

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
0606550512855601

a. DATES			b. DATES			
Complete			Start		Complete	
Q	FY	Q	FY	Q	FY	Q
<u>Closed Cycle</u>						
77			75		77	
			77		80	
77			75		80	
77			75		80	
78			75		80	
78						
79						
79						
80						
80						
80						
76						
78						
79						
80						
80						
80						

s. DEVELOPMENT MILESTONES (continued)
(Limit Title of Milestone to 60 characters and spaces)

(Continue on separate sheet)

Page of

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ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		F)
	FY 1974 (Non-Add)		FY 1975		FY 1976		
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)				23.1		27.7	
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)				3.9		21.0	
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)				1.0		5.8	
d. GRAND TOTAL—OBLIGATIONS							
e. GRAND TOTAL—OUTLAYS				28.0		54.5	

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
0606550512855601

(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)	
Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays
	25.7		18.3		17.4		112.2				
	31.4		14.3		4.1		74.7				
	8.0		3.6		1.1		19.5				
	65.1		36.2		22.6		206.4				

... of the Cooperative programs and the rationale for the division of funding

c. LAND AREA REQUIRED (1) Govt-owned (2) Govt-leased

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

3. DETAIL OF FUNDING REQUIREMENTS--Federal Government Only (in millions of dollars)

a. OPERATING

ITEM	(1) FY 1974 (Nor-Add)		(2) FY 1975		(3) FY 1976	
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays
	TOTAL (Carry forward to summary sheet) ▶					
() Name of Performing Organization: Various						
Open Cycle						
MANPOWER				17.0		22.0
MATERIALS				0.2		0.4
MAJOR PROCUREMENTS				—		—
ALL OTHER				0.8		1.3
TOTAL FOR THIS PERFORMING ORGANIZATION				18.0		23.7
() Name of Performing Organization: Various						
Liquid Metal & Closed Cycle						
MANPOWER				4.5		3.3
MATERIALS				0.2		0.2
MAJOR PROCUREMENTS				—		—
ALL OTHER				0.4		0.5
TOTAL FOR THIS PERFORMING ORGANIZATION				5.1		4.0
() 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:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0606550512855601

Days	(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
2.0		20.5		9.5		9.5		78.5				
.4		0.3		0.2		0.2		1.3				
—		—		—		—		—				
.3		1.2		0.5		0.7		4.5				
3.7		22.0		10.2		10.4		84.3				
3.3		3.0		7.0		6.1		23.9				
1.2		0.3		0.3		0.2		1.2				
—		—		—		—		—				
.5		0.4		0.8		0.7		2.8				
4.0		3.7		8.1		7.0		27.9				

Continue on Separate Sheet)

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2

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)		(2) FY 1975		(3) FY 1976		C																																																																																																								
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays																																																																																																									
TOTAL (Carry forward to summary sheet) ▶																																																																																																															
<p>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.</p>																																																																																																															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="8">TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</td> </tr> <tr> <td style="width: 15%;">State</td> <td style="width: 35%;">County</td> <td colspan="6">TEC (in millions)</td> </tr> <tr> <td colspan="8">Statement:</td> </tr> <tr> <td colspan="8"> This work will be performed under contract or work-statement authorized by lead organization Open Cycle </td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td align="right">2.3</td> <td></td> <td align="right">18.2</td> <td></td> </tr> <tr> <td colspan="8">TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</td> </tr> <tr> <td>State</td> <td>County</td> <td colspan="6">TEC (in millions)</td> </tr> <tr> <td colspan="8">Statement:</td> </tr> <tr> <td colspan="8"> This work will be performed under contract or work-statement authorized by the level organization Liquid Metal & Closed Cycle </td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td align="right">1.6</td> <td></td> <td align="right">2.8</td> <td></td> </tr> <tr> <td colspan="8">TITLE OF PROJECT (Not to exceed characters and spaces.) ()</td> </tr> <tr> <td>State</td> <td>County</td> <td colspan="6">TEC (in millions)</td> </tr> <tr> <td colspan="8">Statement:</td> </tr> </table>								TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()								State	County	TEC (in millions)						Statement:								This work will be performed under contract or work-statement authorized by lead organization Open Cycle												2.3		18.2		TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()								State	County	TEC (in millions)						Statement:								This work will be performed under contract or work-statement authorized by the level organization Liquid Metal & Closed Cycle												1.6		2.8		TITLE OF PROJECT (Not to exceed characters and spaces.) ()								State	County	TEC (in millions)						Statement:							
TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()																																																																																																															
State	County	TEC (in millions)																																																																																																													
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State	County	TEC (in millions)																																																																																																													
Statement:																																																																																																															
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				1.6		2.8																																																																																																									
TITLE OF PROJECT (Not to exceed characters and spaces.) ()																																																																																																															
State	County	TEC (in millions)																																																																																																													
Statement:																																																																																																															

(Continue on Sepa

ORDER OF PRIORITY:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06065505128556J1

(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)	
Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays
	27.0		7.8		3.0		58.3				
	4.4		6.5		1.1		16.4				

Inue on Separate Sheet)

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2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

c. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		Obls
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
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) ▶						
Various - Open Cycle				0.7		5.1	
Various - Liquid Metal & Closed Cycle				0.3		0.7	

(Continue on

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
0606550512855601

(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
	7.0		2.0		0.6		15.4				
	1.0		1.6		0.5		4.1				

(See on Separate Sheet)

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ICHI & DEVELOPMENT
 AT SHEET 1.

Level of Effort:
 MAXIMUM
 ORDERLY
 MINIMUM

MEED

1. IDENTIFICATION NUMBER
 J606550512955601

1	Energy Conversion R&D	
AGENCY	MID - Power Generation	
	NASA	
	Various including OCR, AEC, NBS	
IND SITE	NAME OF CONTRACTOR: Various	
character and contractor; variation for state; 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:	
TION OF	Site where work will be performed	State: County:
	NAME OF CONTRACTOR:	
	Site where work will be performed	State: County:
	NAME OF CONTRACTOR:	
lines of text 70 characters; nature and scope taken, facilities to be acquired	1. Open Cycle	
	<ul style="list-style-type: none"> . Component & Materials Development . System Analysis & Design . Supporting R&D . Facilities Design & Construction <ul style="list-style-type: none"> - Large Scale Generator Test Facility - Long Endurance Materials Test Facility . Construction DEMO Plant (Coal Fired) 	
	2. Liquid Metal	
	<ul style="list-style-type: none"> . Component Development . Materials Studies . Facilities Design & Construction (1 & 5 MW) . Support R&D . Prototype Plant 	
S	3. Closed Cycle	
	<ul style="list-style-type: none"> . Component Development . Feasibility Experiment . Support R&D . Prototype Plant 50 MW 	

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

7. MAJOR RESOURCE REQUIREMENTS

ISCAL YEAR▶	1975	1976	1977	1978	1979
Scientific	168	238	210	210	210
Technical	192 / 600	272 / 850	240 / 750	240 / 750	240 / 750
Support	168	238	210	210	210
Other	72	102	90	90	90
Units of tons or Kilograms of amount of (right.)	0.5 mill	0.8 mill	0.9 mill	0.4 mill	1.0 mill
Govt-owned					
Govt-leased					
Privately-owned	0.3	0.8	0.6	0.5	0.4

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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.

1. Open Cycle
 - . Component & Materials Development
 - . System Analysis & Design
 - . Supporting R&D
 - . Facilities Design & Construction
 - Large Scale Generator Test Facility
 - Long Endurance Materials Test Facility
 - . Construction DEMO Plant (Coal Fired)
2. Liquid Metal
 - . Component Development
 - . Materials Studies
 - . Facilities Design & Construction (1 & 5 MW)
 - . Support R&D
 - . Prototype Plant
3. Closed Cycle
 - . Component Development
 - . Feasibility Experiment
 - . Support R&D
 - . Prototype Plant 50 MW

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 <i>(In man years)</i>	(1) Scientific	168	238	210	210	210
	(2) Technical	192	272	240	240	240
	(3) Support	168	238	210	210	210
	(4) Other	72	102	90	90	90
b. RAW MATERIALS <i>(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.)</i>		0.5 mill	0.8 mill	0.9 mill	0.4 mill	1.0 mill
c. LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned	0.5 "	0.8 "	0.6 "	0.5 "	0.4 "
	(4) Other					
d. OTHER RESOURCES NEEDED <i>(Specify item and unit of measure below. Show quantity of each in columns at right.)</i>	(1)					
	equipm. + test facilities travel, etc.	9.0 "	35.0 "	49.0 "	50.0 "	45.0 "
		1.0 "	1.4 "	1.5 "	1.1 "	1.2 "

3

BLANK PAGE

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

on 24 lines of text
than 70 characters
per line)

Describe nature and scope
of work undertaken,
new facilities
to be acquired
and

1. Open Cycle
 - Component & Materials Development
 - System Analysis & Design
 - Supporting R&D
 - Facilities Design & Construction
 - Large Scale Generator Test Facility
 - Long Endurance Materials Test Facility
 - Construction DEMO Plant (Coal Fired)
2. Liquid Metal
 - Component Development
 - Materials Studies
 - Facilities Design & Construction (1 & 5 MW)
 - Support R&D
 - Prototype Plant
3. Closed Cycle
 - Component Development
 - Feasibility Experiment
 - Support R&D
 - Prototype Plant 50 MW

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	168	238	210	210	210
(2) Technical	192	272	240	240	240
(3) Support	168	238	210	210	210
(4) Other	72	102	90	90	90
MATERIALS State units of measure, such as tons of fuel, kilograms of etc. Show amount of materials at right.)	0.5 mill	0.8 mill	0.9 mill	0.4 mill	1.0 mill
ACQUISITION (1) Govt-owned (2) Govt-leased (3) Privately-owned (4) Other	0.5 "	0.8 "	0.6 "	0.5 "	0.4 "
PERSONNEL State unit of measure. Show quantity of personnel at right.)	(1) 9.0 "	35.0 "	49.0 "	50.0 "	45.0 "
test facilities	1.0 "	1.4 "	1.5 "	1.1 "	1.2 "

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

0606550512855601

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.

There are three basic approaches to MHD electrical power generation that are various stages of development in the U.S. and abroad. They are the open cycle Plasma, closed cycle Plasma and the closed cycle Liquid Metal Systems. There exists a substantial degree of commonality in the three MHD concepts; each system however possesses unique characteristics which tend to set it apart in regard to the contribution that it can make to the Nation's energy program. The role of MHD power generation is perhaps appropriately addressed in relation to how successful development of pressing National goals which would (1) reduce air pollution and (2) reduce thermal pollution, (3) develop more economical and reliable power producing systems and (4) conserve our natural resources. All three MHD systems would contribute to the attainment of these goals.

The projected efficiencies of the MHD power systems lie in the 50-65% range. The increased efficiency would reduce the amount of heat rejected per kilowatt by greater than a factor of two. The air pollution is similarly alleviated. These systems offer unique possibilities for the control of particulates and chemical emissions and thus the prospect of considerably lower pollution than from conventional plants.

