Level of Effort:

☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER

(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total Est. FY 1975-C	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	
20.0		28.0		26.0		87.0	87.0	88.0	88.0	175.0	
		2.0	2.0	4.0	4.0	6.0	6.0	12.0	12.0	18.0	
20.0		30.0		30.0		93.0		100.0		193.0	
			2.0		4.0		93.0		100		

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS–Federal Government Only *(In millions of dollars)*

a. OPERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	FY Obls.
TOTAL *(Carry forward to summary sheet)* ▶			3.0		10.0		20.0
( ) Name of Performing Organization: To be selected			2.5	2.4	9.2	9.0	19.5
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
( ) Name of Performing Organization: Gulf General Atom			0.5	0.4	0.8	0.9	0.5
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
( ) Name of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
( ) Name of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							

(Continue on Separ

Level of Effort:
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUM

	(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		TOTAL E FY 197
itlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls
	10.0		20.0		28.0		26.0		87.0	87.0	2.0	2.0	89.0
2.4	9.2	9.0	19.5	19.6	27.0	27.0	25.0	25.2	83.2	83.2	-	-	-
.4	0.8	0.9	0.5	0.5	1.0	0.9	1.0	1.1	3.8	3.8	2.0	2.0	5.8

(Continue on Separate Sheet)

Page

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

a. CONSTRUCTION

ITEM	Item No.	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1 Obls.
TOTAL *(Carry forward to summary sheet)* ▶								
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* HTGR Direct Cycle-Bottoming State: Calif; County: San Diego; TEC *(in millions)*: 61.8 Statement: Construction of demonstration test plant for HTGR bottoming cycle test. Funding 2/3 industry 1/3 Federal	(3)							
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* State; County; TEC *(in millions)* Statement:	( )							
TITLE OF PROJECT *(Not to exceed characters and spaces.)* State; County; TEC *(in millions)* Statement:	( )							

(Continue on Separat

Level of Effort:

[X] MAXIMUM
[ ] ORDERLY
[ ] MINIMUM

IDENTIFICATION NUMBER

(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) SUBTOTAL FY 1975-79 Obls.	(7) SUBTOTAL FY 1975-79 Outlays	(8) BALANCE TO COMPLETE Obls.	(8) BALANCE TO COMPLETE Outlays	TOTAL [illegible] Obls
				2.0	2.0	4.0	4.0	6.0	6.0	12.0	12.0	18.0
				2.0	2.0	4.0	4.0	6.0	6.0	12.0	12.0	18.0

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

B. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

c. EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*		(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	FY Obls.
For each major performing organization, show total equipment funds, with a separate identification of each item of equipment costing one-half million dollars or more.	TOTAL *(Carry forward to summary sheet)* ▶							

NONE

(Continued on Separate

Level of Effort:
☐ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975–79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 (CR 7 &	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays

NONE

(Use Separate Sheets)

2

ENERGY RESEARCH & DEVELOPMENT

FACT SHEET

☒ MANUAL
☐ ORDERLY
☐ MISSION

1. IDENTIFICATION NO. 0603559711S05A

2. a. PROGRAM	Conversion Techniques
b. SUBPROGRAM	Waste Heat Utilization - Part A
3. a. PROPONENT AGENCY	DOD, NASA, ERDA
b. SUBUNIT	
4. CONTRACTOR AND SITE (No more than 42 characters and spaces for name of contractor; use standard abbreviation for state; up to 16 characters and spaces for county.)	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR: Competitive Bidding
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:

5. BRIEF DESCRIPTION OF PROPOSAL (No more than 24 lines of text and no more than 70 characters and spaces per line) Briefly outline nature and scope of work to be undertaken. Including any new facilities which may have to be acquired or constructed.

A program to demonstrate an optimized advanced total u system in a practical application making maximum use of the ener generated by the power converter using an environmentally clean and also making use of the waste heat generated by the power con whereby the total system efficiency can be measured as 75% will implemented. A thorough investigation, including required exper tion, design studies, integration of design elements, and indivi testing culminating in a second round pilot plant demonstration maximum generated energy utili ation from a converter. Technolo will be considered in the power, heating-ventilation-air conditi waste water treatment, potable water treatment, control, solid processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1976-1977 tim

6. JUSTIFICATION (Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	197
a. MANPOWER (In man years)	(1) Scientific	9	9	4	4	
	(2) Technical	27	27	22	22	
	(3) Support	9	9	32	33	
	(4) Other	12	25	35	35	3
b. RAW MATERIALS (List materials and units of measure below, such as tons of coal, barrels of oil, Kilograms of uranium, etc. Show amount of each in columns at right.)			6250 tons of coal	6250 tons of coal	6250 tons of coal	6250 of c
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned		4	4	4	
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					

...ACT SHEET

☒ MANDATORY
☐ ORDERLY
☐ VOLUNTARY

1. IDENTIFICATION NUMBER
0603552[illegible]

RAM	Conversion Techniques
NT AGENCY	Waste Heat Utilization - Part 3
	DOD, NASA, HUD

R AND SITE
42 characters and
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hreviation for state)
riers and spaces for

NAME OF CONTRACTOR:
Site where work will be performed ▶ | State: | County:

NAME OF CONTRACTOR:
Site where work will be performed ▶ | State: | County:

NAME OF CONTRACTOR: Competitive Bidding
Site where work will be performed ▶ | State: | County:

NAME OF CONTRACTOR:
Site where work will be performed ▶ | State: | County:

NAME OF CONTRACTOR:
Site where work will be performed ▶ | State: | County:

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24 lines of text
an 70 characters
(line)
nature and scope
ndertaken,
ew facilities
to be acquired

A program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel. and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1976-1977 time frame.

2

(Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
1) Scientific	9	9	4	4	4
2) Technical	27	27	22	22	22
Support	9	9	32	33	33
4) Other	12	25	35	35	35
S d units of uch as tons of , Kilograms of ne amount of right.)		6250 tons of coal	6250 tons of coal	6250 tons of coal	6250 tons of coal
Govt-owned		4	4	4	4
Govt-leased					
Privately-owned					
Other					
CES NEEDED					

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b. SUBUNIT

c. CONTRACTOR AND SITE

(No more than 42 characters and spaces for name of contractor; use standard abbreviation for state; up to 16 characters and spaces for county.

NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		Competitive Bidding
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:

f. BRIEF DESCRIPTION OF PROPOSAL

(No more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

A program to demonstrate an optimized advanced total util. system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fu and also making use of the waste heat generated by the power conve whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experim tion, design studies, integration of design elements, and individu testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologi will be considered in the power, heating-ventilation-air condition waste water treatment, potable water treatment, control, solid was processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1976-1977 time.

g. JUSTIFICATION *(Use a separate sheet(s). See Item 6. on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	1979
a. MANPOWER *(In man years)*	(1) Scientific	9	9	4	4	4
	(2) Technical	27	27	22	22	22
	(3) Support	9	9	32	33	33
	(4) Other	12	25	35	35	35
b. RAW MATERIALS *(List materials and units of measure below, such as tons of coal, barrels of oil, Kilograms of uranium, etc. Show amount of each in columns at right.)*			6250 tons of coal	6250 tons of coal	6250 tons of coal	6250 t of co
c. LAND AREA REQUIRED *(In acres)*	(1) Govt-owned		4	4	4	4
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)		None (1)	None	None	None	None

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NDSITE	NAME OF CONTRACTOR:		
characters and f contractor; eration for state; s and spaces for	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		Competitive Bidding
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:

TION OF

lines of text: 70 characters

ure and scope taken, facilities be acquired

A program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel. and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1976-1977 time frame.

ce a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

AL YEAR ▶	1975	1976	1977	1978	1979
ientific	9	9	4	4	4
chnical	27	27	22	22	22
pport	9	9	32	33	33
her	12	25	35	35	35
its of s tons of grams of mount of t.)		6250 tons of coal	6250 tons of coal	6250 tons of coal	6250 tons of coal
vt-owned		4	4	4	4
vt-leased					
ately-owned					
ier					
NEEDED of quantity ght.)	None (1)	None	None	None	None

4

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBI

0603550711S05601

6. JUSTIFICATION–State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or attainment of the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits expected to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties (R/U), plans to minimize R/U, and basis for proceeding in face of R/U. Quantitative data *should be used* to the fullest extent.

A maximum program to demonstrate as fast as possible the application of total energy systems employing optimum management of waste heat would result in a lower cost progr but the demonstrations would not be as meaningful for more efficient energy converter in various development stages at the present time would not be available.

'EARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER

0603550711S05601

ON – State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem of the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties minimize R/U, and basis for proceeding in face of R/U. Quantitative data *should be* used to the fullest extent.

