

UNCLASSIFIED

PD-ACC-350

February 6, 1964

NOTICE TO RECIPIENTS OF THE FY 1965 COUNTRY ASSISTANCE PROGRAM BOOK (CAP)

FOR  
INDIA

Please find attached project narrative sheets that should be inserted in the FY 1965 India CAP volume containing the U.S. Assistance Program (Sec. III).

These sheets should be placed after their respective E-1 table already reproduced in the CAP.

UNCLASSIFIED

AID FORM 10-120 (7-62)	DATE PREPARED Dec. 20, 1963	COOPERATING COUNTRY India	UNCLASSIFIED	386-11-110-028 (386-A-11-AE)	Agricultural Universities Development	E-1
------------------------	--------------------------------	------------------------------	--------------	---------------------------------	---------------------------------------	-----

## 1. The Activity Targets

The overall target for this continuing activity is the development of a minimum number of Indian agricultural universities in representative areas of India; each university is to consist initially of Agriculture and Veterinary Science Colleges and a School of Basic Sciences and Humanities and to include within a few years, Colleges of Agricultural Engineering, Home Science, and Graduate Studies. It is presently projected that such universities in seven states, organized on the U.S. land-grant college pattern, will need, in addition to administrative personnel, 40 deans and 165 professors with doctoral degrees and 2,000 other staff members, half of them with Master's degrees. Total enrollment will be about 14,000 undergraduate and 1,400 graduate students. Plans provide for a main library for each university, with at least 30,000 books and 200 journals, and textbooks adapted to Indian conditions for all students.

Within the first three years of project implementation it is expected that agricultural research programs in the assisted states will be directed by the universities. A main experiment station manned by the college personnel shown above is planned for each institution along with about 4 sub-stations each where limited staffs will do research work. Major attention will be given to solving current problems impeding Indian agricultural production, especially for food crops.

It is expected that within six years of its establishment, each university will be capable of administering the extension education programs of its state. Such programs will require a total of 5,000 extension agents each serving an average of 7,200 rural families; and 100 or more subject matter specialists. In addition to modern techniques, considerable attention must be given to administrative organizations, sociological matters, youth activities, etc.

It is expected that the full integration of teaching, research and extension, and the coordination between colleges will add at least 50% to the efficiency of the existing facilities. Nevertheless, these physical facilities, if they are to accommodate the enlarged student body and staff and to conduct necessary research on a suitable scale, must be doubled during the next four years.

Continuance of efforts to develop an agricultural university in any particular State will be determined by the Mission by mid-1964. For this purpose, the Mission is engaging an expert consultant to study the conditions in each of the seven States now being assisted, and recommend those to which assistance should be continued. The need for 1965 and future fiscal year funds for each of the present Contractors will be based on the findings of this study.

## 2. The Course of Action

A U.S. university will provide to each Indian university continuing to be assisted from six to nine specialists annually in university and college administration and critical technical fields and U.S. training in administration and key technical fields for eight to ten Indian staff members. The future financing for procurement of limited amounts of scientific books and equipment not available in India is currently under discussion with the Government of India.

The U.S. specialists will not occupy administrative or technical posts. Each is to serve as advisor to an Indian official who will be on the job at the time the specialist is furnished. The specialists, however will conduct special demonstration, teaching, and research projects as means of establishing the values of such projects and of training Indian staff and students. Special attention will be given to training within India to meet the future needs of the new universities, and thus make it possible to limit U.S. training largely to key staff members.

AID FORM 10-120 (7-62)	DATE PREPARED Dec. 20, 1963	COOPERATING COUNTRY India	UNCLASSIFIED	386-11-110-028 (386-A-11-AE)	Agricultural Universities Development	E-1
---------------------------------	--------------------------------	------------------------------	--------------	---------------------------------	---------------------------------------	-----

The work of the U.S. universities will be coordinated by the Mission's Agriculture Division, which provides policy guidance to the activity and serves as liaison between the contractors, the GOI and other Mission offices.

The States, with GOI assistance, are expected to meet all Indian staff salary costs and provide for the operation and maintenance of university facilities. The current annual operating costs are stated to be Rs.43 million, and are expected to be Rs.89 million in 1966. All additional land needed for the university campus and research stations will be provided by the concerned States, besides land, buildings, facilities, and equipment valued at Rs. 180 million already provided by the States. It is probable that most of the needs for additional buildings and facilities (estimated at Rs.250 million without land) will be supported by grants of U.S. owned local currency to the Union Government which will, in turn, make grants to States.

### 3. Progress to Date

Project activities are being carried out through continuing contracts with five U.S. universities, as follows:

University of Illinois - Uttar Pradesh and Madhya Pradesh  
The Ohio State University - Punjab and Rajasthan  
University of Missouri - Orissa  
Kansas State University - Andhra Pradesh  
University of Tennessee - Mysore

Four States (Uttar Pradesh, Orissa, Punjab and Rajasthan) have established integrated agricultural universities; agricultural university legislation has been enacted in three others (Madhya Pradesh, Andhra Pradesh, and Mysore), and the universities should be established by mid-1964.

The U.P. Agricultural University started from the ground in 1960 and graduated its first students in 1963. At the other six universities, made up by combining existing colleges, the teaching programs must yet be converted to the U.S. land-grant system. In varying degrees (10% to 100%), the State agricultural research programs have been transferred to the universities. As yet, the administration of agricultural extension programs in the various States has been assumed by the new universities in only limited degree. These schedules are desirable because the new universities are still not ready to administer complete state research and extension programs.

It appears unlikely that the seven other States (Assam, Bihar, Gujerat, Kerala, Maharashtra, Madras and West Bengal) will start agricultural universities during the Third Plan period. The Mission feels that any universities beyond the original group developed with AID assistance, should not require U.S. technical assistance; the universities now being assisted should then be able to help other States in developing an India-wide agricultural universities program on this same basis.

From the 1955 origin of the project, 93 U.S. specialists have served about 190 man-years in India; some 400 Indian college staff members have received U.S. training; and library books, journals, and scientific equipment not available in India, together costing about two million dollars, have been supplied. Because of the widespread nature of the original activities these services and equipment were supplied to about 80 institutions. Probably only one-fourth of the total past assistance was directly related to the new agricultural universities, but the remainder has provided good outside support to them.

AID FORM 10-120 (7-62)	DATE PREPARED Dec. 20, 1963	COOPERATING COUNTRY India	UNCLASSIFIED	386-11-110-028 (386-A-11-AE)	Agricultural Universities Development	E-1
------------------------	--------------------------------	------------------------------	--------------	---------------------------------	---------------------------------------	-----

Within the present Indian agricultural universities and in colleges destined to become parts of such new universities there are now 149 deans and professors, 70 with doctoral degrees; and 738 other staff members, 387 having advanced degrees. The present enrollment is 8,700 undergraduates, with 618 candidates for advanced degrees. The libraries average 20,100 books, but there are virtually no textbooks used regularly or owned by students. Classrooms and laboratories for existing colleges are reasonably adequate, but there are great needs for new libraries, buildings and facilities for new colleges, staff housing, and research farms at most of the new universities.

#### 4. Funding Requirements

##### a. Total Requirements

The E-1 face sheet for this project is too inclusive to furnish an accurate picture of costs to date and total estimated costs of the Agricultural Universities Development program as outlined above. Included are all costs under an old project -- number 028 -- which assisted about 80 colleges and educational agencies throughout India, which are not properly chargeable to the new universities. The Mission therefore has proposed, and AID/W has agreed, to terminate charges under Project 028 as of the dates the U.S. contractors phased out activities thereunder and actually started on the present development program. For Ohio State University and Missouri this was about January 1963 and for Illinois, Kansas and Tennessee the phase-out date probably will be early in 1964. All costs under the original Illinois contract for U.P. Agricultural University (Project 386-11-110-147) are valid, and a separate E-1 has been prepared for this activity.

It is too early to quantify the amount and schedule of assistance required to put the new universities on a self-development basis. The Mission and the five contractors are developing, under the direction of an expert AID consultant, firm estimates which are expected to be available by June 1964.

This appraisal will determine which Indian universities merit continued assistance and will project the amount and schedule of funding needed to complete the project activities. The Mission's rough estimate at this time of the total assistance needed by each agricultural university is about 50 man-years of technician services, training of 45 staff members in the United States, and about \$100,000 worth of teaching and demonstration aids not available in India. On this basis total requirements from FY 1966 funds and onward would be as follows:

State	Technician Man-Years		Participants		Dollar Costs (in 000's) to be Funded FY 1966 and onward	Estimated Final FY of funding
	Funded through FY 1965	To be Funded FY 1966 and onward	Funded through FY 1965	To be Funded FY 1966 and onward		
Uttar Pradesh	26	24	27	18	592	1967
Punjab	27	23	24	21	584	1967
Rajasthan	16	34	23	22	848	1969
Orissa	17	33	27	18	812	1969
Mysore	14	36	22	23	912	1970
Madhya Pradesh	14	36	20	25	920	1970
Andhra Pradesh	13	37	23	22	928	1970
	<u>127</u>	<u>223</u>	<u>166</u>	<u>149</u>	<u>5,596</u>	

The dollar costs are based on \$20,000 per technician year, \$4,000 per participant year, and \$20,000 for teaching and demonstration aids per year per institution.

AID FORM 10-120 (7-62)	DATE PREPARED Dec. 20, 1963	COOPERATING COUNTRY India	UNCLASSIFIED	386-11-110-028 (386-A-11-AE)	Agricultural Universities Development	E-1
------------------------	--------------------------------	------------------------------	--------------	---------------------------------	---------------------------------------	-----

It is estimated that the total rupee costs from FY 1966 onward, at the current level of assistance, involving U.S. owned local currency and necessary in order to supplement dollar expenditures, will approximate:

	Rupee (\$ '000 Equivalent)
Administrative, logistic and technical support	3,600
For general physical development	14,000
<b>Total:</b>	<b>17,600</b>

Sec. 402 Rupees

	Dollar Funding (\$ '000)	Rupee Funding (\$'000 Equiv.)	Total (\$'000)
Demonstration Projects		110	
Training within India		50	
			<u>551</u>

PL 480 Rupees

Joint Use for Ordinary Physical Development		6,000	
U.S. Use for Special Features of New Universities*		7,000	
			<u>13,000</u>
<b>FY 1964 Total Estimated Cost</b>	<u>651</u>	<u>13,551</u>	<u>14,202</u>

b. Operational Year Requirements (FY 1964)

The FY 1964 funding required to carry the activity at the present level through October 31, 1965, by major project elements and in terms of dollars and U.S. owned local currency, is as follows:

Dollar Funding (\$ '000)	Rupee Funding (\$ '000 Equiv.)	Total (\$'000)
-----------------------------	-----------------------------------	-------------------

<u>DG</u>		
U.S. Technicians(48)	*287	
U.S. Training of Indians (63)	**364	
		<u>651</u>

\*If not available in FY 1964, should be transferred and shown as FY 1965 requirements.

Note: Detailed Tables I and II are not included herein. As concerns technicians, each of the seven universities require, in both FY 1964 and FY 1965, American specialists in university administration, veterinary college administration, agricultural college administration, research, extension,

Sec. 402 Rupees

Administrative and Logistic Costs	391
-----------------------------------	-----

\*\$531,300 available from FY 1963 funds.

\*\*Also provides two-month (Sept.-Oct.) funding for FY 1965 trainees.

AID FORM 10-120 (7-62)	DATE PREPARED Dec. 20, 1963	COOPERATING COUNTRY India	UNCLASSIFIED	386-11-110-028 (386-A-11-AE)	Agricultural Universities Development	E-1
------------------------	--------------------------------	------------------------------	--------------	---------------------------------	---------------------------------------	-----

and in either engineering or home science college administration, i.e. six per university or a total of 42 technicians. In addition, the universities in U.P. and Punjab require, in both fiscal years, three technicians each in special fields needing advisors as determined by developments within the universities. Thus the indicated requirements for each fiscal year are 48 technicians.

As concerns participants, each of the seven universities will provide nine for U.S. training in each of the fiscal years 1964 and 1965. The candidates will be selected from university staff members occupying key administrative or technical positions. Composition of the trainee group for each university will depend on specific needs and availability of qualified staff.

c. Budget Year Requirements (FY 1965)

The FY 1965 funding required to carry the activity, at the current level, through October 31, 1966, by major project elements and in terms of dollars and U.S. owned local currency, is as follows:

	Dollar Funding (\$ '000)	Rupee Funding (\$'000 Equiv.)	Total (\$'000)
<u>DG</u>			
U.S. Technicians (48)	960		
U.S. Training of Indians (63)	*364		
Scientific Equipment & Books	-		
			<u>1,324</u>
<u>Sec. 402 Rupees</u>			
Admin. & Logistic Costs		587	
Demonstration Projects		214	
Within India Training		131	
			<u>932</u>

\*Also provides two-month (Sept.-Oct.) funding for FY'66 participants.

	Dollar Funding (\$'000)	Rupee Funding (\$'000 Equiv.)	Total (\$'000)
<u>FL 480 Rupees</u>			
Joint Use for Ordinary Physical Developments		19,000	
U.S. Use for Special Features of New Universities		-	
			<u>19,000</u>
<u>FY 1965 Total Est. Cost</u>	<u>1,324</u>	<u>19,000</u>	<u>21,256</u>

Note: See Note concerning technicians and participants under 4-b above. It is equally applicable to requirements in FY 1965.

The funding estimates for fiscal year 1965 are strictly tentative, and cannot be made firm until the planned survey has been completed and decisions based on its recommendations are made by the Mission and GOI. The E-1 face sheet for this activity will be modified at that time to reflect the revised needs.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-230-199	Trombay Fertilizer Plant	E-1
------------------------	--------------------------------	---------------------------	--------------	----------------	--------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Fertilizer Corporation of India, a Government of India Corporation, with a modern nitrophosphate and urea fertilizer plant at Trombay, Maharashtra. The United States will assist in the attainment of this target by financing the foreign exchange costs of engineering services and imported mechanical and other equipment, and by meeting the local currency costs of construction.