The high efficiencies that are achievable are very important to the Nation's power economy. Economic studies have shown that potential savings of MHD systems can range from 11 to 40 Billion dollars in this century alone.

RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0606550512855601

State the specific energy problem or objective, and specify how the proposed project 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.

are three basic approaches to MHD electrical power generation that are in various stages of development in the U.S. and abroad. They are the open cycle Plasma, the closed cycle Plasma and the closed cycle Liquid Metal Systems. There exists a sub-degree of commonality in the three MHD concepts; each system however possesses characteristics which tend to set it apart in regard to the contribution that it can make to the Nation's energy program. The role of MHD power generation is perhaps not fully addressed in relation to how successful development of pressing National energy goals would (1) reduce air pollution and (2) reduce thermal pollution, (3) develop economical and reliable power producing systems and (4) conserve our natural resources. All three MHD systems would contribute to the attainment of these goals.

The projected efficiencies of the MHD power systems lie in the 50-65% range. The high efficiency would reduce the amount of heat rejected per kilowatt by greater than 50%. The air pollution is similarly alleviated. These systems offer unique advantages for the control of particulates and chemical emissions and thus the prospect of significantly lower pollution than from conventional plants.

The high efficiencies that are achievable are very important to the Nation's power needs. Economic studies have shown that potential savings of MHD systems can range between billions of dollars in this century alone.

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

3. SCHEDULE (include major facilities and m/z, or 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
<u>Open Cycle</u>				
1. Long Endurance Materials Test Facility Operational	75		76	
2. Large Scale Generator Test Facility Generational with Clean Fuels	75		76	
3. Channel, Magnet & Other Parts Completed for US-USSR Exchange	75		77	
4. Generator Enthalpy Extraction Tests Complete	75		78	
5. Test Facility Modification for Coal	75		78	
6. Coal Fired Tests Complete	77		79	
7. Component Lifetime Tests Completed	76		79	
8. Component Performance Verified	76		79	
9. Evaluation of System Performance	75		80	
10. Design of 50 MW Demo Plant Completed	78		80	
<u>Liquid Metal</u>				
1. Component Design Established	75		76	
2. Simulated 1 MW Power System Completed	75		77	
3. Hi-Temp. Test Facility Completed	75		78	
4. Component Testing Completed	75		80	
5. System Performance Demonstrated	75		80	
6. 20 MW Prototype Plant Design Complete	75		80	

Level of Effort:

MAXIMUM

ORDERLY

MINIMUM

IDENTIFICATION NUMBER

0606550512855601

DATES

a. DEVELOPMENT MILESTONES (continued)

b. DATES

(Limit Title of Milestone to 60 characters and spaces)

Complete			Start				Complete			
FY	Q		FY	Q	FY	Q	FY	Q		
<u>Closed Cycle</u>										
75		1. Component Construction Complete	75					77		
76		2. Feasibility Experiment Complete	75					80		
77		3. Design of 50 MW Plant Complete	75					80		
78		4. Proof of Concept	75					80		
78		5. Design of Prototype Plant	75					80		
79										
79										
79										
80										
80										
76										
77										
78										
80										
80										
80										

2

(Continue on separate sheet)

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ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		(4)	
	FY 1974 (Non-Add)		FY 1975		FY 1976		FY 1977	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)				25.5		36.2		
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)				7.6		28.6		
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)				1.9		7.2		
d. GRAND TOTAL—OBLIGATIONS								
e. GRAND TOTAL—OUTLAYS				35.0		72.0		

Level of Effort:

- MAXIMUM
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IDENTIFICATION NUMBER
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(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 (Col. 7 & 8)		
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
36.2		32.4		31.5		32.2		157.8					
28.6		40.0		40.4		36.3		152.9					
7.2		9.6		10.1		9.1		37.9					
72.0		82.0		82.0		77.6		348.6					

----- function & brief description of the Cooperative programs and the rationale for the division of funding

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)		(2) FY 1975		(3) FY 1976		Obls.
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
TOTAL (Carry forward to summary sheet)							
() Name of Performing Organization: Various							
Open Cycle				17.5		27.7	
MANPOWER				0.3		0.5	
MATERIALS				1.2		1.0	
MAJOR PROCUREMENTS				19.0		29.2	
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
() Name of Performing Organization: Various							
Liquid Metal				6.0		6.3	
& Closed Cycle				0.2		0.3	
MANPOWER				—		—	
MATERIALS				0.3		0.4	
MAJOR PROCUREMENTS				6.5		7.0	
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 .

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0606550512855601

ays	(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
.7		25.0		15.3		15.1		100.6				
.5		0.4		0.3		0.4		1.9				
.0		1.1		0.9		0.7		4.9				
.2		26.5		16.5		16.2		107.4				
.3		5.3		13.8		14.9		46.3				
.3		0.3		0.5		0.5		1.8				
-		—		—		—		—				
4		0.3		0.7		0.6		2.3				
0		5.9		15.0		16.0		50.4				

(See 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	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		FY 1977 Obs.
	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	
TOTAL (Carry forward to summary sheet)							
<p>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.</p>							
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p>							
State	County	TEC (in millions)					
<p>Statement: This work will be performed under contract or work statement authorized by the lead organization - open cycle</p>							
			5.6		24.0		
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p>							
State	County	TEC (in millions)					
<p>Statement: This work will be performed under contract or work statement authorized by the lead organization - Liquid Metal & Closed Cycle</p>							
			2.0		4.6		
<p>TITLE OF PROJECT (Not to exceed characters and spaces.) ()</p>							
State	County	TEC (in millions)					
<p>Statement:</p>							

(Continue on Separate)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06065505128555C1

lays	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDED FY 1974 ICs, 7 & 8	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
0		33.0		22.0		18.2		102.8				
5		7.0		18.4		18.1		50.1				

See on Separate Sheet?

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

c. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Peak)		(2) FY 1975		(3) FY 1976		(4) FY 1977	
	Obl.	Outlays	Obl.	Outlays	Obl.	Outlays	Obl.	Outlays
	<p>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.</p> <p>TOTAL (Carry forward to summary sheet) ▶</p> <p>Various - Open Cycle</p> <p>Various - Liquid Metal & Closed Cycle</p>				1.4		5.8	
			0.5			1.4		

(Continue on Separate Sheet)

CONFIDENTIAL

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0606550512855601

Days	(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
5.9		7.5		5.5		4.6		24.8				
2.4		2.1		4.6		4.5		13.1				

Continues on Separate Sheet

Page of

2

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort

- MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
06-07-55-05-11-78-

2. a. PROGRAM	Conversion Techniques			
b. SUBPROGRAM	Potassium Topping Cycle			
3. a. PROPONENT AGENCY	NASA, DOI-OCR, AEC			
b. SUBJECT	Varies			
4. CONTRACTOR AND SITE <i>(No more than 42 characters and spaces for name of contractor; use standard abbreviation for state; up to 16 characters and spaces for county.)</i>	NAME OF CONTRACTOR: General Electric			
	Site where work will be performed	State: Ohio	County: Cincinnati	
	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 <i>(No more than 24 lines of text and no more than 70 characters and spaces per line)</i> Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.	A preliminary design and detailed economic assessment of a 1000 power plant will define the specifications for the program. Based on existing technology, a 300 MW potassium-vapor plant will be designed, built, and tested in 1978. The potassium portion will produce 90 MW.			

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 <i>(In man years)</i>	(1) Scientific	18	18	18	20	2
	(2) Technical	25	65	65	52	
	(3) Support					
	(4) Other					
b. RAW MATERIALS <i>(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.)</i>						
c. LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					
d. OTHER RESOURCES NEEDED						

R & DEVELOPMENT
SHEET

Level of Effort

- MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
06-07-55-05-11-78-03-01

ENC	Conversion Techniques	
	Potassium Topping Cycle	
	NASA, DOI-OCR, AEC	
SITE	Varies	
	NAME OF CONTRACTOR: General Electric	
	Site where work will be performed	State: Ohio County: Cincinnati
	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:	

NOF

A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 300 MW potassium-vapor plant will be designed, built, and tested in 1978. The potassium portion will produce 90 MW.

2

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

7. MAJOR RESOURCE REQUIREMENTS

YEAR	1975	1976	1977	1978	1979
Personnel	18	18	18	20	26
Material	25	65	65	52	56
Equipment					
Construction					
Operating					
Maintenance					
Transportation					
Utilities					
Other					
TOTAL					

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6. PROPOSING AGENCY
 b. SUBUNIT

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.)

NSA, DUL-OUR, AEC

Varies

NAME OF CONTRACTOR: General Electric

Site where work will be performed ▶ State: Ohio County: Cincinnati

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:

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 preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 300 MW potassium-vapor plant will be designed, built, and tested in 1978. The potassium portion will produce 90 MW.

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR ▶	1975	1976	1977	1978	1979
MANPOWER (in man years)	(1) Scientific	18	18	18	20	25
	(2) Technical	25	65	65	52	56
	(3) Support					
	(4) Other					
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.)				3		
LAND AREA REQUIRED (in acres)	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					
OTHER RESOURCES NEEDED (Specify item and unit of measure below. Show quantity of each in columns at right.)						

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-78-03-0

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 objective or solving the problem for which the project is proposed. Outline the risks/uncertainties (IUU), plans to minimize IUU, and basis for proceeding in face of IUU. Quantitative data should be used to the fullest extent.

The potassium topping plant can convert heat to electricity with a plant overall efficiency of 50 percent or more. This represents an increase in efficiency of about 40 percent over the most modern fossil-fueled conventional steam power plant. The improved conversion efficiency will result in a similar percentage reduction in pollutant emissions, a waste heat rejection and, fuel consumption per kilowatt hour of electricity generated.

For the future, the nation is expected to increasingly utilize its domestic supply of coal, either directly as mined or in the form of clean liquids or gases obtained by processing coal. The potassium topping plant, because it is a closed system, can be developed to burn any form of this fuel. One of the objectives of the joint OCR-NASA program is to test two different potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived from coal and a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate electricity is of special significance since energy losses due to coal processing are avoided and sulfur is removed by the addition of limestone to the bed.

In the year 2000, the potassium topping cycle could result in the following benefits:

- 1) Produce 1/4 our electric power, having an economic value exceeding \$50 billion a year
- 2) Save 500 million tons of coal each year.

AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-78-03-01

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

potassium topping plant can convert heat to electricity with a plant overall efficiency of 40 percent or more. This represents an increase in efficiency of about 40 percent over a fossil-fueled conventional steam power plant. The improved conversion efficiency results in a similar percentage reduction in pollutant emissions, a waste heat recovery, and a reduction in fuel consumption per kilowatt hour of electricity generated.

Therefore, the nation is expected to increasingly utilize its domestic supply of coal, not only as mined or in the form of clean liquids or gases obtained by processing of potassium topping plant, because it is a closed system, can be developed to burn potassium as fuel. One of the objectives of the joint OCR-NASA program is to test two potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived from a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate potassium is of special significance since energy losses due to coal processing are avoided and removed by the addition of limestone to the bed.