ım program to demonstrate as fast as possible the application of total energy employing optimum management of waste heat would result in a lower cost program demonstrations would not be as meaningful for more efficient energy converters .. development stages at the present time would not be available.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

E. SCHEDULE *(Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter).*

a. DEVELOPMENT MILESTONES *(number each consecutively)* *(Limit Title of Milestone to 60 characters and spaces)*	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
(1) Theory/Design	75	1	79	1
(2) Component Test	75	2	79	2
(3) System Integration	75	4	76	3
(4) Experimental Test/Demonstration	76	3	79	4

Level of Effort:
- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER
0603550711805601

DATES Complete		a. DEVELOPMENT MILESTONES (continued) (Limit Title of Milestone to 60 characters and spaces)	b. DATES Start		Complete	
FY	Q		FY	Q	FY	Q
79	1					
79	2					
76	3					
79	4					

2

9. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	F Obls.
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0	0	2		3		3
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	2		3		3
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	3		4		4
d. GRAND TOTAL—OBLIGATIONS	0		7		10		10
e. GRAND TOTAL—OUTLAYS		0		7		9	

Level of Effort:

☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
0603550711605601

(4)			(5)		(6)		(7)		(8)		(9)	
1976	FY 1977		FY 1978		FY 1979		Subtotal FY 1975-79		Balance To Complete		Total Excluding FY 1974 (Col. 7 & 8)	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
	3		3		4		15	15	5	5	20	20
	3		3		2		13	13	2	2	15	15
	4		2		1		14	14	1	1	15	15
	10		8		7		42		8		50	
9		10		8		8		42		8		50

2

(4) Other

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

a. OPERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays
TOTAL *(Carry forward to summary sheet)* ▶			2	2	3	3
[ ] Name of Performing Organization:						
MANPOWER						
MATERIALS						
MAJOR PROCUREMENTS						
ALL OTHER						
TOTAL FOR THIS PERFORMING ORGANIZATION						
[ ] Name of Performing Organization:						
MANPOWER						
MATERIALS						
MAJOR PROCUREMENTS						
ALL OTHER						
TOTAL FOR THIS PERFORMING ORGANIZATION						
[ ] Name of Performing Organization:						
MANPOWER						
MATERIALS						
MAJOR PROCUREMENTS						
ALL OTHER						
TOTAL FOR THIS PERFORMING ORGANIZATION						
[ ] Name of Performing Organization:						
MANPOWER						
MATERIALS						
MAJOR PROCUREMENTS						
ALL OTHER						
TOTAL FOR THIS PERFORMING ORGANIZATION						

(Continue

Level of Effort:
- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER: 0603550711605601

'6	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 (Col. 7 + 8)	
utlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
3	3	3	3	3	4	4	15	15	5	5	20	20

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

b. CONSTRUCTION

ITEM	Item No.	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	F Obls.
TOTAL *(Carry forward to summary sheet)* ▶				2	2	3	3	
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )							
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )							
TITLE OF PROJECT *(Not to exceed characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )							

(Continue on Sepa

Level of Effort:
- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER: 06035071190560?

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 COSTS	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
3	3	3	3	3	3	2	2	13	13	2	2	15	15

(Continue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

c. EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outla
For each major performing organization, show total equipment funds, with a separate identification of each item of equipment costing one-half million dollars or more. TOTAL *(Carry forward to summary sheet)* ▶			3	3	4	4	4	

(Continue on Separate Sheet)

Level of Effort:
- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER
0603550711805601

(3) 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8)	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
4	4	4	2	2	1	1	14	14	1	1	15	15

(Continue on Separate Sheet)

2

2. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1[illegible] Obls.	(4) C
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0.2	0.5	7.0	7.0	8.0	8.0	8.0	
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	5.0	5.0	6.0	6.0	6.0	
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	6.0	4.3	7.0	6.0	7.0	
d. GRAND TOTAL—OBLIGATIONS	0.2		18.0		21.0		21.0	
e. GRAND TOTAL—OUTLAYS		0.5		16.3		20.0		2

Level of Effort:

- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMBER: 060355071 1 205

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total Excluding FY 1974 (Col. 7 & 8)	
lays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
2.0	8.0	8.0	7.8	7.8	8.7	8.7	39.4	39.4	7.6	7.6	47.0	47.0
0	6.0	6.0	6.0	6.0	5.0	5.0	28.0	28.0	2.0	2.0	30.0	30.0
0	7.0	8.0	5.0	6.0	4.0	4.7	29.0	29.0	1.0	1.0	30.0	30.0
	21.0		18.8		17.7		96.4		10.6		107.0	
.0		22.0		19.8		18.4		96.4		10.6		107.0

2

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

1. IDENTIFICATION NUMBER
0603550711S05601

a. PROGRAM: Conversion Techniques
b. SUBPROGRAM: Waste Heat Utilization - Part A
c. PROPOSED BY AGENCY: DOD, NASA, DOD,
d. CONTACT:

CONTRACTOR AND SITE

NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR: Competitive Bidding		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:

BRIEF DESCRIPTION OF PROPOSAL

(No more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

An orderly program to demonstrate an optimized advanced total utili[zation] system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fue[l] and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% w[ill] be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuel to be used. The demonstration plant is expected to be operative i[n] 1977-1978 time frame.

6. JUSTIFICATION (Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978	1979
a. MANPOWER (In man years)	(1) Scientific	8	8	4	4	4
	(2) Technical	25	25	20	20	20
	(3) Support	8	8	30	30	30
	(4) Other	10	20	30	30	30
b. RAW MATERIALS (List materials and units of measure below, such as tons of coal, barrels of oil, Kilograms of uranium, etc. Show amount of each in columns at right.)					6250 ton of coal	6250 ton coal
c. LAND AREA REQUIRED	(1) Govt-owned					
	(2) Govt-leased				4	4

RCH & DEVELOPMENT
T SHEET

Level of Effort:
- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

1. IDENTIFICATION NUMBER
060355071180560l

Conversion Techniques
Waste Heat Utilization - Part A

AGENCY: DOD, NASA, DOD,

AND SITE
* character and
of contractor,
location for state
and space for

NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR: Competitive Bidding		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:

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ature and scope
dertaken,
facilities
to be acquired

An orderly program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1977-1978 time frame.

2

(Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
Scientific	8	8	4	4	4
Technical	25	25	20	20	20
Support	8	8	30	30	30
Other	10	20	30	30	30
units of ch as tons of Kilograms of w amount of ight.)				6250 ton of coal	6250 ton of coal
Govt-owned				4	4
Govt-leased					
Privately-owned					

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	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		Competitive Bidding
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:

BRIEF DESCRIPTION OF PROPOSAL

(Do not use more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

An orderly program to demonstrate an optimized advanced total utili system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% wi be implemented. A thorough investigation, including required experi mentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1977-1978 time frame.

6. JUSTIFICATION *(Use a separate sheet(s). See Item 6. on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	1979
a. MANPOWER *(In man years)*	(1) Scientific	8	8	4	4	4
	(2) Technical	25	25	20	20	20
	(3) Support	8	8	30	30	30
	(4) Other	10	20	30	30	30
b. RAW MATERIALS *(List materials and units of measure below, such as tons of coal, barrels of oil, Kilograms of uranium, etc. Show amount of each in columns at right.)*					6250 ton of coal	6250 ton coal
c. LAND AREA REQUIRED *(In acres)*	(1) Govt-owned				4	4
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)		None (1)	None	None	None	None

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NAME OF CONTRACTOR: Competitive Bidding

Site where work will be performed ▷	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▷	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▷	State:	County:

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An orderly program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable water treatment, control, solid waste processing, distribution systems, and the fuels to be used. The demonstration plant is expected to be operative in 1977-1978 time frame.

separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

YEAR ▷	1975	1976	1977	1978	1979
ific	8	8	4	4	4
ical	25	25	20	20	20
t	8	8	30	30	30
	10	20	30	30	30
ns of ms of nt of				6250 ton of coal	6250 ton of coal
wned				4	4
ased					
owned					
EDED					
ntity	None	None	None	None	None

(1)

4

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:
- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

IDENTIFICATION NUM: 060355071180560

6. JUSTIFICATION - State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or attainment of the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits expected to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties (R/U), plans to minimize R/U, and basis for proceeding in face of R/U. Quantitative data *should be used* to the fullest extent.

The specific problem in waste heat utilization is the fact that in most cases there a[re] [la]rge heat rejected to the environment that is converted to useful power. By judicio[us] [im]plement of this waste heat into other useful heat energy requiring applications, t[he] total efficiency of an energy generating converter can be raised to 75%.