Background: A fundamental problem in the development of the Indian economy is the inordinately low yield per acre of cultivated land. One major factor responsible for low agricultural productivity has been inadequate use of fertilizers. A program was initiated in 1951 to stimulate use of commercial fertilizer. During the first two Five Year Plans the use of nitrogenous and phosphatic fertilizers increased fourfold and tenfold respectively and total commercial fertilizer consumption in 1962/63 was 607,000 tons (in terms of nutrient content). The 1965/66 consumption target is 1.4 million tons (nutrient content).

Within the context of foreign exchange availabilities and growing domestic demands, a coordinate program for increasing indigenous production of fertilizer was started. A production target of 1.2 million tons (nutrient basis) was established for 1965/66. The Trombay Plant will be capable of producing about 99,000 tons of urea (nitrogen content: 45,000 tons) and 330,000 tons of nitro-phosphate (nitrogen content: 42,600 tons; phosphate content 42,600 tons) per year. It will be the largest fertilizer plant in India and the only indigenous producer of nitrophosphate fertilizer. The production of the Trombay plant will amount to about 9% of the 1965/66 target consumption of nitrogenous fertilizer and about 11% of that of phosphatic fertilizer.

Consideration of a fertilizer project at Trombay dates back to mid-1955 when the Government's Fertilizer Production Committee

assigned high priority to Trombay as a suitable location for a fertilizer plant utilizing available refinery gases. The Trombay proposal was reviewed and early in 1957 initiation of the project was authorized by the Government. Project studies and fuel price negotiations were conducted through mid-1958. A Trombay Fertilizer Project Committee was then constituted to determine the type and amounts of fertilizers to be produced at Trombay, to consider alternative processes and recommend the specific ones to be employed, and to estimate the costs of the project.

### 2. The Course of Action

Financing: To provide \$30 million through a dollar development loan to meet the foreign exchange cost of the Trombay Fertilizer Plant; and Rs. 134.3 million (equivalent to \$28.05 million) through a PL 480 Section 104 (g) loan to meet local currency costs of the project.

Description of Project: The plant will manufacture as intermediate materials ammonia, nitric acid and sulphuric acid, and as end products urea and nitrophosphate. Argon gas will be a by-product. One-half of the raw material for ammonia production will be refinery gas from the Burmah Shell Refinery in Trombay and one-half naphtha (gasoline). Two major raw materials, sulphur and phosphate rock, must be imported.

The ammonia plant will carry out the steps of partial oxidation, sulphur removal and recovery, carbon monoxide shifting, carbon dioxide removal, liquid nitrogen wash, compression, synthesis, and storage. Its capacity will be 350 metric tons per day of ammonia.

The urea plant will have an installed capacity of 300 metric tons of prilled urea per day. The ammonia content of the urea tail gas will be sufficient to meet the requirements of the ammoniation step in the nitrophosphate plant. The required quantity of carbon dioxide for urea manufacture will be supplied from the ammonia plant and the necessary purification steps for the carbon dioxide incorporated.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-230-199	Trombay Fertilizer Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	--------------------------	-----

The nitric acid plant design is based on a capacity of 320 metric tons per day of nitric acid (as 100% HNO<sub>3</sub>) in a concentration of 53 to 54%. Conventional catalytic oxidation processes are planned.

The nitrophosphate plant will provide for the use of either the carbonitric process or the sulphonitric process. The expected production capacity of 330,000 tons per year of nitrophosphate is based on the use of the sulphonitric process, producing water soluble nitro phosphate, which will normally be used.

The necessary utilities, storage, raw materials and products handling facilities, the water treatment system, the purchased power facilities, and necessary auxiliaries will be included in the project. Fuel for steam will be obtained from the plant waste heat sources and from coal or fuel oil.

The annual output of the plant will be 99,000 tons of urea, and 330,000 tons of nitrophosphate, plus 117,000 cubic meters of by-product argon gas. The plant described above represents some enlargement of the original concept which did not provide for the sulpho-nitric process for producing nitrophosphate, nor for the recovery of argon gas. It is now proposed to add to the fertilizer plant a methanol plant (to produce 33,000 tons per year). Additions to the fertilizer plant, together with over-runs in costs and minor plant improvements have increased the foreign exchange cost of the fertilizer plant by \$1.84 million and the foreign exchange cost of the methanol plant is estimated to be \$5.93 million, making a total additional foreign exchange requirement of \$7.8 million. The Government of India has made application for an AID loan to cover this amount.

### 3. Progress to Date

#### Financing:

(a) Funding for this project has been obligated as

follows:

FY 61, DLF Loan No. 162 signed Dec. 29, 1960	-	\$ 30,000,000
Project Agreement No. 108 signed April 3, 1961 PL 480 rupees equivalent to	-	\$ 28,052,000

(b) Future funding may include:

FY 64 Second dollar loan, if approved by A.I.D.	-	\$ 7,800,000
FY 64/65 PL 480 rupees to reimburse GOI for increased local currency costs, provided application is received with adequate justification.		

Other: Progress on major items of the project is given below (September, 1963):

Urea, Nitric Acid and Ammonia Plants	96% of equipment on hand 36% of erection complete
Nitrophosphate Plant	48% of equipment on hand
Other equipment for workshop, auto shop, laboratory, etc.	From 60% to 100% for various shops
Civil works:	
Main Plants	65% complete
Product Storage Facilities	15% complete
Water System & Facilities	38% complete
Conveyors	25% complete

Chemico estimates completion of the ammonia, nitric acid and urea plants between June and December, 1965. Erection of equipment by Chemical and Industrial Construction Co. (nitro-phosphate plant) has just begun.

Engineering: FCI has completed process and plant layout design and the design and construction of civil works. Detailed plant design is to be accomplished by the three major American companies who are furnishing the plant and equipment for the project.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-230-199	Trombay Fertilizer Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	--------------------------	-----

Suppliers: The ammonia, nitric acid, and urea plants are being supplied by Chemical Construction Corporation (CHEMICO); the nitro-phosphate plant by Chemical and Industrial Construction Company; and the steam generating plant by Vitro Corporation. Chemico has been given a letter of intent for the sulphuric acid plant.

4. Funding Requirement

Cost Estimate: The original cost estimate for the Trombay Fertilizer Plant, and revised estimate contained in the September, 1963, quarterly report are given below (amounts in million dollars):

Item	Original Estimate			September, 1963, Estimate		
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total
Main Plant	25.75	3.84	29.59	26.27	7.48	33.75
Erection	1.05	2.80	3.85	1.40	2.59	3.99
Steam Generating Plant	0.32	-	0.32	0.40	0.17	0.57
Equipment	0.62	0.48	1.10	1.08	0.74	1.82
Power Supply	0.19	0.13	0.32	0.26	0.24	0.50
Spares	1.90		1.90	1.72	0.63	2.35
Miscellaneous	-	0.01	0.01	-	0.01	0.01
Sub-totals	29.83	7.26	37.09	31.13	11.86	42.99
Land, buildings, township, roads, and other costs not involving D.L.F. funds		20.79	20.79		20.79	20.79

Item	Original Estimate			September, 1963, Estimate		
	Foreign Exchange	Local Currency	Total	Foreign Exchange	Local Currency	Total
Sulphuric Acid Plant				.63		.63
Argon Plant				.14		.14
Other additions to Plant				.11		.11
New Methanol Plant	-	-	-	5.93	2.01	7.94
Totals	\$ 29.83	\$ 28.05	\$ 57.88	\$ 37.94*	\$ 34.66	\$ 72.60

It is anticipated that the local currency requirement in connection with additions to the primary project plant and the new methanol plant, will also rise but estimates of the increased rupee requirements are not, as of December 1963, available.

\* Note: Minor recent adjustments in the estimate have reduced the estimated total foreign exchange requirement to \$37.77 million, which corresponds to the proposed additional financing of \$7.8 million.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1968	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-120-233	Beas Dam Project	E-1
------------------------	---------------------------------	---------------------------	--------------	----------------	------------------	-----

### 1. The Activity Target

Beas Dam (with the associated Pong Power Plant) is one of the three projects or "units" planned for developing the irrigation and hydroelectric power potentials of the Beas River. The principal targets of the over-all Beas development plan are the irrigation of 3.5 million acres of land now largely desert and the installation of 996 MW of new hydro-electric generating capacity. The plan also provides for some extension and improvement of existing irrigation and power developments. The U.S. will assist in the attainment of these targets by providing part of the required foreign exchange financing.

Background: Development of the Beas River is part of a comprehensive plan for utilization of the waters of the Ravi, Beas and Sutlej Rivers, the tributaries of the Indus River which originate in India. The basic Indian plan for Indus Basin development was formulated and partly implemented before the signing of the Indus Waters Treaty by India and Pakistan in 1960. (Bhakra Dam and the Bhakra-Nangal irrigation system of the Sutlej development were substantially completed before 1960.) Briefly, this plan provides for river to river diversion of water (Ravi to Beas and Beas to Sutlej) to maximize power and irrigation benefits, construction of large storage reservoirs on the Sutlej and Beas and extensive irrigation canal systems in Punjab and Rajasthan. The formal allocation of Ravi, Beas and Sutlej waters to India by the treaty has accelerated the development of these rivers.

The International Bank for Reconstruction and Development (World Bank) tentatively agreed to loan GOI \$23 million for the purchase of equipment required in constructing irrigation works on the Beas River and in the Rajasthan desert and the Development Loan Fund allocated \$33 million for a Beas Project loan. The originally proposed DLF loan was to be for Beas Dam (part of Unit II of the presently planned Beas-Rajasthan development) and it

was understood that the loan would be contingent upon meeting requirements of the then existing Section 517 of the Foreign Assistance Act. D.L.F. planned to use the findings of the World Bank on the technical and economic feasibility of the project in making the "517 review". After some time, however, the World Bank elected not to make a detailed feasibility study. Consequently, A.I.D. in the spring of 1963 engaged the Bureau of Reclamation to investigate the technical and economic feasibility of Beas Dam and to make a brief review of plans for the other units of the Beas-Rajasthan development plan.

#### Plan for Beas Development:

The three units of the Beas-Rajasthan development plan are:

Unit I - Beas-Sutlej Link, which would divert 3.8 million acre feet of water annually from the Beas River into the Bhakra Reservoir on the Sutlej. Principal features of the project are a 220-foot high concrete diversion dam, two tunnels (one 8 miles long, 25 feet in diameter and one 8.5 miles long, 28-feet in diameter) a 7.2 mile long canal, a balancing reservoir and a power plant with six units of 106 MW each, or a total of 636 MW of installed capacity. Beas water diverted to the Sutlej will also pass through the Bhakra Power House, resulting in an additional 148 MW of firm power (100% plant factor) at Bhakra. While some downstream irrigation benefits will result from Unit I, the main benefits will be from electricity generation in dropping the water 1400 feet.

Unit II - Beas Dam and Pong Power Plant consists of a 35 to 40 million cubic yard earthfill dam and an adjacent 360 MW power plant with six 60 MW units. The 380-foot high dam, located about 100 miles downstream from the Unit I diversion dam, will form a 6.55 million acre foot reservoir. Unit II is primarily an irrigation storage project, with 70% of the benefits from the Unit estimated to come from storage of water for the downstream Rajasthan Canal irrigation development.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-120-233	Beas Dam Project	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	------------------	-----

Unit III - Rajasthan Canal consists of a 426 mile long main canal and a system of lateral canals to carry Beas-Sutlej water to the Rajasthan desert. At the Harike Diversion Barrage, about 100 miles downstream from Beas Dam and immediately below the confluence of the Beas and Sutlej Rivers, the canal capacity will be 18,500 cu. ft. per second. The total irrigable area commanded by the canal system is 4.5 million acres, but the water supply (principally from releases from Beas Reservoir) is estimated to be sufficient for irrigating only 3.5 million acres.

The 1961/62 Punjab State System electric power load was 294 MW versus an installed capacity of 221 MW. The expected situation in 1970/71 (the last year of the electric power survey demand estimates) is that the system demand will be 1100 MW and the system capability of 957 MW. Generation from the Beas Unit I and Unit II power plants probably would not begin until 1971-72.

#### 2. Course of Action:

It is proposed to provide an A.I.D. loan of \$33.0 million. It was originally contemplated that the proposed \$33 million D.L.F. loan would be used only for foreign exchange costs of Beas Dam and providing for future construction of Pong Power Plant. Subsequently GOI requested that the proposed loan funds be made available for procurement of construction equipment for both the Beas-Sutlej Link (Unit I) and Beas Dam and Pong Power Plant (Unit II).

#### 3. Progress to Date:

Unit I: Work on this feature has been limited to investigation, planning, and preparation of preliminary designs and estimates for the diversion dam, tunnels, canal, reservoir, and powerhouse.

Unit II: Several items of construction work have been initiated at the Beas Dam site. Construction of access and utility facilities is well advanced. Many of the living quarters have been completed and approximately 5,000 workers are on the site. (About 50% of the 10,000 - 11,000 workers expected during later construction periods.) Site preparation has started and excavation work is being carried on at the portals of some of the diversion tunnels.

Unit III: Construction work has been in progress for several years and some features have been completed. The Harike diversion structure is complete, as is the greater portion of the Rajasthan Feeder Canal (the upstream 134-mile portion of the main canal). Construction is being carried on by a force of 12,000 laborers, with about half of the excavation being done by manual labor and half by mechanized methods.

It would appear that construction of the main canal has been pushed ahead without adequate soil investigation in the irrigable area. Considerable waste may result from providing irrigation water for very poor land and unwise allocations of available irrigation water.

