I. ENABLING TECHNOLOGY

The Energy Conversion Program as a whole needs an undergirding base of enabling technology which promotes improvement in the major systems or makes feasible entirely new concepts. All central station conversion plants, for instance, can benefit from the application of superconducting machinery through lower capital costs, increased reliability and slight increases (1/2%) in system efficiency. In a similar vein, materials behavior, optimization and development can provide more reliable systems or bring to realization new devices. Because of its supporting nature, this subprogram has also received our lowest priority.

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort
☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

1. IDENTIFICATION NUMBER
0601505105560Z

2. PROGRAM
Conversion Techniques

3. a. PROGRAM AGENCY
Enabling Technology

b. SUBMIT
Various: ALC, DoI, DoC, DoD

4. CONTRACTOR AND SITE
(Use more than 32 characters and spaces for name of contractor, use standard abbreviation for state; up to 16 characters and spaces for county).

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Gov't Labs & FERDC's

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Unspecified Universiti

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Unspecified Industrial

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

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

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting generators. The goal would be to cor and test a 100 MW a.c. superconducting generator.

Undergirding materials R&D for all conversion systems components including development of materials for advanced systems requiring materials beyond the current state-of-the-are; the performance of testing and acquisition of a bank of engineering data on currently available materials to enable prediction of long term reliability.

[redacted]

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	11	32	42	43	42
	(2) Technical	13	36	48	47	48
	(3) Support	11	32	42	43	42
	(4) Other	5	14	19	18	19
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.)*		Research quantities elements and compounds				
c. LAND AREA REQUIRED	(1) Government-owned	Existing research facilities - no additional				
	(2) Commercial					

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ARCH & DEVELOPMENT
ACT SHEET

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

1. IDENTIFICATION NUMBER 0601550510555602

Conversion Techniques

...AM: Enabling Technology

...T AGENCY: Various: ALC, DoI, DoC, DoD

...R AND SITE (...42 characters and ...e of contractor; ...ation for state ...ters and space for ...)

NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County: Various Gov't Labs & FERDC's
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County: Various Unspecified Universities
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County: Various Unspecified Industrial Labs
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:

...IPTION OF (...24 lines of text ...an 70 characters ...line) ...nature and scope ...undertaken, ...ew facilities ...e to be acquired

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting generators. The goal would be to construct and test a 100 MW a.c. superconducting generator.

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2

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
(1) Scientific	11	32	42	43	42
(2) Technical	13	36	48	47	48
(3) Support	11	32	42	43	42
(4) Other	5	14	19	18	19
...LS (...d units of ...uch as tons of ...l, Kilograms of ...ow amount of ...at right.)	Research quantities elements and compounds				
(1) Govt-owned	Existing research facilities - no additional				
(2) Govt-leased	"	"	"		
(3) Privately-owned	"	"	"		
(4) Other	"	"	"		
...CES NEEDED					

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a. PROPONENT AGENCY	Various: ALC, DoI, DoC, DoD
b. SUBUNIT	

4. CONTRACTOR AND SITE

(No more than 32 characters and spaces for name of contractor, use standard abbreviations for states, up to 16 characters and spaces for county.

NAME OF CONTRACTOR:			
Site where work will be performed ▷	State:	County:	Various Gov't Labs & FERDC's
NAME OF CONTRACTOR:			
Site where work will be performed ▷	State:	County:	Various Unspecified Universities
NAME OF CONTRACTOR:			
Site where work will be performed ▷	State:	County:	Various Unspecified Industrial
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

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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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7. MAJOR RESOURCE REQUIREMENTS

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	(3) Support	11	32	42	43	42
	(4) Other	5	14	19	18	19
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.)*		Research quantities elements and compounds			3	
LAND AREA REQUIRED *(In acres)*	(1) Government-owned	Existing research facilities - no additional				
	(2) Government-leased	"	"	"		
	(3) Privately-owned	"	"	"		
	(4) Other	"	"	"		
OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)*	(1)	None	None	None	None	None

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

(a) Superconducting Electrical Machinery - increased conversion efficiency (up to 1% for large installations), circumvention of size limitations of components which may be shipped from factory to installation site (approx 650 MW), avoid of foreign competitors from capturing future markets for electrical machinery (motors, generators, and transformers).

The development of electrical machinery using conventional approaches appears to have been maximized. Exploitation of the phenomena of superconductivity appears to be the only avenue to proceed for further improvements in efficienc and to enable the production of larger units for central station application.

The principal risks/uncertainties center around the complexity of the envisior systems and thus their acceptability to industry and the utilities. No scien breakthroughs are required but considerable engineering R&D is required. The discovery of higher temperature superconductors would reduce system complexit costs of acquisition and operation, and provide further increases in system efficiency and reliability. The minimum program would provide for design and construction of a 100 MW a.c. generator and deemphasize work on auxiliary components.

(b) Undergirding materials R&D for all components of advanced conversion systems - heat exchangers, MHD, high temperature gas turbines, etc.

Advanced concepts (higher power, higher temperature) will require materials which are now beyond the current state-of-the art. For example gas turbines with 2500° F inlet temperatures will require new vane and first row blade materials. MHD will require special materials for ducts, electrodes, and insulators. High temperature heat exchangers will require high strength mater resistant to thermal shock and cyclic fatigue and which will minimize inter-diffusion of contaminants from one working fluid into the other. The effect of micro impurities in hot work fluids on the long term properties of high temperature materials is poorly understood and in some cases not at all. Ther is a need not only for new materials but also a more complete bank of engineer data on existing materials to allow prediction of long term reliability. This is a level-of-effort activity to permit study of only the most obviously impor problems and is intermediate between short term development and multidirection basic research.

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

IDENTIFICATION NUMBER
0601550510555602

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

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2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

DULE *(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
Engineering design for 100 MW superconductor generator	75	1	77	2
Construction of 100 MW generator*	77	1	79	2
Testing of 100 MW generator*	79	2		
*(use conventional auxiliary components)				
Strive for development of materials for 2500° F (inlet temperature) gas turbine short life operation	74	1	79	1
MHD - electrode & insulator matls developed for reduced temp. operation	75	1	79	2
Minimal acquisition of test data for engineering data bank	75	1	-	-
Studies of selected micro-impurities attack on properties of materials at high temp. - minimal effort	75	1	ongoing	

(Continue to next column)

[illegible]
☐ VARIOUS
☐ CRUEPLY
☒ VIRUVUR

IDENTIFICATION NUMBER

0601153D21555622

ES Complete FY	Q	a. DEVELOPMENT MILESTONES (continued) (Limit Title of Milestone to 60 characters and spaces)	b. DATES Start FY	Q	Complete FY	Q
	2					
	2					
	1					
	2					
	-					
oing						

(Continue on separate sheet)

Page of

2

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

Requirement	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	(4) FY 1977 Obls.	C
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0.5	0.5	1.6	1.6	4.6	4.6	6.1	
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	0.2	0.2	0.4	0.4	0.9	
d. GRAND TOTAL—OBLIGATIONS	0.5		1.8		5.0		7.0	
e. GRAND TOTAL—OUTLAYS		0.5		1.8		5.0		7

Industry might be expected to cost share (provide additional support) the development of superconducting electrical machinery data in the program. The exact amount cannot be determined at this time.