An orderly program to demonstrate a total utility system making maximum use of the en[er]gy generated with an environmentally clean fuel will be implemented by thorough investig[a]tion, experimentation, design studies, and individual testing culminating in a second round pilot plant demonstration in the 78-79 time frame. The technologies to be con[si]dered are:

Power

Fuel Cells/Advanced
Photothermal Solar Conversion (high temperature heat source)
Hybrid Turbine Systems Brayton-Rankine combinations
Direct Solar Conversion
Stirling Engine Prime Mover/Generator Combo
MHD
Geothermal Heat Source/Steam Generation
Radio Nuclide Heat Sources
HTGR
Rotating Organic Boiler/Closed Rankine Cycle
Hydrogen Fuel Generation and Use
Reactor Power Sources
Multifueled Closed Gas Turbine
High Temperature Open Cycle Gas Turbine
Combined Cycle
Energy Depot Systems

Fuels

Solid Waste
Low Sulphur Coal Burning - Conventional Furnace
Hydrogen
High Sulphur Coal Burning - Fluidized Bed Combustion

RCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort
- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

IDENTIFICATION NUMBER
0603550711805601

–State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem
ic objective. Include reasons for selection the recommended approach over other alternatives. Also include the benefits
rived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties
minize R/U, and basis for proceeding in face of R/U. Quantitative data *should be used* to the fullest extent.

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rejected to the environment that is converted to useful power. By judicious
of this waste heat into other useful heat energy requiring applications, the
ciency of an energy generating converter can be raised to 75%.

program to demonstrate a total utility system making maximum use of the energy
with an environmentally clean fuel will be implemented by thorough investiga-
rimentation, design studies, and individual testing culminating in a second
t plant demonstration in the 78-79 time frame. The technologies to be considered

ls/Advanced
rmal Solar Conversion (high temperature heat source)
urbine Systems Brayton-Rankine combinations
olar Conversion
Engine Prime Mover/Generator Combo

al Heat Source/Steam Generation
clide Heat Sources

Organic Boiler/Closed Rankine Cycle
Fuel Generation and Use
Power Sources
led Closed Gas Turbine
perature Open Cycle Gas Turbine
Cycle
epot Systems

ste
ur Coal Burning – Conventional Furnace

phur Coal Burning – Fluidized Bed Combustion

2

[redacted] RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

SCHEDULE (Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter).

a. DEVELOPMENT MILESTONES (number each consecutively) (Limit Title of Milestone to 60 characters and spaces)	b. DATES				
	Start		Complete		
	FY	Q	FY	Q	
Theory/Design	75	1	79	1	(1)
Component Test	76	1	79	2	(2) I
System Integration	76	2	77	2	(3) F
Experimental Test/Demonstration	77	2	79	4	(4) E
					(5) A
					(6) I
					(7) S
					(8) AE
					(9) Cc
					(10) Te

(Continue to next column)

b. DATES			a. DEVELOPMENT MILESTONES (continued) (Limit Title of Milestone to 60 characters and spaces)	b. DATES			
Start		Complete		Start		Complete	
Q	FY	Q		FY	Q	FY	Q
1	79	1	(1) Identify candidate innovative technologies	75	1	75	3
1	79	2	(2) Develop evaluation criteria	75	1	75	3
2	77	2	(3) Forecast commercial feasibility	75	1	75	3
2	79	4	(4) Evaluate Technologies	75	4	75	4
			(5) Activities				
			Obtain laboratory models	76	1	79	2
			Prototype testing	76	2	79	2
			Re-establish commercial feasibility	76	3	76	4
			(6) Interface requirement evaluation	76	2	77	2
			(7) System analysis/design	76	3	77	2
			(8) AE efforts	77	1	77	3
			(9) Construction	77	2	78	2
			(10) Test operation	78	2	79	4

(Continue on separate sheet)

8. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	FY Obls.
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0	0	3	3	4	4	5
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	2	2	2	2	2
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	2	2	3	3	-
d. GRAND TOTAL—OBLIGATIONS	0		7		9		1
e. GRAND TOTAL—OUTLAYS		0		7		9	

[illegible] proposed. Indicate the amount by year of both private and Federal government funding.

☐ MAXIMUM
☒ CORRECTLY
☐ MINIMUM

IDENTIFICATION NUMBER

	(4)		(5)		(6)		(7)		(8)		(9)	
	FY 1977		FY 1978		FY 1979		Subtotal FY 1975-79		Balance To Complete		Total Excluding FY 1974 (Col. 7 & 8)	
utlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls	Outlays	Obls.	Outlays
4	5	5	5	5	5	5	22	22	8	8	30	30
2	2	2	2	2	2	2	10	10	10	10	20	20
3	3	3	1	1	1	1	10	10	15	15	25	25
	10		8		8		42		33		75	
9		10		8		8		42		33		75

funding. A brief description of the Cooperative programs and the rationale for the division of funding

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

AIL OF FUNDING REQUIREMENTS–*Federal Government Only (In millions of dollars)*

PERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	F Obls.
TOTAL *(Carry forward to summary sheet)* ▶			3		4		5
e of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
ne of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
ne of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
ne of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							

(Continue on Se

Privately-owned

Level of Effort:
- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

IDENTIFICATION NUMBER

[redacted]

utlays	(4) FY 1977 Obls.	Outlays	(5) FY 1978 Obls.	Outlays	(6) FY 1979 Obls.	Outlays	(7) SUBTOTAL FY 1975-79 Obls.	Outlays	(8) BALANCE TO COMPLETE Obl's.	Outlays	(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8) Obl's.	Outlays
	5		5		5		22		8		30	

(Continue on Separate Sheet)

Page of

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

9. DETAIL OF FUNDING REQUIREMENTS–Federal Government Only *(In millions of dollars)*

b. CONSTRUCTION

ITEM		(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY Obls.
TOTAL *(Carry forward to summary sheet)* ▶				2		2		2
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.	Item No.							
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )							
State / County / TEC *(in millions)*								
Statement:								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )							
State / County / TEC *(in millions)*								
Statement:								
TITLE OF PROJECT *(Not to exceed characters and spaces.)*	( )							
State / County / TEC *(in millions)*								
Statement:								

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Level of Effort:

- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

IDENTIFICATION NUMBER: 0603550711935601

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCL FY 1974 Cos	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	O
	2		2		2		10		10		20	

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

AIL OF FUNDING REQUIREMENTS–Federal Government Only *(In millions of dollars)*

QUIPMENT

ITEM *(Each item not to exceed 50 characters and spaces)*	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	Obl
...s, or performing organization, ...al equipment funds, with a separate ...ation of each item of equipment ...ne half million dollars or more. TOTAL *(Carry forward to summary sheet)* ▶			2		3		3		1

(Continue on Separate Sheet)

Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
0603550711805501

(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8)	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
3		1		1		10		15		25	

ue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT [illegible]

[illegible]

1. IDENTIFICATION NU

03550711S05601

2. a. PROGRAM	Conversion [illegible]
b. SUBPROGRAM	Waste Heat Utilization - Part A
3. a. PROPONENT AGENCY	DOD, NASA, HUD
b. SUBUNIT	

4. CONTRACTOR AND SITE

(No more than 42 characters and [illegible] standard abbreviation for state; up to 16 characters and spaces for county.)

NAME OF CONTRACTOR:		Competitive Bidding
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:

5. BRIEF DESCRIPTION OF PROPOSAL

(No more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

A program to demonstrate an optimized advanced total utility sys[illegible] a practical application making maximum use of the energy generat[illegible] the power converter using an environmentally clean fuel and als[illegible] use of the waste heat generated by the power converter whereby [illegible] system efficiency can be measured as 75% will be implemented. [illegible] rough investigation, including required experimentation, design [illegible] integration of design elements, and individual testing culminati[illegible] second round pilot plant demonstration of maximum generated ener[illegible] 'lization from a converter. Technologies will be considered in t[illegible] power, heating-ventilation-air conditioning, waste water treatme[illegible] potable (water treatment, control, solid waste processing, distr[illegible] systems, and the fuels to be used. The demonstration plant is e[illegible] to be operative in 1980-1981 time frame.