#### 4. Funding Requirements:

Estimated Costs: (In millions of dollars)

	<u>Local Currency</u>	<u>Foreign Exchange</u>	<u>Total</u>
Unit I - Beas-Sutlej Link	153.48	56.53	210.01
Unit II - Beas Dam and Pong Power Plant	177.84	54.86	232.70
Unit III - Rajasthan Canal	436.65	-*	436.65
Totals	767.97	111.39	879.36

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-120-233	Beas Dam Project	E-1
---------------------------------	------------------------------------	------------------------------	--------------	----------------	------------------	-----

\*The Rajasthan Canal unit will have some foreign exchange costs (principally for imported construction equipment), but no request for U.S. financing has been made for this unit.

The combined financing commitment of A.I.D. and the World Bank amount to about 50% of the estimated total foreign exchange requirement. No application for additional financing has been received, but tentative provision for a loan of \$56.5 million for Unit I in FY 1965 was indicated in the E-1 for Project No. 386-22-250-278. If the currently proposed loan is used for construction equipment for both Units I and II rather than for all foreign exchange costs for Unit II only then the proposal for a future second loan will have to be revised appropriately.

AID FORM 10-120 (7-62)	DATE PREPARED 20 Dec. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-186 386-22-220-240	Chandrapura Thermal Plant Stage I Chandrapura Thermal Power Station Stage II	E-1
------------------------	-------------------------------	------------------------------	--------------	----------------------------------	---	-----

## 1. The Activity Target

The objective of these projects is to provide to the Damodar Valley Corporation's power system a 420-MW thermal electric power plant at Chandrapura. The United States will assist in the realization of this target by financing the foreign exchange costs of imported electrical generating equipment and associated costs of consulting engineering advisory services on design and supervision of construction through a dollar development loan, meeting also the local currency costs of construction and engineering through a development loan of PL 480 Section 104(g) rupees.

Background: The southern part of Bihar State and the State of West Bengal, with Calcutta on the eastern extremity, are known as the south Bihar-lower Bengal area for electric system identification. One of the most industrialized areas in India, it has one of India's heaviest concentrations of electrical generation and distribution capacity and the largest electrical system growth potential.

The establishment and expansion of critically needed steel production, chemical industries, heavy and light manufacturing, irrigation pumping, and railway electrification depend upon an adequate power supply, to which the Chandrapura power station will contribute substantially.

The Damodar Valley Corporation, a semi-autonomous government organization established for control and development of the Damodar River, is a multipurpose scheme with responsibilities for flood control, navigation and power. Hydroelectric generating facilities have been installed at the major dams which are operated for the combined benefits of flood control, navigation and electric energy generation.

The Damodar Valley area is rich in natural and human resources, and possesses good road and rail transport facilities toward Calcutta and to the west. As a result, industry has developed rapidly and the Corporation's hydroelectric system could not meet the demand

within its service area. Thus it is necessary to supplement the hydroelectric power installations with thermal power plants, the first of which came into operation in late 1953.

An extensive network of 132 KV transmission line and substations extending from central Bihar State to Calcutta also is part of the Corporation power system. The West Bengal State Electricity Board (WBSEB) and the Calcutta Electric Supply Corporation are two other major suppliers of electric energy in this area. The former and the Damodar Valley Corporation together give bulk supplies to almost three dozen licensees. The DVC's and the Board's generation and transmission systems are integrated; both make bulk sales to Calcutta Electric Supply. Through an interconnection to the Rihand Hydro Plant (also U.S. assisted) almost 100 megawatts were imported into the DVC system on a few occasions, usually varying between 24 and 40 MW. Another tie line, of limited capacity due to its length, connects Hirakud Hydro Plant in Orissa with the DVC-WBSEB system. Scheduled generating capacity additions (including Chandrapura units 1 and 2), allowing for retirements of obsolete capacity, will supplement net capability in the area by 1,360 MW by March 1967, while projected increases in peak load will add 1,000 MW to the existing demand. The Chandrapura Plant will represent about 30% of the increase in generating capacity.

## 2. The Course of Action

Financing: On June 30, 1960, DLF Loan No. 125 was signed providing \$30 million to meet the foreign exchange costs of units No. 1 and 2 of the Chandrapura Thermal Station and additions to the transmission and subtransmission system and existing substations, and some new substations.

On October 21, 1963, AID Loan Agreement No. 84 was signed providing for \$16 million to meet the foreign exchange costs of the third unit in Chandrapura.

On April 3, 1961, under Project Agreement No. 102, Rs. 205 million (equivalent to \$42.82 million) was provided to meet local currency costs of Stage I.

AID FORM 10-120 (7-62)	DATE PREPARED 20 Dec. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-186 386-22-220-240	Chandrapura Thermal Plant Stage I Chandrapura Thermal Power Station Stage II	E-1
------------------------	-------------------------------	------------------------------	--------------	----------------------------------	---	-----

Description of Project: The Chandrapura Thermal Power Station, whose first stage consists of two 140 MW maximum-continuous-rating turbine-generators and whose Stage II calls for a third identically-rated unit, is now being built in the Damodar Valley area, about 20 miles northeast of the Bokaro Thermal Plant. Bokaro, which began operation in 1953, was then the largest thermal plant in south Asia; its present capacity is 225 MW. Chandrapura power plant is essentially a mouth-of-mine power plant which will get its fuel supply of middlings from the Dugda Coal Washery, about 8,000 feet distant. This 600-ton per hour coal washery, one of a number now going into operation in India, is owned and operated by the Hindustan Steel Corporation primarily to provide washed coal of metallurgical grade for steel plants in the area. Its first stage is operating and a second stage, under implementation, will double the capacity.

Stage I of the Chandrapura Project provided for additions to the DVC's 132 KV transmission system. Aside from lines directly connecting the Chandrapura Power Plant, the DVC transmission system is being "heavied up" to assure satisfactory operation over its entire area, taking into account the additional power to be available from the Chandrapura third unit and from other power plant extensions going into the system. Additions to the 33 KV subtransmission system and substation facilities also are included under Stage I.

Gibbs and Hill, a U.S. consulting firm, is responsible for advisory services in design engineering, supervision of construction and initial operation for the entire first stage. Scope of services for engineering on Stage II has been established and tenders soon will be issued for consulting engineering services.

Major suppliers of equipment to Chandrapura stage I are as follows:

Turbine-generators - General Electric. These now are stored at site.

Boilers - Combustion Engineering. Shipment to be completed by November 1963.  
Condensers - Allis-Chalmers. Shipment to be completed by November 1963.

Cost Estimate - in millions of dollars

<u>Stage I</u>	<u>Foreign Exchange</u>	<u>Local Rupee equiv.</u>	<u>Total</u>
2 boilers	7.5 )		
2 turbine generators	6.5 )	28.8	
2 condensers, coal and ash plant transformers, switchgear, engineering	9.3 ) 4.6 )		
Subtotal	27.9	28.8	56.7
Transmission equipment	2.1	10.7	12.8
Miscellaneous	-	3.5	3.5
Total-Stage I	30.0	43.0	73.0

Stage II - Cost Estimate - in millions of dollars

	<u>Foreign Exchange</u>	<u>Local Rupee equiv.</u>	<u>Total</u>
1. Site Preparation and Improvements	-	.2	.2
2. Civil Works & Construction	-	2.6	2.6
3. Equipment & Erection	14.4	4.1	18.5
4. Engineering & Testing	.4	.2	.6
5. Establishment & Overheads	-	1.2	1.2
6. Contingencies	.4	.2	.6
7. Miscellaneous Buildings	-	.6	.6
8. Special Tools & Parts	.8	.4	1.2
Total - Stage II	16.0	9.5	25.5

PA 25.5

AC-42b

AID FORM 10-120 (7-62)	DATE PREPARED 20 Dec. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	86-22-220-186 86-22-220-240	Chandrapura Thermal Plant Stage I Chandrapura Thermal Power Station Stage II	E-1
---------------------------------	-------------------------------	------------------------------	--------------	--------------------------------	---	-----

### 3. Progress to Date

Progress to date on Stage I is described below. Only preliminary exploration and design work has been done on Stage II, but since Stage II is essentially a duplication of the units in Stage I the basic engineering is mostly done and engineering effort now will be directed to detailed designs to adapt unit 3 to the site situation. Civil engineering features are being executed largely by the DVC, including such major items as foundation and superstructure for the turbine-generators and powerhouse. Cooling towers are being built under contract; International Combustion Engineering Ltd., is erecting and installing the boilers; turbine-generators will be erected by the DVC, assisted in erection engineering by the manufacturer.

Excavation	- about 72% complete
Structural Steel, unit No. 1	- 100% complete
Structural Steel, unit No. 2	- 99%
Cooling Tower No. 1	- 100%
Cooling Tower No. 2	- 55%

Erection of turbine generator has started.

### 4. Funding Requirements

Funding for this project has been obligated as follows:

FY 60, DLF Loan No. 125	\$ 30,000,000
FY 64, AID Loan No. 84	\$ 16,000,000
FY 61, Project Agreement No. 102 PL 480 Rupees equivalent to	\$ 42,819,000

Additional local currency equivalent to \$9,500,000 will be required for Stage II, and a request for this amount is anticipated.

AID FORM 10-120 (7-62)	DATE PREPARED 20 DEC. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	886-22-220-198	Barapani Hydroelectric	E-1
---------------------------------	-------------------------------	------------------------------	--------------	----------------	------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Assam State Electricity Board with a 27 MW hydroelectric development on the Uiam River near Shillong. The United States will assist in the attainment of this target by financing the foreign exchange costs of construction equipment and hydroelectric generating equipment and by meeting at least part of the local currency costs of construction.

Background: Assam is located in the northeastern part of India where, due to poor transportation facilities, power development has been slow. It is expected to develop rapidly in the next few years, in view of the appreciable occurrence of oil and natural gas in the Naharkatiya area, and with the setting up of a refinery at Gauhati. Tea gardens are an important industry in this state, which produces the bulk of the tea produced in India. It also has considerable hydroelectric and coal resources, is rich in forests and has an abundance of bamboo and sabai grass.

Assam State and Nagaland form a separate power region, along with the North East Frontier Agency (NEFA) and Manipur and Tripura, which are small Union Territories located within Assam State. There are at present two power systems being developed which, in due course, will cover the state. One is the Umtru-Uiam Power System which serves the southern and western part of the state, and the other is the Naharkatiya Power System which serves the eastern and northern part of the state. The present project is a part of the Umtru-Uiam System.

The project, under construction by the Assam State Electricity Board, is essential to economic development in Assam. Only about 2.5% of the estimated 10,000,000 population of Assam is served by existing (13,000 KW) power facilities. The present annual per capita power consumption approximates only 1.61 kwh.

### 2. The Course of Action

Financing: To provide AID development loans of \$2.5 million and Rs.64 million (equal to \$13.44 million) to meet foreign exchange and local currency costs respectively of the project.

Description of Project: The project is located on the Uiam River, about 9 miles from Shillong, the capital of Assam.

A concrete gravity dam, 210 feet in height above foundations (178 feet above stream bed), and 580 feet long in crest length, will store a total of 124,500 acre ft. of water, of which 93,000 acre feet will be live storage. The watershed above the dam has a total area of 84.6 sq. mi. and average annual precipitation is 105 inches. There is, however, little dry weather flow. Therefore the live storage (93,000 acre feet) will have to carry the power generation for an eight-month period each year. This would permit an average depletion of about 400 acre feet per day (less evaporation).

The spillway is designed to accommodate a flood flow of 65,000 cu. ft. per second. Control will be provided by three 40 ft. by 36.4 ft. gates. Normal full reservoir level is at 3210 ft. elevation. The top of the dam (roadway) is at 3216 feet elevation.

Two earth dams, one with a maximum height of 80 feet and a length of 1400 feet, and the other with a maximum height of 40 feet and a length of 550 feet, occupy saddles in the reservoir area.

The power house is located in an adjacent watershed, with tunnel connection to the reservoir. The tunnel terminates in a twin penstock, each branch of which again divides just prior to reaching the turbines. Three Francis type turbines, of 9,000 kw each, are to be installed with a tail water elevation of 2660 feet. Design flow (available during the monsoon) is 775 cu. ft. per second. The gross head will vary from 550 feet to a minimum of 490 feet. (min. reservoir level is 3150). Net head is stated to be 507 (max.) to 428 (min.), with an average (dry season) of 467 feet. At a dry season withdrawal of 400 acre ft. per day,

AID FORM 10-120 (7-62)	DATE PREPARED 20 DEC. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-198	Barapani Hydroelectric	E-1
------------------------	-------------------------------	------------------------------	--------------	----------------	------------------------	-----

flow would amount to approximately 200 cu. ft. per sec. This would result in approximate power generation of 6200 KW at 100% load factor, or 12,500 KW at 50% L.F.

Transmission of power will be at 132 KV. The project includes 72 miles of double circuit and 33 miles of single circuit transmission lines to serve the Cherrapunji, Shillong, and Gauhati areas in Assam.

Discharge from the Barapani Power House will flow into the Umtru River and will be available for augmenting flow available at the existing Umtru Power House. This plant is located at elevation 404 feet. A total of 2256 feet of head remains available for development and the Assam State Electricity Board is preparing plans for utilizing the head between Barapani tail race and Umtru.

Engineering: Engineering for this project has been performed by the staff of the Assam Electricity Board. The Central Water and Power Commission assists State Engineers with special problems and reviews designs and specifications.

Suppliers: World-wide procurement was authorized for this project, and many U.S. construction equipment manufacturers received orders for backhoes, drills, tractors, scrapers, cranes, laboratory equipment, etc.

Turbines and generators are being supplied by the S. Mitsui Co., Japan. Other electrical equipment has been supplied by manufacturers in the U.S., U.K., West Germany, Switzerland, Sweden, Italy, Austria and France.

