

A HANDBOOK
OF
IRRIGATION AND POWER DATA

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CENTRAL BOARD OF IRRIGATION AND POWER

PREFACE

In the field of water resources development quite an impressive record of achievement has been registered since Independence—thanks to the foresight and pre-eminent importance being given to this by the Planning Commission and the Government of India in the successive Plans. The number of dams constructed, irrigation area increased, power generation stepped up, in the various parts of India are so colossal that it has become necessary to get a comprehensive appraisal of their magnitude in a single reference book.

The Central Board of Irrigation and Power has been endeavouring to collect statistical information in this regard from various authorities, but it has not been possible to get a complete picture up-to-date from any source so far. Meanwhile, quite a number of enquiries are being received in the office of the Board requesting information on these topics from various organisations both from abroad and within the country. It was, therefore, considered necessary to bring out a handbook on the available information.

It is not claimed, however, that what is contained in this small booklet is either up-to-date or complete and it is our intention to review and re-edit it from time to time with the active co-operation of the profession.

In compiling this handbook, Shri T.N. Taploo of this office has taken considerable pains and initiative in searching out the various data from the Library and other sister institutions and in this task his has been a labour of love.

The valuable suggestions for improvement of this edition, we expect to receive, will be a measure of the need for such a handbook and we hope in the coming years, this annual pamphlet of the Board will become a useful reference book with every engineer in the profession.

P. H. VAIDYANATHAN

Secretary

Central Board of Irrigation and Power.

NEW DELHI :

1ST MARCH, 1962

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IRRIGATION STATISTICS
INDIA
CLASSIFICATION OF AREA—STATE-WISE
(1956-57)

(Thousand acres)

<i>State</i>	<i>Net area sown</i>	<i>Total cropped area</i>	<i>Area sown more than once</i>
Andhra Pradesh	28,106	30,750	2,644
Assam	5,118	6,003	885
Bihar	19,190	25,005	5,815
Bombay	67,225	70,361	3,136
Jammu & Kashmir	1,678	1,906	228
Kerala	4,525	5,382	857
Madhya Pradesh	38,352	43,573	5,221
Madras	14,414	17,145	2,731
Mysore	24,898	25,699	801
Orissa	13,854	14,958	1,104
Punjab	18,108	23,786	5,678
Rajasthan	30,702	33,881	3,179
Uttar Pradesh	41,813	52,766	10,953
West Bengal	12,849	14,977	2,128
Centrally administered areas	1,628	2,186	558
Total	322,460	368,378	45,918

CLASSIFICATION OF AREA
(1958-59)

(Thousand acres)

Geographical area according to Surveyor General of India	806,300
Area according to village papers	724,100
Forests	128,100
Not available for cultivation	115,600
Other uncultivated land excluding fallow land	97,400
Fallow lands	59,400
Net area sown	323,600
Total cropped area	372,200
Area sown more than once	48,600

AREA IRRIGATED—STATE-WISE
(1956-57)

(Thousand acres)

<i>State</i>	AREA IRRIGATED FROM				
	<i>Canals</i>	<i>Tanks</i>	<i>Wells</i>	<i>Other sources</i>	<i>Total</i>
Andhra Pradesh ..	3,149	2,916	793	210	7,068
Assam ..	899	—	—	634	1,533
Bihar ..	1,515	595	525	1,749	4,384
Bombay ..	689	520	2,299	108	3,616
Jammu & Kashmir	709	3	7	24	743
Kerala ..	414	77	29	309	829
Madhya Pradesh ..	965	270	727	87	2,049
Madras ..	1,997	2,195	1,236	89	5,517
Mysore ..	408	809	320	292	1,829
Orissa ..	556	1,223	94	541	2,414
Punjab ..	4,952	13	2,465	29	7,459
Rajasthan ..	690	468	2,238	94	3,490
Uttar Pradesh ..	4,279	1,040	5,412	689	11,420
West Bengal ..	1,515	963	40	491	3,009
Centrally administered areas ..	178	7	41	96	322
Total	22,915	11,099	16,226	5,442	55,682

Gross area irrigated	..	..	..	..	63,525
Area irrigated more than once	..	..	..	..	7,843

ALL INDIA AREA IRRIGATED
(1958-59)

(Thousand acres)

Area irrigated by canals ..	..	..	..	..	23,900
Area irrigated by tanks ..	..	..	..	..	11,700
Area irrigated by wells ..	..	..	..	..	16,700
Area irrigated by other sources of irrigation ..	..	..	..	..	5,600
Total area irrigated	..	..	..	..	57,900

AREA UNDER DIFFERENT FOOD CROPS—STATE-WISE
(1956-57)

(Thousand acres)

<i>State</i>	<i>Rice</i>	<i>Jowar</i>	<i>Bajra</i>	<i>Maize</i>	<i>Ragi</i>	<i>Wheat</i>	<i>Barley</i>	<i>Other cereals and millets</i>
Andhra Pradesh	7,233	6,209	1,504	464	743	57	10	2,569
Assam	4,262	—	—	36	—	6	—	8
Bihar	12,313	8	12	1,513	355	1,882	922	663
Bombay	4,343	17,635	8,703	491	744	3,634	37	1,056
Jammu & Kashmir	527	1	44	521	8	373	53	66
Kerala	1,883	5	—	—	12	—	—	14
Madhya Pradesh	9,619	4,064	425	1,064	33	8,009	509	3,570
Madras	5,724	1,838	1,338	15	882	4	—	1,373
Mysore	2,268	6,380	1,314	25	2,179	766	6	1,191
Orissa	9,173	136	11	79	414	11	1	347
Punjab	749	668	2,436	1,091	9	4,965	501	253
Rajasthan	230	2,109	9,302	1,238	—	3,347	1,447	185
Uttar Pradesh	9,531	2,209	2,781	2,506	466	9,980	4,934	1,685
West Bengal	10,732	3	—	166	28	220	183	38
Centrally administered areas	746	29	55	283	40	415	90	65
Total all India	79,333	41,294	27,925	9,492	5,913	33,669	8,693	13,083

**TOTAL AREA UNDER CEREALS AND MILLETS—STATE-WISE
(1956-57)**

(Thousand acres)

Andhra Pradesh	18,789
Assam	4,312
Bihar	17,668
Bombay	36,643
Jammu & Kashmir	1,593
Kerala	1,914
Madhya Pradesh	27,293
Madras	11,174
Mysore	14,129
Orissa	10,172
Punjab	10,672
Rajasthan	17,858
Uttar Pradesh	34,092
West Bengal	11,370
Centrally administered areas	1,723
Total	219,402

**AREA IRRIGATED UNDER DIFFERENT CROPS
(1956-57)**

(Thousand acres)

Rice	28,352
Jowar	1,398
Bajra	856
Maize	1,242
Ragi	926
Wheat	9,889
Barley	3,267
Other cereals and millets	307
Total cereals and millets	46,237

Gram	..	..	..	..	..	2,597
<i>Tur or Arhar</i>	..	..	..	..	..	20
Other pulses	..	..	..	..	..	1,688
Total pulses						4,305
Total food grains						50,542
<hr/>						
Sugar-cane	..	..	..	..	..	3,394
Condiments and spices	..	..	..	..	..	576
Fruits and vegetables including root crops	..	..	..	..	..	893
Other food crops	..	..	..	..	..	1,537
Cotton	..	..	..	..	..	2,221
Oilseeds	..	..	..	..	..	873
Tobacco	..	..	..	..	..	210
Fodder crops	..	..	..	..	..	2,313
Other non-food crops	..	..	..	..	..	966
Total gross area irrigated						63,525

PRINCIPAL IRRIGATION WORKS

<i>State/Irrigation Works</i>	<i>Year of completion</i>	<i>Total outlay (Rs. lakhs)</i>	<i>Area irrigated (Thousand acres)</i>
1	2	3	4
ANDHRA PRADESH—			
Godavari Delta System	.. .. 1890	220	1,111
Nizam Sagar	.. .. 1931	392	275
Ramperu Drainage	.. .. 1956	128	8
Rallapad	.. .. 1957	103	8
Upper Pennar	.. .. 1958	152	10
K. C. Canal	.. .. 1958	428	278
Godavari (Stage I)	.. .. 1958-59	601	65
Prakasam Barrage	.. .. 1959-60	237	1,170
Bhairavani Tippan	.. .. 1960	142	10

	1	2	3	4
BIHAR—				
Sone Canals	1874	268	858
Kamala Canal	1951	23	38
Mayurakshi Left Bank Canal	1958	81	25
Tribeni Canal Extension	1958-59	113	62
GUJARAT—				
Rangola	1952	62	10
Brahmani	1954	91	27
Moj	1955	96	15
Aji	1957-58	80	3
Machhu I	1962-63	148	22
JAMMU & KASHMIR—				
Sind Valley	1956	124	18
KERALA—				
Kuttanad	1956	60	121
Peechi	1957-58	235	46
Chalakudy (Stage I)	1957-58	153	28
Walayar Reservoir	1958-59	117	8
Wadakkancheri (Vezhani)	1958-59	108	9
Nayyar	1959-60	210	19
Malampuzha	1959-60	532	48
MADHYA PRADESH—				
Tandula Canals	1925	34	165
Mahanadi Canals	1927	159	210
MADRAS—				
Periyar System	1897	108	143
Kaveri Mettur	1934	663	301
Perinchari	1956	44	6
Lower Bhavani	1956	951	207
Mettur Canals	1957	193	45
Araniar Reservoir	1957	106	12
Krishnagiri	1958	202	9
Sathanur	1959	289	21
Amaravathy	1959	324	54
Kattalai High Level Canal Scheme	1959	157	21
Pullambadi Canal Scheme	1959	142	22

1	2	3	4
MAHARASHTRA—			
Nira Left Bank Canal	1906	106	83
Pravara River Works	1911	153	84
Nira Right Bank Canal	1938	602	81
Gangapur Reservoir	1959	396	45
MYSORE—			
Krishnarajasagar Canal	1930	450	100
Tunga Anicut	1958-59	231	22
Nugu	1958-59	311	20
Ghataprabha Left Bank Canal	1958-59	545	120
ORISSA—			
Rushi Kulya Canal System	1895	28	140
PUNJAB—			
Upper Bari Doab Canal	1878-79	227	828
Western Yamuna Canal	1886	202	1,018
Sirhind Canal	1886-87	265	1,483
Eastern Yamuna Canal Extension	1933	838	349
Western Yamuna Canal Extension	1944-45	158	121
Nangal Barrage	1954	395	2,750
RAJASTHAN—			
Jawai Project	1958-59	246	46
Parbati Project	1959-60	106	35
Meja Project (Gudha)	1960-61	63	30
UTTAR PRADESH—			
Ganga Canal	1891	465	1,727
Agra Canal	1891	129	447
Lower Ganga Canal	1891	469	1,152
Betwa Canal	1893	122	206
Gavai and Ghaggar Canal	1918	120	55
Sarda Canal	1930	1,137	1,972
Sarda Canal Extension	1955-56	137	176
Mata tila (Stage I)	1957-58	488	265
Sarda Canal Reservoir	1960-61	479	167
WEST BENGAL—			
Damodar Canals	1935	130	172
Mayurakshi	1961-62	1,611	650

**IRRIGATION SCHEMES UNDER I, II & III
FIVE-YEAR PLANS**

A. Schemes included in I Plan

<i>State</i>	<i>Name of Scheme</i>	<i>Estima- ted cost (Rs. crores)</i>	<i>Ultimate benefit (Lakh acres)</i>
1	2	3	4
ANDHRA PRADESH ..	1. Ramperu Drainage* ..	1.28	—
	2. Bandakethu Channel* ..	0.03	0.04
	3. Nakkalagandi* ..	0.15	0.01
	4. Paleru* ..	0.07	0.01
	5. Upputeru* ..	0.11	0.02
	6. Vidyaranya Swami gudi* ..	0.02	0.00
	7. Krishna Barrage† ..	0.37	1.17
	8. Rallapad II Stage† ..	1.03	0.11
	9. Upper Pennart ..	1.45	—
	10. Sarla Sagar† ..	0.37	0.05
	11. Nagavalli† ..	0.17	0.09
	12. Vegavathi† ..	0.20	0.16
	13. Seethanagaram† ..	0.13	0.14
	14. Narayanapuram† ..	0.54	0.37
	15. Gambhiragedda† ..	0.14	0.009
	16. Kalangit ..	0.16	0.05
	17. Mallimadugu† ..	0.89	0.04
	18. Siddalagandi† ..	0.10	0.004
	19. Lower Sagileru† ..	0.68	0.06
	20. Pinchanadi† ..	0.56	0.04
	21. Chennaraya Swami gudi† ..	0.34	0.01
	22. Sirala† ..	0.019	0.03
	23. Koilsagar† ..	0.89	0.12
	24. Beemanpalli† ..	0.08	0.02
	25. Nagarjunasagar† ..	91.12	20.60
	26. Godavari I Phase† ..	6.01	0.86
	27. Bhairavanitippa† ..	1.42	0.12
	28. Rajolibunda† ..	5.33	0.94
	29. Improvements to K.G. Canal† ..	6.59	3.01
	30. Musi† ..	2.50	0.38
	31. Ananiyar Scheme* ..	1.059	0.116

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

	1	2	3	4
ASSAM	1.	Schemes for permanent improvements to scarcity areas taken up during I Plan consisting of 37 minor irrigation schemes† ..	1·11	1·428
BIHAR	1.	Sakri Lower Valley*	0·338	0·500
	2.	Triveni Canal Extension*	0·298	0·280
	3.	Drainage of Chauras and other Irrigation Schemes*	0·593	0·927
	4.	Emergency River Pumping Scheme*	0·390	0·130
	5.	Irrigation Weirs and Dams in Hilly Districts*	0·311	0·366
	6.	Botane Irrigation Schemes†	0·185	0·165
	7.	Upper Morhar Irrigation Schemes†	0·561	0·360
	8.	Lilajan Irrigation Scheme	0·650	0·560
	9.	Durgavathi†	0·322	0·260
	10.	Kaurihari†	0·482	0·288
	11.	Durgapur Lake Scheme†	0·226	0·120
	12.	Dhawa Irrigation Scheme†	0·155	0·105
	13.	Lower Morhar†	0·568	0·370
	14.	Adri†	0·153	0·105
	15.	Jinjoi	0·148	0·069
	16.	Mayurakshi L.B. Canal†	0·811	0·250
	17.	Nagi Irrigation Scheme†	0·401	0·075
	18.	Triveni Canal Extension†	1·129	0·621
	19.	Kamla Canal†	0·226	0·380
	20.	Kosi†	24·815	14·050
GUJARAT	1.	Rangola†	0·666	0·100
	2.	Brahmani†	0·909	0·270
	3.	Sasoi†	0·760	0·093
	4.	Puna*	0·199	0·015
	5.	Bhimdad*	0·226	0·030
	6.	Surajwadi	0·343	0·030
	7.	Ghee†	0·236	0·035
	8.	Moj†	0·965	0·150
	9.	Malan†	0·420	0·056
	10.	Gajod*	0·126	0·052
	11.	Sanandro*	0·116	0·062

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

	1	2	3	4
GUJARAT—contd.	12.	Kanakavathi*	0.165	0.070
	13.	Kaila*	0.142	0.069
	14.	Mahi Right Bank Canal†	22.70	4.60
	15.	Kakrapar†	18.70	5.62
	16.	Ozat†	0.454	0.150
	17.	Hiran†	0.872	0.065
	18.	Raval†	0.109	0.050
	19.	Machundri†	0.201	0.065
	20.	Aji†	0.800	0.042
	21.	Machhu Irrigation Scheme†	1.475	0.220
	22.	Bhogavo I†	0.574	0.042
	23.	Rudramata†	0.539	0.150
	24.	Harnav River Scheme†	0.462	0.100
	25.	Constructing Tank at Karol†	0.094	0.030
	26.	Motifatewadi Canal†	0.592	0.732
	27.	Patadungri Tank†	0.622	0.120
	28.	Bandara across Hiran River†	0.173	0.068
	29.	Bandara across Vir River†	0.093	0.040
	30.	Raising Doswada Tank†	0.069	0.026
	31.	Karad Tank Scheme†	0.997	0.152
	32.	Gondli†	0.215	0.033
	33.	Munjaiasar†	0.468	0.042
JAMMU AND KASHMIR	1.	Awantipore Canal*	0.100	0.100
	2.	Pratap Canal remodelling†	1.301	0.200
	3.	Kishtwar Canal†	1.030	0.050
KERALA	1.	Kuttanad Development Scheme*	0.596	1.210
	2.	Peechi†	2.350	0.720
	3.	Chalakydy I Stage†	1.533	0.568
	4.	Wadakancheri (Vazhani)†	1.076	0.176
	5.	Walayar†	1.167	0.160
	6.	Mangalam†	1.042	0.160
	7.	Nayyar I Stage†	2.240	0.380
	8.	Malampuzha†	5.320	1.000
MADHYA PRADESH	1.	Area Tank	0.281	0.100
	2.	Gondli†	0.892	0.076
	3.	Sampna†	0.488	0.095