6. JUSTIFICATION *(Use a separate sheet(s). See Item 6, on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978	1979
a. MANPOWER *(in man years)*	(1) Scientific	7	7	3	3	[illegible]
	(2) Technical	22	22	18	18	18
	(3) Support	7	7	27	27	27
	(4) Other	9	19	27	27	27
b. RAW MATERIALS *(List materials and units of measure below, such as tons of coal, barrels of oil, kilograms of uranium, etc. Show amount of each in columns at right.)*						
c. LAND AREA REQUIRED *(in acres)*	(1) Govt-owned			NONE		
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					

ARCH & DEVELOPMENT
ACT SHEET

1. IDENTIFICATION NUMBER
[illegible]02350711895601

	Conversion Techniques
RAM	Waste Heat Utilization - Part A
NT AGENCY	DOD, NASA, HUD

R AND SITE	NAME OF CONTRACTOR:		
42 characters and ...	Site where work will be performed	State:	County:
...abbreviation for state ...	NAME OF CONTRACTOR:		Competitive Bidding
...ctors and spaces for...	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:

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24 lines of text ... than 72 characters line)

nature and scope undertaken, new facilities to be acquired

A program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable (water treatment, control, solid waste processing, distribution) systems, and the fuels to be used. The demonstration plant is expected to be operative in 1980-1981 time frame.

2

ON *(Use a separate sheet(s). See Item 6. on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
(1) Scientific	7	7	3	3	3
(2) Technical	22	22	18	18	18
(3) Support	7	7	27	27	27
(4) Other	9	19	27	27	27
IALS *(... and units of ..., such as tons of ... oil, Kilograms of ... how amount of ... at right.)*					
(1) Govt-owned			N O N E		
(2) Govt-leased					
(3) Privately-owned					

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(No more than [illegible] characters and [illegible] use standard abbreviation for state, up to 16 characters and spaces for county.

NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	
NAME OF CONTRACTOR:			Competitive Bidding
Site where work will be performed ▶	State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	

5. BRIEF DESCRIPTION OF PROPOSAL

(No more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

A program to demonstrate an optimized advanced total utility syst[em] a practical application making maximum use of the energy generate[d by] the power converter using an environmentally clean fuel and also [make] use of the waste heat generated by the power converter whereby th[e] system efficiency can be measured as 75% will be implemented. A [tho]rough investigation, including required experimentation, design s[tudies,] integration of design elements, and individual testing culminatin[g in a] second round pilot plant demonstration of maximum generated energ[y uti]lization from a converter. Technologies will be considered in th[e] power, heating-ventilation-air conditioning, waste water treatmen[t,] potable (water treatment, control, solid waste processing, distri[bution] systems, and the fuels to be used. The demonstration plant is ex[pected] to be operative in 1980-1981 time frame.

6. JUSTIFICATION *(Use a separate sheet(s). See Item 6. on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

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c. LAND AREA REQUIRED (In acres)	(1) Govt-owned			NONE		
	(2) [illegible] leased					
	(3) Privately-owned					
	(4) Other					
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)		NONE (1)	NONE	NONE	NONE	NON[E]

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[illegible]	▶ State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed	▶ State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed	▶ State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed	▶ State:	County:	

A program to demonstrate an optimized advanced total utility system in a practical application making maximum use of the energy generated by the power converter using an environmentally clean fuel and also making use of the waste heat generated by the power converter whereby the total system efficiency can be measured as 75% will be implemented. A thorough investigation, including required experimentation, design studies, integration of design elements, and individual testing culminating in a second round pilot plant demonstration of maximum generated energy utilization from a converter. Technologies will be considered in the power, heating-ventilation-air conditioning, waste water treatment, potable (water treatment, control, solid waste processing, distribution) systems, and the fuels to be used. The demonstration plant is expected to be operative in 1980-1981.time frame.

parate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

YEAR ▶	1975	1976	1977	1978	1979
	7	7	3	3	3
	22	22	18	18	18
	7	7	27	27	27
	9	19	27	27	27
of as of of					
ned			NONE		
sed					
ound					
DED					
ity	NONE (1)	NONE	NONE	NONE	NONE

4

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort
- ☐ MAXIMUM
- ☐ ORDERLY
- ☒ MINIMUM

IDENTIFICATION NUMBER
0603550711805G

6. JUSTIFICATION – State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or attainment of the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits expected to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties (R/U), plans to minimize R/U, and basis for proceeding in face of R/U. Quantitative data *should be used* to the fullest extent.

A minimum program to demonstrate effectively the application of total energy systems employing optimum management of waste heat would result in a stretchout of demonstrat applications, thereby increasing the cost of full technology demonstration until the 1980's.

Level of Effort
- ☐ MAXIMUM
- ☐ OPPORTUNITY
- ☒ MINIMUM

IDENTIFICATION NUMBER
0603550711805601

ON - State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties minimize R/U, and basis for proceeding in face of R/U. Quantitative data *should be used* to the fullest extent.

a program to demonstrate effectively the application of total energy systems
e optimum management of waste heat would result in a stretchout of demonstrated
ions, thereby increasing the cost of full technology demonstration until the

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

LLE (Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter).

a. DEVELOPMENT MILESTONES (number each consecutively) (Limit Title of Milestone to 60 characters and spaces)	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
ry/Design	75	1	79	1
ment Test	76	1	79	2
tem Integration	76	2	79	2
rimental Test/Demonstration	80	2	32	4

(Continue to next column)

☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

KEY DATION NUMBER

0603502711605601

8. DEVELOPMENT MILESTONES *(continued)*

(Limit Title of Milestone to 60 characters and spaces)

DATES Complete FY	DATES Complete Q	DATES Start FY	DATES Start Q	DATES Comp FY	DATES Comp Q
79	1				
79	2				
79	2				
82	4				

(Continue on separate sheet)

2

8. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
a. OPERATING *(See p. 5 for detail)* Total Operating Requirements *(from Detail Sheet)*	0	0	2		3		3	
b. CONSTRUCTION *(See p. 6 for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	1		1		1	
c. EQUIPMENT *(See p. 7 for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	1		1		1	
d. GRAND TOTAL—OBLIGATIONS	0		4		5		5	
e. GRAND TOTAL—OUTLAYS		0						

... programs are proposed, indicate the amount by year of both private and Federal government funding. A brief descriptio

☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER

[illegible]

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total Excluding FY 1974 (Col. 7 & 8)	
utlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
	3		4		4		16	.15	24	24	40	40
	1		2		2		7	7	18	18	25	25
	1		2		2		7	7	18	18	25	25
	5		8		8		30		60		90	
								30		60		90

ending. A brief description of the Cooperative programs and the rationale for the division of funding

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

TAIL OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

PERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) FY 197 O
TOTAL *(Carry forward to summary sheet)* ▶			2	2	3	3	3	
ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								

(Continue on Separat

Level of Effort
- ☐ MAXIMUM
- ☐ ORDERLY
- ☒ MINIMUM

[illegible]

...ys	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) SUBTOTAL FY 1975-79 Obls.	(7) SUBTOTAL FY 1975-79 Outlays	(8) BALANCE TO COMPLETE Obls.	(8) BALANCE TO COMPLETE Outlays	(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8) Obls.	(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8) Outlays
3	3	3	4	4	4	4	16	16	24	24	40	40

ntinue on Separate Sheet)

2

B. CONSTRUCTION

ITEM		(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4 FY 1 Obls.
TOTAL *(Carry forward to summary sheet)* ▷				1	1	1	1	1
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) (number each item consecutively). Every project costing one million dollars or more should be separately identified with a brief statement as to why it is required. TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	Item No. ( )							
State / County / TEC *(in millions)*								
Statement:								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )							
State / County / TEC *(in millions)*								
Statement:								
TITLE OF PROJECT *(Not to exceed characters and spaces.)*	( )							
State / County / TEC *(in millions)*								
Statement:								

(Continue on Separat

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974	
utlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
1	1	1	2	2	2	2	7	7	18	18	25	25

ntinue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

TAIL OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
...or performing organization, ...al equipment funds, with a separate ...ation of each item of equipment ...e half million dollars or more. TOTAL *(Carry forward to summary sheet)* ▶			1	1	1	1	1	1

(Continue on Separate Sheet)

Level of Effort
☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER
0603550711605601

ays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) SUBTOTAL FY 1975-79 Obls.	(7) SUBTOTAL FY 1975-79 Outlays	(8) BALANCE TO COMPLETE Obls.	(8) BALANCE TO COMPLETE Outlays	(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8) Obls.	(9) TOTAL EXCLUDING FY 1974 (Cols. 7 & 8) Outlays
1	1	1	2	2	2	2	7	7	18	18	25	25

nue on Separate Sheet)

2

9. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) Ou
a. OPERATING *(See p. 5 for detail)* Total Operating Requirements *(from Detail Sheet)*	0	0	2		3		3	
b. CONSTRUCTION *(See p. 6 for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	1		1		1	
c. EQUIPMENT *(See p. 7 for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	1		1		1	
d. GRAND TOTAL—OBLIGATIONS	0		4		5		5	
e. GRAND TOTAL—OUTLAYS		0						