Cost Estimate: The cost estimate contained in the loan application, together with an estimate compiled from the September, 1963, quarterly report of expenditures made and anticipated in the future, is shown below (in million of dollars):

Item	1959 Estimate			1963 Estimate		
	Local Currency	Foreign Exchange	Total	Local Currency	Foreign Exchange	Total
Main Concrete Dam	4.10	0.40	4.50	4.18	0.15	4.33
Earth Dams	0.25	0.10	0.35	2.43	0.65	3.08
Intake & Tunnel	1.33	0.10	1.43	1.36		1.36
Penstock	0.78		0.78	0.78	0.11	0.89
Power House	0.44		0.44	0.61		0.61
National Highway	0.44		0.44	0.82	0.05	0.87
Elec. Gen. Equipment	0.80	1.20	2.00	6.96	1.27	8.23
Elec. Dist. Equipment	1.69	0.70	2.39			
Colony, land, roads, and Misc. exp.	3.27		3.27	4.99	0.01	5.00
	<u>13.10</u>	<u>2.50</u>	<u>15.60</u>	<u>22.13</u>	<u>2.24</u>	<u>24.37</u>

There is an apparent increase in the local currency cost of the project which approaches \$9 million since the original cost estimates were prepared, while the foreign exchange cost has remained within the original estimate. Additional rupee financing required for the project will be provided by the GOI.

### 3. Progress to Date

Financing: On December 5, 1960, DLF Loan No. 141 was signed, providing \$2.5 million in dollar financing to meet the foreign exchange cost of the Barapani Hydroelectric Power Project.

AID FORM 10-120 (7-62)	DATE PREPARED 20 DEC. 1963	COOPERATING COUNTRY IND IA	UNCLASSIFIED	306-22-220-198	Barapani Hydroelectric	E-1
---------------------------------	-------------------------------	-------------------------------	--------------	----------------	------------------------	-----

On April 13, 1961, Project Agreement No. 107 was signed, providing Rs. 64 million (dollar equivalent \$ 13.44 million) under PL 480 Section 104 (g), to meet local currency costs of the project.

Other: The progress attained to September, 1963, on construction of the project is shown in the following:

Construction commenced	:	October, 1961
General Contractor	:	Hind Construction Company
Dam - Concrete Work	:	54% complete
Tunnel - bore completed	:	50% complete
- lining	:	50% complete
Penstock	:	61% complete
Power House - Excavation	:	complete
- columns	:	All erected to roof elevation
- crane beams	:	complete
- roof trusses	:	44% complete
Earth Dams	:	50% complete
Transmission Lines -		
single circuit	:	95% complete
double circuit	:	70% complete

Presently scheduled commissioning dates are:

1st 9 MW unit	-	November, 1964
2nd 9 MW unit	-	January, 1965
3rd 9 MW unit	-	April, 1965

#### 4. Funding Requirements

Funding for this project has been obligated as follows:

FY 61, DLF Loan No. 141, signed December 5, 1960, \$2,500,000  
 ProAg No. 107 signed April 13, 1961, PL 480 Section 104(g)  
 rupees equivalent to \$ 13,440,000.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	306-22-220-207	Talcher Thermal Power Plant	L-1
------------------------	------------------------------------	------------------------------	--------------	----------------	-----------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Orissa State Electricity Board power system with an additional 250 MW of generating capacity to meet the growing power requirements within and near the State. U.S. A.I.D. has agreed to finance through loans the total foreign and local currency costs of the project.

Background: The project is located near the town of Talcher on the Brahmani River in Northern Orissa about 70 air miles from the state capital, Bhubaneswar. The project is to include a 250 MW thermal power station complete with power transmission equipment and lines to deliver the generated energy to existing transmission-distribution systems. The project site is near a coal producing area and is essentially a mine-mouth plant; the entire fuel requirements are to be delivered to the project by a 5½ mile belt conveyor from the mining area.

### 2. The Course of Action

Financing: To provide a \$33,000,000 development loan to meet foreign exchange costs of the Talcher Thermal Power Project and a PL 480 Section 104 (g) loan of Rs. 85 million (equivalent to \$17.8 million) to meet local currency costs.

Description of Project: The Talcher Project, a 250 MW addition to the existing Orissa State Electricity Board facilities, will be comprised of four units of 50/62.5 MW turbo-generators, each supplied steam from a 570,000/hour boiler. The project will include necessary coal supply and ash handling equipment, cooling towers, 82 miles of 132 KV double-circuit transmission line and 62 miles of 132 KV single-circuit transmission line. The project will be inter-connected at Joda and Chainpal with the Hirakud hydro system and at Cuttack with the Hindustan Steel Company System. With the Hirakud (and Chapline) Stations having 209.5 MW installed and

61.5 MW under construction and the Hindustan Steel plant having an installed capacity of 75 MW, the inter-connected system installed capacity upon completion of the Talcher Project will be 596 MW. Dependable peaking capability would be approximately 450 MW, due to variations of water conditions at Hirakud and Chapline, first call of Hindustan Steel on their capacity and allowing one Talcher unit to be out of service for maintenance. As load grows, it is expected the Talcher plant will be expanded by the addition of two 140 MW thermal units.

Engineering: Preliminary engineering and planning were accomplished by the Orissa State Electricity Board in cooperation with the Central Water and Power Commission. The contract for engineering services negotiated with Gibbs and Hill of New York contains understanding that part of the work would be sub-contracted to an Italian firm, Societa Edison. A portion of the detailed design has been undertaken by the Orissa State Electricity Board, but all engineering is to be reviewed and approved by Gibbs and Hill, who are responsible for all engineering.

Suppliers: The Talcher Project has been allocated four identical turbo-generators of 50/62.5 MW capacity procured under a bulk purchase plan for International General Electric.

#### Other Major Units

#### Supplier

Boilers

Babcock and Wilcox, U.S.A.

Structural Steel

Stupp Bros. Bridge & Iron Co.  
St. Louis, Mo.

Boiler Feed Pumps

Pacific Pumps

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-207	Talcher Thermal Power Plant	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	-----------------------------	-----

### 3. Progress to Date

With the approval of the project for financing and the signing of DLF Loan Agreement No. 190 (\$33.0 million) in August 1961, the Orissa State Electricity Board began immediate implementation of the project and has taken the following steps:

Obtained engineering services	October 1961
Procured land	Oct./Nov. 1961
Initiated construction of colony	May 1962
Selected construction contractor	April 1963
Site grading begun	May 1963
Grading completed	November 1963
Foundation construction started	December 1963

Present construction progress is somewhat behind the original schedule, but project officials feel that the initial generation date of December 1965 is possible if no major problems are encountered. This revised schedule delays initial operation several months, but does not make allowance for such contingency time.

### 4. Funding Requirements:

#### Cost Estimate:

#### Foreign Currency Costs:

Turbine-Generators, Boilers, Structural Steel, Feed Pumps, Coal and Ash Handling, Cooling towers, etc.	26,800,000
Indoor Switchgear	840,000
Outdoor Switchgear & Power Transmission	2,000,000

Transmission Line Insulators	420,000
Substation Equipment	1,570,000
Aluminum ingot for ACSR	520,000
High tensile strength steel wire for ACSR	160,000
Engineering Services	690,000
Total	\$ 33,000,000

(Covered by DLF Loan No. 190, Signed August 16, 1961.)

#### Local Currency Costs (Rupee Cost in US \$ equivalent)

Power Plant	10,700,000
Transmission and Substation	2,760,000
Engineering, Management, etc.	4,340,000
(To be provided through a PL 480 rupee loan)	\$ 17,800,000
Total Project Estimate	\$ 50,800,000

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-208	Birsinghpur (Amarkantak) Thermal Plant	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	--	-----

### 1. The Activity Target

The objective of this project is to provide the Madhya Pradesh Electricity Board with a 60 MW thermal electric power plant in the eastern Madhya Pradesh area. The United States will assist in the realization of this target by financing the foreign exchange costs of the imported electrical generating and transmission equipment and the local currency cost of engineering and construction.

Background: The Amarkantak power plant is located near the town of Amlai which is in eastern Madhya Pradesh on the Southeastern Railway between Katni and Bilaspur. The first site chosen for this power plant was at Birsinghpur about 35 miles northwest of Amlai, and the project was given the name Birsinghpur initially. The site subsequently was moved to Amlai because of a better cooling water pond situation, with the result that the project occasionally has been called Amlai. The official project name now is Amarkantak, the name of a village shrine at the headwaters of the Narmada River some 25 miles from the power plant site. The State Electricity Board has adopted the designation of Amarkantak to perpetuate the name of the shrine.

Madhya Pradesh is the largest state in India in terms of area as well as in terms of distances from east to west and north to south, which are of the order of 625 miles. With a population density of 189 persons per square mile, the State is among the least densely populated parts of India.

Nevertheless, many of the isolated distribution systems originally serving small local areas have been inter-connected by 33 KV and 66 KV sub-transmission circuits to a greater degree than might be expected. In terms of major transmission, there now are three sub-systems, one in the eastern part of the state to which Amarkantak will be connected, another in the central sector which connects electrically with part of the eastern Maharashtra system, and the third in the western portion of the state.

Integration of these systems will be effected within the next five years by 220 KV and 132 KV main transmission circuits.

The coal field belt which plays such a prominent part in the economy of West Bengal and Bihar extends to the east-central and southern parts of Madhya Pradesh. Amarkantak Power Plant is in the Rewa colliery area and it was no surprise that coal was found in digging foundations for the power plant. In the south-eastern part of the state are the Bhilai steel project, put into operation within the last 18 months, and the Korba thermal plant of 100 MW installed capacity, also recently commissioned. The Bhilai steel plant is connected to Korba by double-circuit 132 KV line, which will serve as a sub-transmission feature when a double-circuit 220 KV line to Bhilai and south to Bailadilla goes into operation. North of Jabalpur are several cement factories and one diamond mine. The city of Jabalpur, headquarters of the Madhya Pradesh Electricity Board, at present is dependent upon 13.5 MW of old steam capacity and 1.5 MW of diesel. An ordinance center dating back almost 100 years, Jabalpur is experiencing an upsurge in manufacturing activity as a result of the military situation.

The Gandhi Sagar Hydroelectric/Irrigation Scheme, which serves areas in both Rajasthan and Madhya Pradesh, at present has 92 MW of capacity operating, of which 46 MW are reserved for Madhya Pradesh. This power is being delivered into the Ujjain-Indore-Bhopal area by 132 KV transmission. The Gwalior area in the extreme northern part of Madhya Pradesh also is receiving power from Gandhi Sagar.

### 2. The Course of Action

Financing: To provide a dollar development loan of \$8,400,000 to meet the foreign exchange cost of the Amarkantak Power Plant including the turbine generator, boiler, coal and ash handling equipment, as well as imported equipment for sub-stations inclusive of switchgear and some transformers, and a PL 480 Section 104(g) loan of Rs. 66.7 million (equivalent to \$ 14 million) to meet local currency costs of the project.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	36-22-220-208	Birsinghpur (Amarkantak) Thermal Plant	E-1
------------------------	------------------------------------	------------------------------	--------------	---------------	--	-----

Description of Project: The Amarkantak project combines generation, transmission and sub-transmission features. The equipment has come from worldwide sources, including Austrian boilers; AEG (German) turbo-alternators, consisting of 2-30 MW units; Austrian coal handling equipment from the same suppliers furnishing the boilers; a Westinghouse auxiliary supply transformer; switchgear from ASEA, and Oerliken (Swiss); Brown-Boveri carrier communications equipment (Swiss); Italian transformers; and Japanese line-insulators and hardware. Although the boiler equipment is Austrian, boiler controls are being supplied by Siemens (Germany). Coal will be supplied to the plant from nearby collieries in the Amlai and Birsinghpur areas, brought in by rail. Cooling water for the plant will be provided by a small reservoir, covering roughly 1300 acres, formed by an earthfill/rock-fill dam, 3390 feet in length, maximum height 67 feet, built on the Sathna nullah (which joins the Narmada River just below the dam). Cooling will be effected by the circulation and heat radiation provided by the area of the lake.

Transmission features included in the project are a 132 KV line from Amarkantak east to Chirimiri, about 50 miles; a 132 KV line from Chirimiri to the existing Korba Thermal Plant; and certain line sections north of Jabalpur to load centers along the railway leading to Allahabad. The line sections with which DLF financing is directly involved are the Amarkantak-Chirimiri and the Katni-Kymore-Satna lines plus miscellaneous 33 KV sub-transmission lines. Most of the higher voltage switching equipment and some of the control and communications equipment is DLF financed.

Basic design for the power plant was done by the Madhya Pradesh Electricity Board with detailed design, supply, erection and commissioning of the turbine-generator, condenser, and piping to be done by the supplier. Similarly, detailed design, supply and erection of the boiler, coal handling, and hydraulic ash handling equipment is the responsibility of the Austrian firm, Sinmering-Graz-Panker.

Powerhouse steel design, detailing, fabrication and erection is to be done by an Indian engineering firm.

Cost Estimate: No complete cost estimate is available in the DLF loan documents filed with USAID. The estimate given below accounts for the foreign exchange cost (amounts in millions of dollars). The local currency cost for the project is expressed as an overall total of Rs. 66.3 million.

<u>Item</u>	<u>Foreign Exchange Cost</u>
Two boilers, with coal and ash-handling equipment	\$ 4.2
Two turbo-alternators with condensers and auxiliaries	1.9
Switchgear, transformers, insulators, etc.	2.3
Total	<u>\$ 8.4</u>

U.S. A.I.D. has requested precise cost data from the Madhya Pradesh State Electricity Board.

### 3. Progress to Date

Financing: DLF loan No. 191, signed August 16, 1961, \$3,400,000. Project Agreement No. 113, signed June 1, 1962, Rs. 66,700,000 (equivalent to \$ 14,000,000).