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

☐ MAY VARY
☐ CRITICAL
☒ MINIMUM

IDENTIFICATION NUMBER

(3) 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) Subtotal FY 1975-79 Obls.	(7) Subtotal FY 1975-79 Outlays	(8) 80-85 Balance To Complete* Obls.	(8) 80-85 Balance To Complete* Outlays	(9) Total Excluding FY 1976 (Col. 7 & 8) Obls.	(9) Total Excluding FY 1976 (Col. 7 & 8) Outlays
4.6	6.1	6.1	5.9	5.9	6.1	6.1	24.3	24.3	36.6	36.6	60.9	60.9
			NONE									
0.4	0.9	0.9	1.1	1.1	0.9	0.9	3.5	3.5	5.4	5.4	8.9	8.9
	7.0		7.0		7.0		27.8		42.0		69.8	
5.0		7.0		7.0		7.0		27.8		42.0		69.8

(pport) the

*These are ongoing programs

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

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

OPERATING — Estimated

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) C
TOTAL *(Carry forward to summary sheet)* ▶	0.5	0.5	1.6	1.6	4.6	4.6	6.1	
Name of Performing Organization:								
Various - not specified — MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION	0.4	0.4	0.5	0.5	2.6	2.6	3.4	
Superconducting Electrical Machinery								
Name of Performing Organization:								
Various - not specified — MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION	0.1	0.1	1.1	1.1	2.0	2.0	2.7	
Undergirding Materials R&D								
Name of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
Name of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								

(Continue on Separ

Level of Effort
☐ MAXIMUM
☐ OPTIMUM
☒ MINIMUM

IDENTIFICATION NUMBER
0501550S10555602

80-85

(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	4.6	6.1	6.1	5.9	5.9	6.1	6.1	24.3	24.3	36.6	36.6	60.9	60.9
..6	2.6	3.4	3.4	3.2	3.2	3.4	3.4	13.1	13.1	20.4	20.4	33.5	33.5
0	2.0	2.7	2.7	2.7	2.7	2.7	2.7	11.2	11.2	16.2	16.2	27.4	27.4

*These are ongoing programs

(Continue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

b. CONSTRUCTION

NONE

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

Title of project, Location *(State and County)* and Total Estimated Cost (TEC) (number each item consecutively). Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.

Item No.	TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	State	County	TEC *(in millions)*	Statement:
( )					
( )	TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	State	County	TEC *(in millions)*	Statement:
( )	TITLE OF PROJECT *(Not to exceed characters and spaces.)*	State	County	TEC *(in millions)*	Statement:

(Continue on Separa

[X] (10) MAXIMUM ORDERLY MINIMUM

IDENTIFICATION NUMBER: 0601SS0501SS5602

	(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	
rs	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays

(Issue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	(4) FY 1977 Obls.	Outlays
h ma or performing organization, tal equipment funds, with a separate ation of each item of equipment one half million dollars o. more. TOTAL *(Carry forward to summary sheet)* ▶	0	0	0.2	0.2	0.4	0.4	0.9	0.9
a) Various organizations - no major items	0	0	0.1	0.1	0.2	0.2	0.6	0.6
b) Various organizations - no major items	0	0	0.1	0.1	0.2	0.2	0.3	0.3

(Continue on Separate Sheet

Level of Effort:
☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER
06015505105555602
SC-SS

(3) 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) SUBTOTAL FY 1979-83 Obls.	(7) SUBTOTAL FY 1979-83 Outlays	(8) BALANCE TO COMPLETE* Obls.	(8) BALANCE TO COMPLETE* Outlays	(9) TOTAL EXCLUDING FY 1984 (COL 7 & 8) Obls.	(9) TOTAL EXCLUDING FY 1984 (COL 7 & 8) Outlays
0.4	0.9	0.9	1.1	1.1	0.9	0.9	3.5	3.5	5.4	5.4	8.9	8.9
0.2	0.6	0.6	0.8	0.8	0.6	0.6	2.3	2.3	3.6	3.6	5.9	5.9
0.2	0.3	0.3	0.3	0.3	0.3	0.3	1.2	1.2	1.8	1.8	3.0	3.0

*These are ongoing programs

(Continue on Separate Sheet)

2

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

FACT SHEET

[ ] PARTIAL
[X] ORIGINAL
[ ] REVISED

1. IDENTIFICATION NUMBER: 0601950510555600

2. a. PROGRAM: Conversion Technologies
b. SUBPROGRAM: Fossil Fuel Technology

3. a. PROGRAM MANAGEMENT AGENCY: Various: ANL, BNL, BNW, DOE
b. SUBUNIT:

4. CONTRACTOR AND SITE (Use more than 45 characters and spaces for name of contractor, and alphabetical abbreviation for state, up to 16 characters and spaces for county.)

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Gov't Labs & FFRDC's

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Unspecified Universiti

NAME OF CONTRACTOR:
Site where work will be performed ▶ State: County: Various Unspecified Industrial

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.

Superconducting Electrical Machinery: R&D to develop the next ger of superconducting motors, generators, transformers, and auxiliar cryogenics. The goal would be to construct and test a 100 MW sc conducting generating system.

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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	51	56	68	87	61
	(2) Technical	59	64	78	100	70
	(3) Support	51	56	68	87	61
	(4) Other	22	25	31	40	28
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.)		Research quantities elements and compounds				
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned	Existing research facilities - no additional				
	(2) Govt-leased	Existing research facilities - no additional				
	(3) Privately-owned	Existing research facilities - no additional				
	(4) Other	Existing research facilities - no additional				
d. OTHER RESOURCES NEEDED (Specify item and unit of						

…ARCH & DEVELOPMENT
…TACT SHEET

[ ] MAXIMUM
[X] ORDERLY
[ ] MINIMUM

1. IDENTIFICATION NUMBER
0601552510755[illegible]

…A	Conversion Techniques
…GRAM	Enabling Technology
…NT AGENCY	Various: AEC, DOI, DOC, DOD

…R AND SITE			
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County: Various Gov't Labs & FFRDC's
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County: Various Unspecified Universities
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County: Various Unspecified Industrial Labs
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County:

…RIPTION OF

(24 lines of text … 70 characters … line) … nature and scope … undertaken, … new facilities … to be acquired

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2

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

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Technical	50	64	76	100	70
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Other	22	25	31	40	28
…S (…units of …ch as tons of …, Kilograms of …e amount of …right.)	Research quantities elements and compounds				
Govt-owned	Existing research facilities - no additional				
Govt-leased	Existing research facilities - no additional				
Privately owned	Existing research facilities - no additional				
Other	Existing research facilities - no additional				
…ES NEEDED (…nit of …e quantity)					

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up to 16 characters and spaces for county.			
	Site where work will be performed ▶	State:	County: Various Unspecified Universities
	NAME OF CONTRACTOR:		
	Site where work will be performed ▶	State:	County: Various Unspecified Industrial
	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

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	(3) Support	51	56	68	87	61
	(4) Other	22	25	31	40	28
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.)*		Research quantities elements and compounds				
c. LAND AREA REQUIRED *(In acres)*	(1) Govt-owned	Existing research facilities - no additional				
	(2) Govt-leased	Existing research facilities - no additional				
	(3) Privately-owned	Existing research facilities - no additional				
	(4) Other	Existing research facilities - no additional				
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)	(1)	None	none	none	none	none

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Site where work will be performed ▶	State:	County: Various Unspecified Industrial Labs	
NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	
NAME OF CONTRACTOR:			
Site where work will be performed ▶	State:	County:	

CRIPTION OF

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lire nature and scope be undertaken, ny new facilities have to be acquired ited.

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting motors, generators, transformers, and auxiliary cryogenics. The goal would be to construct and test a 100 MW ac superconducting generating system.

Undergirding materials R&D for all conversion systems components includin development of materials for advanced systems requiring materials beyond the current state-of-the-art; the performance of testing and acquisition of a bank of engineering data on currently available material to enable prediction of long-term reliability.