Therefore, the potassium topping cycle could result in the following benefits:

1. Provide 100,000 MW of electric power, having an economic value exceeding \$50 billion a year.

2. Save 10 million tons of coal each year.

2

ENERGY 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
74	3	75	2
74	3	75	2
75		76	
76		78	
78		81	

- 1) Preliminary design and economic assessment of commercial plant
- 2) Conceptual design of pilot plant
- 3) Scale-up tests
- 4) Build demonstration plant
- 5) Test demonstration plant

(Continue to next column)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-78-03-01

a. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

b. DATES

Start		Complete	
FY	Q	FY	Q

(Continue on separate sheet)

Page of

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		(4)		Obl.
	FY 1974 (Non-Add)		FY 1975		FY 1976		FY 1977		
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)	1.0		7.2		8.6		7.4		7.2
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)									
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)					14.0		26.3		9.0
d. GRAND TOTAL—OBLIGATIONS	1.0		7.2		22.6		33.7		17.2
e. GRAND TOTAL—OUTLAYS									

... from the amount for use of both refunds and Federal government funding. A brief description of th

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-78-03-01

(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)	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
7.4		7.6		7.9		39.7					
26.3		9.8		13.9		64.0					
33.7		17.4		21.8		103.7		17.0		120.0	

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

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

a. OPERATING

ITEM	(1)		(2)		(3)		Obl.
	FY 1974 (Non-Add)		FY 1975		FY 1976		
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
TOTAL (Carry forward to summary sheet) ▶	1.0		7.2		8.6		7.
() Name of Performing Organization: General Electric							
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 on 3c)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER:

06-07-55-05-11-78-03-01

(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 (Cols. 7 & 8)	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
4.6		7.4		7.6		7.9		39.7					

(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	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		Obis.																																																			
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays																																																				
TOTAL (Carry forward to summary sheet) ▶																																																										
<p>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.</p>																																																										
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="3">TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</td> <td rowspan="4" style="vertical-align: middle; text-align: center;">Item No.</td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> </tr> <tr> <td style="width: 20%;">State</td> <td style="width: 40%;">County</td> <td style="width: 40%;">TEC (in millions)</td> </tr> <tr> <td colspan="3">Statement:</td> </tr> <tr> <td colspan="3"> </td> </tr> <tr> <td colspan="3">TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</td> <td rowspan="4" style="vertical-align: middle; text-align: center;">Item No.</td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> </tr> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> <tr> <td colspan="3">Statement:</td> </tr> <tr> <td colspan="3"> </td> </tr> <tr> <td colspan="3">TITLE OF PROJECT (Not to exceed characters and spaces.) ()</td> <td rowspan="4" style="vertical-align: middle; text-align: center;">Item No.</td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> <td rowspan="4"></td> </tr> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> <tr> <td colspan="3">Statement:</td> </tr> <tr> <td colspan="3"> </td> </tr> </table>								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.) ()			Item No.					State	County	TEC (in millions)	Statement:						TITLE OF PROJECT (Not to exceed characters and spaces.) ()			Item No.					State	County	TEC (in millions)	Statement:					
TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()			Item No.																																																							
State	County	TEC (in millions)																																																								
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TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()			Item No.																																																							
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TITLE OF PROJECT (Not to exceed characters and spaces.) ()			Item No.																																																							
State	County	TEC (in millions)																																																								
Statement:																																																										

(Continue on Separ

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-78-03-01

(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 (Cols. 7 & 8)		
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays

(Continue on Separate Sheet)

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2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

a. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		(4) FY
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
	For each major performing organization, show total equipment funds, with a separate specification of each item of equipment costing one-half million dollars or more.					14.0	
TOTAL (Carry forward to summary sheet)							

(Continue on separate sheet)

Level of Effort:
 MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER
 06-07-55-05-11-75-03-01

1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1976 (Cols. 7 & 8)	
	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	
	26.3		9.8		13.9		64.0					

(Continue on Separate Sheet)

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ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort:
 MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
06-07-55-05-11-83-03-0

a. PROGRAM	Conversion Techniques		
b. SUBPROGRAM	Potassium Looping Cycle		
c. FUNDING AGENCY	NASA, DOI-DCR, AEC		
d. SUBUNIT	Varies		
CONTRACTOR AND SITE <i>(No more than 42 characters and space for name of contractor; use standard abbreviation for state up to 16 characters and space for county.)</i>	NAME OF CONTRACTOR:	General Electric	
	Site where work will be performed	State: Ohio	County: Cincinnati
	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 <i>(No more than 24 lines of text and no more than 50 characters and space per line)</i> Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.	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:
<p>A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1979. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1983; the potassium portion will produce 90 MW.</p>			

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978	1979
MANPOWER <i>(In man years)</i>	(1) Scientific	18	18	18	20	26
	(2) Technical	25	65	65	52	56
	(3) Support					
	(4) Other					
RAW MATERIALS <i>(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 of right.)</i>						3 billion cubic feet of gas
LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					

TECH & DEVELOPMENT
 T SHEET

Level of Effort:

- MAXIMUM
- ORDINARY
- MINIMUM

1. IDENTIFICATION NUMBER
 06-07-55-05-11-S3-03-01

	Conversion Techniques		
NAME	Potassium Topping Cycle		
AGENCY	NASA, DOI-OCS, AEC		
WEBSITE	Varies		
characters and contractor; location for state and space for	NAME OF CONTRACTOR: General Electric		
	Site where work will be performed	State: Ohio	County: Cincinnati
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
NAME OF CONTRACTOR:			
Site where work will be performed	State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed	State:	County:	
DESCRIPTION OF	<p>A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1979. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1983; the potassium portion will produce 90 MW.</p>		
lines of text 70 characters (1) nature and scope of work, facilities to be acquired			

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

7. MAJOR RESOURCE REQUIREMENTS

CALENDAR YEAR	1975	1976	1977	1978	1979
Scientific	18	18	18	20	26
Technical	25	65	65	52	56
Support					
Other					
units of as tons of kilograms of amount of (ft.)					3 billion cubic feet of gas
Govt-owned					
Govt-leased					
Privately-owned					
Other					

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<p>b. SUBUNIT</p> <p>4. CONTRACTOR AND SITE</p> <p><i>No more than 42 characters and spaces for name of contractor; use standard abbreviation for sites; up to 16 characters and spaces for county.</i></p>	<p>Varies</p> <p>NAME OF CONTRACTOR: General Electric</p> <p>Site where work will be performed ▶ State: Ohio County: Cincinnati</p> <p>NAME OF CONTRACTOR:</p> <p>Site where work will be performed ▶ State: County:</p> <p>NAME OF CONTRACTOR:</p> <p>Site where work will be performed ▶ State: County:</p> <p>NAME OF CONTRACTOR:</p> <p>Site where work will be performed ▶ State: County:</p> <p>NAME OF CONTRACTOR:</p> <p>Site where work will be performed ▶ State: County:</p>
<p>5. BRIEF DESCRIPTION OF PROPOSAL</p> <p><i>(No more than 24 lines of text and no more than 70 characters and spaces per line)</i></p> <p>Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.</p>	<p>A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1979. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1983; the potassium portion will produce 90 MW.</p>

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
8. MANPOWER <i>(In man years)</i>	(1) Scientific	18	18	18	20	26
	(2) Technical	25	65	65	52	56
	(3) Support					
	(4) Other					
9. RAW MATERIALS <i>(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.)</i>				3		3 billion cubic feet of gas
10. LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other					
11. OTHER RESOURCES NEEDED <i>(Specify item and unit of measure below. Show quantity of each in columns at right.)</i>						
(1)	(1)					

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-S3-

G. 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 potassium topping plant can convert heat to electricity with a plant overall efficiency of 50 percent or more. This represents an increase in efficiency of about 40 percent over the most modern fossil-fueled conventional steam power plant. The improved conversion efficiency will result in a similar percentage reduction in pollutant emissions, a waste heat rejection and, fuel consumption per kilowatt hour of electricity generated.

For the future, the nation is expected to increasingly utilize its domestic supply of coal, either directly as mined or in the form of clean liquids or gases obtained by processing the coal. The potassium topping plant, because it is a closed system, can be developed to burn any form of this fuel. One of the objectives of the joint OCR-NASA program is to develop two different potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived from coal and a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate electricity is of special significance since energy losses due to coal processing are avoided and sulfur is removed by the addition of limestone to the bed.

In the year 2000, the potassium topping cycle could result in the following benefits:

- (1) Produce 1/4 our electric power, having an economic value exceeding \$50 billion
- (2) Save 500 million tons of coal each year.

ARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-S3-03-01

N- State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem 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.

ium topping plant can convert heat to electricity with a plant overall efficiency cent or more. This represents an increase in efficiency of about 40 percent over modern fossil-fueled conventional steam power plant. The improved conversion will result in a similar percentage reduction in pollutant emissions, a waste tion and, fuel consumption per kilowatt hour of electricity generated.

ture, the nation is expected to increasingly utilize its domestic supply of coal, ectly as mined or in the form of clean liquids or gases obtained by processing

The potassium topping plant, because it is a closed system, can be developed to .orm of this fuel. One of the objectives of the joint OCR-NASA program is to test -ent potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived and a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate y is of special significance since energy losses due to coal processing are id sulfur is removed by the addition of limestone to the bed.

r 2000, the potassium topping cycle could result in the following benefits:

ice 1/4 our electric power, having an economic value exceeding \$50 billion a year.

500 million tons of coal each year.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

B. 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) Preliminary design and economic assessment of commercial plant	74	3	75
(2) Conceptual design of pilot plant	74	3	75	2
(3) Scale-up tests	75		77	
(4) Build pilot plant	76		78	
(5) Test pilot plant	78		81	
(6) Build demonstration plant	81		83	
(7) Test demonstration plant	83		85	

(Continue to next column)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
06-07-55-05-11-83-03-01

b. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

d. DATES

complete	Q		Start		Complete	
			FY	Q	FY	Q
	2					
	2					

(Continue on separate sheet)

Page of

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		(4)	
	FY 1974 (Non-Add)		FY 1975		FY 1976		FY 1977	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)	1.0		7.2		8.6		7.4	
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)								
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)					10.0		22.3	
d. GRAND TOTAL—OBLIGATIONS	1.0		7.2		18.6		29.7	
e. GRAND TOTAL—OUTLAYS								

Indicate the amount by year of both private and Federal government funding. A brief descrip

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-83-03-01

is.	(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 (Col. 7 & 8)	
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
.6		7.4		7.6		7.9		39.7					
.0		22.3		5.8		9.9		48.0					
.6		29.7		13.4		17.8		87.7		32.3		120.0	

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

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

a. OPERATING

ITEM	(1)		(2)		(3)	
	FY 1974 (Non-Add)		FY 1975		FY 1976	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
TOTAL (Carry forward to summary sheet)	1.0		7.2		8.6	
() Name of Performing Organization: General Electric						
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						

(Cont)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-83-03-01

976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1975 (Cols. 7 & 8)	
	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
	7.4		7.6		7.9		39.7					