Other: As of November 1963 the Amarkantak Power Plant is 85% completed according to progress reports. A site inspection by mission personnel in November, 1963, showed the power house superstructure finished; both

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1964	COOPERATING COUNTRY INDIA	UNCLASSIFIED	B 6-22-220-208	Birsinghpur (Amarkantak) Thermal Plant	E-1
---------------------------------	------------------------------------	------------------------------	--------------	----------------	--	-----

boilers hydrostatically tested, with work being concentrated on one boiler to finish installation of boiler controls; the number one turbine top half about ready to be put in place, boiler controls and instrumentation set in place, but not yet connected; substation control building footings and foundations in place; coal handling plant about two-thirds completed; most of the earth work and rockfill on the dam completed with masonry spillway and installation of gates being the major incomplete items on the dam. Progress on transmission lines varies from the completion of the Amarkantak-Chirimiri 132 KV line to 10% completion of the Kymore-Satna line. Progress on substation construction is not equally advanced, only site preparation being done at several locations. However, all equipment and material is on hand and completion of these features by the end of May, 1964, is feasible. Initial operation of Unit No. 1 at Amarkantak is scheduled for May, 1964.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-236	Ramagundam Thermal Power Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	--------------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Andhra Pradesh State Electricity Board with a 62.5 MW thermal power plant and associated additional transmission facilities. The United States will assist in the attainment of this target by financing the foreign exchange costs of imported electrical generating equipment and of related engineering services and by meeting the local currency costs of construction.

Background: Andhra Pradesh is presently served by three separate power systems: The Machkund system in the north; the Telengana system in the east; and the Tungabhadra system in the south and west. In the future development of zonal grids in India, the Tungabhadra system will be absorbed into Region I - Western Ghats, consisting of Kerala, Madras, Mysore and South Andhra Pradesh. The other two systems will form a part of Region II - Eastern Ghats, covering North Andhra Pradesh, South Orissa, East Maharashtra, and South Madhya Pradesh.

The present project will form a part of the existing Machkund Power System, which is a joint system of the States of Orissa and Andhra Pradesh, serving the southern part of the former and the northern portion of the latter. In 1961-62, this system had a capability of 114 MW (79 MW in Andhra Pradesh). By 1965-66, the Telengana and Machkund systems are scheduled to be inter-connected and the total capability (in Andhra Pradesh) to amount to 433 MW, but attainment of this system capability may be delayed.

There is presently (December 1963) a serious power shortage in the Machkund system area and power restrictions aggregating 20 MW or more are enforced.

The principal service area for Ramagundam is the Hyderabad-Secunderabad metropolitan area where a major railroad division point, cement factories, paper and textile mills, and other industries are dependent on the power produced. Coal mines in

the vicinity will also be served by the power station.

### 2. The Course of Action

Financing: To provide \$8.4 million in dollar development loan financing to meet the foreign exchange cost of the 62.5 MW Ramagundam Power Project; and a PL-480 Section 104 (g) loan of 37.7 million rupees (approximately \$7.8 million dollar equivalent) to meet local costs of the project.

Description of Project: The Ramagundam Power Plant is located in the northern part of the State of Andhra Pradesh, about 150 miles north-east of Hyderabad, the state capital. The new plant will be an extension to an existing 37.5 MW installation. The turbo-generator for this project is one of 14 similar units purchased from International General Electric under a bulk purchase contract. In addition to the thermal plant, transmission and distribution facilities covering portions of northern Andhra Pradesh are included in the project. The power plant is about six miles from the Janagaon Collieries, the primary source of fuel. Other producing coal mines are also in the general vicinity. Water supply will be obtained from the Godavari River, where the existing pumping plant will be augmented by additional pumping capacity.

In addition to the I.G.E. 62.5 MW turbine-generator, major items of the project include a 600,000 pound per hour coal fired steam generating unit; one 75 MVA and two 20 MVA power step-up transformers at Ramagundam; a 50 MVA transformer and two 15 MVA synchronous condensers at the Yerragadda substation at Hyderabad; 130 miles of double-circuit 132 KV transmission line from Ramagundam to Yerragadda; and distribution load center sub-stations in the service area.

Unique features of this project are that coal will be transported from Janagaon to Ramagundam by aerial ropeway and that steel and aluminum will be procured in the U.S. for fabrication into ACSR transmission line conductor cable in Indian factories.

Engineering: Burns and Roe, Inc., a U.S. consulting engineering firm

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-236	Ramagundam Thermal Power Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	--------------------------------	-----

is to provide, and/or review and approve or comment on detailed designs for the power station, supervision of construction, and supervision of initial plant commissioning.

3. Progress to Date

Financing: FY 63 AID Loan No. 49 signed May 21, 1963, \$8,400,000. FY 64 Scheduled Project Agreement providing Rs. 37.7 million (equivalent to \$7.8 million).

Other: Some site cleaning and preliminary work is under way. A contract has been awarded for construction of the circulating water cooling towers and foundation work is underway. The Burns and Roe engineering service contract was signed in July 1963 and four U.S. engineers are at the job site. The major portion of design work, however, is expected to be done in the New York Office of the firm. Specifications for the steam generating unit have been issued and the bids will be opened in January, 1964.

The scheduled target date for commissioning is June, 1965.

4. Funding Requirements

Cost Estimate: The cost estimate for this project is as follows: (in \$ million):

<u>Item</u>	<u>Foreign Exchange</u>	<u>Local Currency (\$ Equiv.)</u>	<u>Total</u>
Boiler, coal and ash-handling, and other mechanical equipment.	\$ 3.9	\$ 2.4	\$ 6.3
Turbo-generator and Switchgear	1.9	0.5	2.4
Transformers, Circuit Breakers	0.7	0.1	0.8
Aerial Ropeway	0.7	0.1	0.8

<u>Item</u>	<u>Foreign Exchange</u>	<u>Local Currency (\$ Equiv.)</u>	<u>Total</u>
Transmission lines	\$ 0.8	\$ 4.3	\$ 5.1
Engineering Services	0.4	-	0.4
Contingencies	-	0.4	0.4
	<u>\$ 8.4</u>	<u>\$ 7.8</u>	<u>\$ 16.2</u>

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-238	Satpura Thermal Power Plant	E-1
------------------------	--------------------------------	---------------------------	--------------	----------------	-----------------------------	-----

## 1. The Activity Target

ive

The object of this project is to provide the Madhya Pradesh Electricity Board with a 312 MW thermal-electric power plant in the southern Madhya Pradesh area. The United States will assist in the realization of this target by financing the foreign exchange costs of the imported electrical generating equipment plus associated costs of consulting engineering services for design and supervision of construction.

Background: The Satpura power plant site is in southern Madhya Pradesh, about 12 miles east of Ghoradongri, a station on the Betul-Itarsi line of the Central Railway. Conditions favoring selection of this site were proximity to extensive coal deposits and a good site for barrage on the Tawa River which will form a condenser water cooling pond capable of handling a plant of up to 1,000 MW capacity. Another consideration was the desirability of placing substantial thermal power plant capacity toward the south-western portion of the state since there are now several sizable installations in the eastern part. Furthermore, the State of Rajasthan will utilize the capacity of two of the five units to be installed at Satpura as part of an arrangement of sharing hydro capacity on the Chambal River which separates Rajasthan and Madhya Pradesh on the north-west boundary of the latter.

Madhya Pradesh is the largest state in India in area as well as in terms of distances from east to west and north to south, which are in the order of 625 miles. With a population density of 189 persons per square mile, the state is among the less densely populated areas in India. Nevertheless, many of the isolated distribution systems originally serving small local areas have been inter-connected by 33 KV and 66 KV subtransmission circuits to a greater degree than might be expected considering this sparse population density. In terms of major transmission, there now are three sub-systems, one in the eastern part of the state, another in the central sector which connects electrically with part of the eastern Maharashtra system and to which the Satpura

Power Plant will be connected, and a third in the north-western part of the state which connects with the Chambal hydro system and which in turn feeds the extreme northern part of Madhya Pradesh. Integration of these systems will be effected within the next five years by 220 KV and 132 KV main transmission circuits. The Chambal River scheme mentioned previously includes the Gandhi Sagar Hydro-electric Plant which is very close to the Madhya Pradesh-Rajasthan state boundary. This plant at present has 92 MW of capacity operating, of which 46 MW are reserved for Madhya Pradesh. This is being delivered into the Ujjain-Indore-Bhopal area by 132 KV transmission lines going through Rajasthan into extreme northern Madhya Pradesh.

The coal field belt which plays such a prominent part in the economies of West Bengal and Bihar extends to the east-central and southern part of Madhya Pradesh. Coal deposits known as the Pench Valley System extend along the southern part of Madhya Pradesh and it is adjacent to one of these fields that Satpura Power Plant site is located. Mineral as well as coal deposits in Madhya Pradesh are assuming increasing importance with such development as the Bhilai Steel Project, put into operation within the last eighteen months, and several cement plants north of Jabalpur. The city of Jabalpur, headquarters of the Madhya Pradesh Electricity Board, at present is dependent upon 13.5 MW of obsolete steam capacity and 1.5 MW of diesel capacity. An ordinance center dating back almost 100 years, Jabalpur is experiencing an upsurge in manufacturing activity as a result of military situation in India.

## 2. The Course of Action

Through an AID development loan to provide \$25.1 million to meet the foreign exchange costs of the Satpura Power Plant including the turbine-generators, station electrical equipment, coal and ash handling plants, main transformers and principal switchgear equipment for the substation and major station service equipment. About 7.6 million dollars equivalent in Sterling credits will be provided for British made boiler parts and equipment, independent of U.S. dollar financing. If funds available permit, a PL 480 Section 104 (g) rupee loan may be made to cover local costs of the project.

PAGE AC-94a

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-238	Satpura Thermal Power Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	-----------------------------	-----

Description of Project: The Satpura Thermal Power Plant Project, as defined in the loan description, consists of five 62.5 M. turbine-generator units, a substation with switching facilities for 220 KV and 132 KV, coal storage and coal handling facilities, ash handling facilities, a large cooling water pond and a residential colony for employees. The surrounding country is almost entirely virgin forest with the railhead at Ghordangri being the only center of any consequence in the area. In addition to the power plant itself, and financed by non-AID foreign exchange and local funds, is a transmission network connecting Satpura with Tawa to the north and Jabalpur to the east, plus 220 KV connections through Punasa-Indore-Ujjain and also through Bhopal to the western sub-system. These transmission lines along with others will inter-connect the three separate sub-systems in Madhya Pradesh into one system.

Turbine-generator equipment for Satpura will come from the bulk purchase agreement under which fourteen such units are being furnished to various projects by the General Electric Company. The boilers are being fabricated in India from raw material and semi-finished material imported from the United Kingdom. Physical and electrical layout of the power plant will follow conventional practices with the boilers, turbine-generators and main power transformers being arranged on a unit system. One unique feature is the cooling water arrangement whereby a lake, formed by building a barrage on the Tawa River, will virtually surround the power plant on three sides making it possible to have the cooling water intake directly on the lake. The cooling water discharge will go into a 2,000 cu. sec. canal at a slightly higher elevation which will follow the contour of the lake until it reaches the vicinity of the barrage, at which point it will empty into the river below the barrage.

Consideration is being given to increasing the capacity of the Satpura Power Plant to 1,000 MW. Power plant design features needed by a plant of such size are being planned accordingly,

including a proposed arrangement for carrying the cooling water discharge further around the artificial lake and emptying it into the lake opposite the power plant at some distance away. Under this arrangement, mixing of the warm water with lake water and radiation of heat from the lake is expected to provide ample cooling for a 1,000 MW plant.

Design, supervision of construction and responsibility for initial operation have been entrusted to the Kuljian Corporation, U.S. consulting engineers with a subsidiary office in Calcutta.

### 3. Progress to Date

Funding for this project has been obligated as follows:

FY 63, AID loan No. 77 signed March 8, 1963 - \$25.1 million.

The GOI has requested a FL 480 Section 104(g) rupee loan of Rs. 162 million (= \$34,015,000) to meet local costs of this project, which will be formalized when available funds permit.

As of November, 1963, all the basic plant characteristics have been determined and the detailed design work is about 75% complete. A road has been built from Ghoradongri railroad station to the power plant site which has suitable alignment, width grade, and bridges for hauling the heavy equipment to the site. Temporary field engineering offices have been in operation since the middle of the year, the consulting engineers' permanent offices and residences are ready for occupancy, work on colony housing and the project guest house has started and excavations for the No. 1 turbine generator have been started. Some of the boiler parts are at the Ghoradongri Railroad Station and will be transported to the site as soon as the levelling work of the storage area now nearing completion is actually finished. Some of the heavy structurals for the power plant superstructure also are lying at the railroad station. Exploratory core drilling for the barrage foundations will be finished within a month. Construction power for the project site has been provided from Khaperkheda in Maharashtra through Chindwara and Panara through a

AID FORM 19-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-238	Setpura Thermal Power Plant	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	-----------------------------	-----

25 mile extension from the latter station. This line now is energized at 11 KV, but a transformer is now at Ghoradongri which will enable this circuit to be operated at 66 KV. Tenders have been invited for the erection of the power house super-structure steel, most of which will come from Indian sources except for 1,000 tons of plates from the U.S. Steel fabrication will be done on the site. Boiler erection is scheduled to start in the last week of January, 1964 and initial operation of the first unit should be possible in the 3rd quarter of 1966.

#### 4. Funding Requirements

Cost Estimate: (Thousands of Dollars)

<u>Item</u>	<u>Foreign Exchange</u>	<u>Local Currency</u>	<u>Total</u>
Civil Works and Colony	2,100	9,900	12,000
Turbine-generators	13,440(1)	-	13,440
Boilers	7,612	16,948	24,560
Station Elec. Equipment	2,632	658	3,290
Miscellaneous Plant	-	360	360
Substation	2,055	505	2,560
Coal and ash plant	2,640	-	2,640
Contingencies	-	1,739	1,739
Over head and expenses	-	3,245	3,425
Consultant's fee	735	735	735
Tools, Spares, etc.	1,453	480	1,933
	<u>32,667</u>	<u>34,015</u>	<u>66,682</u>

(1) Financed by sterling credits  
Net dollar amount = \$ 25,055,000.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	306-22-980-239	Tarapur Atomic Power Station	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	------------------------------	-----

## 1. The Activity Target

The objective of this project is to supply needed electrical energy to the states of Gujarat and Maharashtra and particularly to the coastal area between Bombay and Ahmedabad. This is one of the nation's most industrialized areas with a large and diverse power load that is expected to increase rapidly in the coming years. The GOI has placed high priority on the installation of a 380 MW Nuclear Power Station in this area. The U.S. Government has agreed to assist in this project by providing foreign currency financing and the U.S. Atomic Energy Commission is considering an application for deferred payment financing of the nuclear fuel costs.