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
R (1) Scientific	51	56	68	87	61
rs) (2) Technical	59	64	78	100	70
(3) Support	51	56	68	87	61
(4) Other	22	25	31	40	28
ERIALS *ls and units of ow, such as tons of of oil, Kilograms of . Show amount of mns at right.)*	Research quantities elements and compounds				
A (1) Govt-owned	Existing research facilities - no additional				
(2) Govt-leased	Existing research facilities - no additional				
(3) Privately-owned	Existing research facilities - no additional				
(4) Other	Existing research facilities - no additional				
OURCES NEEDED *n and unit of ow. Show quantity lumns at right.)*					
(1)	None	none	none	none	none

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

IDENTIFICATION NUMBER
0601550510555602

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 problem, 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.

) Superconducting Electrical Machinery - increased conversion efficiency (up to 1% for la
stallations), circumvention of size limitations of components which may be shipped from fa
installation site (approx. 650 MW), avoidance of foreign competitors from capturing futu
rkets for electrical machinery (motors, generators, and transformers).

e development of electrical machinery using conventional approaches appears to have been r
ploitation of the phenomena of superconductivity appears to be the only avenue to proceed
rther improvements in efficiency and to enable the production of larger units for central
plication.

e principal risks/uncertainties center around the complexity of the envisioned systems anc
eir acceptability to industry and the utilities. No scientific breakthroughs are requirec
nsiderable engineering R&D is required. The discovery of higher temperature superconducto
uld reduce system complexity, costs of acquisition and operation, and provide further incr
system efficiency and reliability. The orderly program would provide for design, constru
i testing of a 100 MW system. The value of continued development would be assessed at thi

) Undergirding materials R&D for all components of advanced conversion systems - heat exch
), high temperature gas turbine, etc.

anced concepts (higher power, higher temperature) will require materials which are now b
e current state-of-the-art. For example, gas turbine with 2500°F inlet temperatures will
v vane and first row blade materials. MHD will require special materials for ducts, elec
l insulators. High temperature heat exchangers will require high strength materials resi
thermal shock and cyclic fatigue and which will minimize interdiffusion of contaminants
rking fluid into the other. The effect of micro impurities in hot working fluids on the
operties of high temperature materials is poorly understood and in some cases not at all.
a need not only for new materials but also a more complete bank of engineering data on e
terials to allow production of long-term reliability. This is a level-of-effort activity
mit steady scientific and technical advancement and is intermediate between short-term
velopment and multidirectional basic research.

ARCH AND DEVELOPMENT FACT SHEET (Continued)

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

IDENTIFICATION NUMBER
0601550510555602

ON State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem or the objective. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits derived from meeting the objectives or solving the problem, 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.

ducting Electrical Machinery - increased conversion efficiency (up to 1% for large), circumvention of size limitations of components which may be shipped from factory on site (approx. 650 MW), avoidance of foreign competitors from capturing future lectrical machinery (motors, generators, and transformers).

nt of electrical machinery using conventional approaches appears to have been maximize of the phenomena of superconductivity appears to be the only avenue to proceed for ements in efficiency and to enable the production of larger units for central station

. risks/uncertainties center around the complexity of the envisioned systems and thus bility to industry and the utilities. No scientific breakthroughs are required but ngineering R&D is required. The discovery of higher temperature superconductors system complexity, costs of acquisition and operation, and provide further increases iciency and reliability. The orderly program would provide for design, construction a 100 MW system. The value of continued development would be assessed at this time.

ing materials R&D for all components of advanced conversion systems - heat exchangers, perature gas turbine, etc.

pts (higher power, higher temperature) will require materials which are now beyond ate-of-the-art. For example, gas turbine with 2500°F inlet temperatures will require irst row blade materials. MHD will require special materials for ducts, electrodes, . High temperature heat exchangers will require high strength materials resistent ock and cyclic fatigue and which will minimize interdiffusion of contaminants from one into the other. The effect of micro impurities in hot working fluids on the long-ter high temperature materials is poorly understood and in some cases not at all. There only for new materials but also a more complete bank of engineering data on existing llow production of long-term reliability. This is a level-of-effort activity to scientific and technical advancement and is intermediate between short-term id multidirectional basic research.

2

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
) Engineering design for superconductor 100 MW generator and auxiliary components	75	1	77	1
Construction of 100 MW system*	76	3	79	1
Testing of 100 MW system*	79	1	79	4
(using concurrently developed components)				
) Development of advanced blade and vane materials for 2500°F (inlet temp) gas turbine	74	1	79	2
New materials for MHD and heat exchange applications	75	1	Ongoing	
Acquisition of engineering data for performance predictability	Ongoing			
Studies of effects, and mechanisms and kinetics of attack of micro impurities on properties of materials at high temperatures (optimum rate)	Ongoing			

(Continue to next column)

☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
060155051055560Z

ES Complete FY	Q	8. DEVELOPMENT MILESTONES *(continued)* *(Limit Title of Milestone to 60 characters and spaces)*	9. DATES Start FY	Q	Complete FY	Q
7	1					
9	1					
9	4					
9	2					
going						
3						

(Continue on separate sheet)

Page of

2

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

Requirement	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	(4) FY 1977 Obls.	Outla
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0.5	0.5	7.2	7.2	8.1	8.1	9.8	9.
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	0.8	0.8	0.9	0.9	1.2	1.
d. GRAND TOTAL—OBLIGATIONS	0.5		8.0		9.0		11.0	
e. GRAND TOTAL—OUTLAYS		0.5		8.0		9.0		11.

Starting in fiscal '77 industry might be expected to cost share (provide additional su
The exact rate cannot be determined at this time.

*These are ongoing programs.

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

Level of effort:
☐ MAXIMUM
☒ CRUCIAL
☐ MINIMUM

IDENTIFICATION NUMBER
0601550810555632

'80L'85

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1978-79		(8) Subject To Completion*		(9) Total Estimate to FY 1979 (Col. 7 Plus	
...ays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
.1	9.8	9.8	12.6	12.6	8.8	8.8	46.5	46.5	52.4	52.4	98.9	98.9
.9	1.2	1.2	1.8	1.8	1.2	1.2	5.9	5.9	7.6	7.6	13.5	13.5
	11.0		14.4		10.0		52.4		60.0		112.4	
.0		11.0		14.4		10.0		52.4		60.0		112.4

additional support) thedevelopment of superconducting electrical machinery.

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

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

OPERATING

ITEM	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	FY Obls.
TOTAL *(Carry forward to summary sheet)* ▷	0.5	0.5	7.2	7.2	8.1	8.1	9.8
Name of Performing Organization:							
Various - not specified — MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
Superconducting Electrical Machinery	0.4	0.4	4.5	4.5	4.5	4.5	4.4
Name of Performing Organization:							
Various - not specified — MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
Undergirding Materials R&D	0.1	0.1	2.7	2.7	3.6	3.6	5.4
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 Sepa

Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
05315503L0355502

'80 - '85

(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		BALANCE TO COMPLETION		(8) TOTAL EXCLUDING FY 1974 Cols. 7 & 8	
Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
9.8	9.8	12.6	12.6	8.8	8.8	46.5	46.5	52.4	52.4	98.9	98.9
4.4	4.4	7.2	7.2	3.4	3.4	24.0	24.0	20.4	20.4	44.4	44.4
5.4	5.4	5.4	5.4	5.4	5.4	22.5	22.5	32.0	32.0	54.5	54.5

*These are ongoing programs

on Separate Sheet)

Page of

2

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

B. CONSTRUCTION

ZONE

ITEM		(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) C.
TOTAL *(Carry forward to summary sheet)* ▶									
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief justification as required.	Item No. ( )								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement:									
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement:									
TITLE OF PROJECT *(Not to exceed characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement:									