(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	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		F Obis.
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
TOTAL (Carry forward to summary sheet) ▶							
<p>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.</p>							
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p>							
State	County	TEC (in millions)					
Statement:							
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p>							
State	County	TEC (in millions)					
Statement:							
<p>TITLE OF PROJECT (Not to exceed characters and spaces.) ()</p>							
State	County	TEC (in millions)					
Statement:							

(Continue on Separ

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

A. OPERATING

ITEM	(1)		(2)		(3)	
	FY 1974 (Non-Add)		FY 1975		FY 1976	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
TOTAL (Carry forward to summary sheet)					10.0	
() 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						

(Continued)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
06-07-55-05-11-83-G3-01

(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	
	22.3		5.8		9.9		48.0						

(Continue on Separate Sheet)

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2

FACTORY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
06-07-55-05-11-86-03-C

2. a. PROGRAM	Conversion Techniques		
b. SUBPROGRAM	Potassium Topping Cycle		
3. a. PROPONENT AGENCY	NASA, DOI-OCR, AEC		
b. SUBUNIT	Varies		
4. CONTRACTOR AND SITE	NAME OF CONTRACTOR: General Electric		
<i>(No more than 42 characters and spaces for name of contractor; use standard abbreviation for state; up to 16 characters and spaces for county.)</i>	Site where work will be performed	State: Ohio	County: Cinti
	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	<p><i>(No more than 24 lines of text and no more than 70 characters and spaces per line)</i></p> <p>Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.</p>
	<p>A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1981. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1986, the potassium portion will produce 90 MW.</p>

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 <i>(In man years)</i>	(1) Scientific	18	18	18	20	26
	(2) Technical	25	65	65	52	56
	(3) Support					
	(4) Other					
RAW MATERIALS <i>(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.)</i>						
LAND AREA REQUIRED	(1) Govt-owned					
	(2) Govt-leased					

SEARCH & DEVELOPMENT
FACT SHEET

Level of Effort:
 MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
06-07-55-05-11-S6-03-01

PROGRAM NAME	Conversion Techniques		
PROGRAM	Potassium Topping Cycle		
SPONSORING AGENCY	NASA, DOI-OCR, AEC		
LOCATION	Varies		
DESCRIPTION OF WORK AND SITE <small>(Less than 42 characters and name of contractor; 1 abbreviation for state; less than 42 characters and spaces for)</small>	NAME OF CONTRACTOR: General Electric		
	Site where work will be performed	State: Ohio	County: Cincinnati
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
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

(Less than 24 lines of text than 70 characters per line)
 Describe nature and scope of work to be undertaken, any new facilities to be acquired, etc.

A preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1981. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1986, the potassium portion will produce 90 MW.

2

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

7. MAJOR RESOURCE REQUIREMENTS					
FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	18	18	18	20	26
(2) Technical	25	65	65	52	56
(3) Support					
(4) Other					
MATERIALS <small>(Specify units of measure, such as tons of coal, kilograms of uranium, etc. Show amount of each at right.)</small>					
(1) Govt-owned					
(2) Govt-leased					
(3) Privately-owned					

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a. PROPONENT AGENCY

NASA, DUTCOR, AEC

b. SUBUNIT

Varies

CONTRACTOR AND SITE

NAME OF CONTRACTOR: General Electric

(No more than 40 characters and spaces for name of contractor; use standard abbreviation for state; up to 16 characters and spaces for county.)

Site where work will be performed ▶ State: Ohio County: Cincinnati

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 preliminary design and detailed economic assessment of a 1000-MW power plant will define the specifications for the program. Based on existing technology, a 30-MW potassium-vapor pilot plant will be designed, built, and tested in 1981. By expansion of this pilot plant, a complete 300-MW demonstration plant will be built and operation will begin in 1986, the potassium portion will produce 90 MW.

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	18	18	18	20	26
	(2) Technical	25	65	65	52	56
	(3) Support					
	(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.)						
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned					
	(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)	(1)		3			

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-86-03-C

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 potassium topping plant can convert heat to electricity with a plant overall efficiency of 50 percent or more. This represents an increase in efficiency of about 40 percent over the most modern fossil-fueled conventional steam power plant. The improved conversion efficiency will result in a similar percentage reduction in pollutant emissions, a waste heat rejection and, fuel consumption per kilowatt hour of electricity generated.

For the future, the nation is expected to increasingly utilize its domestic supply of coal either directly as mined or in the form of clean liquids or gases obtained by processing the coal. The potassium topping plant, because it is a closed system, can be developed to burn any form of this fuel. One of the objectives of the joint OCR-NASA program is to develop two different potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived from coal and a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate electricity is of special significance since energy losses due to coal processing are reduced and sulfur is removed by the addition of limestone to the bed.

In the year 2000, the potassium topping cycle could result in the following benefits:

- (1) Produce 1/4 our electric power, having an economic value exceeding \$50 billion a year.
- (2) Save 500 million tons of coal each year.

CH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-S6-03-01

State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or 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 involved, R/U, and basis for proceeding in face of R/U. Quantitative data should be used to the fullest extent.

A potassium topping plant can convert heat to electricity with a plant overall efficiency of 40 percent or more. This represents an increase in efficiency of about 40 percent over a conventional fossil-fueled steam power plant. The improved conversion will result in a similar percentage reduction in pollutant emissions, a waste reduction, and fuel consumption per kilowatt hour of electricity generated.

Currently, the nation is expected to increasingly utilize its domestic supply of coal, primarily as mined or in the form of clean liquids or gases obtained by processing. The potassium topping plant, because it is a closed system, can be developed to utilize a portion of this fuel. One of the objectives of the joint OCR-NASA program is to test two potassium furnaces: a pressurized furnace that combusts a low-BTU gas derived from a fluidized bed combustor of coal. Use of coal in a fluidized bed to generate electricity is of special significance since energy losses due to coal processing are avoided and sulfur is removed by the addition of limestone to the bed.

By the year 2000, the potassium topping cycle could result in the following benefits:

- 1/4 our electric power, having an economic value exceeding \$50 billion a year.
- 1 million tons of coal each year.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

2. DEVELOPMENT MILESTONES (number each consecutively)

(Limit Title of Milestone to 60 characters and spaces)

b. DATES

Start		Complete	
FY	Q	FY	Q
74	3	75	2
74	3	75	2
75		77	
77		80	
80		83	
83		86	
86		88	

- 1) Preliminary design and economic assessment of commercial plant
- 2) Conceptual design of pilot plant
- 3) Scale-up tests
- 4) Build pilot plant
- 5) Test pilot plant
- 6) Build demonstration plant
- 7) Test demonstration plant

(Continue to next column)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-86-03-01

TES

a. DEVELOPMENT MILESTONES (continued)

b. DATES

Complete

Start || Complete

(Limit Title of Milestone to 60 characters and spaces)

FY Q

FY Q || FY Q

'5 2
'5 2
7
0
3

(Continue on separate sheet)

Page of

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		(4)	
	FY 1974 (Non-Add)		FY 1975		FY 1976		FY 1977	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)	1.0		4.2		10.6		7.4	
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)								
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)							7.6	
d. GRAND TOTAL—OBLIGATIONS	1.0		4.2		10.6		15.0	
e. GRAND TOTAL—OUTLAYS								

... to determine the amount by year of both private and Federal government funding. A brief description

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-86-03-01

31*	(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	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays
		7.4		7.6		7.9		38.7					
		7.6		7.4		7.1		22.1					
		15.0		15.0		15.0		60.8		79.2		120.0	

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

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)		(2) FY 1975		(3) FY 1976		Obl.
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
TOTAL (Carry forward to summary sheet) ▶	1.0		4.2		10.6		7.
General Electric							
() 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 on Sep

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-86-03-01

s.	(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 (Cols. 7 & 8)	
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
.6		7.4		7.6		7.9		38.7					

(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)		(2) FY 1975		(3) FY 1976		(4) FY 1977																												
	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays																											
	TOTAL (Carry forward to summary sheet) ▶																																		
<p>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.</p>																																			
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="9">TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</td> </tr> <tr> <td style="width:10%;">State</td> <td style="width:20%;">County</td> <td colspan="7">TEC (in millions)</td> </tr> <tr> <td colspan="9">Statement:</td> </tr> </table>									TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()									State	County	TEC (in millions)							Statement:								
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State	County	TEC (in millions)																																	
Statement:																																			

(Continue on Separate

LEVEL OF EFFORT:
 MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER
 06-07-55-05-11-86-03-01

(3) Y 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

(Continue on Separate Sheet)

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

C. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		(4) FY 1977	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
	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.							7.6
TOTAL (Carry forward to summary sheet) ▶								

(Continue on Separate Sheet)

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06-07-55-05-11-86-03-01

Days	(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)	
	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays
	7.6		7.4		7.1		22.1					

(Line on Separate Sheet)

Page of

2

5. DEVELOPMENT SHEET

LESS EXPENSE
 MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NUMBER
 0608550712805602

Fuel Cell Decentralized Conversion		
Integrated energy Systems, Fuel Cell Power Plants, Low Emission Energy		
NCY	EPA, NASA, NBS, OCR	
DATE	NAME OF CONTRACTOR: Several, Unspecified	
Number of contractors and contractor:	Site where work will be performed	State: County:
in for state:	NAME OF CONTRACTOR:	
1 space 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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 required

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolytes to be used with the high temperature solid electrolyte fuel cell listed above.



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

7. MAJOR RESOURCE REQUIREMENTS

YEAR	1975	1976	1977	1978	1979
Manpower	36	56	60	65	65
Material	72	112	120	130	130
Equipment	36	56	60	65	65
Other					
of					
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nt of					
ures					
ased					
resources					

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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.

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a large scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the cathode.
5. A high temperature (1000°C) solid electrolyte (stabilized) fuel cell that may be used with coal gasification to produce energy at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolytes to be used with the high temperature solid electrolyte fuel cell listed above.

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978
a. MANPOWER (In man years)	(1) Scientific	36	56	60	65
	(2) Technical	72	112	120	130
	(3) Support	36	56	60	65
	(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.)			3		
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned				
	(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)				
	Gas Various H/C Propane H ₂ Coal			Small quant. X X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton/yr.	Small quant. X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton/yr.

BLANK PAGE

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
 lines of text
 70 characters
)
 nature and scope
 of work to be
 undertaken,
 facilities
 to be acquired

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be used with the high temperature solid electrolyte fuel cell listed above.

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
1) Scientific	36	56	60	65	65
2) Technical	72	112	120	130	130
3) Support	36	56	60	65	65
4) Other					
LS and units of such as tons of oil, kilograms of raw amount of at right.)				4	
1) Govt-owned					
2) Govt-leased					
3) Privately-owned					
4) Other					
RESOURCES NEEDED and unit of Show quantity units at right.)	(1)				
Gas Various H/C Propane H ₂ Coal			Small quant. X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton yr.	Small quant. X 140 x 10 ⁶ Btu 3.5 x 10 ⁶ ton yr.	Small quan X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton yr.

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MAY 1967

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6. JUSTIFICATION - State the specific energy problem or objective and specify how the proposed work contribute to the solution of the problem or attainment of the objective. Include reasons for selection of the recommended approach over other alternatives. Also include the benefits expected to be derived from meeting the objectives or solving the problem, for each of the projects 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.