Background: The GOI has for many years considered the possible advantages of Nuclear Power Stations. It selected the Maharashtra-Gujarat State area as the most suitable location for the first Indian nuclear power station largely because:

1. The general area is an industrial region with an existing large power requirement which is expected to grow.
2. Conventional thermal power stations fueled with oil, coal, or gas or not attractive due to high fuel costs and it is not feasible to develop hydro-electric capacity fast enough to meet the demand.
3. Circulating cooling water needed can be taken from the ocean and reactor boiling water make-up is available in sufficient quantity from a nearby river.

In addition to the above reasons, which contributed to AID's finding that the project is economically and technically feasible, the GOI is anxious to start a nuclear power development program now to prepare for the time in the not too distant future when increased power requirements and less costly nuclear power generation are expected to result in a more significant part for

nuclear energy in the electric power supply in India.

## 2. The Course of Action

Financing: To make available to the GOI and its Department of Atomic Energy U.S. dollar credits in the amount of \$30 million for meeting foreign exchange project costs of the project, and \$15 million to cover initial fuel costs. These funds will be used to cover plant construction costs of \$67.9 million and fuel fabrication costs of approximately \$10.5 million. A separate financing agreement is being negotiated between GOI and the U.S. Atomic Energy Commission for initial fuel costs of about \$15 million. Local currency financing is to be provided from GOI budget funds. The overall local currency costs are expected to total \$33.6 million for a total equivalent project cost of \$101.5 million, not including fuel nor interest during construction. Overall financing (foreign and local costs) to place the plant in operation (construction cost, 10% allowance for total interest during construction, fuel cost and fuel fabrication cost) will be approximately \$141 million. While the fuel costs are normally considered operating costs, in this instance because of the nature of the fuel its part of long range operating costs must by necessity be financed prior to initial plant operation.

Description of Project: Tarapur Nuclear Power Project is to be constructed on the western coast of India approximately sixty-two miles north of Bombay. The plant is to consist of two identical power units which will be serviced by some joint feature auxiliaries. The nuclear power units are to be of the boiling water reactor type similar to other operating nuclear stations in the world, but will be modified to include the recent design improvements of internal moisture separation in the reactor and vapor suppression containment.

Each reactor will deliver steam to a separate turbine-generator unit of the following characteristics:

### TURBINE

200,000 KWe  
Tandem-Compound, Two-flow  
1500 RPM

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-980-239	Tarapur Atomic Power Station	E-1
------------------------	-----------------------------------	------------------------------	--------------	----------------	------------------------------	-----

#### GENERATOR

235,000 KVA @ 30 psi Hydrogen Pressure  
0.85 Power Factor  
12,000 Volt line to line voltage  
1500 RPM

The guaranteed net electrical output of the total station after taking into account station service requirements is 380 MW. This power will be fed over high voltage (220 KV) lines from the Tarapur Nuclear Power Station switchyard into the systems of Gujarat State and Maharashtra State. It has been proposed that a committee be established to develop plans for division of power, rates, and dispatching procedures. This project is scheduled for completion in May, 1968.

Engineering: As described in a previous paragraph, International General Electric will be responsible for all phases of engineering design, project construction and start-up operations under a single encompassing "Turn Key" project. Inasmuch as the nuclear station in many respects is similar to previous plants designed and constructed by General Electric, much time should be saved in the preparation of the Tarapur Project design. The Company has been working on various aspects of the project for several years. Engineering has progressed to a point where construction can start with the completion of contractual requirements which are expected to be finalized in December 1963.

With International General Electric being the prime contractor for the project, the major portion of all items of foreign procurement will be manufactured and supplied by General Electric.

#### 3. Progress to Date

AID Loan Agreement No. 386-H-091 for \$80 million was signed on December 7, 1963.

By late 1960, planning had progressed to a point where invitations to bid were issued for a Nuclear Plant on a "turnkey" basis (i.e. a single contract for design, construction and start up) to be located at Tarapur. Bids were received from seven firms on different types of reactor power plants in August 1961. Bid evaluation showed the proposal of International General Electric to be most suited to the needs of the proposed project and a qualified letter of intent was issued to International General Electric by the GOI Department of Atomic Energy on September 24, 1962. The proposed contract is contingent upon receiving sufficient financial assistance from outside sources (AID) and upon obtaining agreements with the U.S. Atomic Energy Commission and the State Department.

GOI prepared an "Application for loan for financing the foreign exchange requirements of the Tarapur Atomic Power Station" in November 1962 and made subsequent application to AID for such financing. AID/W engaged Burns and Roe, Inc., Consulting Engineers, in February 1963 to study the economic and technical feasibility of the proposed project. The Burns and Roe report, (issued in June 1963) and the information submitted by GOI and U.S.A.I.D. New Delhi, were evaluated by AID and the project was approved. A Project Agreement was developed over a period of several months and was signed in early December 1963. The GOI Atomic Energy Commission is rushing final agreements with International General Electric so that a 52 month construction schedule may be initiated by Dec. 15, 1963.

The physical work accomplished to date at the project site includes initiation of construction of a water supply and power supply for plant construction and workers' housing and temporary warehouses. Subsurface foundation exploration was undertaken during 1959 and 1960. Some bridges on the access road to the project have been completed and the access road right-of-way clearing and grading are in process.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-980-239	Tarapur Atomic Power Station	E-1
------------------------	--------------------------------	---------------------------	--------------	----------------	------------------------------	-----

#### 4. Funding Requirements

While this point is covered to some extent in previous paragraphs, a summary of foreign and local costs, all expressed in equivalent terms of \$, is given below:

Item	Foreign Exchange (\$ 1000)	Rupees \$ Equiv. (1000)	Total (\$ 1000)
Complete Nuclear Power Station installed per I.G.E. Contract	60,980	25,432	86,412
Site Preparation	1,470	5,880	7,350
Contingency (3%) + Escalation (6%) = 9%	5,488	2,289	7,777
Total*	\$ 67,938	\$ 33,601	\$ 101,539

\* As previously noted, there is no allowance in the above figures for "interest during construction" nor for fuel and fuel fabrication costs.

AID FORM 10-120 (7-62)	DATE PREPARED 20 DEC. 1963	COOPERATING COUNTRY INDIA	INCLASSIFIED	386-22-330-252	Railway Modernization	E-1
---------------------------------	-------------------------------	------------------------------	--------------	----------------	-----------------------	-----

See E-1, Project 386-22-330-254, Railways V.

AID FORM 10-120 (7-62)	DATE PREPARED 20 DEC. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-330-253	Railways-Diesel Locomotives	E-1
---------------------------------	-------------------------------	------------------------------	--------------	----------------	-----------------------------	-----

See E-1, Project 386-22-330-254, Railways V.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-330-252 386-22-330-253 386-22-330-254	Indian Railways	E-1
------------------------	------------------------------------	------------------------------	--------------	--	-----------------	-----

### 1. The Activity Target

The objective of these projects is to provide the Indian Railway System with modern motive power and other railway equipment in order to increase the efficiency and volume of railway passenger and commodity transport operations. The United States will assist in the attainment of this target by financing the foreign exchange costs of imported railway operating equipment.

Projects 386-22-330-252, 386-22-330-253 and 386-22-330-254 are covered by this description.

Background: The Indian Railway system with over 36,000 miles of main line routes is the fourth largest in the world, after the U.S., U.S.S.R., and Canada. As shown in Table 1, the tonnage transported by the railway system has doubled since the First Five Year Plan began in 1950-51 and is expected to approximate 245 million tons by 1965-66 (an increase of almost 60% during the Third Plan). Coal has constituted about one-third of total tonnage to date and is expected to be about 37% of the total by 1965-66. Transport of the railways' own stores accounts for an additional 9-10% of total tonnage. All other commodity transport is included in the remaining tonnage, a little over half the total.

Table 1  
Indian Railway Freight Tonnage  
(in million tons)

Class of Freight (Reference)	1950-51	1955-56	1960-61	1961-62	1962-63	Est. 1963-64	III Plan Target 1965-66
	(1)	(1)	(2)	(2)	(2)	(2)	(3)
Steel & Raw Mats.	5.8	8.1	14.0	16.9	20.2	22.5	34.0
Coal	30.9	35.9	49.7	53.1	60.2	69.6	90.0
Cement	2.5	4.0	6.4	6.6	6.6	6.3	12.0
General	53.8	67.9	83.7	81.4	87.7	92.6	109.0
(a) Export ore	-	-	(2.5)	(2.5)	(3.2)	(4.1)	(11.0)
(b) Rly. Stores	-	-	(16.7)	(14.6)	(15.9)	(17.2)	(22.5)
(c) All other	-	-	(64.5)	(64.3)	(68.6)	(71.3)	(75.5)
Totals	93.0	115.9	153.8	158.0	174.7	191.5	245.0

Ref: (1) A Review of the Performance of Indian Govt. Railways (1963)  
(2) The Third Plan - Mid Term Appraisal (1963)  
(3) Third Five Year Plan (1961)

At the beginning of the First Plan, in 1950-51, capital investment in the Indian Railways system amounted to \$1,760 million and in 1960-61 (start of Third Plan) was \$3,208 million, an increase of \$1,448 million in ten years.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-330-252 386-22-330-253 386-22-330-254	Indian Railways	E-1
------------------------	------------------------------------	------------------------------	--------------	--	-----------------	-----

## 2. The Course of Action

To assist in financing the foreign exchange costs of improvement and additions to the Indian Railways.

## 3. Progress to Date

As a part of the project, the following loans have been made to cover the foreign exchange cost of imported railway material and equipment.

(a) DLF Loan No. 2, signed June 23, 1958, provided \$30 million in Project 386-22-330-252 for the import of structural steel and other steel products used in the manufacture of railroad rolling stock and in the construction and strengthening of railroad bridges.

(b) DLF Loan No. 12, signed December 24, 1958, provided \$35 million in Project 386-22-330-252 for the procurement of locomotives, rolling stock, components, steel products, electric and signalling equipment, and machinery and tools for railroad repair shops.

(c) DLF Loan No. 151 signed December 5, 1960 provided \$50 million in Project 386-22-330-252 for the procurement of 147 diesel locomotives and about \$6 million of Central Traffic Control (CTC) equipment. The purchase of 117 electric locomotives was also partially financed from this loan, the balance being provided from one IBRD loan.

(d) AID Loan No. 35, signed June 21, 1962 provided \$43 million in Project 386-22-330-253 for the procurement of 158 diesel locomotives.

(e) AID Loan No. 86 signed October 21, 1963, provided \$15.85 million for the procurement of 54 diesel locomotives.

### Disbursement:

(a) DLF Loan No. 2 has been completely disbursed.

(b) DLF Loan No. 12 has been completely disbursed.

(c) DLF Loan No. 151 was 85% disbursed as of October 31, 1963.

(d) AID Loan No. 35 was 40% disbursed as of October 31, 1963.

(e) AID Loan No. 86 - This loan was signed on October 21, 1963; no procurement has yet taken place.

The Indian Railways have received foreign assistance, in the form of loans, grants, or both, between 1950 and 1963, as follows:

<u>AID</u>	<u>Dollars (millions)</u>
DLF Loan 2, 12, 151	115.000
AID Loans 35, 86	58.850
EXIM Loan 2085	19.000
Railway portion of Orissa Iron Ore Project Loan	12.630
Project 386-X-33-BG	74.510
Total U.S. Assistance	279.990

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-330-252 386-22-330-253 386-22-330-254	Indian Railways	E-1
------------------------	------------------------------------	------------------------------	--------------	--	-----------------	-----

AID

Dollars (millions)

IBRD Railways Loans I-VI	377.800
Canada	30.771
Australia	4.422
<b>Total Foreign Aid</b>	<b>692.983</b>

4. Funding Requirements

Funding for these projects has been obligated as follows:

FY 58 DLF Loan No. 2	\$30,000,000
FY 59 DLF Loan No. 12	35,000,000
FY 61 DLF Loan No. 151	50,000,000
FY 62 AID Loan No. 35	43,000,000
FY 64 AID Loan No. 86	15,850,000

Total to date: \$173,850,000

Project 386-1-30-BG: This project provided dollar foreign exchange assistance for 100 broad gauge locomotives, 8,730 freight wagons (half broad gauge and half meter gauge), 280,000 tons of steel (shapes, plates, alloys, etc.), 60,000 tons of steel rail and 1900 tons of fish plates. Under Operational Agreement 17 a total of about \$78 million was obligated during FYs 1954, 1955, 1956, and 1957. Subsequent deobligations have reduced the total amount to \$74.51 million.

Project 386-22-210-209: This project for the development of iron ore export facilities in Orissa was financed by a loan from the Asian Economic Development Fund in FY 58. Of the total amount \$12.63 million was used for the procurement of 25 diesel locomotives, rails, bridge girders, and equipment for railroad construction.

ExIm Loan 2085: This loan, authorized March 28, 1963, provides \$19.0 million to cover the foreign exchange costs of equipment for the Railways' diesel locomotive factory at Varanasi.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1962	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-258	Coal Washery Plant, Bihar	E-1
------------------------	---------------------------------	---------------------------	--------------	----------------	---------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Hindustan Steel Company, a Government of India Corporation, with a 2 million ton per annum coal washery in the Jharia coal field adjacent to the Patherdih yard of the Eastern Railway. The United States will assist in the attainment of this target by financing the foreign exchange cost of engineering services and imported machinery and equipment.

