00	0.91	0.2275
Magnolia	2.0	9.6	0.4	0.09	120.0	0.4	0.23	23.0	4.0	4.7	49.5	0.47	0.1175
P. Toment	1.5	13.6	1.1	0.08	270.0	0.1	0.18	3.0	1.1	19.6	31.5	0.67	0.1675
R. Spruce	1.0	2.5	0.2	2.94	680.0	0.1	0.14	3.0	1.1	3.4	45.0	0.55	0.1375
Hackberry	1.3	2.6	0.3	0.07	60.0	0.2	0.33	8.0	1.5	11.0	46.5	1.09	0.2725
Hard Maple	1.6	9.0	0.4	11.00	70.0	0.2	0.20	10.0	1.8	5.0	49.0	0.23	0.0575
Corn	0.6	29.4	0.8	0.34	1000.0	0.1	0.4	41.0	0.8	4.3	14.6	0.75	0.1875
Y. Pop	0.6	6.1	0.5	4.96	210.0	0.1	0.49	3.0	2.6	14.3	60.0	0.22	0.055
B. Birch	0.5	2.8	0.3	15.97	108.0	ND	0.19	2.0	0.5	4.2	67.1	0.30	0.075
Red Oak	0.6	2.5	0.2	4.41	111.0	ND	0.24	2.0	0.5	1.8	74.8	0.36	0.09
Dogwood	0.9	3.0	0.4	0.11	70.0	0.1	0.28	4.0	3.6	5.0	74.8	0.27	0.0675
Red Maple	0.8	4.2	0.3	9.6	360.0	ND	0.28	5.0	0.3	3.3	67.1	0.55	0.1375
White Oak	0.6	3.4	0.3	1.40	160.0	0.1	0.20	2.0	1.4	2.1	74.8	0.28	0.07
JA Stalk	0.6	4.5	0.4	1.40	500.0	0.1	0.17	16.0	0.9	4.1	63.25	0.37	0.0925
Elm	0.9	4.6	0.4	0.77	120.0	0.1	0.32	10.0	0.8	6.4	66.0	0.27	0.0675
Hickory	0.8	3.4	0.3	5.28	2090.0	ND	0.50	3.0	2.3	6.9	66.0	0.20	0.05
B. Cherry	3.0	9.6	0.5	1.14	210.0	0.45	0.30	29.0	5.5	4.5	37.5	0.60	0.15
Sweet Gum	1.1	4.4	0.3	3.15	170.0	0.1	0.31	6.0	2.0	7.4	63.8	0.25	0.0625

Schedule Status:

Although the schedule status for Task 2 is nearly six months behind due to equipment problems and unanticipated difficulties in developing standardized procedures data is now being generated at an excellerated rate.

Next Month:

Additional samples will be analyzed by TGA.

Scope Changes:

In the clarification proposal biomass characterization was limited to only one analytical procedure. Since the original submission Dr. Bailie has found that other experimental techniques may provide even more useful data concerning the characterization of biomass in thermochemical environments and these have been included to make the study more informative.

These changes are summarized in the following table.

Non-Catalytic Studies on Biomass
(Atmospheric)

		Original Plan	Present Plan
1.	Large TGA (Pellets N_2, CO_2, H_2O, H_2 atm.		
	a) Pyrolysis curves	X	X
	b) Gasification of Char		X
2.	Ultimate Analysis	X	X
3.	Proximate Analysis (A.S.T.M.)	X	X
4.	Proximate analysis - P & E TGA		X
5.	Thermogram		X
6.	Pyro-gas chromatograph		X
7.	Analysis of Ash		X
8.	Analysis of Mineralogy		X
9.	Surface Area Measurements of Char		X
10.	Wood Chemistry		X
11.	E.G.A.	X	X

Catalytic Studies

	Original Plan	Present Plan
1. Large TGA (Pellets		
a) Pyrolysis	X	X
b) Gas Char Reactivity		X
2. Thermogram		X
3. Pyrogaschromatograph		X

Task 3 - Pressurized TGA Runs: Evaluation of Effects of Temperature and Pressure

Technical Status:

Task 3 has remained inactive except for work being done to prepare the new pressurized TGA.

Schedule Status:

Task 3 is approximately 12 weeks behind schedule.

Next Month:

Work will continue on preparing the new pressurized TGA for the required runs.

Task 4 - Catalytic Testing by Atmospheric TGA Runs

Technical Status:

No activity took place on this task during the reporting period.

Schedule Status:

Task 4 has been rescheduled to take place during the last month of the project.

Next Month:

No activity is anticipated on this task.