(Continue on Separate

☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

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

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

EQUIPMENT

ITEM (Each item not to exceed 60 characters and spaces)		(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Estimated Obls.	(3) FY 1976 Estimated Outlays	(4) FY 1977 Estimated Obls.	(4) FY 1977 Estimated Outlays
[illegible] performing organization, [illegible] equipment funds, with a separate [illegible] of each item of equipment [illegible] one half million dollars or more.	TOTAL (Carry forward to summary sheet) ▶	0	0	0.8	0.8	0.9	0.9	1.2	1.2
Various Organizations - no major items				0.5	0.5	0.5	0.5	0.6	0.6
Various Organizations - no major items				0.3	0.3	0.4	0.4	0.6	0.6

(Continue on Separate Sheet)

Level of Effort:
☐ MAXIMUM
☒ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
0601550510555602

	(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
	1.2	1.2	1.8	1.8	1.2	1.2	5.9	5.9	7.6	7.6	13.5	13.5
	0.6	0.6	1.2	1.2	0.6	0.6	3.4	3.4	3.6	3.6	7.0	7.0
	0.6	0.6	0.6	0.6	0.6	0.6	2.5	2.5	4.0	4.0	6.5	6.5

*These are ongoing programs

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

1. IDENTIFICATION NUM

a. [illegible]	Conversion Techniques
b. [illegible]	[illegible]
a. PERFORMING AGENCY	[illegible], DOC, DOD
b. SUBUNIT	
c. CONTRACTOR NAME (No more than 12 characters and spaces for name of contractor; use standard abbreviation for [illegible] up to 16 characters and spaces for county.	Site where work will be performed ▶ State: County: Various Govt. Labs. & FFRDC's
	Site where work will be performed ▶ State: County: Various Unspecified Universit
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County: Various Unspecified Industria
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:

4. 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.

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting motors, generators, transformers, and auxiliary cryogenics. The goal would be to construct, test, and connect to a power distribution system a 100MW a.c. supercond generating system. Also, preliminary design and testing of compo for a 600 MW system.

Undergirding materials R&D for all conversion systems components including development of materials for advanced systems requiring materials beyond the current state-of-the-art; the performance of testing and acquisition of a bank of engineering data on currentl available materials to enable prediction of long-term reliability.

5. 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	78	83	97	97	97
	(2) Technical	90	96	111	111	111
	(3) Support	78	83	97	97	97
	(4) Other	34	38	44	44	44
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.)		Research quantities elements and compounds.				
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned	Existing research facilities - no additional				
	(2) Govt-leased	"	"	"		
	(3) Privately-owned	"	"	"		
	(4) Other	"	"	"		

...MENT
...SHEET

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

1. IDENTIFICATION NUMBER
0601550[illegible]

Conversion Techniques

..., DOC, DOD

...an 12 characters and ...of contractor, ...Numbers and agency ... performed	State:	County: Various Govt. Labs. & FFRDC's
	State:	County: Various Unspecified Universities
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County: Various Unspecified Industrial Sites
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:

...CRIPTION OF
...n 24 lines of text ...than 70 characters ...r line)
...e nature and scope ...undertaken, ...new facilities ...have to be acquired

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting motors, generators, transformers, and auxiliary cryogenics. The goal would be to construct, test, and connect to a power distribution system a 100MW a.c. superconducting generating system. Also, preliminary design and testing of components for a 600 MW system.

Undergirding materials R&D for all conversion systems components including development of materials for advanced systems requiring materials beyond the current state-of-the-art; the performance of testing and acquisition of a bank of engineering data on currently available materials to enable prediction of long-term reliability.

2

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR ▶	1975	1976	1977	1978	1979
(1) Scientific	78	83	97	97	97
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(3) Support	78	83	97	97	97
(4) Other	34	38	44	44	44
...ALS ...and units of ..., such as tons of ...oil. Kilograms of Show amount of ...ns at right.)	Research quantities elements and compounds.				
(1) Govt-owned	Existing research facilities - no additional				
(2) Govt-leased	"	"	"		
(3) Privately-owned	"	"	"		
(4) Other	"	"	"		

...URCES NEEDED

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county.	Site where work will be performed ▶ State:	County: Various Unspecified Universiti
	NAME OF CONTRACTOR:	
	Site where work will be performed ▶ State:	County: Various Unspecified Industrial
	NAME OF CONTRACTOR:	
	Site where work will be performed ▶ State:	County:
	NAME OF CONTRACTOR:	
	Site where work will be performed ▶ State:	County:

4. 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.

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting motors, generators, transformers, and auxiliary cryogenics. The goal would be to construct, test, and connect to a power distribution system a 100MW a.c. superconduc generating system. Also, preliminary design and testing of compon for a 600 MW system.

Undergirding materials R&D for all conversion systems components including development of materials for advanced systems requiring materials beyond the current state-of-the-art; the performance of testing and acquisition of a bank of engineering data on currently available materials to enable prediction of long-term reliability.

5. 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	78	83	97	97	97
	(2) Technical	90	96	111	111	111
	(3) Support	78	83	97	97	97
	(4) Other	34	38	44	44	44
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.)*		Research quantities elements and compounds.				
c. LAND AREA REQUIRED (In acres)	(1) Govt-owned	Existing research facilities - no additional				
	(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)	None	None	None	None	None

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		Various Unspecified Universities
NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County: Various Unspecified Industrial Sites
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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ure and scope taken. acilities be acquired

Superconducting Electrical Machinery: R&D to develop the next generation of superconducting motors, generators, transformers, and auxiliary cryogenics. The goal would be to construct, test, and connect to a power distribution system a 100MW a.c. superconducting generating system. Also, preliminary design and testing of components for a 600 MW system.

Undergirding materials R&D for all conversion systems components including development of materials for advanced systems requiring materials beyond the current state-of-the-art; the performance of testing and acquisition of a bank of engineering data on currently available materials to enable prediction of long-term reliability.

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

7. MAJOR RESOURCE REQUIREMENTS

CAL YEAR ▶	1975	1976	1977	1978	1979
cientific	78	83	97	97	97
Technical	90	96	111	111	111
Support	78	83	97	97	97
Other	34	38	44	44	44
nits of as tons of Kilograms of amount of ght.)	Research quantities elements and compounds.				
Govt-owned	Existing research facilities - no additional				
Govt-leased	"	"	"		
rivately-owned	"	"	"		
Other	"	"	"		
ES NEEDED *nit of ow quantity at right.)*	(1) None	None	None	None	None

ERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

Level of Effort
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
0601550510555602

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.

) Superconducting Electrical Machinery - increased conversion efficiency (up to 1% for stallations) circumvention of size limitations of components which may be shipped from fa installation site (approx. 650 MW), avoidance of foreign competitors from capturing fut rkets for electrical machinery (motors, generators, and transformers).

e development of electrical machinery using converional approaches appears to have been ximized. Exploitation of the phenomena of superconductivity appears to be the only avem proceed for further improvements in efficiency and to enable the production of larger u r control station application.

e principal risks/uncertainties center around the complexity of the envisioned systems a eir acceptability to industry and the utilities. No scientific breakthroughs are requir nsiderable engineering R&D is required. The discovery of higher temperature superconduc uld reduce system complexity, costs of acquisition and operation, and provide further in system efficiency and reliability. The maximum program would provide for design and con ion of a 100 MW system, its auxiliary components, connection to a commercial power distri stem, and preliminary design and testing of components of a 600 MW system. This would p r the maximum rate of advancement without unnecessary duplication.

b) Undergirding materials R&D for all components of advanced conversion systems - heat D, high temperature gas turbines, etc.

dvanced concepts (higher power, higher temperature) will require materials which are now he current state-of-the-art. For example, gas turbine with 2500°F inlet temperatures wi ew vane and first row blade materials. MHD will require special materials for ducts, el nd insulators. High temperature heat exchangers will require high strength materials re o thermal shock and cyclic fatigue and which will minimize interdiffusion of contaminant ne working fluid into the other. The effect of micro impurities in hot working fluids o long-term properties of high temperature materials is poorly understood and in some cases ll. There is a need not only for new materials but also a more complete bank of enginee n existing materials to allow prediction of long-term reliability. This is level-of-eff ctivity to accelerate scientific and technical advancement and is intermediate between s development and multidirectional basic research.