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4	
MADHYA PRADESH— <i>contd.</i>	4. Dukhrikeda†	0.391	0.066	
	5. Mola Project†	0.300	0.070	
	6. Shivgarh Bhedi Tank†	0.103	0.036	
	7. Kundah Nala Tank†	0.244	0.040	
	8. Gangulpara†	0.498	0.085	
	9. Saroda Tank†	1.150	0.182	
	10. Dudhwa†	2.500	1.400	
	11. Chambal Project Stage I†	47.825	11.000	
	12. Borad†	0.995	0.016	
	13. Morwah Tank†	0.486	0.020	
	14. Barodia Tank†	0.205	0.015	
	15. Kulgarhi Canal Project†	0.255	0.045	
	16. Gurma Nalah†	0.945	0.190	
	17. Narkoni Canal Project†	0.800	0.181	
	18. Sagarnadi Project†	0.260	0.039	
	19. Dhuadhar Project†	0.230	0.034	
	20. Dharoli†	0.240	0.036	
	21. Jirgiri†	0.300	0.064	
	22. Bhitrigarh†	0.157	0.025	
	MADRAS	1. Lower Bhavani*	10.00	2.070
		2. Kodayar*	0.768	0.060
		3. Thorapparappa Weir Canal*	0.190	0.015
4. Manimuthar Project†		5.050	1.030	
			(including stabilisation)	
5. Vaigai Schemet†		3.300	0.200	
6. Mittur Canal		1.929	0.450	
7. Sathanur Reservoir Project†		2.580	0.210	
8. Krishnagiri Reservoir Project†		2.024	0.075	
9. Amravathi Reservoir Project†	3.298	0.535		
MAHARASHTRA	1. Gangapur Stage I†	3.959	0.450	
	2. Ranand†	0.302	0.027	
	3. Pushpavathi†	0.158	0.040	
	4. Budhial†	0.725	0.105	
	5. Bandhara on Tarali†	0.131	0.051	
	6. Bendsura†	0.585	0.093	

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4	
MAHARASHTRA— <i>contd.</i>	7. Khasapur†	0·513	0·104	
	8. Ghod†	4·850	0·600	
	9. Extension of Krishna Canal‡ ..	0·445	0·141	
	10. Mosen River†	0·573	0·150	
	11. Bandhara on Urmodi†	0·170	0·041	
	12. Shivna Anicut†	0·016	0·008	
	13. Talwar†	0·142	0·030	
	14. Dheku†	0·334	0·067	
	15. Jui†	0·321	0·057	
	16. Purna†	0·024	0·006	
	17. Kamli†	0·200	0·026	
	18. Radhanagri H.E. Project† ..	1·663	0·185	
	MYSORE	1. Sangannahalli*	0·330	0·016
		2. Tuppadahalli*	0·176	0·014
		3. Uyarhalli*	0·095	0·003
		4. Iraksandra*	0·148	0·010
		5. Gandimakunte*	0·094	0·008
		6. K. R. Sagar and Allied Works* ..	0·650	0·030
7. Honamachanally*		0·055	0·008	
8. Parsurampur*		0·120	0·009	
9. Mathugadur*		0·079	0·004	
10. Other Schemes including Extension of Visvesvaraya Canal* ..		1·414	0·224	
11. Narayana Pura†		0·254	0·022	
12. Kariyala†		0·275	0·020	
13. Lakhanpur†		0·044	0·026	
14. Kalloli†		0·034	0·033	
15. Improvement to Tank at Ganjigatti†		0·076	0·011	
16. Arwatgi†		0·026	0·007	
17. Benchi†		0·024	0·007	
18. Improvement to Tank at Hammnardi†		0·082	0·018	
19. Badhra†		33·530	2·447	
20. Ghataprabha I†		5·450	1·200	
21. Tunga Anicut†		2·311	0·213	

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4
MYSORE— <i>contd.</i>	22. Kolchi Weir†	0.429	0.032
	23. Ambligola†	0.916	0.073
	24. Nugu†	3.110	0.200
	25. Ramanhalli†	0.408	0.048
	26. Kallaskop†	0.198	0.028
	27. Areshankar†	0.217	0.031
	28. Tungabhadra†	47.050	8.210
	ORISSA	1. Hirakud†	24.76	5.700
2. Mahanadi Delta Scheme†		25.00	17.58
PUNJAB	1. Extension of Irrigation to arid area of Jandiala & Gurdaspur Divisions of Upper Bari Doab Canal*	0.133	0.168
	2. Excavation of New Distributaries of Kasur Branch*	0.233	0.679
	3. Kiran Nallah Scheme*	0.148	0.174
	4. Raising and strengthening banks of Channels*	1.149	0.390
	5. Harike Project*	9.145	0.341
	6. Remodelling of Shahnagar Canal*	0.383	0.470
	7. Kohls in Kangra District*	0.099	0.020
	8. Dadri*	0.792	—
	9. Other schemes (spillover Schemes of Old Punjab)†	0.570	—
	10. Madhopur Beas Line†	2.450	—
	11. Bhakra Nangal†	101.891	36.040
	12. Western Yamuna Canal remodeling†	5.470	6.037
	13. Sirhind Feeder†	6.700	—
RAJASTHAN	1. Kantri Tank†	0.014	0.009
	2. Bagolia Project†	0.131	0.066
	3. Kala Bhata†	0.024	0.016
	4. Deoria Tank†	0.047	0.022
	5. Ora Project†	0.159	0.080
	6. Atwara†	0.050	0.032
	7. Pai Balapura†	0.081	0.035
	8. Jawai†	2.460	0.460

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4
RAJASTHAN— <i>contd.</i> ..	9. Parbati Scheme ‡	0·945	0·350
	10. Guda †	0·670	0·200
	11. Meja †	0·665	0·300
	12. Morel †	0·440	0·190
	13. Jugar †	0·148	0·077
	14. Lodisarkanaka †	0·143	0·013
	15. Sarari Project on Musi River † ..	0·370	0·180
	16. Khari Project †	0·340	0·110
	17. Kalisi †	0·240	0·080
	18. Gandhi Sarowar (or Narayan Sagar Scheme) †	0·381	0·090
	19. Gadala Project †	0·047	0·109
	20. Gambheri †	0·610	0·135
	21. Survania †	0·130	0·046
	22. Arwar Project †	0·415	0·160
	23. Namona Canal Project †	0·443	0·120
	24. Galwa Project †	0·395	0·160
	25. Mashri Project †	0·320	0·105
	26. Parwan flow Irrigation Project ..	0·180	0·125
	27. Kalisingh Project †	0·370	0·265
	28. Bhimsagar †	0·390	0·125
	29. Bundi ka Gothra †	0·150	0·045
	30. Surwal	0·100	0·018
UTTAR PRADESH ..	1. 803 miles Extension of Sarda Canal* ..	0·490	} 1·760
	2. 1,062 miles Extension of Sarda Canal*	1·478	
	3. Partapgarh Branch*	0·737	0·594
	4. Transkalyani*	0·816	0·471
	5. Saprar Dam*	0·963	0·420
	6. Kabrai Lake*	0·233	0·048
	7. Ahraura Dam*	0·399	0·219
	8. Rangrovar (Rangawan)*	1·172	0·930
	9. Shahganj Distributary*	0·187	0·200
	10. Lalitpur*	0·541	0·430
	11. Nagwa*	0·726	0·673
	12. Chandraprabha †	0·877	0·350
	13. Naugarh Dam and Chandoli Canals † ..	1·330	0·860

* Schemes completed during I Plan Period.

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4
UTTAR PRADESH— <i>contd.</i>	14. Sardar Stage I†	4.795	1.674
	15. Belan and Tons Canal†	2.491	1.050
	16. Increasing Capacity of Upper Ganga Canal†	0.154	1.123
	17. Remodelling Agra Canal†	0.732	0.274
	18. Narayani Gandak Poktwa Canal†	0.922	0.540
	19. Banganga Canal†	0.131	0.222
	20. Arjan Dam†	1.150	0.266
	21. Afzalgarh Canal†	0.168	0.100
	22. Remodelling of Jani Escape†	0.172	—
	23. Remodelling of Eastern Yamuna Canal†	0.821	0.220
24. Tanda Canal†	0.852	0.679	
25. Dohri <i>Ghat</i>	1.750	1.188	
WEST BENGAL ..	1. Surankar Dansa Scheme*	0.136	0.060
	2. Berai Canal Project*	0.137	0.050
	3. Sonapur Ara Panch and Matla Schemes I & II*	1.286	0.464
	4. Bagjora Jatragachi Scheme*	1.089	0.256
	5. Improvement of Tengrathichi and Thinkra Khab in 75th mile and 88th mile of 24-Parganas†	0.055	0.160
	6. Mayurakshi Project†	20.150	6.450
	7. D.V.C.†	34.680	10.730

B. Schemes included in II Plan

ANDHRA PRADESH ..	1. Tungabhadra High Level Canal Stage I†	15.580	1.870
	2. Paleru Bitragunta Scheme†	0.176	0.048
	3. Paidigani Project†	0.118	0.035

* Schemes completed during I Plan Period.
† Schemes completed during II Plan Period.
‡ Spillover Schemes into III Plan.

1	2	3	4	
ANDHRA PRADESH— <i>contd.</i>	4. Torrigedda Pumping Scheme†	0.364	0.154	
	5. Zurreru Reservoir†	0.252	0.020	
	6. Jutpally Project†	0.162	0.022	
	7. Lakhanapur Project†	0.208	0.030	
	8. Suvarna Project (Jowali Nalla)†	0.479	0.110	
	9. Ramaduga Project†	0.298	0.048	
	10. Sali Vagoo Project†	0.234	0.025	
	11. Bahuda Reservoir at Nadanapali	0.340	0.029	
	12. Varha Reservoir at Kalyana Pulava†	0.348	0.000	
	13. Tandava Reservoir at Gantavari Kothagudam†	0.613	0.210	
	14. Votigadda Project†	0.778	0.112	
	15. Kalyani Project†	0.500	0.201	
	16. Vansadhara Project†	14.500	3.100	
	17. Swarnamukhi L.B. Canal†	0.250	0.080	
	18. Kottapalli Vagoo†	0.180	0.026	
	19. Nalla Vagoo†	0.248	0.071	
	20. Sudda Vagoo†	0.586	0.180	
	ASSAM	<i>Nil</i>		
	BIHAR	1. Sone Barrage†	14.430	7.34
		2. Remodelling of the Sone Canal System†	—	3.07
3. Badua (excluding Belharna Reser- voir)†		3.90	0.98	
4. Morwa†		0.403	0.12	
5. Kohira†		0.568	0.26	
6. Lower Kuli†		0.867	0.64	
7. Khajia (2nd Phase)†		0.228	0.55	
8. Torlow†		0.139	0.06	
9. Kanchi†		0.935	0.45	
10. Chako†		0.132	0.06	
11. Roro†		0.921	0.27	
12. Sakri (Phase II)†		0.292	0.13	
13. Panchano†		0.441	0.31	
14. Chandan Distribution System Phase I†		0.413	—	

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

	1	2	3	4
BIHAR—contd.	15.	Tilaiya High Level Canal Irrigation Scheme†	0.397	0.16
	16.	Kamla Weir Scheme†	0.487	0.38
	17.	Gandak (U.P., Bihar and Nepal)‡	38.71	38.08
	18.	Sone H.L. Canals†	6.260	2.76
GUJARAT	1.	Hathmati†	1.870	0.585
	2.	Shamlaji (Meshwa)†	1.040	0.360
	3.	Khodiar (Shatrunji)†	1.248	0.190
	4.	Narmada (Broach)†	43.090	9.626
	5.	Dantiwada (Banas)†	8.270	1.100
	6.	Dami†	0.510	0.056
	7.	Ghelo†	0.206	0.036
	8.	Bhogawo Stage II†	0.667	0.060
	9.	Limbdi Bhogawo†	0.531	0.080
	10.	Bhadar†	3.230	0.446
	11.	Rojki†	0.270	0.035
	12.	Dhatarwadi†	0.206	0.070
	13.	Fulzar†	0.419	0.045
	14.	Sapda†	0.209	0.025
	15.	Sakroli†	0.249	0.031
	16.	Shatrunji (Palitana)†	6.733	0.800
	17.	Kalindri†	0.154	0.020
	18.	Gajansar†	0.116	0.039
	19.	Niruna†	0.484	0.126
	20.	Mahi Stage II (Kanada) Banaswada†	16.000	6.810
	21.	Machhu Stage II†	1.720	0.287
	22.	Ukai†	28.974	3.920
	23.	Saraswati†	1.000	0.395
	24.	Vartu†	0.617	0.078
	25.	Gona†	0.583	0.054
	26.	Suvi†	0.205	0.063
JAMMU AND KASHMIR	1.	Liddar Canal†	1.000	0.074
	2.	Kathua Feeder†	0.666	0.283
	3.	Ujh†	22.000	0.720

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4
KERALA ..	1. Chalakudy Stage II† 2. Boothathan—Kettu (Periyar Valley Scheme)† 3. Cheerzkuzhi† 4. Regulator at Thannirmukkam (Kuttanad Salt Water Barrier)† 5. Kattampally† 6. Neyyar Stage II† 7. Mennakara including Chulliar Reservoir† 8. Pothundy†	0·60 3·48 0·47 1·50 0·286 1·45 1·35 1·70	0·20 0·63 0·04 — 0·04 0·099 0·11 —
MADHYA PRADESB ..	1. Tawa (Irrigation)† 2. Development of Maniari Tank .. 3. Bila† 4. Kedar Nalla† 5. Keswa Nalla† 6. Barna† 7. Nan-danwara† 8. Beniganj† 9. Chandrakeshar† 10. Chillar† 11. Rana Partap Sagar (Share of M.P.) 12. Removing shortage in Harsi Irrigation Scheme† (a) Pick-up Weir on Parbati River (b) Chait Tank. } 13. Nagda Nalla† 14. Raigwan† 15. Remodelling Mahanadi Canal System† 16. Nahlesara† 17. Jassaiya Banskhedhi Dam Project (Koncha)† 18. Kaliasote Project† 19. Devendra Nagar† 20. Galhatta† 21. Bhansa Khedi Project†	21·836 0·25 1·57 0·37 0·465 5·516 0·120 0·455 0·886 0·511 3·511 0·483 0·43 0·633 2·450 0·634 0·78 0·38 0·309 0·30 0·224	7·50 0·24 0·32 0·12 0·08 1·64 0·04 0·10 0·12 0·13 1·50 0·12 0·08 0·08 — 0·09 0·14 0·15 0·06 0·08 0·03

1	2	3	4
MADHYA PRADESH—	22. Akhajiri†	0.219	0.04
<i>contd.</i>	23. Provision for Irrigation Scheme in Rajgarh Distt. (Chappi)† ..	0.35	—
	24. Provision for Irrigation Scheme in Bhilsa Distt. (Katan)† ..	0.30	—
	25. Pampawati Tank†	0.170	0.03
	26. Parresi†	0.290	0.04
	27. Dhara Tank†	0.136	—
	28. Jalgaon Tank†	0.109	—
	29. Jabera Tank†	0.11	—
	30. Gopalpura Tank†	0.130	—
	31. Bhainswar Tank†	0.240	—
	32. Kharadi Tank†	0.248	—
	33. Burwaha Tank†	—	—
MADRAS	1. New Kattalai Canal Scheme† ..	1.72	0.21
	2. Pullambady Canal Scheme† ..	1.57	0.22
	3. Vidur Reservoir Project† ..	0.880	0.02
	4. Diversion of West flowing rivers to East—Parambikulam Aliyar Project†	25.45	2.10
MAHARASHTRA ..	1. Gangapur Stage II†	0.95	0.19
	2. Vir†	5.41	1.00
	3. Mula†	15.00	1.31
	4. Girna†	8.65	1.43
	5. New Khadakvasla†	10.55	0.77
	6. Upper Dudna†	0.42	0.08
	7. Galhati†	0.58	0.12
	8. Harni†	0.31	0.06
	9. Mannar Phase I†	1.92	0.25
	10. Sindi Phana†	0.39	0.07
	11. Bor†	2.12	0.26
	12. Pandharbori†	0.40	0.05
	13. Tirna†	0.37	0.04
	14. Kada†	0.24	0.07
	15. Wan†	0.80	0.13
	16. Mehkri†	0.57	0.10
	17. Jivrakha†	0.29	0.06

† Schemes completed during II Plan Period.

‡ Spillover Schemes into III Plan.

1	2	3	4
MAHARASHTRA— <i>contd.</i>	18. Khelna‡	0.50	0.08
	19. Nalganga‡	2.01	0.25
	20. Chandni‡	0.60	0.09
	21. Sukhna‡	0.76	0.13
	22. Mohesangvi‡	0.28	0.05
	23. Ekburji‡	0.40	0.08
	24. Purna‡	12.84	1.52
	25. Dina Nadi‡	2.44	1.31
	26. Warna‡	1.63	0.20
	27. Kurnoor‡	1.65	0.15
	28. Katepurna	2.28	2.24
	29. Bagh‡	6.10	0.60
	30. Itiadoh‡	6.92	0.75
MYSORE	1. Kabini‡	3.200	0.300
	2. Jambadhalla‡	0.490	0.060
	3. Hagari Bammanahalli‡	0.830	0.073
	4. Habbahalla‡	0.280	0.015
	5. Mangala‡	0.130	0.013
	6. Dharma‡	0.690	0.130
	7. Lakshmanatirtha‡	0.300	0.030
	8. Ghataprabha Stage II Hidakal Dam Project Phase I‡	13.180	1.780
	9. Hatli Kone‡	0.590	0.053
	10. Chickhole‡	0.463	0.026
	11. Kanaka Nala‡	0.450	0.350
	12. Arkavathi at Arabole‡	0.398	0.051
	13. Nagathana Tank‡	0.144	—
ORISSA	1. Salandi‡	4.656	3.28
	2. Salki‡	0.520	0.45
	3. Darjang‡	0.825	0.25
	4. Budhi Sudhiani‡	0.358	0.09
	5. Salia‡	0.698	0.27
	6. Gadhado‡	0.404	0.11
	7. Dhanai‡	0.381	0.13
PUNJAB	1. Extension of Irrigation (lift) to Rewari and adjoining Areas‡	1.073	..