Task 12 - Process Economics

Progress to Date:

Currently fourteen process configurations for biomass conversion are being addressed under this task as follows:

1. low Btu gas
2. medium Btu gas
3. SNG
4. low Btu gas/combined cycle power plant/300 MW/baseload service
5. low Btu gas/conventional power plant/200 MW/baseload service
6. medium Btu gas/combined cycle power plant/200 MW/baseload service
7. medium Btu gas/conventional power plant/200 MW/baseload service
8. methanol/combined cycle power plant/100 MW/intermediate service
9. methanol/gas turbine/50 MW/peaking service
10. direct biomass combustion/conventional power plant/200 MW/baseload service
11. ammonia
12. gasoline from methanol via Mobil M-gasoline
13. fuel oil via pyrolysis
14. fuel grade methanol

Background economic data used for computer analysis of the biomass systems have been developed for each of the fourteen process configurations. Parametric studies have been done for all configurations except for configurations (8) and (9). Results of parametric analyses for several process configurations were discussed in detail in last months report. Analagous trends have been observed in the other configurations analyzed.

Schedule Status:

Preparation of inputs for the biomass allocation model is somewhat behind schedule. However, it appears the overall schedule for task 12 can be met.

Future Plans:

The immediate objective is preparation of efficiency and cost inputs to the biomass allocation model. Results of the parametric studies, literature review, and engineering judgement will be used to develop representative values for plant capacity, capacity factor and thermal efficiency for each of the fourteen process configurations. For the 61 biomass types included in the study, values for heating, density and cost will be developed. Due to the scarcity of information available for many of the specific biomass types, some categorical generalization may be necessary. One such generalization could consider the 61 biomass types as one of the following four types:

1. hardwoods
2. softwoods
3. low moisture non-wood biomass materials
4. high moisture non-wood biomass materials

It is likely that such a classification scheme will be used in assigning biomass costs, since it was employed in a biomass market study performed earlier in the project.

Once process and feedstock parameters are finalized, the computer program will be used to develop finalized costs data. These cost data, along with the estimates of process efficiencies, are the inputs required to execute the biomass allocation program.

Scope Changes:

The overall objective of this task is to perform economic analyses of selected biomass conversion processes. Product manufacturing costs developed by this analysis, along with data on process efficiencies were to be used as inputs to the data bank of the biomass allocation model.

Achievement of the object stated above is, of necessity, being realized by an approach different from that stated in the technical proposal. Originally, process designs and conversion data were to be developed partially based on efficiency information developed in task 7. Economic evaluations, based on Discounted Cash Flow (DCF) analysis were to be performed for process configurations producing low Btu gas, medium Btu gas, SNG, ammonia and methanol from biomass feedstocks.

Instead, a data base of best available information on process economics of biomass conversion systems was compiled entirely from literature. A computer program was developed to permit a user to estimate process economics for biomass conversion processes at selected process conditions and specified financial parameters. A key advantage of the approach is flexibility. As better information on process economics becomes available it may be stored in the data bank, replacing other information.

In addition to modifying the approach, the scope of effort was expanded in three ways. First, a number of products were added to those originally proposed. Second, the computer program developed provides financial analysis by the Utility Financing Method (UFM) as well as DCF. Although the biomass allocation model will be used with only DCF product costs, the capability to use UFM analysis in future efforts now exists. Finally, in addition to preparing inputs for the biomass allocation model, a sensitivity analysis of plant size and biomass cost has been performed for several of the process configurations.

Task 7 - Develop Process Models

Technical Status:

Due to delays in the availability of TGA experimental data for timely execution of this task, the biomass process modeling has been based on coal gasification models developed by Dr. C. Y. Wen of West Virginia University. Computer models have been run for entrained and fixed bed biomass gasification.

Schedule Status:

Task 7 is approximately 1 month behind schedule due to the lack of experimental data required to input the models, and the necessity to obtain data from the literature for imputting the model.

Future Activity:

Future activity in this task will be limited to the documentation which will be required for the final report.

Scope Changes:

Task 7 (Process Modeling) was originally conceived to serve as a transitional linkage between Tasks 2, 3, 4 (TGA Runs) and Task 12 (Process Design and Economics). As envisioned, experimental TGA data from Tasks 2, 3, and 4 were to be utilized to develop, first of all, kinetic rate equations for various biomass species. The rate equations would then be incorporated into reactor modeling studies to predict gasification efficiencies of commercial-scale reactors (entrained bed, fixed bed, etc.), which in turn will be incorporated into the process design and economics calculations of Task 12.