1. This is a simple cell which is modular in nature. It is in an advanced state and should be pushed to successful completion.

2. The molten carbonate cell is worthwhile since it can make use of a variety of fuels.

3. The alkaline hydrogen fuel cell is fifteen percent higher in efficiency than the acid cell and are able to use silver, silver oxide, and perovskites as the air electrode, this decreasing the possibility of a tight platinum supply situation.

4. The fuel in the methanol cell is inexpensive and easily stored in large quantities. Furthermore, the cell can be used on both stationary and mobile (automobile) sources.

5. The potential of the high temperature solid electrolyte fuel cell to utilize coal gasification at an efficiency of eighty percent more than counterbalance this cell's high risks.

6. Catalyst and solid electrolyte R&D is an integral and necessary part of the high temperature solid electrolyte fuel cell project.

11/10
OCEAN-FLY
11/10/10

0608550712805602

1104- State the specific energy problem or objective and specify how the proposed work contribute to the solution of the problem or to the objective. Include the necessary background information, the recommended approach over other alternatives. Also include the benefits to be gained from meeting the objectives or solving the problem for which the project is proposed. Outline the risks/uncertainties to minimize R&U, and basis for proceeding in face of R&U. Quantitative data should be used to the fullest extent.

This is a simple cell which is modular in nature. It is in an advanced stage and should be pushed to successful completion.

The molten carbonate cell is worthwhile since it can make use of a wide range of fuels.

The alkaline hydrogen fuel cell is fifteen percent higher in efficiency than the silver cell and are able to use silver, silver oxide, and perovskites as the air electrode, this decreasing the possibility of a tight platinum supply situation.

The fuel in the methanol cell is inexpensive and easily stored in large quantities. Furthermore, the cell can be used on both stationary and mobile (vehicle) sources.

The potential of the high temperature solid electrolyte fuel cell to utilize a wide range of fuels at an efficiency of eighty percent more than counterbalance this high risks.

Catalyst and solid electrolyte R&D is an integral and necessary part of the high temperature solid electrolyte fuel cell project.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

SCHEDULE *Includes 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) <u>Decentralized Conversion Gas On-Site Fuel Cell Power Plants</u>				
Laboratory Experimentation Completed	75		79	
Engineering Development	75		79	
Technical & Economic Studies	75			
Component Testing	76			
Engineering Development	78			
Pilot Plant	77			
Demonstration Plant	79			
Demonstration Plant	77		79	
First Commercial Application	78			
<u>Fuel Cell Decentralized Conversion</u>				
First Commercial Application	78			
First Commercial Application	77			
Demonstration Plant	77			
Engineering Development	79		80	
Demonstration Plant	77			
Component Testing	77			
<u>Decentralized Conversion-Evaluation and Demonstration of Low Emission Advanced Clean Energy Systems For Non-Utility (Area) Sources of Pollution</u>				
Theory Established			73	
Economic Viability	73			
Experiment Designed	74			
Component Testing	75			
Bench Model Completed	74			
Laboratory Experiments Completed	76			
Engineering Development	77			
Demonstration Plant	78			
First Commercial Application	79			
Subsequent Application	81			

ENERGY 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
Central Station Conversion				
Electrocatalysis				
a) Pure Platinum	75			
b) Platinum Alloys & Kinetics	76		78	
c) Platinum Substitutes & Kinetics	79			
Solid-State Electrolytes				
a) Identify Systems, Screen Samples, Lab Procedure Fixed	75			
b) Ion Exchange Technique for Measurement of Fast Ion Conductors	76		77	
c) Add oxides of Bismuth & Large Trivalent Ions	77		78	
d) Material Properties	79			
Data				
a) Data Base Completed	75			
b) Compile Available Data	76			
c) Critically Evaluate Data	77		78	
d) Publish Data	78			
Central Station Conversion				
Component Testing	75			
Bench Model Completed	75			
Laboratory Experiments Completed	77			
Engineering Development	79			
Pilot Plant	82			
Demonstration Plant	84			
First Commercial Application	88			
Subsequent Application	85		95	

Level of Effort:

MAXIMUM

ORDERLY

MINIMUM

IDENTIFICATION NUMBER:

0608550712805602

DATES

a. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

Complete		1 2	DATE		
FY	Q		FY	Q	FY
76					
77					
78					
78					
95					

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)		(2) FY 1975		(3) FY 1976		
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
TOTAL (Carry forward in summary sheet)			12.11	11.36	20.50	17.78	2
Name of Performing Organization: EPA, NASA, NBS, OCR-							
MANPOWER			2.26	2.11	4.0	3.43	5
MATERIALS							
MAJOR PROCUREMENTS			9.85	9.25	16.50	14.33	1
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION			12.11	11.36	20.50	17.78	2
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							

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0608550712605602

(3) FY 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		TOTAL FY 1976
	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	
17.78	22.63	19.34	18.68	20.64	15.16	20.72	88.96	88.96			
3.43	5.28	3.93	3.72	4.19	2.56	4.06	17.70	17.70			
14.33	17.35	15.21	14.96	15.45	12.60	16.66	71.26	71.26			
17.78	22.63	19.14	18.68	20.64	15.16	20.72	88.96	88.96			

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-Ask)		(2) FY 1975		(3) FY 1976		Item No.			
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays				
TOTAL (Carry forward in summary sheet)			0	0	.27	.16	1			
<p>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.</p> <p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p> <p align="center">This is made up of a number of projects, none of which is greater than one million dollars.</p>	State	County	TEC (in millions)							
State	County	TEC (in millions)								
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p>	State	County	TEC (in millions)							
State	County	TEC (in millions)								
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p>	State	County	TEC (in millions)							
State	County	TEC (in millions)								

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Level of Effort

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- MAXIMUM
- ONDIARY
- MINIMUM

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(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1976-79		(8) BALANCE TO COMPLETE	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
.27	.16	1.32	.53	.41	.75	.25	.81	2.25	2.25		

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

c. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976	
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays
	TOTAL (Carry forward to summary sheet)			1.85	1.60	7.47
Evaluation, development, and demonstration of advance fuel cell technology for providing low cost, highly efficient clean energy small sources - pilot plant equipment					0.70	

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0608550712805602

ls.	(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXP FY 1975-79
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	
47	5.17	20.53	9.86	8.10	12.69	4.82	13.65	42.70	42.70				

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		FY 1977 Obis.
	FY 1974 (Non-Actd)		FY 1975		FY 1976		
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)			12.11	11.36	20.50	17.18	22.63
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)			0	0	.27	.16	1.32
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)			1.85	1.60	7.47	5.17	20.53
d. GRAND TOTAL—OBLIGATIONS			13.96		28.23		44.48
e. GRAND TOTAL—OUTLAYS				13.00		23.11	

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
0608550712805602

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total FY 1975-79
Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.
0.50	17.18	22.63	19.14	18.68	20.64	5.16	20.72	88.96	88.96			
.27	.16	1.32	.53	.41	.75	.25	.81	2.25	2.25			
.47	5.17	20.53	9.86	8.10	12.69	4.82	13.65	42.70	42.70			
.8.23		44.48		27.19		20.26		133.91				
	23.11		29.53		34.08		35.16		133.91			

2. a. PROGRAM: Fuel Cell Development Conversion
 b. SUPERPROGRAM: Alternative Energy Systems, Fuel Cell Power Plants, Low Emission
 3. a. PROPOSING AGENCY: EPA, NASA, NSS, OCN
 b. SUBUNIT:

4. CONTRACTOR AND SITE

(No more than 40 characters and spaces for name of contractor; use standard abbreviation for state up to 16 characters and spaces for county.	NAME OF CONTRACTOR: Several	Inspected
	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.

1. A acid hydrogen cell wherein the hydrogen may come from fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on scale by Exxon. The problem is to develop an air electrode th inert to the alcohol and to prevent the alcohol from reaching electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized fuel cell that may be used with coal gasification to produce at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be u with the high temperature solid electrolyte fuel cell listed

6. JUSTIFICATION (Use a separate sheet(s). See Item 5. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978
a. MANPOWER (In man years)	(1) Scientific	36	56	60	65
	(2) Technical	72	112	120	130
	(3) Support	35	56	60	65
	(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.)					
c. LAND AREA (1) Government					

1. IDENTIFICATION NUMBER
0608550712805602

FUEL CELL ... CONVERSION
... ENERGY SYSTEMS, Fuel Cell Power Plants, Low Emission Fuel
... AEA, NASA, NBS, OCR

2. NAME OF CONTRACTOR: Several Unspecified

3. STATE AND COUNTY: State: County:

4. NAME OF CONTRACTOR: State: County:

5. NAME OF CONTRACTOR: State: County:

6. NAME OF CONTRACTOR: State: County:

7. NAME OF CONTRACTOR: State: County:

8. DESCRIPTION OF PROJECT:

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolytes to be used with the high temperature solid electrolyte fuel cell listed above.

2

9. (Use a separate sheet(s). See Item 5. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	36	56	60	65	65
(2) Technical	72	112	120	130	130
(3) Support	36	56	60	65	65
(4) Other					
ALS (and units of such as tons of fuel, kilograms of Show amount of at right.)					
(1) General					

BLANK PAGE

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.

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4. Methyl alcohol cells of the type successfully operated on scale by Exxon. The problem is to develop an air electrode th inert to the alcohol and to prevent the alcohol from reaching electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized fuel cell that may be used with coal gasification to produce e at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be u with the high temperature solid electrolyte fuel cell listed a

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE Y	FISCAL YEAR	1975	1976	1977	1978
a. MANPOWER (In man years)	(1) Scientific	36	56	60	65
	(2) Technical	72	112	120	130
	(3) Support	36	56	60	65
	(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.)					
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned				
	(2) Condemned				
	(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)	3			
	Gas Various H/C Propane H ₂ Coal		Small quant. X X 140 x 10 ⁶ Btu 8.5 x 10 ³ ton/yr.	Small quant. X 140 x 10 ⁶ Btu 8.5 x 10 ³ ton/yr.	Small 140 x 5.5 x

BLANK PAGE

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

DESCRIPTION OF

24 lines of text
 less 50 characters
 line)
 nature and scope
 undertaken,
 new facilities
 to be acquired

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting RSD for catalysts and solid electrolyts to be used with the high temperature solid electrolyte fuel cell listed above.

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	36	56	60	65	60
(2) Technical	77	112	120	130	130
(3) Support	36	56	60	65	65
(4) Other					
RLS (and units of such as tons of oil, kilograms of flow amount of oil night)					
(1) Government					
(2) Contract					
(3) Other					
RESOURCES NEEDED (unit of each quantity must be stated)					
Gas Liquid H/C Propane H ₂ Coal		4	Small quant. X X 140 x 10 ⁶ gal 8.5 x 10 ⁶ gal	Small quant. X 140 x 10 ⁶ gal 8.5 x 10 ⁶ gal	Small quant. X 140 x 10 ⁶ gal 8.5 x 10 ⁶ gal

6. JUSTIFICATION: Since the fuel cell is a very important area and one of the most important areas in the energy field, it is necessary to have a program to develop the technology, especially in the area of solid electrolyte fuel cells. The program should be designed to provide the necessary data for the development of the fuel cell project. Goals of the program are to (1) determine R&D and data for proceeding in favor of R.U. Quantitative data should be used to the fullest extent.