1	2	3	4
PUNJAB— <i>contd.</i>	2. Western Yamuna Canal Feeders Project†	2.560	--
	(Total cost Rs. 256 lakhs) share of Punjab Rs. 161.00 lakhs.		
	3. Gurgaon Canal Project (Revised 1961)†	5.900	2.75
	Flow-cum-Lift Irrigation.		
	4. Remodelling and canalising Main Line, Lower W.Y.C.† ..	0.442	0.45
	5. Extension of non-perennial irrigation to area of Upper Bari Doab Canal†	0.360	0.40
PONDICHERRY	1. Anicut across Ponnai at Sornavur	0.10	0.066
RAJASTHAN	1. Rana Pratap Sagar Dam, Chambal Stage II (Share of Rajasthan)†	3.511	1.50
	2. Berach Irrigation Project near Vallab Nagar†	0.495	0.11
	3. Berach Irrigation Project near Badgaon†	0.568	0.18
	4. Alnia Irrigation Project† ..	0.555	0.12
	5. Khari Feeder for Rajasmand†	0.600	0.08
	6. West Banas Irrigation Project†	0.488	0.13
	7. Bharatpur Feeder†	0.150	0.18
	8. Mahi Irrigation Project† ..	3.080	0.70
	9. Orai Irrigation Project† ..	0.412	0.11
	10. Lesaria†	0.170	0.05
	11. Lakham (Major)†	2.334	0.33
	12. Banas Irrigation Project† ..	7.760	2.10
	13. Bandi Irrigation Project† ..	0.50	0.08
	14. Angore and Khemari (Khari Storage)†	0.32	0.14
	15. Sukli River Project†	0.58	0.08
	16. Gurgaon Canal Project† ..	0.34	0.08
	17. Sawanbhadon Irrigation Project†	0.41	0.10
	18. Reservoir between Govindgarh and Pisanganj on Sabarmati River†	0.20	0.02
	19. Rajasthan Canal†	66.47	16.84

† Spillover Schemes into III Plan.

1	2	3	4
UTTAR PRADESH ..	1. Ohen Reservoir Project‡ ..	0.844	0.15
	2. Tumaria Reservoir Project‡ ..	1.779	0.40
	3. Nanak Sagar Scheme ..	3.807	1.33
	4. Upper Khajuri Reservoir Project‡	0.480	0.14
	5. Jirgo Reservoir Project‡ ..	1.214	0.64
	6. Kuwano Pumped Project‡ ..	0.500	0.53
	7. Meja Reservoir Project‡ ..	2.105	0.71
	8. Matatila Dam Stage II Irriga- tion‡	7.824	1.48
	9. Sarda Sagar Stage II‡ ..	6.357	1.85
	10. Ramganga River Project Irriga- tion‡	26.128	17.05
WEST BENGAL ..	1. Amta Drainage Scheme (area claimed 0.21 <i>lakhs</i>)‡ ..	0.233	—
	2. Karatowa Talma‡	0.464	0.22
	3. Kangsabati‡	25.260	9.00
	4. Sahrajore‡	0.200	0.10

C. New Schemes for III Plan

ANDHRA PRADESH ..	1. Vamsadhara	14.50	2.284
	2. Kanupur Canal Scheme ..	0.65	0.170
	3. Varadarajaswamigudi ..	0.50	0.050
	4. Vottigedda	0.78	0.112
	5. Pampa Reservoir	0.61	0.300
	6. Lakkasagar	0.29	0.050
	7. Kotepallivagu	0.18	0.026

‡ Spillover Schemes into III Plan.

1	2	3	4
ASSAM	1. Yanuna Irrigation Scheme ..	1.680	0.640
	2. Longa Irrigation Scheme (Goalpara Distt.)	0.280	0.300
	3. Mora Dhansiri Irrigation Scheme	0.200	0.300
	4. Sukla Irrigation Scheme (Kamrup Distt.)	0.320	0.380
	5. Rangma Irrigation Scheme (Sibsagar Distt.)	0.190	0.230
BIHAR	1. Kosi Project	17.700	11.490
	2. Ajoy Barrage at Sikha	3.000	0.900
	3. Gumani Reservoir Project	2.000	0.412
	4. Chandan Reservoir Project	3.000	1.350
	5. Udrastan Irrigation Scheme	0.790	0.660
	6. Kokro Irrigation Scheme	0.160	0.060
	7. Khudia Irrigation Scheme	0.500	0.250
	8. Araj Irrigation Scheme	0.160	0.060
	9. Banki (Left) Irrigation Scheme	0.250	0.080
	10. Sona Irrigation Scheme	0.380	0.100
	11. Bijoy Irrigation Scheme	0.130	0.050
	12. Kamla Irrigation Scheme	0.610	0.600
JAMMU & KASHMIR ..	1. High Level Canal from Veshow to New Kareva	0.750	0.150
	2. Waripora Storage Tank	0.410	0.050
	3. Chech Dam around Charislurifin Badgam and Beroo area	0.120	0.080
	4. Bringhi Canal	0.120	0.050
KERALA	1. Kallada	8.400	1.070
	2. Pamba	3.850	0.330
	3. Kuttiyadi	4.600	0.250
	4. Chitturpuzha	1.000	0.250
	5. Kanjirapuzha	3.550	0.240
MADHYA PRADESH ..	1. Hasdeo	16.00	3.00
	2. Betwa Valley Development (a) Halali (b) Bah (c) Sagar	8.500	2.160
	3. Medium Schemes not finalised	3.00	Not known
MADRAS ..	1. Modernising existing Vaigai Channels in Ramnathapuram Distt.	1.250	0.250

1	2	3	4
MADRAS—contd.	.. 2. Improvement to Palar Anicut and Channels	0.480	0.033
	3. Sathanur Project 2nd Stage	0.550	0.050
	4. Chittor Pattanamkal Scheme	1.780	0.150
	5. Gomukhinadi Scheme	0.870	0.080
	6. Manjalar Scheme	0.860	0.033
	7. Diversion of West flowing rivers	—	—
MAHARASHTRA	.. 1. Koyna Irrigation Scheme	9.500	0.262
	2. Bhima Lift Irrigation Scheme	9.460	2.000
	3. Kal River Project	0.900	0.225
	4. Irrigation Tank at Malangam	0.280	0.071
	5. Purna Arna River Project	3.220	0.367
	6. Pus River Project	2.160	0.252
	7. Man Utavali River Project	1.730	0.205
	8. Munna River Project	1.080	0.148
	9. Murna River Project	0.560	0.139
	10. Manjra River Project	2.150	0.370
	11. Andhali Irrigation Tank	0.220	0.056
	12. Shiralwadi Irrigation Scheme	0.140	0.336
	13. Tambve Irrigation Tank	0.110	0.026
	14. Karwand	1.260	0.112
MYSORE	.. 1. Malaprabha Project	20.00	3.000
	2. Harangi Project or Kambada Koda Project	9.00	0.573
	3. Hemavati Project	3.50	0.355
	4. Bijur	0.52	0.500
	5. Kattinahole	0.12	0.010
	6. Srinivassagar Tank	1.60	0.011
	7. Other Schemes	1.00	0.100
ORISSA	.. 1. Birgovindpur Irrigation Scheme	5.070	1.700
	2. Pipalpankha	1.340	0.454
	3. Siaria	0.180	0.044
	4. Remodelling H.L. Canal	0.200	0.067
	5. Behuda Stage I	0.780	0.370
PUNJAB	.. 1. Beas Project—		
	(a) Unit I—Sutlej Beas Link	32.60	7.300
	(b) Unit II—Pang Dam	15.23	

1	2	3	4
PUNJAB— <i>contd.</i>	2. Utilisation of Sutlej waters released by construction of Sirhind Feeder	0.30	0.050
	3. Remodelling of Harike Head Works	0.15	0.025
RAJASTHAN	1. Beas Project	69.60	—
	2. Gopalpur	0.39	0.080
	3. Manpura	0.30	0.040
	4. Saran Kheri	0.13	0.025
	5. Jetpura	0.40	0.080
	6. Sali	0.75	0.150
	7. Wagli	0.60	0.120
	8. Khod	0.25	0.050
	9. Ratplas	0.25	0.500
	10. Rasundhari	0.25	0.050
UTTAR PRADESH	1. Sarju Canal	10.78	4.185
	2. Gandak Canal	11.31	7.05
	3. Remodelling of Narora Weir	4.00	—
	4. Constructing 40 miles of Channels on Dhanapur Distributary	0.06	0.125
	5. Tarighat Distributary Project ..	0.06	0.100
	6. Extension of Channels of Saprar Dam	0.02	0.030
	7. Extension of 90 miles Channels on Belan Canals	0.10	0.153
	8. Extension and construction of 10 miles of Channels on Kabrai Distributary System ..	0.02	0.020
	9. Extension of Channels on Arjun Dam	0.05	0.060
	10. Lalitpur Canal	0.10	0.100
	11. Projects for 5 miles of Channels on Ohen Canals	0.01	0.007
	12. Jahangirganj Branch ..	0.39	0.339
	13. Tumaria Extension	1.50	0.560
	14. Gomti Reservoir	3.00	1.000
	15. Project for 78 miles of Channels on Ken Canal System ..	0.10	0.320

1	2	3	4
UTTAR PRADESH— <i>contd.</i>	16. Baur Reservoir	1.53	0.393
	17. Pilli Reservoir	1.10	0.258
	18. Jamni Dam	1.34	0.300
	19. Chittaurgarh	1.02	0.209
	20. Pathkauli Reservoir	0.32	0.064
	21. Barwa Dam	0.45	0.090
	22. Magru Dam	0.45	0.075
	23. Malin Reservoir	1.34	0.236
	24. Western Yamuna Canal Remodelling Extension Unit	0.13	—
	(b) Western Yamuna Canal Remodelling		
WEST BENGAL ..	1. D.V.C. Extension and Improve- ment of Irrigation System ..	6.64	1.10
	2. Hinglow Irrigation Scheme ..	0.78	0.251
	3. Bandhu River Irrigation Project	0.18	0.071

ABSTRACT OF BENEFITS ANTICIPATED FROM MAJOR AND MEDIUM IRRIGATION PROJECTS

(One acre) gross area

Name of State	Irrigation on full development from First and Second Plan Schemes	First and Second Plan Schemes				New Schemes of Third Plan		Total from continuing Schemes and new Schemes of Third Plan to end of Third Plan		Additional benefits in Third Plan	
		Potential created to end of Second Plan	Utilisation to end of Second Plan	Potential to end of Third Plan	Utilisation to end of Third Plan	Potential to end of Third Plan	Utilisation to end of Third Plan	Potential (Col. 5 + 7)	Utilisation (Col. 6 + 8)	Potential (Col. 9—3)	Utilisation (Col. 10—4)
1	2	3	4	5	6	7	8	9	10	11	12
1. Andhra Pradesh ..	3,720	830	736	3,361	2,159	134	134	3,495	2,293	2,665	1,557
2. Assam ..	—	—	—	—	—	88	79	88	79	88	79
3. Bihar ..	5,569	915	720	3,192	2,402	482	318	3,674	2,720	2,759	2,000
4. Gujarat ..	3,809	640	227	1,716	1,091	..	..	1,716	1,091	1,076	864
5. Jammu & Kashmir ..	153	5	5	55	32	11	11	66	43	61	38
6. Kerala ..	555	358	358	527	527	86	86	613	613	255	255
7. Madhya Pradesh ..	2,242	95	75	1,365	905	40	20	1,405	925	1,310	850
8. Madras ..	890	611	581	791	789	33	33	824	822	213	241
9. Maharashtra ..	1,248	233	105	999	713	353	100	1,352	813	1,119	708
10. Mysore ..	1,430	707	324	1,348	1,173	52	27	1,400	1,200	693	876
11. Orissa ..	2,615	1,000	720	2,287	1,666	..	..	2,287	1,666	1,287	946
12. Punjab ..	4,351	3,307	2,957	4,157	1,058	200	200	4,357	4,258	1,050	1,301
13. Rajasthan ..	3,666	734	618	2,357	1,754	25	9	2,382	1,763	1,648	1,145
14. Uttar Pradesh ..	4,262	2,118	1,479	2,800	2,423	912	98	3,712	2,521	1,594	1,042
15. West Bengal ..	2,990	1,690	1,084	2,071	1,936	32	32	2,103	1,968	413	884
Total ..	37,560	13,243	9,989	27,026	21,628	2,448	1,147	29,474	22,775	16,231	12,786

Additional utilisation in Third Plan from the continuing Schemes of First and Second Plans (Col. 6—4) - 11,639,000 acres.

BENEFITS FROM IRRIGATION SCHEMES—YEAR-WISE

Year	Potential at channel outlets (in million acres)	Gross area (in million acres)	Irrigated as percentage of potential at outlet	Net area irrigated (in million acres)
1955-56	6.5	3.1	48	2.9
1956-57	7.4	4.2	58	3.4
1957-58	8.2	5.8	71	4.9
1958-59	9.7	6.5	67	5.9
1959-60	11.5	8.3	72	7.4
1960-61	13.2	10.0	76	9.0

Source: Ministry of Agriculture, Government of India, New Delhi.

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INTERNATIONAL

AREA IRRIGATED IN SOME COUNTRIES OF THE WORLD

(Latest Figures available)

Name of Country	Area irrigated in million acres
1	2
Afghanistan	6.00
Africa—South	1.35
Argentina	2.72
Australia	2.00
Burma	1.30
Canada	1.00
Ceylon	0.73
Chile	3.36
China	131.82
France	6.15
India	65.74
Indonesia	11.12
Iran	3.78
Iraq	7.20
Italy	6.60
Japan	8.31
Korea—North	0.93

1	2
Korea—South	1·42
Mexico	6·20
Netherlands	2·52
Pakistan	26·62
Peru	3·00
Philippines	1·24
Spain	4·50
Sudan	3·50
Taiwan	1·34
Thailand	3·26
U.A.R.	7·47
U.S.A.	37·70
U.S.S.R.	30·34

**WHEAT PRODUCTION IN SOME COUNTRIES OF THE WORLD
DURING 1959**

<i>Name of Country</i>	<i>(Thousand metric tonnes)</i>
1	2
AFRICA—	
Algeria	1,105
Kenya	128
Morocco	1,956
Tunisia	517
U.A.R., Egypt	1,443
Union of South Africa	720
AMERICA—NORTH—	
Canada	11,254
Mexico	1,306
United States	30,794
AMERICA—SOUTH—	
Argentina	5,837
Brazil	792
Chile	1,080
Columbia	144
Peru	136
Uruguay	214

1	2
ASIA—	
China (Mainland)	28,950 (1958)
China (Taiwan)	42
Cyprus	81 (1958)
India	9,929
Iran	3,103
Iraq	659
Israel	74
Japan	1,459
Jordan	104
Pakistan	3,915
Republic of Korea	118
Turkey	7,987
U.A.R., Syria	632
EUROPE—	
Albania	101 (1958)
Austria	589
Belgium	793
Bulgaria	2,426
Czechoslovakia	1,649
Denmark	364
Eastern Germany	1,353 (1958)
Federal Republic of German	4,522
Finland	243
France	11,544
Greece	1,770
Hungary	1,909
Ireland	370
Luxembourg	50
Netherlands	494
Norway	28
Poland	2,484
Portugal	623
Rumania	4,001
Spain	4,644
Sweden	836
Switzerland	366
Italy	8,466
United Kingdom	2,830
Yugoslavia	4,134

1	2
OCEANIA—	
Australia	5,307
New Zealand	230
U.S.S.R.—	
U.S.S.R.	69,100

**MAIZE PRODUCTION IN SOME COUNTRIES OF THE WORLD
DURING 1959**

1	2
<i>Name of Country</i>	
	<i>(Thousand metric tonnes)</i>
AFRICA—	
Angola	320 (1958)
Congo	333
Ethiopia	150 (1958)
French West Africa	512 (1958)
Ghana	183 (1958)
Kenya	87
Morocco	398
Rhodesia, Nyasaland, Northern Rhodesia	100
Southern Rhodesia	263
Ruanda-Urundi	175
Togo	82
Union of South Africa	3,776
U.A.R., Egypt	1,397
AMERICA—NORTH—	
Canada	788
Costa Rica	60 (1957)
Cuba	191
Dominican Republic	98 (1958)
El Salvador	151
Guatemala	469 (1958)
Honduras	281
Mexico	5,499
Nicaragua	99
Panama	80 (1958)
United States	1,10,778

1	2
AMERICA—SOUTH—	
Argentina	4,108
Brazil	7,747
Columbia	650
Chile	120
Equador	157
Paraguay	125 (1958)
Peru	290 (1958)
Uruguay	133 (1958)
Venezuela	358 (1958)
ASIA—	
Cambodia	43
India	3,673
Indonesia, Java and Madura	2,101
Japan	104
Pakistan	488
Philippines	989
Thailand	282
Turkey	1,000
Viet-Nam	26
EUROPE—	
Albania	160 (1958)
Austria	146
Bulgaria	1,506
Czechoslovakia	503
France	1,825
Greece	278
Hungary	3,558
Italy	3,880
Poland	19
Portugal	479
Rumania	5,680
Spain	959
Yugoslavia	6,670
OCEANIA—	
Australia	124
U.S.S.R.—	
U.S.S.R.	12,000

**RICE PRODUCTION IN SOME COUNTRIES OF THE WORLD
DURING 1959**

<i>Name of Country</i>	<i>(Thousand metric tonnes)</i>
AFRICA—	
Congo	165
Fr. Equat. Africa	40 (1958)
Fr. West Africa	727 (1957)
Ghana	30 (1958)
Madagascar	1,100 (1958)
Morocco	21
Sierra Leone	264
Tanganyika	18
U.A.R., Egypt	1,535
Zanzibar, Pamba	14
AMERICA—NORTH—	
Costa Rica	57 (1958)
Cuba	249
Dominican Republic	116 (1958)
El Salvador	12
Guatemala	12 (1958)
Honduras	22
Mexico	261
Nicaragua	33
Panama	127
Trinidad, Tobago	10 (1958)
United States	2,410
AMERICA—SOUTH—	
Argentina	188
Brazil	4,082
British Guiana	106
Chile	130
Columbia	422
Equador	186
Peru	295 (1958)
Surinam	79
Uruguay	49 (1958)
Venezuela	37

1	2
ASIA—	
Burma	6,843
Cambodia	1,406
Ceylon	746
China (Mainland)	1,13,700 (1958)
China (Taiwan)	2,307
Federation of Malaya	871
India	44,713
Indonesia (Java, Madura and other islands)	12,402
Iran	526
Iraq	91
Japan	15,626
Korea, Republic of	3,255
Laos	520
Nepal	1,157 (1958)
North Borneo	66
Pakistan	14,419
Philippines	3,668
Thailand	7,275
Turkey	153
U.A.R., Syria	2
Viet-Nam, Republic of	5,311
EUROPE—	
France	132
Greece	72
Hungary	59
Italy	712
Portugal	163
Rumania	37 (1958)
Spain	386
Yugoslavia	21
OCEANIA—	
Australia	124
Fiji Islands	24 (1958)

POWER STATISTICS

INDIA

The growth of installed capacity and energy generated is given in the following statements:—

GROWTH OF INSTALLED CAPACITY IN MILLION kW.