;ARCH AND DEVELOPMENT FACT SHEET (Continued)

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

IDENTIFICATION NUMBER
060155051055502

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

nducting Electrical Machinery - increased conversion efficiency (up to 1% for large· is) circumvention of size limitations of components which may be shipped from factory :ion site (approx. 650 MW), avoidance of foreign competitors from capturing future electrical machinery (motors, generators, and transformers).

ent of electrical machinery using converional approaches appears to have been Exploitation of the phenomena of superconductivity appears to be the only avenue or further improvements in efficiency and to enable the production of larger units station application.

l risks/uncertainties center around the complexity of the envisioned systems and thus :ability to industry and the utilities. No scientific breakthroughs are required but e engineering R&D is required. The discovery of higher temperature superconductors e system complexity, costs of acquisition and operation, and provide further increases fficiency and reliability. The maximum program would provide for design and construc-00 MW system, its auxiliary components, connection to a commercial power distribution preliminary design and testing of components of a 600 MW system. This would provide imum rate of advancement without unnecessary duplication.

rding materials R&D for all components of advanced conversion systems - heat exchanges mperature gas turbines, etc.

ncepts (higher power, higher temperature) will require materials which are now beyond state-of-the-art. For example, gas turbine with 2500°F inlet temperatures will requir d first row blade materials. MHD will require special materials for ducts, electrodes. ors. High temperature heat exchangers will require high strength materials resistant shock and cyclic fatigue and which will minimize interdiffusion of contaminants from fluid into the other. The effect of micro impurities in hot working fluids on the roperties of high temperature materials is poorly understood and in some cases not at is a need not only for new materials but also a more complete bank of engineering data materials to allow prediction of long-term reliability. This is level-of-effort accelerate scientific and technical advancement and is intermediate between short-term and multidirectional basic research.

2

HEDULE *(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
(a) Engineering design for 100 MW superconductor generator and components	75	1	76	4
Construction of 100 MW system	76	1	78	2
Testing of 100 MW system	78	2	79	2
Tie-in to commercial power distribution system	79	2	79	4
Preliminary design of components for 600 MW system	76	2	Ongoing	
(b) Development of advanced materials for 2500°F (inlet temperature) gas turbine	74	1	78	3
New materials for MHD and heat exchangers applications	75	1	Ongoing	
Acquisition of engineering data for performance predictability		Ongoing		
Studies of effects and mechanisms and kinetics of attack of micro impurities on properties of materials at high temperatures		Ongoing		

(Continue to next column)

Level of Effort:
☑ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
05 01 55 05 10 55 5602

a. DEVELOPMENT MILESTONES *(continued)*

(Limit Title of Milestone to 60 characters and spaces)

. DATES			b. DATES			
t	Complete		Start		Complete	
)	FY	Q	FY	Q	FY	Q
1	76	4				
1	78	2				
2	79	2				
2	79	4				
2	Ongoing					
1	78	3				
1	ongoing					
	going					
	ngoing					

(Continue on separate sheet)

Page of

2

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

Requirement	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	(4) FY 1977 Obls.	Outl
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	0.5	0.5	11.2	11.2	12.0	12.0	14	14
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*	0	0	1.6	1.6	2.0	2.0	3.4	
d. GRAND TOTAL—OBLIGATIONS	0.5		12.8		14.0		17.4	
e. GRAND TOTAL—OUTLAYS		0.5		12.8		14.0		1

Starting in fiscal '77 industry might be expected to cost-share (provide additio
machinery at the rate of approximately $2 M per year - the exact amount cannot b

*These are ongoing programs.

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

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

IDENTIFICATION NUMBER: 06 01 55 05 10 55 5602

'80-'85

1978 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays	(5) FY 1978 Obls.	(5) FY 1978 Outlays	(6) FY 1979 Obls.	(6) FY 1979 Outlays	(7) Subtotal FY 1975-79 Obls.	(7) Subtotal FY 1975-79 Outlays	(8) Balance To Complete * Obls.	(8) Balance To Complete * Outlays	(9) Total Excluding FY 1974 (Col. 7 & 8) Obls.	(9) Total Excluding FY 1974 (Col. 7 & 8) Outlays
12.0	14	14.0	14	14.0	14.0	14.0	65.2	65.2	86.2	86.2	151.4	151.4
			NONE									
2.0	3.4	3.4	3.4	3.4	3.4	3.4	13.8	13.8	18.2	18.2	32.0	32.0
	17.4		17.4		17.4		79.0		104.4		183.4	
14.0		17.4		17.4		17.4		79.0		104.4		183.4

rovide additional support) the development of superconducting electrical
mount cannot be determined at this time.

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

2

(4) Other	"	"	"	
6. OTHER RESOURCES NEEDED				

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

OPERATING — Estimated

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	FY 1 Obls.
TOTAL *(Carry forward to summary sheet)* ▶			11	11.2	12.0	12.0	14.0
Name of Performing Organization:							
Various - not specified — MANPOWER							
MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
Superconducting Electrical Machinery	0.4	0.4	7.2	7.2	7.2	7.2	7.2
Name of Performing Organization:							
MANPOWER							
Various - not specified — MATERIALS							
MAJOR PROCUREMENTS							
ALL OTHER							
TOTAL FOR THIS PERFORMING ORGANIZATION							
Undersirding Materials R&D	0.1	0.1	4.0	4.0	4.8	4.8	6.8
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							

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Level of Effort:
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☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
06 01 55 05 10 55 5602

'80-'85

(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 1975 (Cols. 7 &
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.
2.0	12.0	14.0	14.0	14.0	14.0	14.0	14.0	65.2	65.2	86.2	86.2	151.4
.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	36.0	36.0	44.3	44.3	80.3
.8	4.8	6.8	6.8	6.8	6.8	6.8	6.8	29.2	29.2	41.9	41.9	71.1

*These are ongoing programs.

(Continue on Separate Sheet)

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

b. CONSTRUCTION N O N E

ITEM	Item No.	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Out
TOTAL *(Carry forward to summary sheet)* ▶									
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) *(number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.									
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )								
TITLE OF PROJECT *(Not to exceed characters and spaces.)* / State / County / TEC *(in millions)* / Statement:	( )								

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(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)	
bls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

EQUIPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	Estimated (1) FY 1974 (Non-Add) Obls.	Outlays	(2) FY 1975 Obls.	Outlays	(3) FY 1976 Obls.	Outlays	(4) FY 1977 Obls.	Outlays
...ch major performing organization, ...total equipment funds, with a separate ...tion of each item of equipment ...one-half million dollars or more. TOTAL *(Carry forward to summary sheet)* ▶			1.6	1.6	2.0	2.0	3.4	3.4
a. Various organizations - no major items	0	0	0.8	0.8	0.8	0.8	0.8	0.8
b. Various organizations - no major items	0	0	0.8	0.8	1.2	1.2	2.6	2.6

(Continue on Separate Sheet)

8

Level of Effort:
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER
06 01 55 05 10 55 5602
'80-'85

(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
2.0	3.4	3.4	3.4	3.4	3.4	3.4	13.8	13.8	18.2	18.2	32.0	32.0
0.8	0.8	0.8	0.8	0.8	0.8	0.8	4.0	4.0	15.8	15.8	19.8	19.8
1.2	2.6	2.6	2.6	2.6	2.6	2.6	9.8	9.8	2.4	2.4	12.2	12.2

*These are ongoing programs

(Continue on Separate Sheet)

2

[illegible] DEVELOPMENT
FACT SHEET

[illegible]
[illegible]
[illegible]
[illegible]

1. IDENTIFICATION NUMBER
[illegible]

PROGRAM	Energy Conversion Techniques
SUBPROGRAM	Low Temperature Cycles
PROPONENT AGENCY	NASA, AEC
[illegible]	
[illegible] AND SITE	NAME OF CONTRACTOR:
	Site where work will be performed ➤ State: County:
	NAME OF CONTRACTOR: NONE SELECTED
	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:

[illegible] 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.