Being sequential in nature, this approach requires timely development of TGA data as initial imputs to Task 7. Unfortunately, there have been delays in carrying out Task 2 through 4. Biomass TGA data have not been available in time for Gilbert to proceed with process modeling in the manner originally planned. In order not to unduly delay execution of Task 7 (and hence hinder its completion), the alternative approach that has been adopted in process modeling is to modify available existing coal conversion reactor models to simulate the biomass gasification processes. Using this approach, we have completed investigations of the effects of operating parameters on entrained bed and fixed bed gasifier performance, such as water or oxygen/fuel ratio on thermal effieicney and product gas composition, etc.

While the results are interesting from a simulation point of view, it is fact, however, that they may not correlate very well with real situations, since they are based on the kinetic rates of coal conversion reactions. Compared to coal, biomass is known to be significantly more inactive and, as was observed in some of the computer runs, a minor modification in the kinetic parameters would sometimes cause a large difference in predicted results (e.g., bed height). Partly due to this uncertainty, Task 7 has also been divorced from Task 12 such that the results of process modeling are not directly imputed to process design and economic calculations of Task 12. Instead, overall thermal efficiencies of various biomass conversion processes have been obtained from literature sources for the purposes of process design and economic calculations.

In the coming months, the activity of Task 7 will be confined to documentation of process modeling accomplished thus far. Results of parametric studies will be organized into a self-contained package for includion in the final report.

Task 5 - Evaluation of Effect of Biomass Particle Size On Fluidized Bed Runs

Schedule Status:

As scheduled and reported in the previous quarterly report, this task has been completed.

Task 9 - Two Hour Steady State Tests

Technical Status:

o The following fixed bed tests have been run:

- Woodex pellets:air
- Woodex pellets:10% oxygen - 90% steam
- Woodex pellets:15% oxygen - 85% steam
- Peanut hull pellets:air
- Wet bark:air

o The following operational problems have been encountered:

- The bottom three thermocouples on the first thermocouple probe were lost during the first run. The temperature was in excess of 2500°F when the thermocouples were lost.

- Difficulty in obtaining steady state. The bed depth at the end of the day was not the same as the starting depth. There was no clear trend in the bed height variations.

- In the 10% oxygen - 90% steam run the bed temperature kept falling off and the run was terminated when the temperature became too low.

- The gas produced from the first bark run was not sufficient to keep burning in the afterburner. The bark has a moisture content of about 70% on a wet basis.

- The second bark test was better but this was due to the initial charge of material remaining in the hot unit overnight. This resulted in it drying out. Steady state was never reached.

- It has been found necessary to burn the tars out of the stack and cyclone after each day or two days of running.

o The weight feeder has been received.

Future Plans:

A new thermocouple probe will be installed and steam will be added in the air runs to control the "hot zone" temperature at 2400°F. Fixed bed tests will be completed and set-up for the entrained bed tests should be started.

Schedule Status:

The scheduling for this task has been changed since the clarification proposal was prepared in 1978, however the completion data remains the same. The schedule status corresponds with the revised schedule.

Scope Changes:

The original intent of this task as described in the clarification proposal was to verify process models developed from TGA data. This has turned out to be impossible because the TGA data did not start to be generated until the project period was nearly 75% completed. It is also questionable if it would be possible to develop process models from the data generated by the TGA. As a consequence, the biomass characterization work and the PDO studies are being treated as a separate studies independent of the Biomass Allocation Model. Tasks 9 is more accurately described as short term, steady state, shake down studies to develop operational data with different biomass feedstocks in fixed, entrained and fluidized reactor models. This task is developing the data which will allow for the sustained runs to be carried out in Task 11. The total number of runs which will be made during the short term PDU runs will be reduced from the 120 runs suggested in the proposal.

Task 10 - PDU Catalystic Runs

Technical Status:

In preparation for activity on this task, the cracking catalyst has been received.

Schedule Status:

This task has been rescheduled to occur in June after Tasks 9 and 11 are completed because of the need to avoid contaminating the reactor with catalysts which could interfere with the short term steady state and sustained runs (Task 9 and 11).

Next Month:

An attempt will be made to find a source of biomass pellets impregnated with catalysts.

Task 11 - Sustained Runs

Technical Status:

Ten tons of woodex pellets have been ordered.

Schedule Status:

This task is scheduled to occur during May and June.

Next Month:

No activity is scheduled for next month on Task 11.

Task 6 - Creation of a Biomass Feedstock Data Bank; Task 13 - Creation of a Biomass System Data Bank; Task 14 - Develop Biomass Analysis Program

Technical Status:

A small amount of program improvement work has been carried out during the past reporting period and a few test runs have been made. Simulated effieciencies and manufacturing costs are still being used.

Schedule Status:

These tasks are on schedule.

Next Month:

The program testing and program improvement work will continue as soon as actual efficiency and manufacturing cost data become available.