Level of Effort:

- ☐ MAXIMUM
- ☐ ORDERLY
- ☒ MINIMUM

IDENTIFICATION NO.: 0603552721525

(3) 1976 Outlays	(4) FY 1977 Oblig.	(4) FY 1977 Outlays	(5) FY 1978 Oblig.	(5) FY 1978 Outlays	(5) FY 1979 Oblig.	(5) FY 1979 Outlays	(7) Subtotal FY 1975-79 Oblig.	(7) Subtotal FY 1975-79 Outlays	(8) Balance To Complete Oblig.	(8) Balance To Complete Outlays	Total FY 197 Oblig.
	3		4		4		16	16	24	24	40
	1		2		2		7	7	18	18	25
	1		2		2		7	7	18	18	25
	5		8		8		30		60		50
								30		60	

2

Title	Waste Heat Utilization Part B. Waste Fuels
Agency	EPA
	Control Systems Laboratory
Site where work will be performed	State: / County:
NAME OF CONTRACTOR:	
Site where work will be performed	State: / County:
NAME OF CONTRACTOR:	
Site where work will be performed	State: / County:
NAME OF CONTRACTOR:	
Site where work will be performed	State: / County:
NAME OF CONTRACTOR:	
Site where work will be performed	State: / County:

0003350711[illegible]01

BRIEF DESCRIPTION OF PROPOSAL (No more than 24 lines of text and no more than 75 characters and spaces per line) (Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.)

Excluding transportation, clean fuel requirements will exceed 50x STU/year by 1990. By 1990, over 170 million tons of combustible wastes with an estimated clean fuel value of 1.7x10[illegible] BTU will b[e] generated annually. Recovery of this energy could reduce project[ed] oil import requirements by approximately 5%. Utilization of this energy requires development and demonstration of technology for [the] processing, handling, use, and emission control of urban wastes [in the] pyrolysis conversion process and the biochemical conversion proc[ess]. Specifically, technology developed under this program would incl[ude] (1) Fuel Processing Studies. Construction of a 500 tpd fuel proc[essing] plant and conduct of refuse shredding and classification trade o[ff] studies to define process variable which maximize the fraction of fuel recovered subject to handling, storage and overall cost cons[traints]. Systems for recovery of energy intensive raw materials (aluminum [and] ferrous metals) will also be developed. (2) Development of Transp[orta]tion Techniques. A railroad car for transport of urban wastes w[ill be] designed, constructed and its economical use demonstrated. Equi[pment] for loading and unloading processed urban wastes into barges wil[l be] developed and demonstrated. (3) Boiler Performance Evaluation. Studies will be conducted to evaluate the effect of waste process variables, waste properties, waste to fossil fuel ratio & fuel f[iring] techniques (suspension grate or cyclone) on boiler performance. Performance parameters will include fuel energy recovery efficie[ncy]

(Continued on attachment)

6. JUSTIFICATION (Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978	1979
a. MANPOWER (in man years)	(1) Scientific	15.0	15.0	15.0	12.0	10.0
	(2) Technical					
	(3) Support	4.0	4.0	4.0	4.0	4.0
	(4) Other					
b. RAW MATERIALS (List materials and units of measure below, such as tons of coal, barrels of oil, kilograms of uranium, etc. Show amount of each in columns at right.)		N/A	N/A	N/A	N/A	N/A
c. LAND AREA REQUIRED (in acres)	(1) Govt-owned					
	(2) Govt-leased					
	(3) [illegible]	For the most part systems to be installed at [illegible]				

	Waste Heat Utilization - Part B - Waste Fuels
	EPA
	Control Systems Laboratory
	NAME OF CONTRACTOR:
Site where work will be performed	State: County:
	NAME OF CONTRACTOR:
Site where work will be performed	State: County:
	NAME OF CONTRACTOR:
Site where work will be performed	State: County:
	NAME OF CONTRACTOR:
Site where work will be performed	State: County:

DESCRIPTION OF ...
...e than 24 lines of text ...more than 70 characters ...ve per line)
...outline nature and scope ...to be undertaken, ...any new facilities ...ay have to be acquired ...ested.

Excluding transportation, clean fuel requirements will exceed 80x10^{15} BTU/year by 1990. By 1990, over 170 million tons of combustible urban wastes with an estimated clean fuel value of 1.7x10^{15} BTU will be generated annually. Recovery of this energy could reduce projected oil import requirements by approximately 5%. Utilization of this energy requires development and demonstration of technology for the processing, handling, use, and emission control of urban wastes for th pyrolysis conversion process and the biochemical conversion process. Specifically, technology developed under this program would include: (1) Fuel Processing Studies. Construction of a 500 tpd fuel processin plant and conduct of refuse shredding and classification trade off studies to define process variable which maximize the fraction of wast fuel recovered subject to handling, storage and overall cost constrain Systems for recovery of energy intensive raw materials (aluminum and ferrous metals) will also be developed. (2) Development of Transportation Techniques. A railroad car for transport of urban wastes will be designed, constructed and its economical use demonstrated. Equipment for loading and unloading processed urban wastes into barges will be developed and demonstrated. (3) Boiler Performance Evaluation. Studies will be conducted to evaluate the effect of waste processing variables, waste properties, waste to fossil fuel ratio & fuel firing techniques (suspension grate or cyclone) on boiler performance. Performance parameters will include fuel energy recovery efficiency ,

(Continues on attachment)

...CATION (Use a separate sheet(s). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

	FISCAL YEAR ▶	1975	1976	1977	1978	1979
...ER	(1) Scientific	15.0	15.0	15.0	12.0	10.0
...ons)	(2) Technical					
	(3) Support	4.0	4.0	4.0	4.0	4.0
	(4) Other					
...ERIALS (...ds and units of ...ure, such as tons of ...of oil, Kilograms of ...le. Show amount of ...ons of right.)		N/A	N/A	N/A	N/A	N/A
...EA	(1) Govt-owned					
...)	(2) Govt-leased					
	(3) Privately-owned	for the most part, systems to be installed at existing facilities.				
	(4) Other					
...OURCES NEEDED						

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2. a. [illegible]	[illegible]
b. [illegible]PROGRAM	Waste Heat Utilization . Part B — Waste Fuels
3. a. [illegible] AGENCY	EPA
b. [illegible]	Control Systems Laboratory
4. [illegible] AND SITE	NAME OF CONTRACTOR:
([illegible] characters and [illegible] for name of contractor; [illegible] for state; up to [illegible] characters and spaces for county.)	Site where work will be performed ▶ State: | County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: | County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: | County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: | County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: | County:

5. BRIEF DESCRIPTION OF PROPOSAL

(No more than 24 lines of text and no more than 70 characters and spaces per line)

Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.

Excluding transportation, clean fuel requirements will exceed 50x10 BTU/year by 1990. By 1990, over 170 million tons of combustible ur wastes with an estimated clean fuel value of $1.7x10^{15}$ BTU will be generated annually. Recovery of this energy could reduce projected oil import requirements by approximately 5%. Utilization of this energy requires development and demonstration of technology for the processing, handling, use, and emission control of urban wastes for pyrolysis conversion process and the biochemical conversion process. Specifically, technology developed under this program would include: (1) Fuel Processing Studies. Construction of a 500 tpd fuel process plant and conduct of refuse shredding and classification trade off studies to define process variable which maximize the fraction of w fuel recovered subject to handling, storage and overall cost constra Systems for recovery of energy intensive raw materials (aluminum and ferrous metals) will also be developed. (2) Development of Transport tion Techniques. A railroad car for transport of urban wastes will designed, constructed and its economical use demonstrated. Equipmen for loading and unloading processed urban wastes into barges will be developed and demonstrated. (3) Boiler Performance Evaluation. Studies will be conducted to evaluate the effect of waste processing variables, waste properties, waste to fossil fuel ratio & fuel firin techniques (suspension grate or cyclone) on boiler performance. Performance parameters will include fuel energy recovery efficiency

(continued on attachment)

6. JUSTIFICATION *(Use a separate sheet(s). See Item 6. on Instruction Sheet.)*

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	1979
a. MANPOWER *(in man years)*	(1) Scientific	15.0	15.0	15.0	12.0	10.0
	(2) Technical					
	(3) Support	4.0	4.0	4.0	4.0	4.0
	(4) Other					
b. RAW MATERIALS *(List materials and units of measure below, such as tons of coal, barrels of oil, Kilograms of uranium, etc. Show amount of each in columns at right.)*		N/A	N/A	N/A	N/A	N/A
c. LAND AREA REQUIRED *(in acres)*	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned	for the most part, systems to be installed at existing facilities.				
	(4) Other					
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)		(1)				

3

5. BRIEF DESCRIPTION OF PROPOSAL (continuation from page 1)

boiler tube fireside corrosion & fouling, and furnace residue disposal provisions. To determine the effects of size and configuration, demonstrations will be conducted on: two types of small on-site incinerator-boilers, three intermediate size commerical or industrial boilers, and one utility boiler. (4) Emission Studies. During the boiler performance demonstrations, tests will be conducted to evaluate air pollution, residue and water pollution emissions. Pollution control equipment design requirements needed to meet federal and local emission standards will be established.