Background: Reserves of metallurgical coals in India are limited in comparison with demands by India's steel mills for such coal. Two measures of conservation have been adopted to help meet these demands: (1) all metallurgical coals are washed to lower the ash content and thereby enrich the coals and (2) weak coking or semi-coking coals are blended with full coking coals.

As indicated below, the requirements of washed coal for the major steel plants, to be used in the production of about 6 million tons of steel in terms of ingots and about 700,000 tons of market pig iron, are estimated to be about 8 million tons per annum:

<u>Steel Plant</u>	<u>Estimated Need for Washed Coal (million tons)</u>
Rourkela (Hindustan Steel Ltd.)	1.6
Bhilai (Hindustan Steel Ltd.)	1.8
Durgapur (Hindustan Steel Ltd.)	0.8
Jamshedpur (Tata Iron & Steel Co.)	2.4
Burnpur (Indian Iron & Steel Co.)	1.6
Total	<u>8.2</u>

In addition, Durgapur and Burnpur will receive 1.0 million and 0.6 million tons, respectively of mine-run Barakar and Raniganj coal.

Against the present requirement, there are six washeries in operation which can supply about 6.4 million tons a year of washed coal:

<u>Washery</u>	<u>Washed Coal (million tons)</u>
Jamadoba	1.1
West Bokaro	0.4
Lodna	0.2
Kargali	1.5
Durgapur	0.8
Dugda I	2.4
Total	<u>6.4</u>

For the balance of about four million tons, three washeries are now, or will shortly be, under construction: an additional one in Dugda, (Dugda II) another in Bhojudih and the third in Patherdih. It is planned that the washery in Dugda will supply washed Jharia coals to the steel plants in Bhilai and Rourkela, the washery in Bhojudih to the steel works in Jamshedpur and the Patherdih washery to the steel works in Burnpur.

### 2. The Course of Action

Financing: To provide \$4.2 million in dollar financing to meet the foreign exchange cost of the Patherdih Coal Washery.

Description of Project: The project is the construction and equipping of a complete coal preparation plant, including design, supply, erection and commissioning, and installation of all necessary auxiliary equipment. The plant will be located at the eastern part of the Jharia coal field in the state of Bihar, adjacent to the Patherdih yard of the Eastern Railway.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-258	Coal Washery Plant, Bihar	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	---------------------------	-----

It will treat coking coals drawn from approximately 22 collieries located in the Jharia field. The washed coal is scheduled for use mainly at the Indian Iron and Steel Company plant at Burnpur.

The washery plant will include railway dumping facilities; a screening, hand-picking and crushing division; raw coal storage and blending facilities; a main washery with Baum-type jigs, heavy medium separators, heavy medium cyclones, thickener, and the disc filters; clean coal and middlings bunkers; various belt conveyor systems; and miscellaneous auxiliary units. The plant is to be constructed on a turn-key basis, and, on the basis of world-wide bids, a U.S. firm Roberts & Schaefer Co., Chicago, Illinois, has been awarded a contract for the Patherdih plant, including design, supply, erection and commissioning of a complete coal washing plant.

The contractor has guaranteed that on the basis of two shifts of eight hours each per day and 300 working days per year the plant will handle a minimum input of 6,600 metric tons of raw coal per day or 2,000,000 metric tons per year.

Because of the varying nature of the run-of-mine coal that will be treated the average yield and ash content of the washed products can not be accurately forecast. However, laboratory tests indicate that the following results may be obtained from run-of-mine coal with an average ash content of 21.9%.

Products	Weight %	Ash %
Clean Coal (3"x0")	73.05	15.6
Middlings (3" x 1")	10.26	32.7
Middlings (1" x 36 mesh)	9.02	32.4
Rejects (3" x 0")	7.67	55.2
	<u>100.00</u>	<u>21.9</u>

Cost Estimate: The following is the estimated cost of the project, in millions of dollars.

Item	Foreign Exchange	Local Currency	Total
Main plant, machinery, materials and equipment	\$ 2.98	\$ 0.82	\$ 3.80
Standbys and spares	0.34		0.34
Civil Works		1.96	1.96
Fabrication of Structural Steel		0.24	0.24
Plant Erection costs		0.44	0.44
J. S. Technical Personnel	0.20	0.05	0.25
Engineering Services	0.60		0.60
	<u>\$ 4.12</u>	<u>\$ 3.51</u>	<u>\$ 7.63</u>

### 3. Progress to Date

Financing: On June 21, 1962, AID Loan No. 15 was signed providing \$4.2 million to meet foreign exchange cost of the Patherdih Coal Washery. As of October 31, 1963, \$3,510,000 of the loan had been disbursed.

Other: According to the latest progress report which has been received for the project, the project status is as follows:

66% of U.S. machinery and equipment received.  
45% of Indian machinery and equipment received.  
75% of Indian structural steel received.  
Civil works 78% complete  
Fabrication of structural steel 13% complete  
Erection of plant and machinery 7% complete

PAGE AE-12b

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	36-22-210-258	Coal Washery Plant, Bihar	E-1
------------------------	------------------------------------	------------------------------	--------------	---------------	---------------------------	-----

4. Funding Requirements

Funding for this project has been obligated as follows:

FY 62 AID Loan No. 15                      \$4,200,000

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	316-22-210-259	Dugda Coal Washery Expansion	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	------------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Hindustan Steel Company Ltd., a Government of India corporation, with a 2.4 million ton per annum extension to the existing coal washery in the Jharia coal field near Dugda in the State of Bihar. The United States will assist in the attainment of this target by financing the foreign exchange cost of engineering services and imported machinery and equipment.

Background: The steel industry is a vital element in industrial development as envisaged in the Second and Third Five Year Plans. Adequate supply of coking or metallurgical coal to the steel plants can be ensured by washing inferior grades of coal such as those available from the lower seams of the western region of the Jharia coal field. Extensive tests conducted by the Indian Government's Central Fuel Research Institute have established that such a proposal is practicable and realistic. The decision to install another washery at Dugda is the outcome of these investigations and has been accorded the highest priority. The advantage of installing Dugda II as an adjoining plant to Dugda I is that it can avail itself of all existing service facilities thereby reducing considerably local currency costs of installation and operation.

During the Third Plan period, the Government of India has proposed to step up iron and steel production capacity to 10.2 million tons of steel ingot capacity and 1.5 million tons of pig iron a year. This expansion would require an additional washing capacity of 12.7 million tons in terms of raw coal.

The present requirements of washed coal for the major steel plants, however, based on full production at total present rated capacity of about 6 million tons of steel in terms of ingots, and about 700,000 tons of market pig iron, are estimated to be 8.2

million tons per annum, as indicated below:

<u>Steel Plant</u>	<u>Estimated Need For Washed Coal</u>	<u>Present Steel Capacity (Million Tons)</u>
Hourkela (Hindustan Steel, Ltd.)	1.6	1.0
Bhilai (Hindustan Steel, Ltd.)	1.8	1.0
Durgapur (Hindustan Steel, Ltd.)	0.8	1.0
Jamshedpur (Tata Iron and Steel Co.)	2.4	2.0
Burnpur (Indian Iron and Steel Co.)	1.6	1.0
<b>Total</b>	<u>8.2</u>	<u>6.0</u>

In addition, Durgapur and Burnpur will receive 1.0 million and 0.6 million tons, respectively, of mine-run Barakar and Raniganj coal.

Against the present requirement, there are six washeries in operation which can supply about 6.4 million tons of washed coal:

<u>Washery</u>	<u>(Million Tons)</u>
Jamadoba	1.1
West Bokaro	0.4
Lodna	0.2
Kargali	1.5
Durgapur	0.8
Dugda I	2.4
<b>Total</b>	<u>6.4</u>

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-259	Dugda Coal Washery Expansion	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	------------------------------	-----

Several washeries are now, or shortly will be, under construction, including the Dugda II washery providing additional washed coal capacity of 2.4 million tons per year, to meet present and near future requirements.

Coking coal comes almost entirely from the Jharia coal field comprising over 300 collieries. Of these, about 120 raise coal containing ash which can be washed down to a limit acceptable to the steel works. Based on the suitability of the different coals for washing and the convenience of railway transport, the collieries have been divided into groups by Hindustan Steel Company, Limited, with each group of collieries to supply raw coal to one coal washing plant located at a central railway point. The coal to be washed in washing plants at Jamadoba and Bhojudih (under construction) is for the steel works of Jamshedpur (T.I.S.C.O.); at Fatherdih (under construction) for the steel works of Burnpur (I.I.S.C.O.); at Durgapur for the steel works of Durgapur; at Dugda for the steel works of Hourkela. The characteristics of all of this metallurgical coal have been subjected to tests carried out by the Central Fuel Research Institute of India, and the coal washing process adapted in each case to suit the characteristics of the coal from the particular group of collieries supplying the raw coal.

## 2. The Course of Action

Financing: To meet the foreign exchange costs of this project by providing an A.I.D. loan of \$5.1 million.

Description of Project: The project is the construction and equipping of a complete coal preparation plant, including design, supply, erection and commissioning, and installation of all necessary auxiliary equipment in order to wash 2.4 million tons of raw coal per annum. Dugda II is to be the second of a projected three unit coal washery complex at Dugda and is adjacent to Dugda I. It will be located in the western region of the Jharia coal field and will be serviced by 43 collieries mainly in the Bhaga, Mohoda and Katrasgarh areas.

The washery will include standard run-of-mine receiving facilities such as automatic dumpers, screening devices, hand sorting belts and storage bunkers. The railroad car marshalling yard built for Dugda I will provide service for Dugda II and, when required, for Dugda III as well.

The washing section, or main plant, will differ only slightly from Dugda I unit, which followed handling standards which have been tested and approved throughout the industry. Typically, the raw coal from storage bunkers will be washed and fed to a series of separators, thickeners and fitters where as much of the ash making slate will be removed as economically feasible. Each 1% ash in coking coal may reduce blast furnace capacity up to 4%. In the present case, Hindustan Steel specifies that the contractor must guarantee that the cleaned coal will contain no more than 17% ash. Jharia's coal contains upwards of 33% ash. The Indian Bureau of Mines, however, has determined that the Jharia coal ash content can economically be washed down to a level of 15 - 17%.

The completed plant will have a rated capacity of 600 metric tons of raw coal per hour, with a 10% intermittent overload capacity. The annual capacity, based upon two shifts per day for 300 days per year, will be 2.4 million metric tons.

Engineering: It is expected that the U.S. contractor, when selected, will be given a turn-key contract for design and construction of facilities and selection, purchase and installation of equipment.

Cost Estimate: The estimated cost of the project, in millions of dollars, is:

Item	Foreign Exchange	Local Currency	Total
Plant, machinery, materials and equipment	\$ 3.1	\$ 4.8	\$ 7.9
Standby and spares	0.7	0.2	0.9
			PAGE AE-13b

AID FORM 18-125 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	36-22-210-259	Dugda Coal Washery Expansion	E-1
------------------------	------------------------------------	------------------------------	--------------	---------------	------------------------------	-----

<u>Item</u>	<u>Foreign Exchange</u>	<u>Local Currency</u>	<u>Total</u>
Design & construction service	0.9	0.7	1.6
Technical Services	0.3	0.1	0.4
Steel Fabrication		0.4	0.4
Civil Works		3.3	3.3
Ocean freight	0.1		0.1
	—	—	—
Total	\$ 5.1	9.5	14.6
	—	—	—

Local currency requirements will be provided by Hindustan Steel Company, Ltd.

### 3. Progress to Date

AID Loan No. 87 in the amount of \$5.1 million was signed on November 29, 1963. There have been no disbursements to date.

The Government of India is now considering tenders from U.S. engineering firms for the project.

### 4. Funding Requirement

AID Loan No. 87 for \$5,100,000 signed November 29, 1963.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-260	Central Ropeway "F"	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	---------------------	-----

### 1. The Activity Target

The objective of this project is to provide the Government of India Coal Board with a bicable ropeway with a total capacity of 900 tons per hour to transport sand 15 miles from the Damodar River to the Jharia coal field in the State of Bihar. The United States will assist in the attainment of this target by financing the foreign exchange cost of engineering services and of imported equipment and machinery.

Background: Coal has been mined in the Jharia coal field, Bihar State, for nearly a century. Sand stowing (filling the space from which coal has been removed with sand) has become a common practice in this field to facilitate maximum recovery of coal by removal of pillars.

The present Coal Board was established in order to assist in conserving coal and effecting safety in mines. This was to be accomplished primarily by using improved methods for sand stowing. Considering that large scale sand dredging, transporting and stowing are beyond the financial and physical capacity of most of the collieries, the Coal Board was given statutory responsibility to grant financial assistance for this purpose. However, instead of merely granting financial assistance and leaving it to the individual collieries to arrange for delivery of a supply of sand at the mines, it was deemed preferable that the Coal Board provide the sand itself. Also, considering the large number of collieries using sand, it was determined that a series of ropeways, under a Central Authority, could best do the job. Accordingly, the Government of India has authorized construction of a total of four new ropeways, including three in the Jharia coal field. This loan proposal calls for financing one of the three bicable ropeway systems, designated as Ropeway "F". The Government of

India originally proposed that A.I.D. finance the foreign exchange for another Jharia ropeway, but has recently decided to defer the ropeway designated as "B-C" to a later date.

A portion of the target of 97 million tons of coal per annum envisaged by the end of the Third Five Year Plan (1966) will come from extraction of the high grade coal left standing in pillars in the Jharia coal fields. This depillaring will involve the stowing of approximately 14 million tons of sand per annum. Such a large quantity of sand is available only in the river beds of the Damodar and Ajoy rivers which flow alongside the coal fields, but at some distance from most of the mines. The Government of India has proposed, therefore, that sand be extracted and transported from the Damodar River to the Jharia coal field by a bicable aerial ropeway capable of carrying 3 million tons of sand per annum. This will increase coal production by 1.5 million tons a year in the affected mines. Overall erection and operation of the Ropeways will be under the supervision of the Coal Board.