Develop turbo machinery capable of developing useful power levels from low temperature heat sources such as solar, geothermal or hea[t] now discharged from steam and I.C. engines - approximately 250° F to 400° F. Organic working fluids such as: 150 Butane, ammonia o[r] the freons. Develop required technology to design and construct 25 MWe system by approximately 1980.

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE	FISCAL YEAR ➤	1975	1976	1977	1978	197[9]
MANPOWER *(In man years)*	(1) Scientific	9	9	9	12	25
	(2) Technical	10	10	10	4	20
	(3) Support	1.5	1.5	1.5	1	3.2
	(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.)*			NA			
LAND AREA REQUIRED *(in acres)*	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					

...ARCH AND DEVELOPMENT
...ACT SHEET

1. IDENTIFICATION NUMBER

	Energy Conversion Techniques
...GRAM	Low Temperature Cycles
...ENT AGENCY	NASA, AEC

...OR AND SITE

NAME OF CONTRACTOR:	NONE SELECTED	
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:

...RIPTION OF

...an 24 lines of text ...than 70 characters ...er line) ...nature and scope ...undertaken, ...new facilities ...ve to be acquired ...d.

Develop turbo machinery capable of developing useful power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F. Organic working fluids such as: 150 Butane, ammonia or the freons. Develop required technology to design and construct a 25 MWe system by approximately 1980.

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

7. MAJOR RESOURCE REQUIREMENTS

FISCAL YEAR	1975	1976	1977	1978	1979
(1) Scientific	9	9	9	12	25
(2) Technical	10	10	10	4	20
(3) Support	1.5	1.5	1.5	1	3.2
(4) Other					
...IALS (...s and units of ..., such as tons of ...oil, Kilograms of ... Show amount of ...ns at right.)		NA			
(1) Gov't-owned					
(2) Gov't-leased					
(3) Privately-owned					

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a. PROGRAM	Energy Conversion Techniques
b. SUBPROGRAM	Low Temperature Cycles
c. PROPONENT AGENCY	NASA, AEC
d. SUBUNIT	
e. LOCATION/SITE (Enter up to 12 characters and spaces for name of contractor, or standard abbreviation for state, and for city and spaces for county.)	NAME OF CONTRACTOR:
	Site where work will be performed ▶ State: County:
	NAME OF CONTRACTOR: NONE SELECTED
	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:

f. BRIEF DESCRIPTION OF PROPOSAL

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

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

Develop turbo machinery capable of developing useful power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F. Organic working fluids such as: 150 Butane, ammonia or the freons. Develop required technology to design and construct a 25 MWe system by approximately 1980.

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	1979
a. MANPOWER *(in man years)*	(1) Scientific	9	9	9	12	25
	(2) Technical	10	10	10	4	20
	(3) Support	1.5	1.5	1.5	1	3.2
	(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.)*			NA	3		
c. LAND AREA REQUIRED *(in acres)*	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other		NEGLIGIBLE			
d. OTHER RESOURCES NEEDED *(Specify item and unit of measure below. Show quantity of each in columns at right.)* (1)		(1)				

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (CONTINUED)

[ ] MAXIMUM
[ ] CAREFULLY
[ ] MINIMUM

IDENTIFICATION NUMBER

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.

Low-temperature Rankine (vapor) cycles using organic fluids or ammonia are suitat for use with geothermal or solar-thermal energy sources and as bottoming cycles for steam powerplants. The technologies for design of power conversion systems for all three applications are so similar that overall program costs will be dim if a single, integrated R&D program is conducted on these power conversion syst rather than three independent, duplicating programs.

AND DEVELOPMENT FACT SHEET (Cont'd)

( ) MAXIMUM
( ) CAREFULLY
(X) MINIMUM

IDENTIFICATION NUMBER

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

perature Rankine (vapor) cycles using organic fluids or ammonia are suitable with geothermal or solar-thermal energy sources and as bottoming cycles am powerplants. The technologies for design of power conversion systems three applications are so similar that overall program costs will be diminished ngle, integrated R&D program is conducted on these power conversion systems than three independent, duplicating programs.

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ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

7. TITLE *(Include major facilities and major equipment. Indicate dates by Fiscal Year and Quarter).*

8. DEVELOPMENT MILESTONES *(number each consecutively)*

(Limit Title of Milestone to 60 characters and spaces)

	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
ow temperature cold vapor bottoming cycles	75	2	80	2
ankine bottoming cycles for increased power plant efficiency n cold regions	75	2	80	2

DATES			a. DEVELOPMENT MILESTONES (continued)	b. DATES			
t	Complete		(Limit Title of Milestone to 60 characters and spaces)	Start		Complete	
)	FY	Q		FY	Q	FY	Q
?	80	2					
?	80	2					

(Continue on separate sheet)

Page of

2

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

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outla
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	-		1.0	0.9	3.0	2.8	5.0	5
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*								
d. GRAND TOTAL–OBLIGATIONS			1.0		3.0		5.0	
e. GRAND TOTAL–OUTLAYS				0.9		2.8		5.

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

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☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER

	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) Subtotal FY 1975-79		(8) Balance To Complete		(9) Total Excluding FY 1974 Obs. 7 & 8	
	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
..8	5.0	5.1	5.0	5.1	5.0	5.1	19.0	19.0	30.0	30.0	49.0	49.0
	5.0		5.0		5.0		19.0		30.0		49.0	
.8		5.1		5.1		5.1		19.0		30.0		49.0

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

Page

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

...PERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Ou...
TOTAL *(Carry forward to summary sheet)* ▶			1.0	0.9	3.0	1.8	5.0	5
...ne of Performing Organization:	–	–	0.50	0.45	0.50	0.45	0.50	0.
MANPOWER			0.50	0.45	2.50	1.35	4.50	4.
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
...ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
...ne of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								
...me of Performing Organization:								
MANPOWER								
MATERIALS								
MAJOR PROCUREMENTS								
ALL OTHER								
TOTAL FOR THIS PERFORMING ORGANIZATION								

(Continue on Separate ...

LEVEL OF EFFORT:
☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER:

(4)			(5)		(6)		(7)		(8)		(9)	
1976	FY 1977		FY 1978		FY 1979		SUBTOTAL FY 1975-79		BALANCE TO COMPLETE		TOTAL EXCLUDING FY 1976 (Cols. 7 & 8)	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
1.8	5.0	5.1	5.0	5.1	5.0	5.1	19.0	19.0	30.0	30.0	49.0	49.0
0.45	0.50	0.50	0.80	0.75	1.5	1.65	3.8	3.8	10.0	10.0	13.8	13.8
1.35	4.50	4.60	4.20	4.35	3.5	3.45	15.2	15.2	20.0	20.0	35.2	35.2

(Continue on Separate Sheet)

2

(3) Privately-owned			
(4) Other	NEGLIGIBLE		

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

CONSTRUCTION

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
TOTAL *(Carry forward to summary sheet)* ▶								

a. Project, Location *(State and County)* and Total Estimated Cost *(Number each item consecutively)*. Every project costing one million dollars or more should be separately identified with a brief statement of what is required.