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

☐ RANDOM
☒ SYSTEMATIC
☐ RANDOM

IDENTIFICATION NUMBER
0603550711805001

6. JUSTIFICATION – State the specific energy problem or objective and specify how the proposal will contribute to the solution of the problem or attainment of the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits expected to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties (R/U), plans to minimize R/U, and bias for proceeding in face of R/U. Quantitative data should be used to the fullest extent.

Objective - to simultaneously alleviate the solid waste disposal problem and provide an additional source of clean fuel by using combustible urban waste as an energy source.

Why and How Objective Will Be Attained -

In 1970 U. S. combustible waste production from all sources is estimated to have b 810 billion pounds (dry weight)*. By 1990, the total combustible waste production is e to be over 1120 billion pounds of which 340 billion pounds are attributable to urban wa The energy content of combustible urban wastes has been conservatively estimated to hav 1420 trillion Btu in 1970. Projections indicate that the energy content of combustible wastes generated in 1990 will exceed 2540 trillion Btu's.(1) Use of the waste fuel can a significant near term impact in meeting energy requirements. It is estimated that if urban wastes were processed and fired as fuels in utility boilers, 25% of the coal curr being fired in utility power plants could be conserved.(2)

Concepts of processes for waste material energy recovery or conversion are well de Since these processes combine waste disposal and energy generation or fuel recovery the be called "combined processes" or "combined systems." They include:

(1) Combustion of wastes in incinerators with heat recovery to generate steam.

(2) Combustion of waste fuels in industrial and commercial class boilers to provi process energy or central heating.

(3) Combustion of wastes to supplement fossil fuels in utility class boilers used in electrical power generation.

(4) Combustion of wastes in a fluidized beds to drive either gas or steam turbo-electric generators.

(5) Conversion of wastes by pyrolysis or reforming to generate solid, liquid, or gaseous fuels to supplement natural fuels.

(6) Conversion of wastes by biochemical processes to produce a clean burning, liq fuel (ethanol).

A principal advantage of using urban wastes is that they are, in terms of air poll relatively clean fuels. They have low sulfur and nitrogen contents and their low combu temperatures produce an effluent gas stream which requires only cleanup with convention particulate control equipment. Their use as fuels in existing or planned energy system would also aid in solving a growing waste disposal problem.

Waste fuel energy conversion systems can make a near term impact on the energy sho since systems using waste fuels can be developed and in use by 1980. Waste fuel energy conversion in general requires application or modifications of technology currently in commercial use.

A particularly important feature of using urban waste as a fuel is its properties which classify it as clean fuel (low emissions of sulfur and nitrogen oxide compounds). The use of wastes will conserve natural fuels (natural gas, low sulfur oil and coal) or alternatively allow clean fuels (natural gas and low sulfur oil) to be used in a larger number of energy sources, thus reducing either air pollution or the cost of air pollut control. Generally, only control of particulate air pollution emissions will be requir Although particulate emission characteristics have not been established for most systems considered, it is probable that conventional scrubbers, electrostatic precipitators, inertial separat... filters

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EVALUATION AND DEVELOPMENT FACT SHEET (continued)

☐ EXISTING
☒ [illegible]
☐ MINIMUM

IDENTIFICATION NUMBER
0003550711805001

ATION - State the specific energy problem or objective and specify how the proposal will contribute to the solution of the problem ...ect of the objective. Include reasons for selecting the recommended ... over other alternatives. Also include the benefits to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties to minimize E/U, and bases for proceeding in face of E/U. Quantitative data should be used to the fullest extent.

- to simultaneously alleviate the solid waste disposal problem and provide an l source of clean fuel by using combustible urban waste as an energy source.

low Objective Will Be Attained -

)/0 U. S. combustible waste production from all sources is estimated to have been on pounds (dry weight)*. By 1980, the total combustible waste production is expected er 1120 billion pounds of which 340 billion pounds are attributable to urban waste. y content of combustible urban wastes has been conservatively estimated to have been lion Btu in 1970. Projections indicate that the energy content of combustible urban enerated in 1990 will exceed 2540 trillion Btu's.(1) Use of the waste fuel can have cant near term impact in meeting energy requirements. It is estimated that if all tes were processed and fired as fuels in utility boilers, 25% of the coal currently ed in utility power plants could be conserved.(2)

cepts of processes for waste material energy recovery or conversion are well defined. ese processes combine waste disposal and energy generation or fuel recovery they will "combined processes" or "combined systems." They include:

Combustion of wastes in incinerators with heat recovery to generate steam.

Combustion of waste fuels in industrial and commercial class boilers to provide process energy or central heating.

Combustion of wastes to supplement fossil fuels in utility class boilers used in electrical power generation.

Combustion of wastes in a fluidized beds to drive either gas or steam turbo-electric generators.

Conversion of wastes by pyrolysis or reforming to generate solid, liquid, or gaseous fuels to supplement natural fuels.

Conversion of wastes by biochemical processes to produce a clean burning, liquid fuel (ethanol).

incipal advantage of using urban wastes is that they are, in terms of air pollution, y clean fuels. They have low sulfur and nitrogen contents and their low combustion res produce an effluent gas stream which requires only cleanup with conventional te control equipment. Their use as fuels in existing or planned energy systems aid in solving a growing waste disposal problem.

fuel energy conversion systems can make a near term impact on the energy shortage tems using waste fuels can be developed and in use by 1980. Waste fuel energy in general requires application or modifications of technology currently in use.

rticularly important feature of using urban waste as a fuel is its properties ssify it as clean fuel (low emissions of sulfur and nitrogen oxide compounds). wastes will conserve natural fuels (natural gas, low sulfur oil and coal) or ely allow clean fuels (natural gas and low sulfur oil) to be used in a larger energy sources, thus reducing either air pollution or the cost of air pollution Generally, only control of particulate air pollution emissions will be required. articulate emission characteristics have not been established for most systems , it is probable that conventional scrubbers, electrostatic precipitators, eparators, or filtration devices will provide adequate particulate emission control.

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The energy content of combustible urban wastes has been conservatively estimated to have b 1420 trillion Btu in 1970. Projections indicate that the energy content of combustible ur wastes generated in 1990 will exceed 2540 trillion Btu's.[1] Use of the waste fuel can ha a significant near term impact in meeting energy requirements. It is estimated that if all urban wastes were processed and fired as fuels in utility boilers, 25% of the coal current being fired in utility power plants could be conserved.[2]

Concepts of processes for waste material energy recovery or conversion are well defin Since these processes combine waste disposal and energy generation or fuel recovery they w be called "combined processes" or "combined systems." They include:

(1) Combustion of wastes in incinerators with heat recovery to generate steam.

(2) Combustion of waste fuels in industrial and commercial class boilers to provide process energy or central heating.

(3) Combustion of wastes to supplement fossil fuels in utility class boilers used in electrical power generation.

(4) Combustion of wastes in a fluidized beds to drive either gas or steam turbo-electric generators.

(5) Conversion of wastes by pyrolysis or reforming to generate solid, liquid, or gaseous fuels to supplement natural fuels.

(6) Conversion of wastes by biochemical processes to produce a clean burning, liquid fuel (ethanol).

A principal advantage of using urban wastes is that they are, in terms of air polluti relatively clean fuels. They have low sulfur and nitrogen contents and their low combusti temperatures produce an effluent gas stream which requires only cleanup with conventional particulate control equipment. Their use as fuels in existing or planned energy systems would also aid in solving a growing waste disposal problem.

Waste fuel energy conversion systems can make a near term impact on the energy shorta since systems using waste fuels can be developed and in use by 1980. Waste fuel energy conversion in general requires application or modifications of technology currently in commercial use.