1. This is a simple cell which is modular in nature. It is in an advanced state and should be pushed to successful completion.
2. The molten carbonate cell is worthwhile since it can make use of a variety of fuels.
3. The alkaline hydrogen fuel cell is fifteen percent higher in efficiency than the acid cell and are able to use silver, silver oxide, and perovskites as the air electrode, thus decreasing the possibility of a tight platinum supply situation.
4. The fuel in the methanol cell is inexpensive and easily stored in large quantities. Furthermore, the cell can be used on both stationary and mobile (automobile) sources.
5. The potential of the high temperature solid electrolyte fuel cell to enable coal gasification at an efficiency of eighty percent more than counterbalance this cell's high risks.
6. Catalyst and solid electrolyte R&D is an integral and necessary part of the high temperature solid electrolyte fuel cell project.

SECRET

04005507120 500

10. Since the identification of the problem is complete and the data are available, the next step is to determine the solution of the problem. This involves the selection of the recommended program and the evaluation of the results. The program should be designed to solve the problem and the results should be compared to the expected results. Quantitative data should be used to the fullest extent.

This is a simple cell which is modular in nature. It is in an advanced stage and should be pushed to successful completion.

The molten carbonate cell is worthwhile since it can make use of a wide variety of fuels.

The alkaline hydrogen fuel cell is fifteen percent higher in efficiency than the solid oxide cell and are able to use silver, silver oxide, and perovskites as the air electrode, this decreasing the possibility of a tight platinum supply situation.

The fuel in the methanol cell is inexpensive and easily stored in large quantities. Furthermore, the cell can be used on both stationary and mobile sources.

The potential of the high temperature solid electrolyte fuel cell to utilize hydrocarbons at an efficiency of eighty percent more than counterbalance this high risk.

Catalyst and solid electrolyte R&D is an integral and necessary part of the high temperature solid electrolyte fuel cell project.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

1. *Describe 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
<u>High Temperature Conversion Gas On-Site Fuel Cell Power Plants</u>				
1 Laboratory Demonstration Completed	75		79	
2 Engineering Development	75		79	
3 Physical & Economic Studies	75			
4 Component Testing	76			
5 Engineering Development	78			
6 Pilot Plant	77			
7 Demonstration Plant	79			
8 Construction Plant	77		79	
9 First Commercial Application	78			
<u>Fuel Cell Centralized Conversion</u>				
1 First Commercial Application	78			
2 Second Commercial Application	77			
3 Demonstration Plant	77			
4 Engineering Development	79		80	
5 Demonstration Plant	77			
6 Component Testing	77			
<u>High Temperature Conversion-Evaluation and Demonstration of Low Pollution Advanced Clean Energy Systems For Non-Utility (Area)</u>				
1 Control Pollution			73	
2 Feasibility Study	73			
3 Component Designed	74			
4 Component Testing	75			
5 Model Completed	74			
6 Safety Experiments Completed	76			
7 Engineering Development	77			
8 Demonstration Plant	78			
9 First Commercial Application	79			
10 Second Commercial Application	81		95	

11
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Level of Effort:

- MAXIMUM
- ORDINATELY
- MINIMUM

IDENTIFICATION NUMBER

06065507128352

b. DATES:

c. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

Start	Complete		Milestone Title	Start		End		
	Q	FY		FY	Q			
79	79	Q	<u>Decentralized Conversion-Evaluation, Development, and Demonstration of Advance Fuel Cell Technology for Providing Low Cost, Highly Efficient Clean Energy on All Sources</u>	78	80	73		
			Experiment Designed				78	73
			Component Testing					
			Bench Model Completed					78
			Laboratory Experiments Completed					79
			Engineering Development				80	
			Pilot Plant				77	
			Demonstration Plant				78	
			First Commercial Application				79	
			Subsequent Application				85	85
80	80	Q	<u>Hydrogen Energy Systems</u>	74	79	77		
			Theory Established-Experimental Confirmation				74	77
			Materials & Design Evaluation, Control Studies, Catalysts				75	76
			Single Cell Tests				75	77
			Design & Build 10 KW Bench Models				77	78
			Test 10 KW Bench Model				78	81
			Design & Build 10 KW Pilot Plant				79	80
Demonstration and Life Test of Pilot Plant	81							
73								
95								

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

3. DEVELOPMENT MILESTONES (number each consecutively)

(Limit Title of Milestone to 60 characters and spaces)

	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
<u>Central Station Conversion</u>				
Electrocatalysis				
a) Pure Platinum	75			
b) Platinum Alloys & Kinetics	76		78	
c) Platinum Substitutes & Kinetics	79			
Solid-State Electrolytes				
a) Identify Systems, Screen Samples, Lab Procedure Fixed	75			
b) Ion Exchange Technique for Measurement of Fast Ion Conductors	76		77	
c) Add oxides of Bismuth & Large Trivalent Ions	77		78	
d) Material Properties	79			
Data				
a) Data Base Completed	75			
b) Compile Available Data	76			
c) Critically Evaluate Data	77		78	
d) Publish Data	78			
<u>Central Station Conversion</u>				
Component Testing	75			
Punch Model Completed	75			
Laboratory Experiments Completed	77			
Engineering Development	79			
Pilot Plant	82			
Demonstration Plant	84			
First Commercial Application	88			
Subsequent Application	85		95	

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

OPERATING

ITEM	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
TOTAL (Carry forward to summary sheet)			10.89	10.10	18.44	16.00	20.0
Name of Performing Organization:							
MANPOWER			2.03	1.89	3.60	3.08	4.0
MATERIALS							
MAJOR PROCUREMENTS			8.86	8.33	14.85	12.90	15.6
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION			10.89	10.10	18.44	16.00	20.0
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							

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

^E
0602550712805302

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXP. FY 1974-79
Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.
18.44	16.00	20.36	17.22	16.81	18.57	13.64	18.64	80.06	80.06			
3.60	3.08	4.75	3.53	3.34	3.77	2.30	3.65	15.92	15.92			
14.85	12.90	15.62	13.69	13.46	13.90	11.34	14.99	64.13	64.13			
18.44	16.00	20.36	17.22	16.81	18.57	13.64	18.64	80.06	80.06			

(Continue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

D. DETAIL OF FUNDING REQUIREMENTS - Federal Government: Only (in millions of dollars)

D. CONSTRUCTION

ITEM	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		Ot			
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays				
TOTAL (Carry forward to summary sheet)			0	0	.24	.14	1			
<p><i>Note 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.</i></p>										
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <p>Item No. ()</p> <table border="1" style="width:100%"> <tr> <td style="width:15%">State</td> <td style="width:35%">County</td> <td style="width:20%">TEC (in millions)</td> </tr> </table> <p>Statement:</p> <p>This is made up of a number of projects, none of which is greater than one million dollars.</p>								State	County	TEC (in millions)
State	County	TEC (in millions)								
<p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1" style="width:100%"> <tr> <td style="width:15%">State</td> <td style="width:35%">County</td> <td style="width:20%">TEC (in millions)</td> </tr> </table> <p>Statement:</p>								State	County	TEC (in millions)
State	County	TEC (in millions)								
<p>TITLE OF PROJECT (Not to exceed characters and spaces.) ()</p> <table border="1" style="width:100%"> <tr> <td style="width:15%">State</td> <td style="width:35%">County</td> <td style="width:20%">TEC (in millions)</td> </tr> </table> <p>Statement:</p>								State	County	TEC (in millions)
State	County	TEC (in millions)								

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

0608 550712835622

(3) FY 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL LEVEL FY 1974-79	
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
.14	1.19	.48	.37	.68	.18	.73	2.02	2.02				

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

E. EQUIPMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Aid)		(2) FY 1975		(3) FY 1976		(4) F
	Obts.	Outlays	Obts.	Outlays	Obts.	Outlays	Obts.
	TOTAL (Carry forward to summary sheet) ▶			1.66	1.44	6.72	4.65
Evaluation, development, and demonstration of advance fuel cell technology for providing low cost, highly efficient clean energy small sources - pilot plant equipment.					.63		

(Continue on Separate Page)

Level of Effort:
 MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER
 060-550712-25602

(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1977-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXPENDITURE FY 1977-1979	
Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays	Obli.	Outlays
18.48	8.87	7.29	11.62	4.34	12.28	34.16	34.16				

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1)		(2)		(3)		(4)
	FY 1974 (Non-Add)		FY 1975		FY 1978		FY
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)			10.89	10.10	18.44	16.00	20.36
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)			0	0	.24	.14	1.19
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)			1.66	1.44	6.72	4.65	18.48
d. GRAND TOTAL—OBLIGATIONS			12.55		25.40		40.03
e. GRAND TOTAL—OUTLAYS				11.54		20.79	2

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER
 0604 5507 1280 5602

1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total Excluding FY 1974 (C.A. J.S.)	
	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
16.00	20.36	17.22	16.81	18.57	13.64	18.64	80.06	80.06				
.14	1.19	.48	.37	.68	.18	.73	2.02	2.02				
4.65	18.48	8.87	7.29	11.42	4.34	12.28	34.16	34.16				
	40.03		24.47		18.17		116.24					
20.79		26.57		30.67		31.65		116.24				

2. a. PROGRAM: FUEL CELL ECONOMIC DEMONSTRATION
 b. SUBPROGRAM: FUEL CELL POWER PLANTS, LOW EMISSIONS
 3. a. PROPOSING AGENCY: EPA, DHEW, DSS, OCS
 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: Several, Unspecified
 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 raw facilities which may have to be acquired or constructed.

1. A acid hydrogen cell wherein the hydrogen may come from fo fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on scale by Exxon. The problem is to develop an air electrode th inert to the alcohol and to prevent the alcohol from reaching electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized fuel cell that may be used with coal gasification to produce e at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be u with the high temperature solid electrolyte fuel cell listed

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978
a. MANPOWER (in man years)	(1) Scientific	36	56	60	65
	(2) Technical	72	112	120	130
	(3) Support	36	56	60	65
	(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.)

PROJECT TITLE: **Information Control Systems, Fuel Cell Power Plants, Low Emission Fuel**

SPONSORING AGENCY: **EPA, WASH. D.C., USA**

SYNOPSIS: **NAME OF CONTRACTOR: Several, Unspecified**

Character and scope of contract:
Abbreviation for site:
Character and scope of:

Site where work will be performed: **1- State: | County:**

NAME OF CONTRACTOR:
Site where work will be performed: **2- State: | County:**

NAME OF CONTRACTOR:
Site where work will be performed: **3- State: | County:**

NAME OF CONTRACTOR:
Site where work will be performed: **4- State: | County:**

NAME OF CONTRACTOR:
Site where work will be performed: **5- State: | County:**

DESCRIPTION OF

24 lines of text
from 70 characters
per line

The nature and scope
of undertakes,
and facilities
have to be acquired

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolytes to be used with the high temperature solid electrolyte fuel cell listed above.