Item No.	TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	State	County	TEC *(in millions)*	Statements	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
( )					None								NO
( )	TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	State	County	TEC *(in millions)*	Statements								
( )	TITLE OF PROJECT *(Not to exceed characters and spaces.)*	State	County	TEC *(in millions)*	Statements								

(Continue on Separate Sheet)

(4) Other		NEGLIGIBLE			
URCES NEEDED					

'73	(4) FY 1977		(5) FY 1978		(6) FY 1979		(7) SUBTOTAL FY 1975-79		(8) BALANCE TO COMPLETE		(9) TOTAL EXCLUDING FY 1974 (Col's. 7 & 8)	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Ob's.	Outlays	Ob's.	Outlays
		NONE										

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT FACT SHEET (Continued)

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

IPMENT

ITEM *(Each item not to exceed 60 characters and spaces)*	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
or performing organization, TOTAL *(Carry forward to summary sheet)* ▷								
quipment funds, with a separate n of each item of equipment half million dollars or more.								
None								NONE

(Continue on Separate Shee

(1)

Level of Effort:
☐ MAXIMUM
☐ ORDERLY
☒ MINIMUM

IDENTIFICATION NUMBER

(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's. 7 & 8)	
	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Ob's.	Outlays
			NONE										

(Continue on Separate Sheet)

Page of

2

ENERGY RESEARCH & DEVELOPMENT
PROJECT SHEET

Level of Effort
[ ] MANPOWER
[x] DOLLARS
[ ] MANYEARS

1. IDENTIFICATION NUMBER: 0602550712550302

2. a. PROGRAM	Energy Conversion Technologies
b. SUBPROGRAM	Low Temperature Cycles
3. a. PRESENT AGENCY	NASA, AEC
b. SUBUNIT	

4. CONTRACTOR AND SITE

(Use more than 12 characters and spaces for name of contractor. Use standard abbreviation for state; up to 16 characters and spaces for county.

NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:	NONE SELECTED	
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.

Develop turbo machinery capable of developing useful power leve from low temperature heat sources such as solar, geothermal or h now discharged from steam and I.C. engines - approximately 250° to 400° F. Organic working fluids such as: 150 Butane, ammonia the freons. Develop required technology to design and construct 25 MWe system by approximately 1980.

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

7. MAJOR RESOURCE REQUIREMENTS

RESOURCE ▼	FISCAL YEAR ▶	1975	1976	1977	1978	19
a. MANPOWER (In man years)	(1) Scientific	9	9	9	12	2
	(2) Technical	10	10	10	4	2
	(3) Support	1.5	1.5	1.5	1	3.
	(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.)			NA			
c. LAND AREA REQUIRED (Acres)	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					

...H RESEARCH & DEVELOPMENT
...ACT SHEET

Level of Effort
[ ] MAXIMUM
[x] ORIGINALLY
[ ] ...

1. IDENTIFICATION NUMBER
060255071255039?

...OGRAM	Energy Conversion Technologies
...PROGRAM	Low Temperature Cycles
...SPONSORING AGENCY	NASA, ARC
...SUBUNIT	

...FACTOR AND SITE

...more than 12 characters and ...for name of contractor, ...ional abbreviation for state. ...16 characters and spaces for ...y.

NAME OF CONTRACTOR:		
Site where work will be performed ▶	State:	County:
NAME OF CONTRACTOR:		NONE SELECTED
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:

...F DESCRIPTION OF ...OSAL

...more than 24 lines of text ...o more than 70 characters ...aces per line)

...outline nature and scope ...rk to be undertaken, ...ding any new facilities ...may have to be acquired ...structed.

Develop turbo machinery capable of developing useful power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F. Organic working fluids such as: 150 Butane, ammonia or the freons. Develop required technology to design and construct a 25 MWe system by approximately 1980.

2

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

7. MAJOR RESOURCE REQUIREMENTS

...RCE	FISCAL YEAR ▶	1975	1976	1977	1978	1979
...OWER	(1) Scientific	9	9	9	12	25
...an years)	(2) Technical	10	10	10	4	20
	(3) Support	1.5	1.5	1.5	1	3.2
	(4) Other					
MATERIALS ...materials and units of ...ure below, such as tons of ...arrels of oil, Kilograms of ...um, etc. Show amount of ...n columns at right.)			NA			
D AREA ...IRED ...ears)	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					

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NAME OF CONTRACTOR:	NONE SELECTED		
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.

Develop turbo machinery capable of developing useful power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F. Organic working fluids such as: 150 Butane, ammonia or the freons. Develop required technology to design and construct a 25 MWe system by approximately 1980.

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	9	9	9	12	25
	(2) Technical	10	10	10	4	20
	(3) Support	1.5	1.5	1.5	1	3.2
	(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.)*			NA			
c. LAND AREA REQUIRED *(In acres)*	(1) Govt-owned					
	(2) Govt-leased					
	(3) Privately-owned					
	(4) Other		NEGLIGIBLE			
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 NUMBE

(a) (1) (2) State the specific energy problem or objective, and specify how the proposal will contribute to the solution of the problem ... (3) ... of the objectives. Include reasons for selecting the recommended approach over other alternatives. Also include the benefits ... (4) ... 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.

Low-temperature Rankine (vapor) cycles using organic fluids or ammonia are suitab... for use with geothermal or solar-thermal energy sources and as bottoming cycles for steam powerplants. The technologies for design of power conversion systems for all three applications are so similar that overall program costs will be dimi... if a single, integrated R&D program is conducted on these power conversion syste... rather than three independent, duplicating programs.

H AND DEVELOPMENT FACT SHEET (Continued)

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

IDENTIFICATION NUMBER

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

nperature Rankine (vapor) cycles using organic fluids or ammonia are suitable
: with geothermal or solar-thermal energy sources and as bottoming cycles
:ar powerplants. The technologies for design of power conversion systems
three applications are so similar that overall program costs will be diminished
ngle, integrated R&D program is conducted on these power conversion systems
than three independent, duplicating programs.

2

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

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlay
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*	-		1.0	0.9	3.0	2.8	5.0	5.
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*								
d. GRAND TOTAL—OBLIGATIONS			1.0		3.0		5.0	
e. GRAND TOTAL—OUTLAYS				0.9		2.8		5.1

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

☐ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER

(3)	(4)		(5)		(6)		(7)		(8)		(9)	
1976	FY 1977		FY 1978		FY 1979		Subtotal FY 1975-79		Balance To Complete		Total Excluding FY 1974 (Col. 7 & 8)	
Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays
2.8	5.0	5.1	5.0	5.1	5.0	5.1	19.0	19.0	30.0	30.0	49.0	49.0
	5.0		5.0		5.0		19.0		30.0		49.0	
2.8		5.1		5.1		5.1		19.0		30.0		49.0

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

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
1. Low temperature cold vapor bottoming cycles	75	2	80	2
2. Rankine bottoming cycles for increased power plant efficiency in cold regions	75	2	80	2

(Continue to next column)

☒ ORDERLY
☐ MINIMUM

CERTIFICATION NUMBER

a. DEVELOPMENT MILESTONES *(continued)*

(Limit Title of Milestone to 60 characters and spaces)

b. DATES			
Start		Complete	
FY	Q	FY	Q

2

2

(Continue on separate sheet)

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

a. OPERATING

ITEM	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197[illegible] Obls.	(4) FY 197[illegible] Ou[illegible]
TOTAL *(Carry forward to summary sheet)* ▶			1.0	0.9	3.0	1.8	5.0	[illegible]
Name of Performing Organization:	-	-	0.50	0.45	0.50	0.45	0.50	
MANPOWER			0.50	0.45	2.50	1.35	4.50	[illegible]
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 Separa