A particularly important feature of using urban waste as a fuel is its properties which classify it as clean fuel (low emissions of sulfur and nitrogen oxide compounds). The use of wastes will conserve natural fuels (natural gas, low sulfur oil and coal) or alternatively allow clean fuels (natural gas and low sulfur oil) to be used in a larger number of energy sources, thus reducing either air pollution or the cost of air pollution control. Generally, only control of particulate air pollution emissions will be required. Although particulate emission characteristics have not been established for most systems considered, it is probable that conventional scrubbers, electrostatic precipitators, inertial separators, or filtration devices will provide adequate particulate emission cont

A very promising waste energy recovery method is the use of urban waste as an auxilia fuel for combustion with fossil fuels in existing (or new) utility, industrial, or commercial boilers. The use of unprocessed, bulk municipal refuse as an auxiliary fuel is an established technology in Europe. In the U. S. homogenous industrial wastes are widely used for manufacturing and process energy requirements. The use of shredded municipal refuse as an auxiliary fuel to provide 10-15 percent of the energy input in a

[1] Estimates of weights and energy contents are taken from generally excepted EPA studies. While there may be some variance of actual and estimated quantities, the estimates are considered to be sufficiently accurate to establish the relative magnitude of potential energy which may be derived from each source of waste material.

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...20 billion pounds of which 340 billion pounds are attributable to urban waste. content of combustible urban wastes has been conservatively estimated to have been on Btu in 1970. Projections indicate that the energy content of combustible urban rated in 1990 will exceed 2540 trillion Btu's.(1) Use of the waste fuel can have nt near term impact in meeting energy requirements. It is estimated that if all s were processed and fired as fuels in utility boilers, 25% of the coal currently in utility power plants could be conserved.(2)

s of processes for waste material energy recovery or conversion are well defined. processes combine waste disposal and energy generation or fuel recovery they will combined processes" or "combined systems." They include:

mbustion of wastes in incinerators with heat recovery to generate steam.

mbustion of waste fuels in industrial and commercial class boilers to provide ocess energy or central heating.

mbustion of wastes to supplement fossil fuels in utility class boilers used electrical power generation.

mbustion of wastes in a fluidized beds to drive either gas or steam turbo-ectric generators.

nversion of wastes by pyrolysis or reforming to generate solid, liquid, or seous fuels to supplement natural fuels.

nversion of wastes by biochemical processes to produce a clean burning, liquid el (ethanol).

ipal advantage of using urban wastes is that they are, in terms of air pollution, lean fuels. They have low sulfur and nitrogen contents and their low combustion produce an effluent gas stream which requires only cleanup with conventional control equipment. Their use as fuels in existing or planned energy systems id in solving a growing waste disposal problem.

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6. JUSTIFICATION (continuation)

utility boiler is currently being demonstrated under joint sponsorship of the federal Environmental Protection Agency, the City of St. Louis and the Union Electric Co. This program will determine the costs and techniques for processing and suspension firing shredded municipal refuse in an utility boiler fired with pulverized coal. This demonstration is scheduled for completion in 1974. Preliminary studies indicate that the net costs for electrical generation and waste disposal can be reduced by firing solid waste as an auxiliary fuel. No adverse environmental effects are expected. Further work is needed to develop technology for processing urban waste and for firing it in smaller industrial and commercial boilers.

Fluidized bed combustors are under development for use in advanced power plants and waste disposal plants. The waste disposal plant, which is currently under development at pilot plant scale, operates on shredded municipal wastes and generates electricity by use of a gas turbine. Fossil fuels are used only for plant startup. Major development problems include possible material problems associated with the corrosive and erosive nature of the particle laden combustor gases. Of particular concern is possible erosion, corrosion and fouling in the gas turbine. Pilot plant tests are scheduled for completion in 1974. The developers of the plant claim that electrical energy generation costs can be reduced by the use of a similar system which burns shredded municipal wastes and unprocessed sewage sludge. Development of these fluidized bed-gas turbine concepts should be completed through to full scale demonstration.

Fluidized bed combustors with chemically active beds are currently being developed to provide a more cost effective and environmentally acceptable method of producing power from fossil fuels. Demonstration of the use of auxiliary waste fuels in these combustors should be conducted during the overall development program which is scheduled for completion in 1979.

Fuels to supplement natural fossil fuels can be made by the conversion of waste fuels through pyrolysis and reforming techniques. While these processes are not economically or thermally as efficient as direct combustion, fuels can be generated for use elsewhere. The Bureau of Mines estimates a possible production of 170 million barrels of oil per year from organic wastes. The conversion of municipal waste, forestry waste and agriculture waste to oil and gaseous fuels is currently being studied at laboratory and small pilot plant scale. A 200 tpd pyrolysis plant which will operate on municipal wastes is being designed and is scheduled to complete demonstration tests in 1976. About 60% of the dry organics in the incoming waste stream will be converted to an oil with a heating value of 10,500 Btu/lb. Economics of the process depend to a large degree upon credits obtained through recovery of aluminum, glass and ferrous metals contained in the input municipal wastes. Development of waste pyrolysis techniques are not as far advanced as the previously discussed techniques and development times and costs should correspondingly be greater.

An assessment of factors relative to the development of fuel recovery and conversion technologies indicate that there is already a high level of institutional and industrial involvement. Sufficient technical personnel and research facilities are available if needed. Since most work will involve the transfer rather than the development of technology, the principle activities will probably be conducted on mini or full scale demonstration projects.

Biochemical Conversion of Urban Wastes

A. COMPARISON WITH EXISTING TECHNIQUE - Does not result in as high an energy conversion percentage as burning wastes in utility boiler to generate electricity. However, some areas of the country such as New England will depend upon electricity generated by nuclear methods and will need clean fuels such as ethanol for non-utility uses.

B. SIGNIFICANT TECHNICAL UNCERTAINTIES OR OBSTACLES - Fermentation-alcohol conversion rates in continuous operating plant may be too slow--resulting in unexceptably high capital cost requirements for large reaction vessels.

C. CONSTRAINTS - Although unit costs of refuse and sewage sludge disposal may be less than for competitive methods, high capital costs may deter municipalities from using process.

D. SIGNIFICANT CAPITAL INVESTMENTS

10 million federal funds for demo. plant:

FY-76 - 2 million
FY-77 - 8 million

F. BENEFICIAL IMPACT:

Benefits from use of urban wastes as fuel would include: (1) recovery of significant energy; (2) a reduction in costs to the public for waste disposal through credits for the recovered energy; and (3) either a net reduction in air pollution as compared to separate energy generation and waste disposal methods of alternatively a reduction in air pollution costs both from a monetary and energy viewpoint.

The projected weight and energy content of combustible urban wastes (exclusive of sewage sludge) for 1980, 1985, and 1990 is:

	1980	1985	1990
Combustible Solid Wastes Urban Areas-Million tons/yr	124	148	172
Heat Content-10^{15} Btu/yr	1.24	1.48	1.73

Potential energy recovery for different recovery processes assuming a probable application of the proposed technology development:

	Projected Energy Values-10^{12} Btu/yr		
	1980	1985	1990
Combustion in boilers	248	580	865
Pyrolysis to liquid or gaseous fuels	0	74	172
Biochemical Conversion to clean fuels (this sub-program)	0	36	130
Total	248	690	1157

Annual cost saving to the public as compared to waste disposal methods without energy recovery is conservatively estimated to be from 300 to 400 million dollars by 1990. (Assumes 85% use of combustible wastes in urban areas.)

Pyrolysis Conversion of Solid Wastes

A. COMPARISON WITH EXISTING TECHNIQUE - Current pyrolysis processes involving solid wastes not optimized for fuel or energy recovery but for minimum waste disposal costs. Much of coal gasification technology under development can be used for solid wastes.

B. SIGNIFICANT TECHNICAL UNCERTAINTIES OR OBSTACLES - None.

C. CONSTRAINTS - Process costs should be minimized to be competitive with other waste disposal methods. For low Btu gas production there will be siting constraints because of economics of gas transport.

D. SIGNIFICANT CAPITAL INVESTMENTS

8 million for demo and pilot plants.

F. BENEFICIAL IMPACT:

Benefits from use of urban wastes to produce clean fuels would include: (1) recovery of significant energy; (2) a reduction in costs to the public for waste disposal through credits for the recovered energy; and (3) either a net reduction in air pollution as compared to separate energy generation and waste disposal methods or alternatively a reduction in air pollution costs both from a monetary and energy viewpoint.

The projected weight and energy content of combustible urban wastes (exclusive of sewage sludge) for 1980, 1985 and 1990 is:

	1980	1985	1990
Combustible solid wastes urban areas-million tons/yr	124	148	172
Heat Content-10^{15} Btu/yr	1.24	1.48	1.73

Potential energy recovery for different recovery processes assuming a probable application of the proposed technology development:

	Projected energy values-10^{12} Btu/yr		
	1980	1985	1990
Combustion in boilers	248	580	865
Pyrolysis to liquid or gaseous fuels (this sub-program)	0	74	172
Biochemical Conversion to clean fuels	0	36	130
Total	248	690	1167

Annual cost saving to the public as compared to waste disposal methods without energy recovery is conservatively estimated to be from 300 to 400 million dollars by 1990. (Assumes 85% usage of combustible wastes in urban areas.)