	1955	1960-61
State owned public utilities	1.52	3.32
Company owned public utilities	1.18	1.36
Self-generating industrial establishments	0.72	1.02
Total ..	3.42	5.70

TOTAL INSTALLED CAPACITY BY TYPE OF PLANT IN MILLION kW.

	1955	1960-61
Hydro plant	0.94	1.93
Steam plant	2.27	3.46
Oil plant	0.21	0.31
Total ..	3.42	5.70

GROWTH OF ENERGY GENERATED IN MILLION kWh.

	1955	1960-61
State owned public utilities	4,573	11,250
Company owned public utilities	4,019	5,750
Self-generating industrial establishments	2,185	2,850
Total ..	10,777	19,850

TOWNS AND VILLAGES ELECTRIFIED

<i>Population range</i>	<i>Numbers electrified by March 1956</i>	<i>Numbers electrified by March 1961</i>
Over 1,00,000	73	73
50,000 to 1,00,000	111	111
20,000 to 50,000	366	399
10,000 to 20,000	350	756
5,000 to 10,000	1,200	1,800
Less than 5,000	5,300	19,861
Total ..	7,400	23,000

TOWNS AND VILLAGES ELECTRIFIED DURING 1959-60
(STATE-WISE)

Andhra	200
Assam	6
Bihar	450
Bombay	144
Delhi	21
Jammu & Kashmir	25
Kerala	268
Madhya Pradesh	73
Madras	400
Mysore	150
Orissa	35
Punjab	4,000
Rajasthan	32

GROWTH OF ELECTRICITY CONSUMPTION

<i>Class of utilisation</i>	<i>Million kWh. 1955</i>	<i>Million kWh. 1960-61</i>
1	2	3
Domestic or residential light and small power ..	850.426	1,492.0
Commercial light and small power	514.423	870.0
Industrial power	6,757.063	12,313.5
Traction	403.302	449.0

1	2	3
Public lighting	105·631	192·0
Irrigation	254·803	836·0
Public water-works & sewage pumping	284·637	455·0
Consumption of auxiliaries, transmission losses <i>etc.</i> (including 5 per cent of generation in self-generat- ing industrial establishments).	1,606·981	3,242·5
Total Generation	10,777·266	19,850·0

HYDRO-ELECTRIC INSTALLATIONS COMMISSIONED IN THE PRE-PLAN PERIOD

	<i>Year</i>
1. Darjeeling Power House, West Bengal	1897
2. Kotagiri (Madras)	1900
3. Cauvery River Power Scheme (Mysore)	1902
4. Cordite Factory (Madras)	1904
5. Pallivassal Scheme (Kerala)—Stage I	1906
6. Mohora Power House (Kashmir)	1907
7. Mussoorie Power House (U.P.)	1909
8. Jammu Power House (Kashmir)	1909
9. Patiala Power House (Punjab)	1910
10. Simla Power House (Punjab)	1911
11. Gokak Falls (Bombay)	1914
12. The Tata Hydro-electric Power Station (Bombay)	1915
13. Annally (Madras)	1915
14. Bhatghat Dam (Bombay)	1915
15. Amritsar Power House (Punjab)	1916
16. Ganges Hydro-electric Grid (U.P.)	1917
17. Nainital Power House (U.P.)	1921
18. Andhra Valley Power Supply Co. (Bombay)	1922
19. Pannimade (Madras)	1923
20. Jubbal Power House (Himachal Pradesh)	1925
21. Tata Power Co. (Bombay)	1927
22. Glen Morgan (Madras)	1929
23. Manipore State	1930
24. Mandi Hydro-electric Scheme (Punjab)	1933
25. Pykara Power House (Madras)	1933
26. Kursong Hydro-electric Works (West Bengal)	1933
27. Satara Hydro-electric Works (Bombay)	1935

28. Muzaffarabad Power House (Kashmir)	..	..	1935
29. Shillong Power House (Assam)	..	..	1937
30. Mettur Dam (Madras)	..	..	1937
31. Chamba Power House (Himachal Pradesh)	..	..	1938
32. Pallivassal Scheme (Kerala)—Stage II..	..	..	1940
33. Papanasam Scheme (Madras)	..	..	1944
34. Jog Falls (Mysore)	..	..	1947

PRINCIPAL POWER STATIONS COMMISSIONED DURING THE FIRST AND SECOND PLANS

Plants Commissioned during the First Plan (1951—56)

	<i>Installed capacity commissioned in kW.</i>
Nizamsagar Hydro-electric Scheme (Andhra Pradesh)	15,000
Machkund Hydro-electric Project (Andhra Pradesh and Orissa)	34,000
Sindri Thermal Station (Bihar)	80,000
Bokaro Thermal Station (D.V.C.)	1,72,500
Utran Thermal Station (Gujarat)	22,500
Ahemdabad Electric Supply Extension (Private Sector— Gujarat)	60,000
Sengulam Power Station (Kerala)	48,000
Chandni Thermal Station (Madhya Pradesh)	17,000
Indore Thermal Station Extension (Madhya Pradesh)	13,000
Moyar Power House (Madras)	36,000
Pykara Power House (Madras)	27,200
Madras Plant Extension (Madras)	30,000
Khaperkheda Thermal Station (Maharashtra)	30,000
Chola Power Station (Maharashtra)	78,000
Ballarshah Thermal Station (Maharashtra)	7,750
Bhira Hydro-electric Scheme (Maharsashtra)	22,000
Jog Power Station (Mysore)	72,000
Nangal Power House (Punjab)	48,000
Kanpur Thermal Station (Uttar Pradesh)	15,000
Pathri Hydro-electric Scheme (Uttar Pradesh)	20,400
Sarda Hydro-electric Scheme (Uttar Pradesh)	41,400
Calcutta Electric Supply Corporation Extension (West Bengal)	30,000
Delhi Thermal Station (Delhi)	20,000

Plants Commissioned during the Second Plan (1956—61)

	<i>Installed capacity commissioned in kW.</i>
Machkund Hydro-electric Scheme (Andhra Pradesh and Orissa)	81,000
Tungabhadra Hydro-electric Project (Andhra Pradesh and Mysore)	36,000
Ramagundam Thermal Station (Andhra Pradesh)	37,500
Umtru Hydro-electric Scheme (Assam)	8,400
Maithon Hydro-electric Scheme (D.V.C.)	60,000
Panchet Hydro-electric Scheme (D.V.C.)	40,000
Bokaro Thermal Station Extension (D.V.C.)	82,500
Durgapur Thermal Station (D.V.C.)	1,65,000
Ahmedabad Thermal Station Extension (Private Sector—Gujarat)	15,000
Utran Thermal Station (Gujarat)	45,000
Poringalkuthu Hydro-electric Project (Kerala)	32,000
Neriamangalam Hydro-electric Project (Kerala)	45,000
Korba Thermal Station (Madhya Pradesh)	90,000
Gandhisagar Dam Power Station (Madhya Pradesh and Rajasthan)	69,000
Bhilai Steel Plant Power Station (Madhya Pradesh)	25,000
Madras Thermal Station Extension (Madras)	30,000
Periyar Hydro-electric Project (Madras)	1,05,000
Kundah Hydro-electric Project (Madras)	1,45,000
Trombay Thermal Station (Private Sector—Maharashtra)	1,87,500
Akola (Paras) Thermal Station (Maharashtra)	30,000
Ballarshah Thermal Station (Maharashtra)	15,500
Khaperkheda Thermal Station Extension (Maharashtra)	30,000
Tungabhadra Left Bank Power House (Mysore)	9,000
Hirakud Hydro-electric Project (Orissa)	1,23,000
Rourkela Steel Plant Power Station (Orissa)	75,000
Bhakra-Nangal Project (Punjab & Rajasthan)	2,70,000
Kanpur Thermal Station Extension (Uttar Pradesh)	15,000
Eastern Area Power Stations (Uttar Pradesh)	45,000
Durgapur Coke-oven Plant Thermal Station (West Bengal)	60,000
Indian Iron and Steel Co., Power Station, Burnpur (West Bengal)	20,000

**PRINCIPAL GENERATION SCHEMES INCLUDED IN THE THIRD PLAN
WITH BENEFIT POTENTIAL**

Spillover from II Plan

*Total installed
Capacity in kW.*

Tungabhadra Hydro-electric Project Stage II (Andhra Pradesh and Mysore)	36,000
Nellore Thermal Station (Andhra Pradesh)	30,000
Upper Sileru Hydro-electric Project (Andhra Pradesh)	1,20,000
Umiam Hydro-electric Project Stage I (Assam)	36,000
Barauni Thermal Station (Bihar)	30,000
Pathratu Thermal Station (Bihar)	1,00,000
Chandrapura Thermal Station (D.V.C.)	2,80,000
Ahmedabad Thermal Station Extension (Private Sector--Gujarat)	30,000
Panniar Hydro-electric Project (Kerala)	30,000
Sholayar Hydro-electric Project (Kerala)	54,000
Gandhisagar Dam Power Station IV Unit (Madhya Pradesh and Rajasthan)	23,000
Amarkantak Thermal Station (Madhya Pradesh)	60,000
Neiveli Lignite Power Station (Madras)	2,50,000
Kundah Hydro-electric Project (Madras)	35,000
Koyna Hydro-electric Project Stage I (Maharashtra)	2,40,000
Purna Hydro-electric Project (Maharashtra)	15,000
Bhadra Hydro-electric Project (Mysore)	33,200
Tungabhadra Left Bank Power House (Mysore)	18,000
Sharavathy Hydro-electric Project Stage I (Mysore)	1,78,200
Hirakud Hydro-electric Project (Orissa)	1,47,000
Bhakra-Nangal Project (Punjab & Rajasthan)	1,64,000
Rana Pratap Sagar Dam Power House (Rajasthan and Madhya Pradesh)	1,28,000
Rihand Hydro-electric Project (Uttar Pradesh)	2,50,000
Kanpur Thermal Station Extension (U.P.)	15,000
Harduaganj Thermal Station (Uttar Pradesh)	60,000
Matatila Hydro-electric Project (U.P.)	30,000
Yamuna Hydro-electric Project (U.P.)	3,20,000
Ramganga Hydro-electric Project (U.P.)	1,27,500
Jaldhaka Hydro-electric Project (West Bengal)	18,000
Durgapur Coke-oven Plant Power House Extension (West Bengal)	1,50,000
Delhi Thermal Station Extension (Delhi)	30,000

*Total installed
Capacity in kW.*

New Schemes

Kothagudem Thermal Station (Andhra Pradesh)	1,20,000
Ramagundam Thermal Station Extension (Andhra Pradesh)	60,000
Nagarjunasagar Hydro-electric Project (Andhra Pradesh) ..	1,00,000
Srisailem Hydro-electric Project (Andhra Pradesh) ..	3,30,000
Nahorkatiya Thermal Station (Assam)	67,200
Umiam Hydro-electric Project Stage II (Assam)	65,000
Barauni Thermal Station Extension (Bihar)	75,000
Pathratu Thermal Station Extension (Bihar)	2,50,000
Thermal Extensions in D.V.C. Area (D.V.C.)	2,80,000
Gandak Hydro-electric Project (Bihar)	15,000
Kosi Hydro-electric Project (Bihar)	20,000
Ahmedabad Thermal Station Extension (Private Sector— Gujarat)	30,000
Dhuvaran (Cambay) Thermal Station (Gujarat)	2,00,000
Chenani Hydro-electric Project (Jammu & Kashmir) ..	15,000
Jhelum Hydro-electric Project (Jammu & Kashmir) ..	27,000
Salal Hydro-electric Project (Jammu & Kashmir)	60,000
Sabargiri (Pamba) Hydro-electric Project (Kerala) ..	3,00,000
Idikki Hydro-electric Project (Kerala)	3,90,000
Kuttiadi Hydro-electric Project (Kerala)	45,000
Korba Thermal Station Extension (Madhya Pradesh) ..	2,00,000
Satpura Thermal Station (Madhya Pradesh)	1,80,000
Tawa Hydro-electric Project (Madhya Pradesh)	42,000
Punasa Hydro-electric Project (Madhya Pradesh & Gujarat)	5,76,000
Kundah Hydro-electric Project (Madras)	2,40,000
Mettur Tunnel Hydro-electric Project (Madras)	1,00,000
Periyar Hydro-electric Station Extension (Madras) ..	35,000
Neiveli Lignite Power Station Extension (Madras) ..	1,50,000
Parambikulam Hydro-electric Project (Madras)	1,80,000
Koyna Hydro-electric Project Stage II (Maharashtra) ..	3,00,000
Khaperkheda Thermal Station Extension (Maharashtra) ..	60,000
Akola (Paras) Thermal Station Extension (Maharashtra) ..	60,000
Bhusawal Thermal Station (Maharashtra)	60,000
Nuclear Power Station (Maharashtra & Gujarat)	3,00,000
Viatarna Hydro-electric Project (Maharashtra)	45,000
Sharavathy Hydro-electric Project Stage II (Mysore) ..	5,34,600
Sharavathy Tail-race Development (Mysore)	1,45,000
Talcher Thermal Station (Orissa)	2,40,000

*Total installed
Capacity in kW.*

Bhimela/Guntawada Hydro-electric Scheme (Orissa and Andhra Pradesh)	2,40,000
Bhakra Right Bank Power House (Punjab & Rajasthan) ..	2,80,000
Uhl River Hydro-electric Project Stage II (Punjab) ..	40,000
Upper Bari Doab Canal Project (Punjab)	22,000
Beas Project Stage I (Punjab & Rajasthan)	2,40,000
Thermal Extensions (Rajasthan)	90,000
Kotah Hydro-electric Project (Rajasthan & Madhya Pradesh)	78,000
Harduaganj Thermal Station Extension (U.P.)	30,000
Singrauli Thermal Station (U.P.)	2,50,000
Obra Hydro-electric Project (Uttar Pradesh)	80,000
Bandel Thermal Station (West Bengal)	3,00,000
Delhi Thermal Station Extension (Delhi & Punjab) ..	1,80,000

INTERNATIONAL

INSTALLED CAPACITY AND PRODUCTION OF ELECTRICITY IN SOME COUNTRIES OF THE WORLD (1958)

<i>Name of Country</i>	<i>Installed capacity (from all sources) (Thousands kW.)</i>	<i>Production of electricity (from all sources) (Million kWh.)</i>
1	2	3
AFRICA—		
Algeria	420·0	1,115·0
Angola	47·47	76·6 (1956)
Belgian Congo	489·2	1743·0 (1956)
British Somaliland	1·47	1·8 (1956)
Canary Islands	26·84	57·6 (1956)
Ceuta	1·42	7·63 (1956)
Ethiopia	20·85	43·2 (1956)
Federation of Rhodesia & Nyasaland	758·0	2,430·0
French Somaliland	2·88	4·61 (1955)
French Togoland	1·01	2·08 (1956)