2

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	36	56	60	65	65
(2) Technical	72	112	120	130	130
(3) Support	36	56	60	65	65
(4) Other					
UNITS and units of such as tons of oil, kilograms of Show amount of at right.)					

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State:	County:
NAME OF CONTRACTOR:	
State:	County:
NAME OF CONTRACTOR:	
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.

1. A acid hydrogen cell wherein the hydrogen may come from fos fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a scale by Exxon. The problem is to develop an air electrode tha inert to the alcohol and to prevent the alcohol from reaching t electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized fuel cell that may be used with coal gasification to produce el at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be u with the high temperature solid electrolyte fuel cell listed ab

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	36	56	60	65	
	(2) Technical	72	112	120	130	1
	(3) Support	36	56	60	65	
	(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.)						
c. LAND AREA REQUIRED (in acres)	(1) Govt-owned					
	(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)					
	Gas Various H/C Propane H ₂ Coal	(1)		Small quant. X X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton/yr.	Small quant. X 140 x 10 ⁶ Btu 8.5 x 10 ⁶ ton/yr.	Small 140 x 8.5 x

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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

24 lines of text
on 70 characters
lines

nature and scope
undertaken,
new facilities
to be acquired

1. A acid hydrogen cell wherein the hydrogen may come from fossil fuels or nuclear energy.
2. A molten carbonate type of acid hydrogen cell.
3. Alkaline hydrogen fuel cells.
4. Methyl alcohol cells of the type successfully operated on a bench scale by Exxon. The problem is to develop an air electrode that is inert to the alcohol and to prevent the alcohol from reaching the air electrode.
5. A high temperature (1000°C) solid electrolyte (stabilized zirconia) fuel cell that may be used with coal gasification to produce electricity at eighty percent efficiency.
6. Supporting R&D for catalysts and solid electrolyts to be used with the high temperature solid electrolyte fuel cell listed above.

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	36	56	60	65	65
(2) Technical	72	112	120	130	130
(3) Support	36	56	60	65	65
(4) Other					
MATERIALS and units of such as tons of oil, kilograms of Show amount of at right.)				4	
(1) Government					
(2) Contracted					
(3) Property owned					
(4) Other					
SOURCES NEEDED and unit of Show quantity at right.)	(1)				
Gas			Small quant.	Small quant.	Small quant.
various H/C			X	X	X
Propane			X		
H ₂			140 x 10 ⁶ Btu	140 x 10 ⁶ Btu	140 x 10 ⁶ Btu
Coal			8.5 x 10 ⁶ ton/yr.	8.5 x 10 ⁶ ton/yr.	8.5 x 10 ⁶ ton/yr.

1. State the specific problem or objective and state how the proposed work contributes to the solution of the problem.
2. Describe the proposed approach, including the experimental or analytical methods to be used, the technical
background from which the work is being undertaken, and the progress to date. Give particular emphasis to
to minimize R&D, and basis for proceeding in face of R.U. Quantitative data should be used to the fullest extent.

This is a simple cell which is modular in nature. It is in an advanced stage and should be pushed to successful completion.

The molten carbonate cell is worthwhile since it can make use of a wide variety of fuels.

The alkaline hydrogen fuel cell is fifteen percent higher in efficiency than the alkaline cell and are able to use silver, silver oxide, and perovskites as the air electrode, this decreasing the possibility of a tight platinum supply situation.

The fuel in the methanol cell is inexpensive and easily stored in large quantities. Furthermore, the cell can be used on both stationary and mobile power (i.e.) sources.

The potential of the high temperature solid electrolyte fuel cell to utilize hydrocarbons at an efficiency of eighty percent more than counterbalance this high risks.

Catalyst and solid electrolyte R&D is an integral and necessary part of the high temperature solid electrolyte fuel cell project.

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

NOTE: Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter.

b. DEVELOPMENT MILESTONES (number each consecutively)

(Limit Title of Milestone to 60 characters and spaces)

	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
<u>Centralized Conversion Gas On-Site Fuel Cell Power Plants</u>				
Laboratory Experimentation Completed	75		79	
Engineering Development	75		79	
Technical & Economic Studies	75			
Component Testing	76			
Engineering Development	78			
Test Plant	77			
Demonstration Plant	79			
Demonstration Plant	77		79	
First Commercial Application	78			
<u>Fuel Cell Decentralized Conversion</u>				
First Commercial Application	78			
First Commercial Application	77			
Demonstration Plant	77			
Engineering Development	79		80	
Demonstration Plant	77			
Component Testing	77			
<u>Centralized Conversion-Evaluation and Demonstration of Low Pollution Advanced Clean Energy Systems For Non-Utility (Area)</u>				
Project Established			73	
Technical Feasibility	73			
Plant Design	74			
Component Testing	75			
Test Model Completed	74			
Laboratory Experiments Completed	76			
Engineering Development	77			
Demonstration Plant	78			
First Commercial Application	79			
Subsequent Application	81		95	

- MAXIMUM
- ORDINARY
- MINIMUM

IDENTIFICATION

060855 271230

b. DATES

a. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

Start		Complete			Start	
FY	Q	FY	Q		FY	Q
		79		<u>Decentralized Conversion-Evaluation, Development, and Demonstration of Advance Fuel Cell Technology for Providing Low Cost, Highly Efficient Clean Energy on All Sources</u> Experiment Designed Component Testing Bench Model Completed Laboratory Experiments Completed Engineering Development Pilot Plant Demonstration Plant First Commercial Application Subsequent Application		
		79				
		79				
		79				
		79				
		79				
		79				
		79				
		79				
		79				
		80		<u>Hydrogen Energy Systems</u> Theory Established-Experimental Confirmation Materials & Design Evaluation, Control Studies, Catalysts Single Cell Tests Design & Build 10 KW Bench Models Test 10 KW Bench Model Design & Build 10 KW Pilot Plant Demonstration and Life Test of Pilot Plant		
		80				
		80				
		80				
		80				
		80				
		80				
		80				
		80				
		80				
		73				
		95				

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

TABLE (includes 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
<u>Fuel Station Conversion</u>				
Electrolysis				
a) Pure Platinum	75			
b) Platinum Alloys & Kinetics	76		78	
c) Platinum Substitutes & Kinetics	79			
Cell-State Electrolytes				
a) Identify Systems, Screen Samples, Lab Procedure Fixed	75			
b) Ion Exchange Technique for Measurement of Fast Ion Conductor	76		77	
c) Add oxides of Bismuth & Large Trivalent Ions	77		78	
d) Material Properties	79			
a) Data Base Completed	75			
b) Sample Available Data	76			
c) Critically Evaluate Data	77		78	
d) Publish Data	78			
<u>Fuel Station Conversion</u>				
Element Testing	75			
Cell Model Completed	75			
Operative experiments Completed	77			
Design development	79			
Cell Plant	82			
Construction Plant	84			
Cell Commercial Application	88			
Subsequent Application	85		95	
<u>For Unreacted Fuel Cell Concepts</u>				
Request for proposals & awarding of 9 contracts	75		78	
Send best two contracts through pilot plants	79		80	

- MAXIMUM
- ORDINARY
- MINIMUM

IDENTIFICATION NO.

060655071295105

b. DATES

a. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

Start		Complete		Start	FY
FY	Q	FY	Q		
75					
76		78			
79					
75					
76		77			
77		78			
79					
75					
76					
77		78			
78					
75					
75					
77					
79					
82					
84					
85					
75		95			
75		78			
79		80			

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

DETAIL OF FUNDING REQUIREMENTS—Federal Government Only (In millions of Dollars)

OPERATING

ITEM	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
TOTAL (Carry forward to summary sheet)			29.11	28.36	37.50	34.78
Name of Performing Organization:						
MANPOWER			2.26	2.11	4.0	3.43
MATERIALS						
MAJOR PROCUREMENTS			25.85	25.25	35.50	31.33
ALL OTHER						
TOTAL FOR THIS PERFORMING ORGANIZATION			29.11	28.36	37.50	34.78
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 on

Level of Effort

- MAXIMUM
- OTHER
- MINIMUM

IDENTIFICATION NUMBER

66-55-071238-545

FY 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		TOTAL FY 1975-79
	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	
50	34.78	39.63	36.34	28.68	30.64	25.16	30.77	159.96	159.96		
50	3.43	5.28	3.93	3.72	4.19	2.56	4.06	17.70	17.70		
50	31.33	34.35	32.21	24.96	25.45	22.60	26.66	142.26	142.26		
50	34.78	39.63	36.34	28.68	30.64	25.16	30.77	159.96	159.96		

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

B. CONSTRUCTION

ITEM	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976										
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays									
TOTAL (Carry forward to summary sheet)			0	0	.27	.16	1.								
<p>Name 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.</p> <p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p> <p align="center">This is made up of a number of projects, none of which is greater than one million dollars.</p> <p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p> <p>TITLE OF PROJECT (Not to exceed characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> </table> <p>Statement:</p>	State	County	TEC (in millions)	State	County	TEC (in millions)	State	County	TEC (in millions)						
State	County	TEC (in millions)													
State	County	TEC (in millions)													
State	County	TEC (in millions)													

Level of Effort:

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

9
060255 0712805202

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL FUND FY 1975-79	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
.27	.16	1.32	.53	.41	.75	.25	.81	2.25	2.25				

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

TABLE OF FUNDING REQUIREMENTS- Federal Government Only (in millions of dollars)

DEPARTMENT

ITEM <i>(Each item not to exceed 60 characters and spaces)</i>	(1) FY 1974 (Non-Fed)		(2) FY 1975		(3) FY 1976		C
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
	TOTAL (Carry forward in summary sheet) ▶			1.85	1.60	7.47	
evaluation, development, and demonstration of advance fuel cell technology for providing low cost, highly efficient clean energy small sources - pilot plant equipment					0.70		

(Continue on 3c)

Level of Effort:
 MAXIMUM
 ORDINARY
 MINIMUM

IDENTIFICATION NUMBER:
 8
 060655 07123656

(3) 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1976-79		(8) BALANCE TO COMPLETE		TOTAL FY 1976-79
	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	Obis.	
5.17	20.53	9.86	8.10	12.69	1.82	13.65	42.70	42.70			

Continue on Separate Sheet

Page . of

2

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

Requirement	(1)		(2)		(3)		
	FY 1974 (Non-Add)		FY 1975		FY 1976		
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays	
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)			29.11	28.36	37.50	34.78	35
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)			0	0	.27	.16	-
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)			1.85	1.60	7.47	5.17	20
d. GRAND TOTAL—OBLIGATIONS			20.96		45.23		61
e. GRAND TOTAL—OUTLAYS				20.96		40.11	

NOTE: If cooperative programs are proposed, indicate the amount by year of both private and Federal government funding. Cooperative obligations should be separately reported in the above format.