Development of Urban Waste Fuel Technologies

A. COMPARISON WITH EXISTING TECHNIQUE - Most urban waste is disposed of without energy recovery. Development of technology for energy recovery from combustion of wastes is now restricted to programs on advanced fluid bed combustor and a tangentially fired utility boiler. There is no current comprehensive work on fuel (waste) processing technology or development of techniques for firing wastes in industrial, commercial or other utility boiler configurations.

B. SIGNIFICANT TECHNICAL UNCERTAINTIES OR OBSTACLES - None. Primarily transfer of existing commercial technologies.

C. CONSTRAINTS - Waste fuel processing and transportation costs and possible boiler tube corrosion and fouling on fireside.

D. SIGNIFICANT CAPITAL INVESTMENTS ($1000s)

1,500 refuse processing plant
1,200 rail haul and barge loading
2,400 equipment costs for industrial boiler retrofit.
3,000 facility and equipment costs for retrofit of utility boiler
1,000 on-site incinerator-boiler prototypes

F. BENEFICIAL IMPACT:

Benefits from use of urban wastes as fuel would include: (1) recovery of significant energy; (2) a reduction in costs to the public for waste disposal through credits for the recovered energy; (3) either a net reduction in air pollution as compared to separate energy generation and waste disposal methods or alternatively a reduction in air pollution costs both from a monetary and energy viewpoint.

The projected weight and energy content of combustible urban wastes (exclusive of sewage sludge) for 1980, 1985, and 1990 is:

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Biochemical Conversion to clean fuels	0	36	130
Total	248	690	1167

Annual Cost saving to the public as compared to waste disposal methods without energy recovery is conservatively estimated to be from 300 to 400 million dollars by 1990. (Assumes 85% use of combustible wastes in urban areas).

REFERENCES

1. Humpstone, C. C., et al., "Problems and Opportunities in Management of Combustible Solid Wastes," by International Research and Technology Corporation, for U. S. Environmental Protection Agency, Contract No. 68-02-0060, October 1972.

2. Roberts, Michael, et al., "Systems Evaluation of Refuse as a Low Sulfur Fuel" by Environgenics Corp., El Monte, California, for U. S. Environmental Protection Agency, February 1972.

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

8. SCHEDULE *(Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter).*

a. DEVELOPMENT MILESTONES *(number each consecutively)* *(Limit Title of Milestone to 60 characters and spaces)*	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
(1) Complete engineering development of a refuse processing plant	74	2	75	4
(2). Complete development of barge and rail haul equipment	74	4	75	4
(3) Complete development of industrial/commercial boiler	75	1	76	3
(4) Complete development of utility boiler	75	1	76	3
(5) Processing plant demonstration	75	4	78	3
(6) Barge and rail haul equipment demonstration	75	4	76	3
(7) Industrial/commercial boiler demonstration	76	3	78	3
(8) Utility boiler demonstration	76	3	79	3
(9) Pyrolysis conversion laboratory experimentation completed	74	1	76	1
(10) Pyrolysis conversion pilot plant design	76	3	77	1
(11) Obtain data for final economic viability forecast and demonstration plant design	77	1	78	4
(12) Demonstration of the pyrolysis conversion process in a 500 tpd plant	80	1	82	1
(13) Complete laboratory experimentation with biochemical conversion process	74	2	76	4

Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NO.
0603550711[illegible]

b. DATES Start FY	Start Q	Complete FY	Complete Q	a. DEVELOPMENT MILESTONES (continued) (Limit Title of Milestone to 60 characters and spaces)	b. Slip FY	b. Slip Q
74	2	75	4	(14) Biochemical conversion pilot plant design	76	4
74	4	75	4	(15) Construction and commercial demonstration of 250 tpd plant module	77	2
75	1	76	3			
75	1	76	3			
75	4	78	3			
75	4	76	3			
76	3	78	3			
76	3	79	3			
74	1	76	1			
76	3	77	1			
77	1	78	4			
80	1	82	1			
74	2	76	4			

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

9. SUMMARY OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0.2	0.5	5.0	5.0	5.0	5.0	5.0	5.0
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*	0	0	3.0	3.0	3.0	3.0	3.0	3.0
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	3.0	1.3	3.0	3.0	3.0	4.0
d. GRAND TOTAL–OBLIGATIONS	0.2		11.0		11.0		11.0	
e. GRAND TOTAL–OUTLAYS		0.5		9.3		11.0		12.0

Level of Effort:

☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
060355071180S631

	(4)		(5)		(6)		(7)		(8)		(9)
'6	FY 1977		FY 1978		FY 1979		Subtotal FY 1975-79		Balance To Complete		Total Est. FY 1974 (C)
utlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
.0	5.0	5.0	4.8	4.8	4.7	4.7	24.4	24.4	2.6	2.6	27.0
.0	3.0	3.0	3.0	3.0	3.0	3.0	15.0	15.0	0	0	15.0
.0	3.0	4.0	3.0	4.0	3.0	2.7	15.0	15.0	0	0	15.0
	11.0		10.8		10.7		4.4		2.6		57.0
.0		12.0		11.8		10.4		54.4		2.6	

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(in millions of dollars)*

a OPERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	F Obls.
TOTAL *(Carry forward to summary sheet)* ▶	0.2	0.5	5.0	5.0	5.0	5.0	5.0
1 Name of Performing Organization: EPA							
MANPOWER	0.1	0.1	0.75	0.75	0.75	0.75	0.7.
MATERIALS	0.1	0.4	0	0	0	0	0
MAJOR PROCUREMENTS	0	0	4.0	4.0	4.0	4.C	4.0
ALL OTHER	0	0	0.2	0.2	0.2	0.2	0.2
TOTAL FOR THIS PERFORMING ORGANIZATION	0.2	0.5	4.95	4.95	4.95	4.95	4.95
1 Name of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
1 Name of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
1 Name of Performing Organization:							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							

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Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
0603550711605601

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		TOTAL E[illegible]
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	C[illegible]
5.0	5.0	5.0	5.0	4.8	4.8	4.7	4.7	24.4	24.4	2.6	2.6	27.0
0.75	0.75	0.75	0.75	0.60	0.60	0.50	0.50	3.35	3.35	2.0	2.0	5.35
0	0	0	0	0	0	0	0	0	0	0	0	0
4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	20.0	20.0	0	0	20.0
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.0	1.0	0.6	0.6	1.6
4.95	4.95	4.95	4.95	4.8	4.8	4.7	4.7	24.35	24.35	2.6	2.6	26.95

(Continue on Separate Sheet)

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

5. DETAIL OF FUNDING REQUIREMENTS—Federal Government Only *(In millions of dollars)*

b. CONSTRUCTION

ITEM	Item No.	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	
TOTAL *(Carry forward to summary sheet)* ▷		0	0	3.0	3.0	3.0	3.0	3.
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* CONVERSION SYSTEMS FOR WASTE AND FUELS State | County | TEC *(in millions)* Statement: required to reduce the need for importation of crude oil and to alleviate a growing waste disposal problem.	(1)	0	0	3.0	3.0	3.0	3.0	3.
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* State | County | TEC *(in millions)* Statement: N/A	( )							
TITLE OF PROJECT *(Not to exceed characters and spaces.)* State | County | TEC *(in millions)* Statement: N/A	( )							

Level of Effort:
- ☐ MAXIMUM
- ☒ ORDERLY
- ☐ MINIMUM

IDENTIFICATION NUMBER: 0603550711805601

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		TOTAL FY 1974
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	15.0	15.0	0	0	15.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	15.0	15.0	0	0	15.0

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

DETAIL OF FUNDING REQUIREMENTS – Federal Government Only *(In millions of dollars)*

c. EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) FY 197 Ou
...ch major performing organization, ...eral equipment funds, with a separate ...ation of each item of equipment ...ing one-half million dollars or more. TOTAL *(Carry forward to summary sheet)* ▶	0	0	3.0	1.3	3.0	3.0	3.0	4.
	0	0	3.0	1.3	3.0	3.0	3.0	4.

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Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
060355071180560l

(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 ITEMS	
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	O
0	4.0	3.0	4.0	3.0	2.7	15.0	15.0	0	0	15.0	15.
0	4.0	3.0	4.0	3.0	2.7	15.0	15.0	0	0	15.0	15.

Separate Sheets

2