### 2. The Course of Action

Financing: To provide \$7.7 million in dollar development loan financing to meet the foreign exchange cost of the ropeway project.

Description of Project: The ropeway project, as presently envisioned, will consist of:

1. Three portable type dredges, each with a rated sand/gravel output of 240 cubic yards (300 tons) per hour, will gather and stockpile the sand on the river bank where it will be naturally dewatered.
2. Two mobile 450 ton per hour loading systems will reclaim the sand and place it on a 1,000 ton per hour belt conveyor which will convey it to a 300,000 ton stockpile. As needed, the sand will be loaded by gravity on to another conveyor and deposited in two 1,000 ton bins at the head of the twin ropeways. Auxiliary equipment will be provided for keeping sand within reach of the conveyors.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-30	Central Ropeway "F"	E-1
------------------------	------------------------------------	------------------------------	--------------	---------------	---------------------	-----

3. Twin main ropeway systems, of a special bicable type, will extend from the loading terminal for a distance of about 10 miles. One will then branch off and extend for about 2.3 miles to serve three unloading terminals, while the other will continue for about 3.2 miles to serve four unloading terminals. Each ropeway will have a capacity of 450 tons of sand per hour. Sixty (60) cubic feet (2.7 tons) tramway cars designed to ride the track cables will be used. Arrangements provide for the cars to be automatically loaded and discharged at the terminals. The ropeway will be provided with two 2 inch diameter track cables for carrying the loaded tram cars and with two 1-1/2 inch track cables for the empty cars. Specifications for the towers, terminals, track cables, haulage cables, tram cars, power equipment auxiliary equipment, and safety guards required for the ropeway have been prepared.

4. One nine hundred ton steel bin is to be provided at each of seven bunker sites located near the mines to be served. The bins will be designed to permit gravity loading into road trucks or rail cars. Provision is also made for delivery of sand to a long boom belt so that a 60,000 ton stockpile may be stored; portable loaders will then be able to reclaim sand from such stockpiles.

5. A two year supply of spare parts is to be provided.

6. Tools and equipment required to erect the Ropeway will be turned over to the Coal Board by the contractor.

An adequate supply of sand is an essential requisite for the successful operation of the ropeway. The quantity extractable from the Damodar River, year by year, has been studied by several agencies and while there has been considerable variance in the several estimates, it is believed the supply will be adequate for about 15 years.

The project calls for a "turnkey" job insofar as the ropeway and accessory equipment is concerned. Materials normally available in India, such as steel, cement, etc., will be utilized by the

contractor and an ample supply of labor is available. Suitable Indian personnel will be placed with the contractor for training, both in the U.S. and in India. The contractor will also assign an adequate staff to stay in India for a limited period after the completion of construction, to assist the Indian personnel in the maintenance, and operation of the facility. The Coal Board will assign qualified engineering officers from their staff for the overall supervision of the project. In addition, the Coal Board will arrange for power and water and will provide work shops and any other ancillary facility that may be needed.

Engineering: The Government of India has planned that Ropeway "F" be constructed by a U.S. firm, Interstate Equipment Corporation. The Coal Board stated that Interstate's proposal, while not the lowest bid submitted, was "technically superior" to British and German offers received. Also the U.S. firm will complete the installation of the ropeway within thirty months after the date of the signed contract.

Cost Estimate: The estimated cost of the project, in millions of dollars, is:

Item	Estimated Costs (\$ million)		Total
	Foreign Exchange	Local Currency	
Dredges and Pipeline Equipment	0.9	0.7	1.7
Stockpile and Sand Storage Facility	0.5	0.4	0.9
Ropeway	5.6	4.0	9.6
Handling System for Storage at Bunker Sites; Loading Equipment for Mines Transport	0.3	0.3	0.6

AID FORM 19-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-210-260	Central Ropeway "F"	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	---------------------	-----

<u>Item</u>	<u>Estimated Costs</u> ( $\downarrow$ million)		
	<u>Foreign Exchange</u>	<u>Local Currency</u>	<u>Total</u>
Spare Parts	$\downarrow$ 0.3	$\downarrow$ 0.1	$\downarrow$ 0.4
Tools	$\downarrow$ 0.1	$\downarrow$ 0.1	$\downarrow$ 0.2
	<u>          </u>	<u>          </u>	<u>          </u>
Total	$\downarrow$ 7.7	$\downarrow$ 5.6	$\downarrow$ 13.3
	<u>          </u>	<u>          </u>	<u>          </u>

### 3. Progress to Date

As the loan has just been signed, no physical progress has taken place.

As stated above under Engineering, the Government of India has selected a U.S. contractor <sup>and</sup> as of December, 1963, it is anticipated that the contract will be signed in the near future.

### 4. Funding Requirements

Funding for this project has been obligated as follows:

FY 64, AID Loan No. 81 -- \$7,700,000  
(Signed October 21, 1963)

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-196	Durgapur Thermal Power Project	E-1
------------------------	---------------------------------	---------------------------	--------------	----------------	--------------------------------	-----

### 1. The Activity Target

The objective of this project is to provide the West Bengal State Electricity Board with a 150 MW extension to the existing 30 MW thermal power plant at Durgapur, West Bengal. The United States will assist in the attainment of this target by financing the foreign exchange cost of engineering services and of imported electrical generating and transmission equipment and by meeting the local currency costs of construction.

Background: The area around, and west of, Calcutta is known as the south Bihar-lower Bengal area for the purpose of electric system identification. It has one of the heaviest concentrations of electrical generation and distribution capacity in India. At the same time, being the most industrialized area in the country, it has the greatest demand for electric power, the greatest gap between supply and demand, and by far the greatest estimated future growth in demand for electrical generating capacity.

The establishment and expansion of such critically needed facilities as steel production, chemical industries, heavy and light manufacturing, irrigation pumping, and railway electrification are dependent upon an adequate power supply, to which Durgapur will make a substantial contribution.

The south Bihar-lower Bengal area is now served by the Damodar Valley Corporation (DVC), the Calcutta Electric Supply Company and the West Bengal State Electricity Board (WBSEB). Calcutta Electric Supply retails in and around Calcutta while the DVC and the WBSEB deliver bulk supplies to almost three dozen licensees. Among the resources available to these systems is an interconnection between Rihand Dam Power Plant (also U.S. assisted) and DVC through which the area has imported power to the extent of 100 MW.

In addition to the U.S. aided 150 MW expansion, a third 75 MW unit is scheduled to be commissioned in the WBSEB Durgapur Plant by October, 1965. This unit consists of a Siemens turbo-generator, financed under a West German credit, and a Japanese steam generating unit, financed under a Yen credit.

Scheduled additions to generating capacity in the south Bihar-lower Bengal area (including Durgapur), allowing for retirements of obsolete capacity, will enlarge the area's net capability by 1,033 MW by the end of the Third Plan in 1966, while projected increase in peak load will add 707 MW to the existing demand. The Durgapur Plant expansion, including the third 75 MW unit, will represent about one-fourth of the increase in capacity.

### 2. The Course of Action

Financing: To provide \$20 million in dollar development loan financing to meet the foreign exchange costs of the 150 MW Durgapur Thermal Plant expansion and Rs.34.3 million (dollar equivalent \$7.2 million) to meet local currency costs of the project through a PL 400 Section 104 (g) loan.

Description of Project: The Durgapur Thermal Plant is located about 80 miles northwest of Calcutta, at the eastern edge of the Raniganj coalfield. The thermal plant is located about 80 miles northwest of Calcutta, at the eastern edge of the Raniganj coalfield. Power it produces is scheduled for use in the industrialized area adjacent to the plant site. The WBSEB Durgapur plant will be interconnected with the DVC transmission grid covering the area. The project includes construction of double circuit 132 KV transmission line between the Durgapur Plant and the Bandel Plant (see 386-22-220-221).

Two 75 MW turbo-generators are being installed, each serviced by a 700,000 pound per hour steam generating unit designed to burn pulverized middlings and low-grade coal with a calorific value of about 9,000 Btu/lb.

AID FORM 10-120 (7-62)	DATE PREPARED 20 December, 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-22-220-196	Durgapur Thermal Power Project	E-1
------------------------	------------------------------------	------------------------------	--------------	----------------	--------------------------------	-----

Engineering: The Kuljian Corporation, a U.S. consulting firm with offices in India, is engaged for assistance in planning, design, engineering coordination, and supervision of construction of the project.

Suppliers: Major suppliers for this project are Babcock and Wilcox, U.S.A., for the steam generating units, coal and ash handling equipment and Siemens, West Germany, for the turbo-generators.

### 3. Progress to Date

Financial: Funding for this project has been obligated as follows:

FY 60, DLF Loan No. 130, signed June 30, 1960	₹20,000,000
FY 61, Project Agreement No. 105 signed April 3, 1961 for Rs. 34,300,000 (PL 480 rupees) equivalent to	₹ 7,200,000

Other: Progress of major parts of the project, to June 1963, is estimated as follows:

Turbine Building	95%
Boiler Superstructure	95%
Cooling Tower	100%
Ash Silo	98%
Roofing	70%
Boiler installation	70%
Turbine installation	47%
Transmission	50%

The plant is scheduled for completion in the first quarter of 1964.

### 4. Funding Requirements

Cost Estimate: The original estimated total cost was ₹23.2 million (dollar equivalent) with the foreign exchange component estimated to be ₹20 million. The estimated local currency cost was subsequently reduced to ₹7.2 million (dollar equivalent), corresponding to an estimated total cost of ₹27.2 million.

As of June, 1963, project quarterly reports show the value of contracts awarded to date to be: (amounts in millions of dollars).

Item	Foreign Exchange	Local Currency	Total
Two steam generating units, coal and ash handling equipment	\$10.56	\$ 0.87	\$11.43
Two 75 MW turbo-alternators and auxiliary equipment	8.36	0.94	9.30
Transformers		0.12	0.12
Rotary wagon Tippler	0.21	0.03	0.24
Civil Works	0.14	2.86	3.00
Laboratory Equipment	0.04		0.04
Transmission Lines	0.40	0.78	1.18
Engineering Services	0.21	0.11	0.32
	<u>\$19.92</u>	<u>\$5.71</u>	<u>\$25.63</u>

AID FORM 10-120 (7-67)	DATE PREPARED 20 Dec. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-24-220-234	Ahmedabad Power Plant	E-1
------------------------	-------------------------------	------------------------------	--------------	----------------	-----------------------	-----

## 1. The Activity Target

The objective of this project is to provide the Ahmedabad Electricity Company, Ltd., with a modern 30 MW addition to the Sabarmati Thermal Power Plant, serving the city of Ahmedabad, Gujarat. The United States will assist in the attainment of this objective by financing the foreign exchange cost of the imported electrical generating equipment.

Background: With the bifurcation of the former Bombay State in 1960, Gujarat State Electricity Board (GSEB) was constituted to promote the coordinated development of generation, supply and distribution of electricity within the new Gujarat State. The creation of the new State has given added impetus to the industrialization of the area. The availability of power is a critical factor in this industrialization.

The Gujarat power system is in the Satpura Region (Region III), one of seven into which India is divided for the purpose of power system integration. Eventually the system will operate as a totally interconnected system with the proposed Nuclear Power Station at Tarapur (Project 386-22-980-239), the Tata-Central Railways-Koyna system (Projects 386-24-220-235 and 386-12-250-011), and the Chambal-Satpura system (Projects 386-12-250-011 and 386-22-220-238) of Madhya Pradesh.

The Ahmedabad Electricity Company serves a 113 square mile distribution area covering the City of Ahmedabad and its environs. The installed generating capacity in the company system, including the present project, is 187.5 MW and the firm capacity is 172.5 MW, about one-half of the existing capacity in the entire State of Gujarat. The State Electricity Board system is interconnected with the company system. Ahmedabad City is a major center for the textile and auxiliary industries and the present project will facilitate planned industrial expansion.

In addition to the present U.S.-aided 30 MW project, the Company is currently (1963) adding a second Indian bank financed 30 MW unit to the Sabarmati Plant; with its completion, the total installed generating capacity will be 217.5 MW.

## 2. The Course of Action

Financing: On June 30, 1960, DLF Loan Agreement No. 121 was signed, providing \$3.9 million in dollar financing to meet the foreign exchange cost of the Ahmedabad Power Plant 30 MW expansion.

Description of Project: The 30 MW expansion of the Sabarmati Thermal Power Plant consists of a steam turbo-alternator; two 200,000 pound per hour steam generating units; and additional coal - and ash-handling equipment.

Engineering: Design and specifications for the plant expansion were prepared by the company's engineering staff in cooperation with equipment manufacturers.

Suppliers: Major items of equipment were procured in the United Kingdom from the following principal suppliers:

Turbo-generator and Electrical Equipment	- Associated Electrical Industries Export, Ltd.
Boilers	- Babcock and Wilcox, Ltd.
Coal and ash-handling Equipment	- Strachan and Henshaw, Ltd.

Cost Estimate: The estimated cost of this project is (in millions of dollars):

	1960	
	Cost Estimate	
	Local	Foreign
	Currency	Exchange
Turbo-generator		2.16

PAGE AC-85

AID FORM 10-120 (7-62)	DATE PREPARED 20 Dec. 1963	COOPERATING COUNTRY INDIA	UNCLASSIFIED	386-24-220-234	Ahmedabad Power Plant	E-1
---------------------------------	-------------------------------	------------------------------	--------------	----------------	-----------------------	-----

	1960 Cost Estimate	
	<u>Local Currency</u>	<u>Foreign Exchange</u>
Boilers		1.60
Coal and ash-handling equipment		.10
Electrical equipment		.04
Civil Works	.76	
Erection costs	.63	
	<u>1.39</u>	<u>3.90</u>

3. Progress to Date

The plant has been completed and has been in commercial operation since June 1962.

4. Funding Requirements

Funding for this project was obligated in FY 1960 under DLF Loan No. 121 in the amount of \$3,900,000.