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER
 060855 07123054

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total School FY 1975-79	
Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays
.50	34.78	39.63	36.34	28.68	30.64	25.16	30.72	159.96	159.96				
27	.16	1.32	.53	.41	.75	.25	.81	2.25	2.25				
47	5.17	20.53	9.86	8.10	12.69	4.82	13.65	42.70	42.70				
23		61.48		44.19		37.26		204.91					
	40.11		46.53		51.08		51.16		204.91				

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

2

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort
 MAXIMUM
 ORDERLY
 MINIMUM

1. IDENTIFICATION NO
060955071056

PROGRAM	Conversion Techniques		
SUBPROGRAM	Advanced Concepts		
PROPOSING AGENCY	DAR, NASA, DOD, AEC		
NUMBER	Various		
CONTRACTOR AND SITE <i>(No more than 42 characters and 10 spaces for name of contractor; no punctuation for state abbreviations; 10 characters and spaces for county.)</i>	NAME OF CONTRACTOR:	Various	
	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:
6. BRIEF DESCRIPTION OF PROPOSAL <i>(No more than 24 lines of text or 410 more than 70 characters and 1 space per line)</i> Briefly outline nature and scope of work to be undertaken, including any new facilities which may have to be acquired or constructed.	A five year analytical and experimental program to conduct basic research and development in a number of advanced energy conversion methods for eventual use in high efficiency central station, decentralized and small power plants.		

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR	1975	1976	1977	1978
a. MANPOWER <i>(In man years)</i>	(1) Scientific	19	19	19	19
	(2) Technical	10	10	10	10
	(3) Support	3	3	3	3
	(4) Other				
b. RAW MATERIALS <i>(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.)</i>		N/A	N/A	N/A	N/A
c. LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned				
	(2) Govt-leased				
	(3) Privately-owned	N/A	N/A	N/A	N/A
	(4) Other				

RESEARCH & DEVELOPMENT
SHEET

Level of Effort
 MAXIMUM
 ORDINARY
 MINIMUM

1. IDENTIFICATION NUMBER
0609550710550302

	Conversion Techniques		
	Advanced Concepts		
AGENCY	INDI, NAGL, DOD, AEC		
	Various		
LOCATION OF SITE	NAME OF CONTRACTOR: Various		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
LOCATION OF SITE	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
LOCATION OF SITE	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed	State:	County:

DESCRIPTION OF PROJECT
 Nature of project
 Justification for state and federal support
 and scope taken, facilities acquired

A five year analytical and experimental program to conduct basic research and development in a number of advanced energy conversion methods for eventual use in high efficiency central station, decentralized and small power plants.

2

(Attach separate sheets). See Item 6. on Instruction Sheet.)

7. MAJOR RESOURCE REQUIREMENTS

CALENDAR YEAR	1975	1976	1977	1978	1979
Manpower	19	19	19	19	19
Technical	10	10	10	10	10
Equipment	3	3	3	3	3
Materials					
Facilities					
Other					
Costs of (a) Manpower (b) Materials (c) Equipment (d) Facilities (e) Other	N/A	N/A	N/A	N/A	N/A
Owned					
Leased					
Partly-owned	N/A	N/A	N/A	N/A	N/A
Other					
TOTAL REQUIRED					

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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 or 1 no more than 70 characters or 1 space 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 five year analytical and experimental program to conduct basic research and development in a number of advanced energy conversion methods for eventual use in high efficiency central station, decentralized and small power plants.

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 <i>(In man years)</i>	(1) Scientific	19	19	19	19	
	(2) Technical	10	10	10	10	
	(3) Support	3	3	3	3	
	(4) Other					
b. RAW MATERIALS <i>(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.)</i>		N/A	N/A	N/A	N/A	N/A
c. LAND AREA REQUIRED <i>(In acres)</i>	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned	N/A	N/A	N/A	N/A	N/A
	(4) Other					
d. OTHER RESOURCES NEEDED <i>(Specify item and unit of measure below. Show quantity of each in columns at right.)</i>	(1)	None	None	None	None	None

3

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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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acquired

A five year analytical and experimental program to conduct basic research and development in a number of advanced energy conversion methods for eventual use in high efficiency central station, decentralized and small power plants.

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

7. MAJOR RESOURCE REQUIREMENTS

CALENDAR YEAR	1975	1976	1977	1978	1979
Scientific	19	19	19	19	19
Technical	10	10	10	10	10
Support	3	3	3	3	3
Other					
of tons of grams of amount of (kt.)	N/A	N/A	N/A	N/A	N/A
Owned					
Out-leased					
Partly-owned or	N/A	N/A	N/A	N/A	N/A
NEEDED of quantity (light.)	(1) None	None	None	None	None

4

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort:

- MAXIMUM
 ORDINARY
 MINIMUM

IDENTIFICATION NUMBER

060955071055036

- d. **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 objective of this subprogram is to increase the efficiency of energy conversion from heat to electricity in central station, decentralized and small special application plants. There are a number of advanced energy conversion devices and concepts that have the potential for higher conversion efficiencies over existing systems. These conversion systems include the Feher (CO₂) cycle, Thermionics and Advanced Thermoelectric Materials. The Feher (CO₂) cycle and Thermionic conversion receive the highest priority under this subprogram because of their potential impact on large power systems. The CO₂ cycle appears to offer efficiencies in the 40% to 50% range for temperatures about 1200°F. Thermionic topping cycles have the indicated potential of increasing the conversion efficiencies of conventional plants from present values of 30 to 40% to the range of 40 to 50%. Because of the modularity of a thermionic system, the efficiency of the conversion system is relatively independent of power level, thus, thermionics may be applied to various types of decentralized power conversion. All of these conversion techniques have technical uncertainties involving materials and/or engineering fixes. This program does not involve large pilot or demonstration plants but rather research oriented tasks and, therefore, the risks are minimal compared to the potential return.

RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort

- MAXIMUM
 ORDINARY
 MINIMUM

IDENTIFICATION NUMBER

0009550710550302

DESCRIPTION - 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 to be derived from meeting the objectives or solving the problems for which the project is proposed. Outline the risks/uncertainties to minimize R/U, and basis for proceeding in face of R/U. Quantitative data should be used to the fullest extent.

Objective of this subprogram is to increase the efficiency of energy conversion from electricity in central station, decentralized and small special application power. There are a number of advanced energy conversion devices and concepts that have potential for higher conversion efficiencies over existing systems. These conversion include the Fehar (CO₂) cycle, Thermionics and Advanced Thermoelectric Materials. The Fehar (CO₂) cycle and Thermionic conversion receive the highest priority under this program because of their potential impact on large power systems. The CO₂ cycle system is expected to offer efficiencies in the 40% to 50% range for temperatures about 1200°F. Thermionic topping cycles have the indicated potential of increasing the conversion efficiencies of conventional plants from present values of 30 to 40% to the range of 40 to 50%. Because of the modularity of a thermionic system, the efficiency of a thermionic conversion system is relatively independent of power level, thus, thermionics may be applied to various types of decentralized power conversion. All of these conversion techniques involve technical uncertainties involving materials and/or engineering fixes. This program involves large pilot or demonstration plants but rather research oriented tasks. Therefore, the risks are minimal compared to the potential return.

2

ENERGY 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

The diverse nature of this subprogram precludes specific development milestones.

The program would consist of analysis, design studies and experimental programs to investigate key issues of feasibility.

Submit Program Plan for different areas of investigation.

Major facilities or major equipment will be required.

75 1

(Continue to next column)

DATES		
?	Complete	
Q	FY	Q

a. DEVELOPMENT MILESTONES (continued)

(Limit Title of Milestone to 60 characters and spaces)

Page		of	
FY	Q	FY	Q

1

(Continue on separate sheet)

Page of

2

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

Requirement	(1)		(2)		(3)	
	FY 1974 (Non-Add)		FY 1975		FY 1976	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
a. OPERATING (See p. for detail) Total Operating Requirements (from Detail Sheet)	1.9	1.9	1.9	1.9	1.9	1.9
b. CONSTRUCTION (See p. for detail) Total Construction Requirements (from Detail Sheet)	0	0	0	0	0	0
c. EQUIPMENT (See p. for detail) Total Equipment Requirements (from Detail Sheet)	.1	.1	.1	.1	.1	.1
d. GRAND TOTAL—OBLIGATIONS	2.0		2.0		2.0	2
e. GRAND TOTAL—OUTLAYS		2.0		2.0		2.0

NOTE: If cooperative programs are proposed, indicate the amount by year of both private and Federal government funding.

- MAXIMUM
- ORDERLY
- MINIMUM

IDENTIFICATION NUMBER

06025597100000000000

(3) FY 1976		(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(2) Balance To Complete		(8) Total Excluding FY 1974 (Col. 7 & 8)	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	9.5	9.5	0	0	9.5	9.5
0	0	0	0	0	0	0	0	0	0	0	0		
.1	.1	.1	.1	.1	.1	.1	.1	.5	.5	0	0	0.5	0.5
2.0		2.0		2.0		2.0		10.0		0		10.0	
	2.0		2.0		2.0		2.0		10.0		0		10.0

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

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

OPERATING

ITEM	(1)		(2)		(3)		Ot
	FY 1974 (Non-Add)		FY 1975		FY 1976		
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	
TOTAL (Carry forward to summary sheet)	2.0	2.0	2.0	2.0	2.0	2.0	2
Name of Performing Organization:							
CO₂ Cycle							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION	0.5	0.5	0.9	0.9	0.9	0.9	
Name of Performing Organization:							
Thermionics							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION	0.7	0.7	0.7	0.7	0.7	0.7	
Name of Performing Organization:							
Thermoelectric Materials							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION	0.4	0.4	0.4	0.4	0.4	0.4	(
Name of Performing Organization:							
Other							
MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION	0.4	0.4	0	0	0	0	

(Continue on

- MAXIMUM
 ORDERLY
 MINIMUM

IDENTIFICATION NUMBER

010955070550000

3) 1976	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDED FY 1974 (Col's 7 & 8)	
	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.	Outlays	Obs.
2.0	2.0	2.0	2.0	2.0	2.0	2.0	10.0	10.0	0	0	10.0	10.0
0.9	0.9	0.9	0.9	0.9	0.9	0.9	4.5	4.5	0	0	4.5	4.5
0.7	0.7	0.7	0.7	0.7	0.7	0.7	3.5	3.5	0	0	3.5	3.5
0.4	0.4	0.4	0.4	0.4	0.4	0.4	2.0	2.0	0	0	2.0	2.0
0	0	0	0	0	0	0	0	0	0	0	0	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)

B. CONSTRUCTION

ITEM	(1) FY 1974 (Non-Add)		(2) FY 1975		(3) FY 1976		Ot						
	Obis.	Outlays	Obis.	Outlays	Obis.	Outlays							
TOTAL (Carry forward to summary sheet)	0	0	0	0	0	0							
<p>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.</p> <p>TITLE OF PROJECT (Not to exceed 30 characters and spaces.) ()</p> <table border="1"> <tr> <td>State</td> <td>County</td> <td>TEC (in millions)</td> </tr> <tr> <td colspan="3"> Statements: No construction of facilities or large power plants contemplated in this time period. </td> </tr> </table>	State	County	TEC (in millions)	Statements: No construction of facilities or large power plants contemplated in this time period.									
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