1	2	3
<i>AFRICA—contd.</i>		
Gambia	3·2	5·0 (1956)
Ghana	—	311·0
Italian Somaliland	6·71	7·06 (1956)
Liberia	—	30·54 (1955)
Madagascar	42·4	— (1955)
Morocco	424·0	949·0
Tunisia	116·5	257·0 (1957)
U.A.R., Egypt	723·6	1,705·9 (1957)
Uganda	—	279·0
Union of South Africa	—	20,200·0
<i>AMERICA—SOUTH—</i>		
Brazil	3,526·6	15,447·3 (1956)
Chile	1,016·1	4,147·3 (1957)
Uruguay	334·0	1,154·8 (1957)
<i>AMERICA—NORTH—</i>		
Canada	—	96,743·0
Mexico	—	9,077·0
<i>ASIA—</i>		
Afghanistan	78·9	15·6 (1956)
Ceylon	—	231·0
India	3,992·0	13,610·0 (1957)
Japan	16,846·0	81,303·0 (1957)
Pakistan	473·0	1,451·7 (1957)
South Korea	366·0	1,118·0 (1956)
Turkey	948·0	2,060·0 (1957)
<i>EUROPE—</i>		
Austria	3,475·0	12,463·0 (1957)
Belgium	3,442·6	12,517·0
Bulgaria	—	3,024·0
Czechoslovakia	—	19,620·0
Denmark	1,522·0	3,650·0
East Germany	—	34,873·0
Finland	—	7,887·0

1	2	3
EUROPE --contd.		
France	—	61,775·0
Greece	426·0	1,565·0
Hungary	—	6,477·0
Iceland	101·1	442·0 (1957)
Ireland	603·5	1,693·0
Italy	12,668·0	44,303·0
Luxembourg	—	1,223·3
Netherlands	3,989·0	12,645·0 (1957)
Norway	4,935·0	27,504·0
Poland	4,270·0	19,332·0 (1957)
Portugal	936·7	2,136·3 (1957)
Rumania	—	6,185·0
Saar	616·4	2,974·0
Spain	—	15,470·0
Sweden	—	30,416·0
Switzerland	—	16,872·0
United Kingdom	31,432·0	99,969·0 (1957)
West Germany	20,090·0	86,396·0 (1957)
Yugoslavia	—	7,356·0
OCEANIA—		
Australia	4,324·6	16,812·8 (1957)
New Zealand	—	5,626·0
U.S.S.R.		
U.S.S.R.	—	2,32,800·0

ENGINEERING RESEARCH STATIONS IN THE COUNTRY

1. ANDHRA PRADESH ENGINEERING RESEARCH LABORATORIES, HYDERABAD

Director

SHRI R. K. V. NARASIMHAM

Problems Tackled :

1. Mid Pennar Regulator.
2. Nagarjunasagar Right Canal Twin Tunnels—Approach and exit transitions.
3. Musi Irrigation Project.
4. Manjira Barrage Scheme.
5. Protection to H.T. Tower No. 348 on Simhachallam—Bommur Power Line, Training River Tandava.
6. New Left Gance Spillway for Kaddam Project.
7. Energy dissipation arrangements on the Right Flank Extension of Kaddam Spillway.
8. Nagarjunasagar Left Canal inlet transition to the tunnel.
9. Nagarjunasagar Left Canal Tunnel exit transition.
10. Krishna Anicut—Old scouring sluices on Vijayawada side.
11. Nagarjunasagar Right Canal—Chandravanka aqueduct transition for approach to and departure from the flume section.
12. Nagarjunasagar Right Canal—Buggavagu Earth Dam—Pipe outlet works.
13. Nagarjunasagar Right Canal—Buggavagu offtake regulator at M. 20-7-76.
14. Suddamada tank across Boggeru, Udayagiri Taluq, Nellore District.
15. Restoring of Boddammidicheroo, Siriconda, Nizamabad District.
16. Breach Filling of Karraram Tank (Pathacheru), Nalgonda District.
17. Formation of new tank across Punjilivagu, Krishna District.
18. Formation of Chandragudem Tank, Krishna District.
19. Erravagu Project, Medak District.
20. Restoring Parkicheru, Kukatpally Village, Hyderabad District.
21. Forming an earthen *bund* across Peddavanka at Govindampalle, Cuddapah District.
22. Kandaleru Reservoir Scheme, Nellore District.
23. Formation of canal embankment for Paleru, Bitragunta Scheme.
24. Vardarajaswamy Reservoir Project—Testing of soil samples for formation of an earthen *bund*.
25. Bethampudi Project, Yellandu Taluq, Khammameth District.

26. Formation of a new reservoir across Venneswaran Vanka near Jyothi Village, Sidhout Taluq, Cuddapah District.
27. Formation of Vajralapadu Reservoir across Pilichintalapaya Vagu near Sriganapadu, Andhra Pradesh.
28. Restoration of an old abandoned Gudipadu Tank across Burogalta Vagu.
29. Construction of a new reservoir across Papagni river.
30. Formation of a new tank across Konayagandi.
31. Alwar Tank, Tirumalai Hills, Chittoor District.
32. Mullavagu Earth Dam, Karimnagar District.
33. Nallavagu Earth Dam, Medak District.
34. Posani Earth Dam, Mahbubnagar District.
35. Proposed Synthetic Drug Factory at Sanathnagar.
36. Proposed Office of the S. E. Elect. at Vijayawada.
37. Bearing capacity determination of foundation soils.
38. Investigation of the effect of remoulding different soils on shear properties.
39. Design of earthen *bund* sections for the summer storage tank, Gudivada Krishna District.
40. A general theory for flexural strength of concrete and mortar.
41. Effect of aggregate size on the apparent strength of concrete and mortars.
42. Effect of Joint Orientation on the strength of aggregate binder systems.
43. Non-destructive testing of concrete.
44. Brick industry in Hyderabad—A preliminary survey of materials and methods.
45. Load distribution on Lintels and Wall Beams—An experimental investigation.
46. Adjustment studies on the standard cement mortar test specimen—Effect of shape.
47. Testing of materials for a pre-stressed concrete bridge at Bhadrachalam.
48. Partial replacement of sand by soil in concrete and mortar.
49. Design of concrete mixes for important works.
50. Standardisation of *surkhi* and other puzzolanic materials.
51. Second crop in the Godavari Delta.
52. A method of estimation of the dependable yields from a data containing periodic functions.
53. Runoffs from the catchments in the Andhra Pradesh.
54. Irrigation in the Krishna Delta.
55. Ground slopes of the Nagarjunasagar Project ayacut.

2. BIHAR INSTITUTE OF HYDRAULIC AND ALLIED RESEARCH, KHAGAUL, PATNA

Director

SHRI B. N. CHATTERJEE

Problems tackled :

1. Model test for Barh Town protection scheme.
2. Experiments on Sone Barrage near Dehri-on-Sone.
3. Effect of mica in sand on the quality of cement mortar and concrete.
4. Model tests for Badua Dam right outlet.
5. Lining of tube-well channels in Bihar.
6. Design of gravel treatment of tube-wells.
7. Determination of values of 'c' and ϕ in triaxial test by Pseudo-stress points.
8. Engineering properties of soil.—Effect on density, pore-pressure and permeability due to different modes of compaction, variation of moisture *etc.*
9. Stabilisation of chemical injection.
10. Rugosity coefficient of unlined channels in Bihar.

3. CENTRAL WATER AND POWER RESEARCH STATION, POONA-3

Director

SHRI S. C. DESAI

Problems tackled :

1. Ballia Baria bund along the Ganga—Determination of afflux by means of a hydraulic model.
2. Hasdeo Barrage (Madhya Pradesh)—Determination of the optimum curvature and bed level for the approach and tail-race channels for the spillway and studying the energy dissipation works downstream.
3. Rana Pratap Sagar (Chambal Project)—Testing of the design of the spillway and the energy dissipating device below.
4. Badua Dam (Bihar)—Design to be verified.
5. Unium-Barapani Dam (Assam)—Testing of the design of spillway and energy dissipating device.
6. Meshwa Dam—Testing of the design of spillway and energy dissipating device.
7. Chatra Canal (Kosi Project)—Exclusion of sand.
8. Sabarigiri (Pamba) Hydro-electric Project (Kerala)—Verification of the design of surge system.
9. Sharavathi Hydrel Project (Mysore)—Analysis of stress distribution around the intake, offtake and surge tank.
10. Bhakra Dam (Punjab)—Evaluating the magnitude of vibration of spillway crest gates to be allowed for in the design and manufacture of gates.
11. Hirebhasgar Dam (Mysore)—Improving the design of siphons.
12. Hirakud Reservoir (Orissa)—Siltation of reservoirs.

13. Bhatkal Port (Mysore)—Maintaining adequate navigable depths in the approach channel all the year round.
14. Haldia Port (West Bengal)—Suitable alignment of the dock entrance and berthing facilities.
15. Hooghly Estuary—Improving the navigability.
16. Kandla Estuary (Gujarat)—Stabilising the approach channel.
17. Vizagapatam Port Breakwater—Reinforcement of the existing breakwater formed of scuttled ships.
18. 7,000 ton Cargo Vessel (Hindustan Shipyard)—Evaluation of hydraulic resistance at various speeds of the vessel.
19. Foundry Forge Project, Ranchi (Bihar) —Investigation of the depth of rock below ground covering one square mile area.
20. Basic research on permeable soils—Subsoil seepage losses from canals; Uplift pressure on hydraulic structures having stratified foundations; grouting of pervious soils.

**4. CIVIL AND HYDRAULIC ENGINEERING SECTION, INDIAN INSTITUTE OF SCIENCE
BANGALORE**

Professor

SRI. N. S. GOVINDA RAO

Problems tackled :

1. Prediction of cavitation damage.
2. Inception of cavitation.
3. Design of cavitation tunnel.
4. Air absorption in water tunnel.
5. The effect of viscosity on the Taylor Instability of the surface of a cavity bubble.
6. Turbulent flow in open channels.
7. Decay of axisymmetric turbulence in a homogeneous shear field.
8. Decay of axisymmetric turbulence in the final period.
9. Direct solution for diameter of pipe in rough turbulent flow.
10. On the fourth root of diagram.
11. On the pre-air-entrained jump.
12. Alternate depths on slide rule.
13. On backwater curves in sewer conduits.
14. On experimental study of the air-entrainment characteristics of the hydraulic jump.
15. Effect of air-entrainment on stilling basin performance.
16. Effect of air-entrainment on stilling basin performance with $\alpha = 1.12$.
17. On the inception of air-entrainment in open channel flows.
18. Studies on submerged jets.
19. Study on axial flow pump.
20. On the pressure distribution over the front face of a centrifugal impeller vane.

21. Design of mixed flow impellers.
22. Study of siphon spillways.
23. Water hammer effect in pipes.
24. Coefficients of discharge of broad crested weirs.
25. Further studies on branch channel flow.
26. Cavitation in centrifugal pumps.
27. Stress distribution in an elastic semi-infinite strip.
28. Analysis of inter connected bridge girders.
29. Ultimate strength of partially pre-stressed rectangular concrete beams in bending.
30. Investigations for a suitable model material.
31. Stress distribution in composite dams.
32. Small-scale soil structure interaction tests (Model analysis).
33. Studies in dam design.
34. Matrix analysis of structures.
35. Behaviour of circular arches on deformable foundations.
36. On a problem in pressure distribution in foundation masonry.
37. Electrical analogy applied for determinate structures.
38. A laboratory pore-pressure measuring device.
39. Density-pressure bulb concept for the design of machine foundations.
40. Penetration tests in soils under dynamic loads.
41. Laboratory studies on machine foundations.
42. Settlement under dynamic loads.
43. Pore water pressure.
44. Magnetostriction nickel vibratory set up.
45. Soil structure on consolidation characteristics.
46. An experimental study of the air-entrainment characteristics of the hydraulic jump.
47. Effect of air concentration on stilling basin performance.
48. On the pre-entrained jump.
49. A simpler method of obtaining Adler's criterion for flow in curved pipes.
50. Optimum design for the scroll case of a reaction turbine.
51. The resistance to the rotation of a free disk.
52. Studies on energy dissipation of submerged jets.
53. On the resistance to flow in smooth pipe bends in turbulent flow.
54. The local friction factor and the length of the downstream tangent of a smooth pipe bend of large relative radius.
55. Friction factors for flow in rough curved pipes.
56. Loss of head due to turbulence in the downstream tangent of a sharp bend.

57. Excess energy loss in 90° circular pipe bends.
58. Inception of cavitation.
59. Design of a two-dimensional contracting channel.
60. Penetration tests in soils under dynamic loads.
61. Effect of vibration on settlement.
62. Use of constant thickness arches in the design of arch dam.
63. A new type of current meter.
64. Velocity distribution in open channels in turbulent flow.

5. KOYNA PROJECT CONCRETE LABORATORY, KOYNA

Research Officer

SHRI M. R. VINAYAKA

Problems tackled :

1. Testing of cement, aggregate and rock admixtures.
2. Study on admixtures.
3. Laboratory investigations on several mixes with varying water-cement ratio and with cement.
4. Studying the methods adopted for placing and transporting the concrete as used in pressure shafts.
5. Tests on permeability, strength and elasticity on rubble concrete.
6. Sampling and testing of concrete placed at the several locations.
7. Instrumentation in the dam.

6. ENGINEERING RESEARCH INSTITUTE, BARODA

Director

SHRI J. P. NAEGAMVALA

7. HIRAKUD RESEARCH STATION, HIRAKUD (ORISSA)

Executive Engineer

SHRI A. B. JENA

Problems tackled

1. Study on use of random rubble masonry as a construction material in dams instead of concrete.
2. Replacement of cement by different types of local puzzolana.
3. Manufacture of aerosin HRS.
4. Work on water proofing compound from local materials.
5. Study on fire proof compound and construction of *kacha* houses with bituminised soil.
6. Testing of soil samples from borrow area and foundation of various projects.
7. Study of behaviour of embedded instruments in dams.

8. IRRIGATION AND POWER RESEARCH INSTITUTE, PUNJAB, AMRITSAR

Director

DR. H. L. UPPAL

Problems tackled:

1. Model studies on increasing the flood capacity of Harike barrage.
2. Model experiments on proposed rail-cum-road bridge on Sohan *Khad*.
3. Training of Ravi river at Sahuwal.
4. Training of Beas river at Passi.
5. Model studies on protection of Beas river at Tahli.
6. Model studies on closing Shingarwan Chhri at Ravi river.
7. Diversion of Patiala Ki Rao and Janta Devi Ki Rao to river Sutlej through Siswan *nadi*.
8. Diversion of Sutlej river to the left creek near village Kamewala.
9. Construction of Rurki Pukhta drain.
10. Providing spill *bunds* for protecting villages Garanga, Nandpur, Kalaur, Sotal, Shergarh and Nabipur in Ambala District.
11. Constructing Soakage Pit for Lissara *nallah* near village Tapa.
12. Flood Control in Ghaggar Valley.
13. Diverting river Sutlej from its existing course to old one upstream of railway crossing.
14. Diverting river Sutlej from its existing course to old one near Khaira Fauja Singh.
15. Protection of left bank of river Sutlej opposite Ludhiana City.
16. Training Soan *nadi* (a) opposite village Oel and Mubarakpur (b) opposite village Bhaira, Tehsil Una, District Hoshiarpur.

17. Closing creeks of river Beas in Thana Kahnawan.
18. Canalization of river Sutlej from Rupar to Harike.
19. Canalizing of Nasrula *Choe*.
20. Training and canalizing of Mehlanwali group of *choes*.
21. Reclamation of saline-cum-alkali soils.
22. Studies on the improvement of brackish subsoil water in Rowari and adjoining areas.

9. IRRIGATION RESEARCH DIVISION, POONDI (VIA. THIRUVELLUR) MADRAS

Executive Engineer (Research)

SHRI K. T. GANAPATHY

Problems tackled :

1. Location of the proposed fishing harbour at Royapuram —Determination of the best alignment of the breakwaters for forming the harbour and the proper location of the entrance to the harbour so that the harbour may afford a safe berthing place for the vessels.
2. Design of high head gates.
3. Control of evaporation from open storages of water by using cetyl alcohol.
4. Mettur Tunnel Scheme —Design of the intake to the penstock, the tail-race pool and the intake arrangements to the power tunnel at entry.
5. Model studies on the open channel leading from Tunakadavu Reservoir to Sarkarpathi Power Tunnel.
6. Design of stilling basin and the river training works downstream of Tunakadavu Dam Spillway.

10. IRRIGATION RESEARCH INSTITUTE, ROORKEE

Director

SHRI DAVA PARKASH

Problems tackled:

1. Model experiments for proposed road bridge at Kursela on river Kosi on National Highway-31 in Bihar.
2. Model experiments for eliminating scour below Railway bridge at mile 130-6-22C at Kanpur Branch.
3. Model experiments for the design of fluming of Railway bridge at mile 0-7-478 of Fatehpur Branch.
4. Model experiments for proposing sloping bars for equitable distribution of flow in the curved reach of Khairnagar distributary from mile 2-1 to 2-4.
5. Design of training works for river Yamuna at Dakpathar, District Dehradun under Hydrel Scheme, Stage I.