Level of Effort:
☐ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER

(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
)	1.8	5.0	5.1	5.0	5.1	5.0	5.1	19.0	19.0	30.0	30.0	49.0	49.0
0	0.45	0.50	0.50	0.80	0.75	1.5	1.65	3.8	3.8	10.0	10.0	13.8	13.8
0	1.35	4.50	4.60	4.20	4.35	3.5	3.45	15.2	15.2	20.0	20.0	35.2	35.2

(Continue on Separate Sheet)

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) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 197 Obls.	(4) FY 197 C
TOTAL *(Carry forward to summary sheet)* ▶									
Title of project, Location *(State and County)* and Total Estimated Cost (TEC) (number each item consecutively). Every project costing one million dollars or more should be separately identified with a brief statement of why it is required.	Item No.								
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement: None									
TITLE OF PROJECT *(Not to exceed 30 characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement:									
TITLE OF PROJECT *(Not to exceed characters and spaces.)*	( )								
State / County / TEC *(in millions)*									
Statement:									

(Continue on Separate

☐ MAXIMUM
☐ ORDERLY
☐ MINIMUM

	(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)	
...lays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obls.	Outlays	Obs.	Outlays	Obls.	Outlays
	NONE											

...inue on Separate Sheet)

ENERGY RESEARCH & DEVELOPMENT
FACT SHEET

Level of Effort:
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

1. IDENTIFICATION NUMBER 0602550712550302

PROGRAM	Energy Conversion Techniques
SUBPROGRAM	Low Temperature Cycles
PROPONENT AGENCY	NASA, AEC
[illegible] UNIT	

CONTRACTOR AND SITE

(... than 12 characters and spaces for name of contractor, standard abbreviation for state, 16 characters and spaces for county.)

NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		
Site where work will be performed	State:	County:
NAME OF CONTRACTOR:		TO BE SELECTED
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.

Develop turbo machiner capable of developing useful power levels fr low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F organic working fluids such as: isobutane, ammonia or the freons develop required technology to design and construct a 25 MWe system by approximately 1980.

Development of a bottoming cycle for the HTGR gas turbine system will be carried out and a test facility built. Demonstration by 1

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	17	22	22	22	35
	(2) Technical	11	12	20	14	30
	(3) Support	2.5	2.5	3.5	3.5	5.2
	(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.)			NA			
c. LAND AREA REQUIRED (in acres)	(1) Govt-owned					
	(2) Govt-leased		NEGLIGIBLE			
	(3) Privately-owned					
	(4) Other					

...EARCH & DEVELOPMENT
FACT SHEET

Level of Effort:
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

1. IDENTIFICATION NUMBER
060255071250502

...AM	Electric Conversion Technologies
...OGRAM	Low Temperature Cycles
...ENT AGENCY	NASA, AEC
...IT	

...TOR AND SITE

...than 42 characters and ... of abbreviation for states ...haracters and spaces for

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

...SCRIPTION OF ...L

...han 24 lines of text ...re than 70 characters ...per line)

...line nature and scope ...be undertaken, ...any new facilities ...have to be acquired ...cted.

Develop turbo machiner capable of developing use..ul power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F organic working fluids such as: isobutane, ammonia or the freons develop required technology to design and construct a 25 MWe system by approximately 1980.

Development of a bottoming cycle for the HTGR gas turbine system will be carried out and a test facility built. Demonstration by 1985.

2

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

7. MAJOR RESOURCE REQUIREMENTS

	FISCAL YEAR ▷	1975	1976	1977	1978	1979
...ER	(1) Scientific	17	22	22	22	35
...ars)	(2) Technical	11	12	20	14	30
	(3) Support	2.5	2.5	3.5	3.5	5.2
	(4) Other					
...ERIALS *...ials and units of ...low, such as tons of ... of oil, Kilograms of ...tc. Show amount of ...umns at right.)*			NA			
...EA	(1) Govt-owned					
...)	(2) Govt-leased		NEGLIGIBLE			
	(3) Privately-owned					
	(4) Other					
...ESOURCES NEEDED						

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1. SUBPROGRAM	Low Temperature Cycles
2. PERFORMING AGENCY	[illegible]
3. BUDGET	

4. CONTRACTOR AND SITE *(Not more than 42 characters and spaces for name of contractor. Use official abbreviations for states (i.e. IL for Illinois) and spaces for counties.*

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: TO BE SELECTED		
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.

Develop turbo machiner capable of developing useful power levels from low temperature heat sources such as solar, geothermal or heat now discharged from steam and I.C. engines - approximately 250° F to 400° F organic working fluids such as: isobutane, ammonia or the freons develop required technology to design and construct a 25 Mie system by approximately 1980.

Development of a bottoming cycle for the HTGR-gas turbine system will be carried out and a test facility built. Demonstration by 1985.

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	17	22	22	22	35
	(2) Technical	11	12	20	14	30
	(3) Support	2.5	2.5	3.5	3.5	5.3
	(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.)			NA	3		
c. LAND AREA REQUIRED (In acres)	(1) Government-owned					
	(2) Government-leased		NEGLIGIBLE			
	(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)	(2)		NONE			

[illegible] (Continued)

Control Limit:
- [x] MAXIMUM
- [ ] ORDERLY
- [ ] MINIMUM

IDENTIFICATION NUMB

1. 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 provisions for assessing the environmental impacts of the project. 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&D, plans to minimize R/U, and basis for proceeding in face of R/U. Quantitative data should be used to the fullest extent.

Low-temperature Rankine (vapor) cycles using organic fluids or ammonia are suitable for use with geothermal or solar-thermal energy sources and as bot cycles for steam powerplants. The technologies for design of power conver systems for all three applications are so similar that overall program cost will be diminished if a single, integrated R&D program is conducted on thes power conversion systems rather than three independent, duplicating progra

AND DEVELOPMENT FACT SHEET (Continued)

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

IDENTIFICATION NUMBER

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

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2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

a. DEVELOPMENT MILESTONES *(number each consecutively)* *(Limit Title of Milestone to 60 characters and spaces)*	b. DATES			
	Start		Complete	
	FY	Q	FY	Q
(1.)				
1. Low temperature bottoming cycles	75	2	80	2
2. Rankine bottoming cycles in cold regions	75	2	80	2
3. HTGR direct cycle-tottoming cycle demo plant	75	4	85	4

Level of Effort:
☒ MAXIMUM
☐ ORDERLY
☐ MINIMUM

IDENTIFICATION NUMBER

a. DEVELOPMENT MILESTONES *(continued)*

mplete Q	*(Limit Title of Milestone to 60 characters and spaces)*	Start FY	Start Q	Complete FY
2				
2				
4				

(Continue on separate sheet)

2

ENERGY RESEARCH AND DEVELOPMENT FACT SHEET (Continued)

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

Requirement	(1) FY 1974 (Non-Add) Obls.	(1) FY 1974 (Non-Add) Outlays	(2) FY 1975 Obls.	(2) FY 1975 Outlays	(3) FY 1976 Obls.	(3) FY 1976 Outlays	(4) FY 1977 Obls.	(4) FY 1977 Outlays
a. OPERATING *(See p. for detail)* Total Operating Requirements *(from Detail Sheet)*			3.0		10.0		20.0	
b. CONSTRUCTION *(See p. for detail)* Total Construction Requirements *(from Detail Sheet)*								
c. EQUIPMENT *(See p. for detail)* Total Equipment Requirements *(from Detail Sheet)*								
d. GRAND TOTAL—OBLIGATIONS			3.0		10.0		20.0	
e. GRAND TOTAL—OUTLAYS								