6. Design of sluice and barrage bays profiles of Yamuna barrage at Dakpathar, District Dehradun under Hydel Scheme, Stage I.
7. Design of head regulator and Yamuna Power Channel along with energy dissipation devices at Dakpathar, District Dehradun under Hydel Scheme, Stage I.
8. Design of excluder for the head of Yamuna Power Channel at Dakpathar, District Dehradun under Hydel Scheme, Stage I.
9. Design of silt ejector for Yamuna Power Channel at Dakpathar, District Dehradun under Hydel Scheme, Stage I.
10. Basic study on Volute Siphons.
11. Basic study on Overhangs.
12. Determination of Critical tractive force for different grades of materials.
13. Determination of rugosity coefficient for lined and unlined channels.
14. Collection of field data on stable channels and derivation of formula.
15. Testing site of Head for Katapathar Canal.
16. Model studies for the efficiency of right guide wall below Matatila dam spillway.
17. Design of downstream protection works below Kalsia Regulator on Eastern Yamuna Canal.
18. Design of fluming at Railway and Road bridges and energy dissipation devices below Meghchapper fall on Eastern Yamuna Canal.
19. Designing and testing profiles of Rangawan dam sluice against cavitation.
20. Training river Dhela for Dhela barrage.
21. Downstream protection work below Tumeria sluice.
22. Improving flow conditions in Dohrighat Canal aqueduct.
23. Training wall and tail-race of power house at Matatila dam.
24. Designing non-silting head of Nalehra distributary.
25. Lining of water courses in laboratory and under field conditions.
26. Determination of uplift pressure below the foundation of spillway portion of Rihand dam.
27. Determination of seepage losses from Ganga Canal upstream of Pathri and Bhola power houses.
28. Effect of model tray boundaries on uplift pressure distributions observed on three-dimensional electrical analogy model.
29. Determination of uplift pressure distribution under the foundation of the outlet head of Sarda Sagar.
30. Basic study on relief of uplift pressure below hydraulic structures on permeable foundations.
31. Dewatering the foundations of Yamuna Scheme Power House.
32. Determination of uplift pressure distribution under the foundation of Nanaksagar barrage by relaxation method.
33. Appraisal of ground water resources of Hindan Krishna Doab.
34. Preparation of geological map of Ganga-Yamuna Doab.

35. Studies on tube-wells.
36. Water requirements of crops.
37. Regeneration of the Ganga, Yamuna and Hindan rivers.
38. Investigations on water-logging and drainage.
39. Rainfall runoff studies for small catchments in Bundelkhand and Ganga-Yamuna Doab.
40. Determination of the optimum number of rainfall stations for some catchments in Uttar Pradesh.
41. Sediment accumulation studies of the Ramganga river.
42. Flood flow studies for the Ganga river.
43. Quantitative analysis of ground water supplies in some doabs West of the Ganga.
44. Studies on evaporation from experimental pans.
45. A study of the Sarla Canal System, U.P. and economic benefits of the same.
46. Determination and interpretation of swelling pressures.
47. Design of sand drains as a means of accelerating consolidation.
48. Effect of strain rate on shearing strength of soils.
49. Observations of settlement and pore-pressures in earth dams by actual installations.
50. Observing hydraulic gradient in dams by actual installations.
51. Model studies on drawdown pore-pressures.
52. Model studies on design of relief wells for earth dams.
53. Development of economic alternative to stones in river protection works.
54. Use of *surkhi* as puzzolana in cement concrete.

11. KERALA ENGINEERING RESEARCH INSTITUTE, PEECHI

Executive Engineer

SHRI K. K. N. NAMBAR

12. MAHARASHTRA ENGINEERING RESEARCH INSTITUTE, NASIK

Director

SHRI G. M. VAIDYA

13. MYSORE ENGINEERING RESEARCH STATION, KRISHNARAJASAGAR MYSORE.

Research Officer

SHRI D. DODDIAH

Problems tackled :

1. Kabini Reservoir Project—Studies for surplus works.
2. Sharavathi Valley Hydro-electric Project—Surge tank studies.
3. Krishnarajasagar Waste Weir Valleys—Studies on protective works.
4. Studies relating to double tunnel near Vodenbyle Sharavathi Valley Hydro-electric Project.
5. Further studies on spillway profile and protective works downstream of Linganamakki dam.
6. Prevention of accumulation of sand at Lokapavani Aqueduct.
7. Model studies of Talakalale Dam Spillway and protective works.
8. Water Supply to Belgaum City—Studies for surplus works of Rakaskop Reservoir Project.
9. Water Supply to Chikkamagalur Town—Studies for surplus works of Hirekolale Tank.
10. Model studies of power channel from Linganamakki to Talakalale Reservoir.
11. Jambadhalla Project—Model studies for surplus works.
12. Hidkal Dam Project—Model studies for surplus works.
13. Transitions for the tunnel at the 25th mile of high level canal—Tungabhadra Project.

14. Yennehole Reservoir Project—Studies for surplus works.
15. Clear overfall waste weir for Dharma Reservoir Project.
16. Model studies for the tail-race water-level of the Sharavathi Valley Hydro-electric Project.
17. Model studies relating to the surplus works of Kanakanala Project.
18. Model studies relating to the approach to power and sluice dam (Linganamakki) Sharavathi Valley Project.
19. Studies relating to the surplus works of Chakenahally Tank Project—Hassan District.
20. Model studies of the transitions of Walali tunnel—Sharavathi Valley Project.
21. Basic studies relating to bucket type energy dissipators.
22. Basic studies on broad crested weirs.
23. Laboratory investigation of soil samples for the embankment work of earth dams.
24. Laboratory investigation of soil samples for the foundation of earth dams.
25. Field investigations of the bearing capacity of foundation soils.
26. Conducting tests on three samples of Shahabad metal for finding their suitability for road work from Gulbarga.
27. Testing the suitability of lime and *surkhi* samples for preparing *surkhi* mortar for Hidkal Dam Project.
28. Conducting chemical analysis of hardened cement mortar used in the construction of the Medical College building at Hubli for finding its mix proportions.
29. Conducting tests on cement, sand, coarse aggregates, size stones, hardened cement mortar and concrete used in Yennehole Project for finding their quality.
30. Conducting studies on gold slimes from Kolar Gold mines for finding their puzzolanic and chemical activity and their possible uses in engineering works.
31. Conducting tests on sand from Bhadra Reservoir Project for finding the effect of mica content in sand on cement concrete and mortar.
32. Conducting tests on coarse aggregates for finding their suitability for asphalted roads, meccadam and cement concrete works, for Bangalore Division.
33. Conducting tests on four samples of lime *kankar* for finding their suitability for masonry works for Major Irrigation Investigation Division, Mysore.
34. Conducting tests on coarse aggregates for finding their suitability for meccadam roads for Chamaraajanagar Division.
35. Conducting sieve analysis on coarse aggregates used in L.C.K. road for Road Research Wing, Mysore Engineering Research Station, Krishnarajasagar.
36. Study on strength characteristics of cement mortar of different proportions and water cement ratios.

37. Study on 1:2 lime mortar for finding its strength in relation with cement mortar.
38. Chemical analysis of soils and lime with a view to correlate the chemical composition with the structural characteristics of *surkhi*.
39. Strength characteristics of (a) *Surkhi* cement, and (b) *Surkhi* cement sand mortar.
40. Estimation of silt load in the flood water samples from different rivers in the State.
41. Chemical analysis of soils for the manufacture of *surkhi*.
42. Chemical analysis of *kankar* for the manufacture of lime.
43. Chemical analysis of cement.
44. Collection of meteorological data.
45. Evaporation studies using cetyl alcohol.

14. RIVER RESEARCH STATION, GAUHATI, ASSAM

Director

SHRI A. N. DUTTA CHOUDHURY

15. SILT AND CONSTRUCTION MATERIALS DIRECTORATE, CENTRAL WATER AND POWER COMMISSION, NEW DELHI

Director

DR. R. C. HOON

Problems tackled :

1. Fine aggregates (a) Routine tests (b) Blue dust from iron mine of Orissa.
2. Coarse aggregates: (i) Routine tests, (ii) Drill core, (iii) Laboratory investigations for the detection of potentially reactive minerals in the aggregates from the Bah Project.
3. Effect of mica contained in sand fraction on the properties of cement mortar concrete.
4. Separation of mica.
5. The use of bentonite as an admixture to cement mortar and concrete.
6. Design of cement concrete and lime *surkhi* mortar and concrete mixes for use in Rajasthan Canal Project Works.
7. Design of lime *surkhi* mortar for the Mahi Project, Banswara, Rajasthan.

8. Investigation for (i) *Surkhi* for Barapani Project, Assam, (ii) *Surkhi* for Rana Pratap Sagar Dam (Rajasthan).
9. Effect of remoulding of different types of soils on their shear characteristics.
10. Comparative studies of different bentonites and Fuller's earth available in some parts of the country.
11. The mineral composition of clay fraction of some Indian soils in relation to their engineering properties.
12. Determination of the swelling pressure of clayey soils.
13. Investigation of foundations for earth dams and other structures (1) Dantiwada Project (Gujarat), (2) Parvati Aqueduct, (3) Trisuli Hydel Project, (4) Kopilli Dam, (5) Water Supply Scheme for Government Dairy Farm at Port Blair (Andaman) and (6) Chambal Project (Rajasthan).
14. Soil surveys and analysis.
15. Classification of soils (i) Hasdeo Project, (ii) Sagar Project, (iii) Punasa Project (extended area), (iv) Mitha-Khari Irrigation Scheme, (v) Delhi State Rehabilitation Scheme and (vi) Project in West Bengal.
16. Programme of setting up of sites for sediment observations on the various rivers in the country.
17. Co-ordination of the sediment data.
18. Survey of the bed material of the Ujh river and its tributaries.
19. Standardisation of the Punjab Bottle silt sampler.
20. Relationship between weight and volume of river sediment.
21. Distribution of coarse and medium grades of sediment along vertical depth.
22. Testing of water samples.
23. Chemical analysis of materials of construction.
24. The use of cetyl alcohol to restrict evaporation losses from open water.

16. SOIL MECHANICS AND RESEARCH DIVISION, CHEPAUK, MADRAS

Superintending Engineer

SHRI J. WALTER

Problems tackled :

1. Sub soil flow studies.
2. Principles of mortar and concrete mix design—Investigation relating to the availability of air-entraining agents: Use of *Sapindus emarginatus* (Soap nut) Powder.
3. *Surkhi* studies.
4. Studies on the corrosive constituents of soils in Madras State.
5. Processing of Ennore sand.
6. Organic impurities in sand Studies on improvements for use in concrete.

7. Lime leaching studies.
8. *In situ* determination of engineering constants of soils like bearing capacity, soil modulus, permeability, etc.
9. Testing of soil for formation of reservoirs and tanks.
10. Design, fabrication and supply of various equipments required for testing soil, concrete and other materials.

17. RIVER RESEARCH INSTITUTE, CALCUTTA

Director

SHRI B. MAITRA

Problems tackled :

1. Determining the effect of distortion on the velocity distribution in models.
 2. Studying the behaviour of a tidal channel at a time when it starts deteriorating.
 3. Supply of cooling water to the Bokaro Thermal Station, D.V.C.
 4. Model studies for the dam and spillway of the Kangsabati Project.
 5. Sundarbans Estuarine Observations.
 6. Determination and interpretation of engineering constants of soils like bearing capacity on the basis of *in situ* tests.
 7. Effect of remoulding of different types of soils on shear characteristics.
 8. Effect of sustained load on the bearing capacity of soils.
 9. Effect of compaction on the engineering properties of soils.
 10. Determination of rugosity coefficient of lined and unlined channels.
 11. Navigation Locks—Kunti lock model.
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FUNDAMENTAL AND BASIC RESEARCH

A scheme of Research on Fundamental and Basic problems relating to River Valley Projects and Flood Control Works was initiated in August 1957 by the Government of India through the Central Board of Irrigation and Power. The following twelve problems were selected for study in the various laboratories in the country during the Second Plan Period.

I. Air-Entrainment

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.
- (2) Irrigation and Power Research Institute, Punjab, Amritsar.

The problem comprises of the following specific studies:—

- (a) Initiation and development of air-entrainment in high velocity flow.
- (b) Air-entrainment and economic sizes of stilling pools for flow in high head conduits.
- (c) Air-entrainment in draft tubes of various types and in vertical penstocks of underground power houses.
- (d) To formulate laws governing the high speed intermixing of air and water so as to lay down design criteria for training walls, chutes, draft tubes, stilling pools and spillways.

II. Turbulence

This problem has been allotted to :

- (1) Indian Institute of Science, Bangalore.
- (2) Central Water and Power Research Station, Poona.

The problem comprises of the following specific studies:—

- (a) Importance of turbulent boundary layer in hydraulic structures—Open flow as well as flow in closed conduits.
- (b) Large scale turbulence in channels.
- (c) Turbulence in reaction and impulse turbines and draft tubes.

III. Cavitation

This problem has been allotted to :

- (1) Irrigation and Power Research Institute, Punjab, Amritsar.
- (2) Indian Institute of Science, Bangalore.
- (3) Central Water and Power Research Station, Poona.

The problem comprises of the following specific studies:—

- (a) Civil structures—Relation between magnitude of negative pressure and cavitation damage and investigations on the resistance of protective coatings against cavitation damage.
- (b) Hydraulic machinery—Protective coatings against cavitation damage.

IV. Design of Channels

This problem has been allotted to :

- (1) U.P. Irrigation Research Institute, Roorkee.
- (2) River Research Institute, West Bengal, Calcutta.
- (3) Irrigation and Power Research Institute, Punjab, Amritsar.
- (4) Andhra Pradesh Engineering Research Laboratories, Hyderabad.

The problem comprises of the following specific studies:—

- (a) To study sediment characteristics and other factors affecting the regime of channels and to standardise the design of alluvial channels under controlled discharges and grades and charge of sediment carried by the channels.
- (b) To verify and ascertain the applicability of the numerous formulae for measurement and estimation of bed load transportation of various sands.
- (c) Determination of rugosity coefficient of lined and unlined channels.
- (d) Collection and analysis of hydraulic data for stable channels (both alluvial and non-alluvial).
- (e) To study the effect of silt charge on the coefficient of various discharge measuring devices.

V. Engineering Properties of Soils

This problem has been allotted to :

- (1) Irrigation and Power Research Institute, Punjab, Amritsar.
- (2) U.P. Irrigation Research Institute, Roorkee.
- (3) River Research Institute, West Bengal, Calcutta.
- (4) Soil Mechanics and Research Division, Madras.
- (5) Andhra Pradesh Engineering Research Laboratories, Hyderabad.
- (6) Bihar Institute of Hydraulic and Allied Research, Patna.
- (7) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (8) Engineering Research Institute, Baroda.

The problem comprises of the following specific studies:—

- (a) Determination and interpretation of engineering constants of soils like soil modulus, permeability consolidation coefficient *etc.*, on the basis of *in situ* tests.
- (b) Soil compaction studies—Effect of density, pore-pressure and permeability due to different modes of compaction, variation of moisture content *etc.*
- (c) To investigate swelling pressures in clay soils.
- (d) To investigate the effect of remoulding of different types of soils on shear characteristics.
- (e) To correlate mechanical and mineral composition of clay structures of different soils in India with their engineering properties.

(f) Soil Stabilisation—

- (i) With admixtures;
- (ii) By electro-chemical treatment;
- (iii) By injection.

VI. Sedimentation studies in Streams and Reservoirs

This problem has been allotted to :

- (1) Irrigation and Power Research Institute, Punjab, Amritsar.
- (2) U.P. Irrigation Research Institute, Roorkee.
- (3) Central Water and Power Research Station, Poona.
- (4) River Research Institute, West Bengal, Calcutta.
- (5) Hirakud Reservoir, Hirakud.
- (6) Panchet Hill and Maithon Reservoirs.
- (7) Gandhisagar Reservoir.
- (8) Andhra Pradesh Engineering Research Laboratories, Hyderabad.
- (9) Mysore Engineering Research Station, Krishnarajasagar.
- (10) Irrigation Research Station, Poondi, Madras.

The problem comprises of the following specific studies:—

- (a) Collection of data relating to bed and suspended load of streams and reservoirs so that life of reservoirs could be correctly estimated.
- (b) Determination of nature and behaviour of density currents and their influence on sediment deposits in reservoirs.
- (c) Model studies of density currents including flume studies and their applicability to prototype.
- (d) Meandering, braiding and avulsions of rivers and their prevention.

VII. Sutsoil Flow

This problem has been allotted to :

- (1) U.P. Irrigation Research Institute, Roorkee.
- (2) River Research Institute, West Bengal, Calcutta.
- (3) Bihar Institute of Hydraulic and Allied Research, Patna.
- (4) Irrigation and Power Research Institute, Punjab, Amritsar.
- (5) Soil Mechanics and Research Division, Madras.
- (6) Mysore Engineering Research Station, Krishnarajasagar.
- (7) Engineering Research Institute, Baroda.
- (8) Irrigation Research Division, Poondi, Madras.
- (9) Maharashtra Engineering Research Institute, Nasik.

The problem comprises of the following specific studies:—

- (a) Tubc-wells.
- (b) Structures on permeable foundations.
- (c) Canal linings.
- (d) Earth and rock-fill dams.
- (e) Water-logging and drainage.

VIII. Standardisation of the use of Surkhi and other Puzzolanic Materials in Mortar and Concrete

This problem has been allotted to :

- (1) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (2) Irrigation and Power Research Institute, Punjab, Amritsar.
- (3) Soil Mechanics and Research Division, Madras.
- (4) Mysore Engineering Research Station, Krishnarajasagar.
- (5) Andhra Pradesh Engineering Research Laboratories, Hyderabad.

The problem comprises of the following specific studies:—

- (a) Determination of suitable indices for puzzolanic activity.
- (b) Standardisation of puzzolanic materials and the conditions under which they can be suitably used.

IX. Principles of Mortar and Concrete Mix Design

This problem has been allotted to :

- (1) Andhra Pradesh Engineering Research Laboratories, Hyderabad.
- (2) Soil Mechanics and Research Division, Madras.
- (3) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (4) Koyna Dam Concrete Laboratory, Koyna.
- (5) Rihand Dam Laboratory, Pipri, U.P.
- (6) Kerala Engineering Research Institute, Peechi.
- (7) Hirakud Research Station, Hirakud.

The problem comprises of the following specific studies:—

- (a) To investigate and arrive at suitable methods of designing mortar and concrete mixes.
- (b) Basic research in concrete and mortar mix design in relation to permeability, thermal properties and dynamic modulus of elasticity.
- (c) To investigate the suitability of materials for mortar and concrete—
 - (i) Aggregate ;
 - (ii) Cement and hydraulic limes ;
 - (iii) Air-entraining agents.
- (d) To study reactivity and petrographic characteristics of aggregates.
- (e) Investigations relating to strength of masonry and concrete.

X. Studies on vibrations in Soil under Machine Foundations

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.
- (2) Indian Institute of Science, Bangalore.

The problem comprises of the following specific studies:—

- (a) Fundamental studies of stresses in soils under foundations due to machine vibrations.
- (b) To evolve a rational design for foundations under machines.

XI. Development of Economic alternatives to Stone for River Protection Works

This problem has been allotted to :

- (1) Irrigation and Power Research Institute, Punjab, Amritsar.
- (2) U.P. Irrigation Research Institute, Roorkee.
- (3) River Research Institute, West Bengal, Calcutta.
- (4) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (5) Bihar Institute of Hydraulic and Allied Research, Patna.
- (6) River Research Station, Ulubari, Gauhati, Assam.

XII. Instrumentation

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.
- (2) U.P. Irrigation Research Institute, Roorkee.
- (3) Irrigation and Power Research Institute, Punjab, Amritsar.
- (4) River Research Institute, West Bengal, Calcutta.
- (5) Indian Institute of Science, Bangalore.

In addition to the above 12 problems, 8 new problems have been added during the 3rd Five-Year Plan and work is progressing on all the 20 problems. The 8 new problems are as follows—

XIII. Utilization of Isotopes in Subsoil investigations and Soil Compaction Control

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.

The problem comprises of the following specific studies:—

- (a) Development of moisture probe and density probe by using polonium-beryllium and radium-beryllium sources and other radioactive tracers and their calibration.
- (b) Effective ratios of probe ranges in homogeneous and heterogeneous soil samples.
- (c) Effect of probe readings on—
 - (i) Salts in soils;
 - (ii) Hydrogen in organic matter;
 - (iii) Air in soils at various moisture contents; and
 - (iv) Chemically bound water soils.
- (d) Development of Cobalt 60 probe and Thimble Chambers for measuring gamma radiation and determination of density of sand.
- (e) Application of field problems like—
 - (i) *In situ* measurement of soil density, porosity and moisture content.

- (ii) *In situ* studies for permeability and porosity of strata in a bore-hole.
- (iii) Study of ground water flow.
- (f) Any other specific problems that might require use of isotopes such as soil compaction control, sub-soil investigation *etc.*

XIV. Investigations on Soil Compaction of different Soils in wet conditions and standing water with particular reference to construction of Earthen Dams

This problem has been allotted to :

- (1) River Research Institute, West Bengal, Calcutta.
- (2) Kerala Engineering Research Institute, Peechi.
- (3) River Research Station, Ulubari, Gauhati, Assam.

The problem comprises of the following specific studies:—

(a) Soil characteristics of—

- (i) Alluvium loam;
- (ii) Loess loam;
- (iii) Silty loam;
- (iv) Bed-rock clay;
- (v) Moranic clay;

and various other types of cohesive soils.

- (b) Tests with models and under semi-field conditions regarding the suitability of the above types of clay for constructing cofferdams, flexible blanket on the upstream side of the dams, for constructing silty loam core in earth dams.
- (c) Dumping soil in water and verification of thickness of layers and their consolidation characteristics.
- (d) Determination of shear, pore-pressure, permeability and consolidation characteristics of compacted soils from different layers lying below and above water.
- (e) Methods of compaction.

XV. Development of precast technique in Hydraulic Structures

- (i) Barrages, Anicuts and Overflow structures
- (ii) Canal structures like Falls, Aqueducts, Siphons, *etc.*
- (iii) Hydraulic Structures and Dams *etc.*

This problem has been allotted to :

- (1) U.P. Irrigation Research Institute, Roorkee.
- (2) Maharashtra Engineering Research Institute, Nasik.

The problem comprises of the following specific studies:—

- (a) Design of precast elements.
- (b) Composition of concrete—

- (i) Designing concrete mixes suitable for the manufacture of precast units.

- (ii) Economical methods of curing concrete.
- (iii) Effective bonding between concrete pannel and mass concrete.
- (iv) Determination of the permeability of thin concrete pannels under various heads.
- (v) Methods of avoiding shrinkage cracks in the concrete elements.
- (vi) Resistance of concrete pannels to mechanical abrasion.
- (c) Alternative designs and drawings of concrete pannels to minimise number of types.
- (d) Reinforcement frames, vibrating and semi-curing of concrete.
- (e) Application of vacuum concrete concept to precast units.

XVI. Minimising loss of head through improvement of trash racks, penstocks, gates, spiral chambers, draft tubes, downstream floor and silt disposal techniques on Hydro-electric structures

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.
- (2) Irrigation and Power Research Institute, Punjab, Amritsar.
- (3) Indian Institute of Science, Bangalore.

XVII. Minimising Losses due to absorption, percolation and evaporation in still and flowing waters on Irrigation Works

This problem has been allotted to :

- (1) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (2) Irrigation and Power Research Institute, Punjab, Amritsar.
- (3) River Research Institute, West Bengal, Calcutta.
- (4) U.P. Irrigation Research Institute, Roorkee.
- (5) Irrigation Research Station, Poondi, Madras
- (6) Mysore Engineering Research Station, Krishnarajasagar.
- (7) Maharashtra Engineering Research Institute, Nasik.

The problem comprises of the following specific studies:—

- (a) Determination of losses—
 - (i) Seepage loss measurements by various methods such as measuring inflow and outflow, compartment method, constant and variable head permeameters.
 - (ii) Determination of factors affecting seepage losses such as ground water-table, silt in water, soil profile, transfer slopes of ground surface, velocity and temperature of flowing water.
- (b) Determination of and minimising evaporation losses in reservoirs—
 - (i) Determination of evaporation losses by evaporimeters and comparison of results with those obtained by empirical formulae such as C. Rowher's formula U.S.A. and any other empirical formula.
 - (ii) Determination of evaporation losses by land pans and floating pans of various diameters and comparison of results, keeping in mind factors such as height above ground levels, wind velocity, vapour pressure, etc.

- (iii) Prevention of evaporation losses by the use of cetyl alcohol.
Development of equally effective substitute for cetyl alcohol to be manufactured in India.
- (iv) Development of wind operated control valve of containers of cetyl alcohol solution.

XVIII. Selection, processing and specification of aggregates both fine and coarse for concrete work in hydraulic structures along with the study of thermal properties and physical characteristics of aggregates and behaviour of concrete under prolonged submergence and continuous wet conditions with particular reference to entry of water in air-pores

This problem has been allotted to :

- (1) Silt and Construction Materials Directorate, Central Water and Power Commission, New Delhi.
- (2) U.P. Irrigation Research Institute, Roorkee.
- (3) Bihar Institute of Hydraulic and Allied Research, Patna.

The problem comprises of the following specific studies:—

- (a) Aggregates—coarse and fine—
 - (i) Physical characteristics ;
 - (ii) Selection ;
 - (iii) Processing.
- (b) Concrete—
 - (i) Thermal properties ;
 - (ii) Prolonged behaviour under normal and abnormal conditions *e.g.*, submergence and continuous water conditions, particularly entry of water into pores, capillaries, *etc.*

XIX. Experimental methods of Stress Analysis in Hydraulic Structures

This problem has been allotted to :

- (1) Indian Institute of Science, Bangalore.
- (2) Soil Mechanics and Research Division, Madras.

The problem comprises of the following specific studies:—

- (a) Comparison of results by the three methods of stress analysis *viz.*, direct model analysis, slab analogy and photo-elasticity and determining model limitations of each method.

XX. Volute Siphon Studies

This problem has been allotted to :

- (1) Central Water and Power Research Station, Poona.
- (2) Irrigation and Power Research Institute, Punjab, Amritsar.
- (3) Mysore Engineering Research Station, Krishnarajasagar.

INTERNATIONAL ENGINEERING BODIES DEALING WITH IRRIGATION AND POWER

1. INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE

CENTRAL OFFICE : 184, GOLF LINKS AREA, NEW DELHI-3 (INDIA)

This Organisation has been formed to stimulate and promote the development and application of the science and technique of irrigation, drainage, flood control and river training in the engineering, economic and social aspects. The objects of the Commission include :

- (a) All matters relating to planning and economics of irrigation and drainage undertakings for the reclamation and improvement of lands as well as the designs, construction and operation of appurtenant engineering works including canals and other artificial channels for irrigation and drainage.
- (b) All matters relating to planning, financing and economics of schemes for flood control as well as the design, construction and operation of appurtenant engineering works, except such matters as relate to the design and construction of large dams, navigation and basic hydrology,.
- (c) Study of river behaviour and all matters relating to planning, financing and economics of schemes for river training and control as well as the design, construction and operation of appurtenant engineering works.

The above objects are accomplished by :

- (i) interchange of information between its several National Committees;
- (ii) holding periodical meetings;
- (iii) organising studies and experiments;
- (iv) publication of proceedings, reports and documents;
- (v) co-operating with other International Organisations, whose interests and activities are related to and are in harmony with its objectives.

PRESIDENT FOR THE YEAR : SHRI N. D. GULHATI (INDIA)

SECRETARY GENERAL FOR THE YEAR : SHRI YADAVA MOHAN (INDIA)

National Committees have been established in the following countries:--

1. Argentine
2. Australia
3. Austria
4. British Guiana.
5. Bulgaria
6. Canada

7. Ceylon
8. Cyprus
9. Czechoslovakia
10. East Africa
11. Equador
12. Federal Republic of West Germany
13. Federation of Malaya
14. Federation of Rhodesia and Nyasaland
15. France
16. Ghana
17. Great Britain
18. Greece
19. Hungary
20. India
21. Indonesia
22. Iran
23. Iraq
24. Israel
25. Italy
26. Japan
27. Mexico
28. Morocco
29. Netherlands
30. North Nigeria
31. Pakistau
32. Philippines
33. Poland
34. Portugal
35. Rumania
36. Spain
37. Sudan
38. Surinam
39. Switzerland
40. Thailand
41. Tunisia
42. Turkey
43. U.A.R.
44. U.S.A.
45. U.S.S.R.
46. Vietnam
47. Yugoslavia

At the last Plenary Session held in May 1960, in Madrid-Spain, India was represented by 3 delegates.

The International Commission on Irrigation and Drainage has published a number of publications, some of which are :

1. Irrigation in the World—A global Review—by Shri N. D. Gulhati.
2. Annual Bulletins.
3. Transactions—First Congress, Second Congress and Third Congress.
4. Multilingual Technical Dictionary on Irrigation and Drainage.
5. Reports of the Fourth Congress on Irrigation and Drainage—Madrid, June 1960.
6. Bibliography on Irrigation, Drainage, River Training and Flood Control.

The above publications can be obtained from the Central Office of the International Commission on Irrigation and Drainage, 184, Golf Links Area, New Delhi-3.

On behalf of the Government of India, The Central Board of Irrigation and Power, Curzon Road, New Delhi-1, acts as the National Committee of this Organisation.

2. INTERNATIONAL COMMISSION ON LARGE DAMS

CENTRAL OFFICE : 51, RUE SAINT-GEORGES, PARIS 9^o (FRANCE)

This organisation has been formed with the object of encouraging improvements in the design, construction, maintenance and operation of large dams by bringing together information thereon and by studying questions relating thereto. These objects are accomplished by :

- (i) interchange of information between its several National Committees;
- (ii) holding periodical meetings;
- (iii) organising studies and experiments;
- (iv) publication of proceedings, reports and documents.

PRESIDENT FOR THE YEAR : DR. ING. E.H. DIPL. ING. LEONHARD WOLF

SECRETARY GENERAL FOR THE YEAR : DIPL. ING. RUNDOLF VON MILLRE

National Committees have been established in the following countries :—

1. Argentine
2. Australia
3. Austria
4. Belgium
5. Brazil
6. Bulgaria
7. Canada

8. Ceylon
9. Columbia
10. Denmark
11. Finland
12. France
13. Great Britain
14. Iceland
15. India
16. Indonesia
17. Italy
18. Japan
19. Laos
20. Luxembourg
21. Malaya
22. Mexico
23. Morocco
24. New Zealand
25. Norway
26. Pakistan
27. Philippines
28. Poland
29. Portugal
30. Rhodesia and Nyasaland
31. Rumania
32. Spain
33. Sudan
34. Sweden
35. Switzerland
36. Thailand
37. Tunisia
38. Turkey
39. U.A.R.
40. United States
41. Uruguay
42. U.S.S.R.
43. Vietnam
44. Yugoslavia

At the last Plenary Session of the International Commission on Large Dams held at Rome (Italy) in June 1961, India was represented by 3 delegates.

On behalf of the Government of India, The Central Board of Irrigation and Power, Curzon Road, New Delhi-1 is the National Committee for this Organisation.

3. INTERNATIONAL SOCIETY OF SOIL MECHANICS AND FOUNDATION ENGINEERING

CENTRAL OFFICE : C/O THE INSTITUTION OF CIVIL ENGINEERS, GREAT GEORGE STREET, LONDON S.W.1, ENGLAND.

The aim of the Society is to promote international co-operation among scientists and engineers in the field of Soil Mechanics and its practical application. This co-operation is ensured by :

- (a) periodically holding International Conferences;
- (b) creating permanent Research Committees;
- (c) publishing a list of members every two years;
- (d) promoting the publication of abstracts.

PRESIDENT FOR THE YEAR: A. W. SKEMPTON (U.S.A.)

SECRETARY FOR THE YEAR: A. BANISTER (ENGLAND)

National Societies have been established in the following countries:—

1. Bulgaria
2. Canada
3. China
4. Columbia
5. Denmark
6. Egypt
7. Finland
8. France
9. Germany
10. Hungary
11. India
12. Ireland
13. Israel
14. Italy
15. Japan
16. Mexico
17. Netherlands
18. New Zealand
19. Norway
20. Poland
21. Portugal
22. Southern Rhodesia
23. Spain
24. Sweden
25. Switzerland
26. Turkey
27. Union of South Africa

28. United Kingdom

29. U.S.A.

30. U.S.S.R.

At the last Session of the International Society of Soil Mechanics and Foundation Engineering held at Paris in July 1961, India was represented by one delegate.

The address of the Indian National Society of Soil Mechanics and Foundation Engineering is as given below :—

C/o Secretary, Central Board of Irrigation and Power, Curzon Road,
New Delhi-1.

4. INTERNATIONAL ASSOCIATION OF HYDRAULIC RESEARCH

CENTRAL OFFICE: SECRETARIAT, RAAM, 61 DELFT, NETHERLANDS.

The objects of the International Association for Hydraulic Research is to stimulate and promote hydraulic research, both basic and applied in all its aspects. These objects are accomplished by :

- (a) holding periodical meetings;
- (b) publication of a periodical bulletin dealing with research activities of its members;
- (c) publication of proceedings, reports and technical notes;
- (d) organisation and co-ordination of special studies and experiments;
- (e) co-operation with other international organisations with related interests and activities.

The Association consists of :

- (i) Individual Members;
- (ii) Corporate Members;
- (iii) Sustaining Members.

PRESIDENT FOR THE YEAR : A. T. IPPEN (U.S.A.)

SECRETARY FOR THE YEAR : H. J. SCHOEMAKER (NETHERLANDS)

The total membership on 1st July, 1961 is 931 Individual Members and 160 Corporate Members, out of which the Indian membership is 77 Individual Members and 12 Corporate Members.

The I.A.H.R. have its membership in the following countries :—

1. Algeria
2. Aram Union
3. Argentine
4. Australia
5. Austria
6. Belgium
7. Brazil
8. Bulgaria

9. Canada
10. Chile
11. China
12. Columbia
13. Congo
14. Czechoslovakia
15. Denmark
16. El Salvador
17. Ethiopia
18. Finland
19. France
20. Germany
21. Ghana
22. Great Britain
23. Greece
24. India
25. Iran
26. Ireland
27. Israel
28. Italy
29. Japan
30. Yugoslavia
31. Korea
32. Lebanon
33. Mexico
34. Mozambique
35. Netherlands
36. New Zealand
37. Norway
38. Pakistan
39. Paraguay
40. Peru
41. Poland
42. Portugal
43. Rumania
44. South Africa
45. Spain
46. Sweden
47. Switzerland
48. Trinidad
49. Tunisia
50. Turkey

51. United Arab Republic
52. United States
53. Uruguay
54. U.S.S.R.
55. Venezuela

Address of the Liaison Organisation in India

C/o Secretary, Central Board of Irrigation and Power, Curzon Road,
New Delhi-1.

The last Session of the International Association of Hydraulic Research was held at Yugoslavia in September 1961 and was attended by one delegate from India out of a total of about 300 delegates from other countries.

5. WORLD POWER CONFERENCE

CENTRAL OFFICE: 201-202 GRAND BUILDING, TRAFALGAR SQUARE,
LONDON W.C. 2.

With a view to carrying out the objectives of the First World Power Conference, the International Executive Council of the First World Power Conference acting under the memorandum approved on 11th July, 1924, considered the advisability of constituting the World Power Conference of prominent international organisations and after submitting proposals for consideration of each of the participating countries, it resolved that the objects as set forth in the said memorandum should be adopted as the objects of the World Power Conference. The objects as modified at the meeting of the International Executive Council 1958 are as follows:—

- (1) The objects of the World Power Conference are the development and peaceful uses of energy resources to the greatest benefit of all, both nationally and internationally.
- (2) To consider the potential resources and the means of production of energy in all their aspects.
- (3) Collecting and publishing data on energy resources and their utilisation.
- (4) World Conference of those concerned in any way with surveying, developing or using energy resources.

PRESIDENT FOR THE YEAR: GEN. DIR. DIPL. ING. FRANZ. HOLZINGER.
SECRETARY FOR THE YEAR: MR. C. H. GRAY (U.K.)

The following countries have National Committees of this International Organisation:—

1. Argentine
2. Australia
3. Austria

4. Brazil
5. Bulgaria
6. Canada
7. Columbia
8. Costa Rica
9. Cuba
10. Czechoslovakia
11. Denmark
12. Finland
13. France
14. Germany
15. Ghana
16. Great Britain
17. Greece
18. Hungary
19. Iceland
20. India
21. Indonesia
22. Iran
23. Ireland
24. Israel
25. Italy
26. Japan
27. Luxembourg
28. Malaya
29. Mexico
30. Morocco
31. Netherlands
32. New Zealand
33. Nigeria
34. Norway
35. Pakistan
36. Paraguay
37. Peru
38. Philippines
39. Portugal
40. Rhodesia & Nyasaland
41. Rumania
42. South Africa
43. Spain
44. Switzerland

45. Thailand
46. Trinidad and Tobago
47. Turkey
48. Uganda
49. U.A.R.
50. Uruguay
51. U.S.A.
52. U.S.S.R.
53. Venezuela
54. Yugoslavia.

On behalf of India, Institution of Engineers (India), 8, Gokhale Road, Calcutta-20 acts as the National Committee.

The last Session of the Conference was held in May 1960, at Madrid and two officers represented India out of a total of 1,300 representing 52 countries.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH LABORATORIES AND UNITS

The Council of Scientific and Industrial Research (C.S.I.R.), constituted in 1942 by a resolution of the then Central Legislative Assembly, is an autonomous body registered under the *Registration of Societies Act XXI of 1860*.

The functions assigned to the Council are :

1. the promotion, guidance and co-ordination of scientific and industrial research in India including the institution and the financing of specific researches;
2. the establishment or development and assistance to special institutions or departments of existing institutions for scientific study of problems affecting particular industries and trades;
3. the establishment and award of research studentships and fellowships;
4. the utilization of the results of the researches conducted under the auspices of the Council towards the development of industries in the country;
5. the establishment, maintenance and management of laboratories, workshops, institutes and organizations to further scientific and industrial research and to utilize and exploit for purposes of experiment or otherwise any discovery or invention likely to be of use to Indian industries;
6. the collection and dissemination of information in regard not only to research but also to industrial matters generally;
7. publication of scientific papers and a journal of industrial research and development; and
8. any other activities to promote generally the objects of the resolution.

The Ministry of Scientific Research and Cultural Affairs provides the administrative link between the Government of India and the Society. The Society of the Council of Scientific and Industrial Research consists of the following members :—

1. The Prime Minister of India as the *ex-officio* President of the Society.
2. The Minister-in-Charge of the portfolio under which the Council of Scientific and Industrial Research is included as the *ex-officio* Vice-President of the Society.
3. The Members of the Governing Body.
4. Any other person or persons appointed by the Government of India.

Governing Body

The Director-General, Scientific and Industrial Research is the Principal Executive Officer of the Society.

The administration of the Council is vested in the Governing Body, of which the Prime Minister is the President and the Minister for Scientific Research and Cultural Affairs, the Vice-President. The Governing Body is composed of eminent scientists, industrialists and administrators.

The Governing Body is advised by the Board of Scientific and Industrial Research, composed of scientists, industrialists and representatives of Government departments interested in industrial research. The Board is assisted in its work by an Expert Technical Committee.

The Board advises the Governing Body on proposals for: instituting specific research; study of problems affecting particular trades and industries in scientific institutions and universities; establishment of research institutes; award of fellowships, studentships and scholarships; and specific studies and surveys of indigenous resources as an essential preliminary to systematic investigation in particularly important fields of research.

The Board is assisted by the following 12 Research Committees dealing with various scientific and industrial subjects:—

1. Aeronautical Research Committee.
2. Biological Research Committee.
3. Chemical Research Committee.
4. Civil Engineering and Hydraulic Research Committee.
5. Electrical and Mechanical Engineering Research Committee.
6. Geological and Mineralogical Research Committee.
7. Metals Research Committee.
8. Pharmaceutical and Drugs Research Committee.
9. Physical Research Committee.
10. Public Health Engineering Research Committee.
11. Radio Research Committee.
12. Joint Committee of the Indian Central Oilseeds Committee and the Council of Scientific and Industrial Research for Vegetable Oils Research.

National Laboratories and Institutes

There are at present 27 laboratories and institutes under the Council including three regional laboratories, a national botanic gardens, a central scientific instruments organisation, an organisation for the development of medicinal plants, an industrial and technological museum and a Central Board of Geophysics. The functions of the various laboratories are given below:—

1. NATIONAL PHYSICAL LABORATORY

Hillside Road, New Delhi-12

The National Physical Laboratory conducts basic and applied research in various branches of physics. One of its main functions is the maintenance of, and research on, basic standards of mass, length and time, and derived standards like those required for electrical and electronic instruments, temperature, luminosity and purity of chemicals for spectroscopic and other specialised

applications, etc. The work also extends to research on standards of quality, performance and practice. Physical research relating to the utilization and processing of industrial raw materials, processes and techniques and control of quality of industrial products are the concern of the laboratory. In addition the laboratory undertakes testing of a wide range of instruments and materials and issues test certificates. A science museum highlighting developments in the field of physical sciences and a planetarium for observing movement and disposition of stars, constellations and other heavenly bodies are located in the laboratory campus.

2. NATIONAL CHEMICAL LABORATORY

Pocora 8

Director

DR. K. VENKATARAMAN

The scope of work of the laboratory embraces all branches of chemistry as applied to the solution of technical problems of Indian industry, with due attention to fundamental research. It includes survey of indigenous raw materials, exploring their industrial potentialities, utilization of by-products of existing industries and development of new or improved processes of possible industrial value. The laboratory maintains the National Collection of Industrial Micro-organisms and supplies cultures of organisms to research institutions and industries.

3. NATIONAL METALLURGICAL LABORATORY

Burma Mines, Jamshedpur

Director

DR. B. R. NIJHAWAN

The National Metallurgical Laboratory is equipped to undertake research on both fundamental and applied metallurgical problems relating to indigenous ores and minerals, refractories, ferrous and non-ferrous metals and alloys in relation to their application to India's metal industries.

4. CENTRAL FUEL RESEARCH INSTITUTE

P. O. Jealgora, Distt. Dhanbad

Director

DR. A. LAHIRI

The Central Fuel Research Institute undertakes basic and applied research on all aspects of the problems of solid, liquid and gaseous fuels and operates the physical and chemical survey of coals of India. A wing for investigations on natural gas, petroleum and petrochemicals was established in 1958.

5. CENTRAL GLASS AND CERAMIC RESEARCH INSTITUTE

Jadavpur, Calcutta-32

Director

DR. ATMA RAM

The Institute conducts fundamental and applied research on problems connected with glass, pottery, vitreous enamels and refractories. A mica research unit has been set up for the development and utilisation of mica and its products.

6. CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE

Cheluvamba Mansion, P.O. V.V. Mohalla, Mysore

Director

DR. V. SURRAHMANYAN

The Institute deals with all aspects of food technology aimed at a better conservation and more efficient utilization of food materials available in the country. It is concerned with the development of improved methods of food preservation and storage; treatment of coarse food materials to improve their palatability, digestibility and general food value; study of new and hitherto unfamiliar food materials and their processing and fortification; production of concentrated foods, vitamins and other food accessories and supplementaries; composite and multipurpose food, ready-to-serve foods; development of new methods for detecting food adulteration; food sanitation; treatment and utilization of waste products of food industries; and study of packaging. The Institute renders technical assistance to the food industry and makes the work of the Institute known to others.

7. CENTRAL DRUG RESEARCH INSTITUTE

Chattar Manzil Palace, Lucknow

Director

DR. B. MUKERJI

The scope of work of the Institute extends from systematic study of crude drugs used in indigenous systems of medicine at one end to synthetics and antibiotics at the other. Its functions include : evaluation and standardisation of drugs; development of new drugs; and clinical trials of drugs in hospitals.

8. CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE

Ceclinagar P.O., Karaikudi-3

Director

DR. K. S. G. DOSS

The Institute conducts basic and applied research on chemical reactions associated with the passage of electricity. The subjects covered include: electrolytic production of organic and inorganic chemicals; electro-deposition; electro-metallurgy and electric furnace products; batteries; electrode kinetics; electro-chemistry of semi-conductors; polarography and other techniques of electro-analysis; and passivity and corrosion.

9. CENTRAL LEATHER RESEARCH INSTITUTE

Adyar, Madras-20

Director

DR. Y. NAYUDAMMA

This Institute is concerned with developing technical know-how for the manufacture of a wide variety of leathers and allied products, dissemination of this knowledge to the Indian leather industry and training of technical personnel. The institute maintains well-equipped laboratories and a model tannery for demonstration of processes to the industry.

10. CENTRAL BUILDING RESEARCH INSTITUTE

Roorkee

Director

LT-GEN. H. WILLIAMS

While many of the problems connected with building research in India are similar to those in other countries and much use is made of the published results of other laboratories, there are a large number of problems which are of special concern to countries in the tropics. This Research Institute deals with the problem of: use of indigenous materials and industrial wastes as building materials; soil engineering; assessment of factors governing comfort and efficiency in buildings; and studies on new constructional techniques.

11. CENTRAL ROAD RESEARCH INSTITUTE

P.O. C.R.R.I., Delhi-Mathura Road, New Delhi-20

Director

PROF. S. R. MEHRA

The Central Road Research Institute is engaged on work directed towards the achievement of economy and better efficiency in the design, construction and maintenance of roads. It carries out research on traffic problems and those bearing on road safety. The functions of the Institute include: fundamental and applied research on economic utilisation of local resources for low-cost road construction and on road design methods as well as road traffic and safety; execution of pilot road projects in different climatic regions of the country for demonstration of new ideas and techniques; collaborative research with other institutions affording technical support and guidance to various highway departments in the design and execution of major projects; dissemination of results of research; and training of research personnel from universities and highway departments.

12. NATIONAL BOTANIC GARDENS

Lucknow

Director

PROF. K. N. KAUL

The National Botanic Gardens is concerned mainly with research on economic plants. Among the functions of the gardens are: botanical and horticultural research including breeding of new plant varieties with economic potentialities; collection, introduction and cultivation of economic plants, particularly medicinal, fibre-yielding and essential oil-bearing plants; phytochemical investigations on promising plants; soil study; maintenance of a herbarium and museum of economic plants; maintenance of an arboretum; training of botanists and horticulturists and publication of literature for scientific worker as well as layman.

13. CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE

Waghavadi Road, Post Bo.: No. 38, Bhavnagar

Director

DR. A. N. KAPPANNA

The main function of the institute is to further the interest of the salt industry by conducting research on methods for: improvement in the quality

of salt required for various industrial purposes; recovery of important chemicals from sea-water; extraction and utilisation of by-products from marine of new methods and techniques for the recovery, production and utilization of various marine and allied chemicals.

14. REGIONAL RESEARCH LABORATORY

Uppal Road, Hyderabad-9

Director

DR. S. HUSAIN ZAHEER

The work of the laboratory is related primarily to the industrial advancement of the region. It undertakes surveys and investigations on raw materials, processes and techniques and industrial products, and acts as a focus for technical consultation and advisory service to government agencies and industries of the region; it also helps in the formulation of projects for new industries.

15. INDIAN INSTITUTE FOR BIOCHEMISTRY AND EXPERIMENTAL MEDICINE

P-27 Prinsep Street, Calcutta-13

Director

DR. J. C. RAY

The main function of the Institute is to carry out fundamental research in biological sciences with a bearing on the practical problems of medicine. Its work, which at present covers the fields of biochemistry, microbiology, physiology and immunology, is being intensified and expanded to include allied areas of study, chiefly biophysics and biophysical chemistry, experimental genetics and radiation biology, experimental pathology, antibiotics and human biology. Researches in these fields relate to: microbial enzymes; protein structure in relation to biological activity; biochemistry of subcellular fractions; nutrition, metabolism and immunology of protozoal parasites; microbial metabolism and antibiotic action; epidemiology of cholera with special reference to bacteriophage typing; cholera immunization; leprosy and acid-fast organisms with special reference to serological methods of diagnosis, biosynthesis of antibody proteins; hormone metabolism in health and disease; collagen metabolism and fibrogenesis; biochemical mechanism of active ion transport; tranquillizing and hypotensive alkaloids from Indian medicinal plants.

16. CENTRAL MINING RESEARCH STATION

Barwa Road, Dhanbad

Officer on Special Duty

DR. K. N. SINHA

Investigations on problems of efficiency, safety and health in mining operations are conducted in this Station.

17. CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE

Pilani

Deputy Director

DR. AMARJIT SINGH

The main objective of the Institute is to promote electronics research specially in some of the fields in which development so far has been very meagre.

18. BIRLA INDUSTRIAL & TECHNOLOGICAL MUSEUM

19 Gurusahay Road, Calcutta-19

Officer-in-Charge

SHRI A. BOSE

The primary function of this museum is to portray recent advances in science and technology and their application to industry and human welfare through suitable static and working models, posters, diagrams and charts.

19. REGIONAL RESEARCH LABORATORY, JAMMU & KASHMIR

Canal Road, Jammu-Tawi

Deputy Director

DR. I. C. CHOPRA

The laboratory is devoted to the study of medicinal and other economic plants of the north-western region, covering Jammu and Kashmir, Kangra and Kulu in the Punjab and Mandi in Himachal Pradesh. The study includes survey, experimental and commercial cultivation, and chemical and biological investigations of medicinal, essential oil-bearing, insecticidal and insect-repellent plants as well as pharmacological and microbiological examination of active principles of medicinal plants.

20. CENTRAL PUBLIC HEALTH ENGINEERING RESEARCH INSTITUTE

70/1 Civil Lines, Nagpur

Director

SHRI R. S. MEHTA

The Institute carries out research in water sewage, industrial wastes, stream pollution, sanitation, air pollution and radiological health.

21. CENTRAL MECHANICAL ENGINEERING RESEARCH INSTITUTE

Mahatma Gandhi Avenue, P.O. Durgapur Steel Project, Durgapur-3

Director

SHRI V. CADAMBE

This Institute is still in the planning stage and will deal with the problems concerning machine operations, cutting tools, heat treatment, forge and foundry, materials handling, production techniques, methods engineering, time and motion study, testing of materials, metrology and heat transfer.

22. CENTRAL INDIAN MEDICINAL PLANTS ORGANISATION

C.S.I.R. Building, Rafi Marg, New Delhi-1

Officer-in-Charge

SHRI P. M. NABAR

The main purpose of this Institute which is still in the formative stage will be to co-ordinate and channelize along fruitful lines the activities of various agencies and State Governments in the field of medicinal and essential oil-bearing plants. It seeks to develop the medicinal plant resources of India and bring under cultivation those plants for which a demand from the drug trade exists.

23. NATIONAL AERONAUTICAL LABORATORY

Jayamahal Road, Bangalore-6

Director

DR. P. NILAKANTAN

This laboratory investigates problems of flight with a view to gaining essential theoretical and practical knowledge of value in the design, construction and operation of aircraft in India. The nucleus of the laboratory will be a Trisonic Wind Tunnel, but eventually the laboratory will have facilities for undertaking research on various aspects of aeronautics, such as aerodynamics, structures, materials and propulsion.

24. CENTRAL SCIENTIFIC INSTRUMENTS ORGANISATION

C.S.I.R. Building, Rafi Marg, New Delhi-1

Director

DR. K. N. MATHUR

The functions of this Organisation are to promote and develop the indigenous manufacture of scientific instruments of all categories needed for teaching, research, industry and essential services.

25. REGIONAL RESEARCH LABORATORY

Jorhat, Assam

Director

DR. B. N. MITRA

The main functions of the laboratory will be to investigate problems relating to the development of natural resources of Assam and adjoining areas and other regional needs posing special problems.

26. INDIAN INSTITUTE OF PETROLEUM

P. O. C.R.R.I., Delhi-Mathura Road, New Delhi-20

Director

DR. J. W. WHITAKER

This Institute is being set up for research in petroleum refining and processing of natural gas, petro-chemicals, etc.

27. CENTRAL BOARD OF GEOPHYSICS

27-29 Brabourne Road, Narayani Buildings, Calcutta-1

Director

DR. M. S. KRISHNAN

The functions of the Board are : to encourage and help geophysical work in existing institutions; to create new research units and projects; and to co-ordinate the work carried out at present in universities and scientific departments. The Board is acting as the National Committee in India for the International Union of Geodesy and Geophysics.

28. INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE

National Physical Laboratory, Hillside Road, New Delhi-12

Head

SHRI S. PARTHASARATHY

The National Centre (Insdoc) provides a full range of documentation services to scientists, technologists, industrialists, research institutions, universities, Government departments, etc.

29. ESSENTIAL OILS RESEARCH CENTRES

Two centres are in operation for studies on cultural and chemical aspects of aromatic plants and their essential oils for planned and co-ordinated programme of research and development. The scope of work covers the cultivation of essential oil-bearing plants, chemical examination of essential oils and their utilization, and studies in semi-synthetics, isolates and synthetics.

1. Indian Institute of Science, Bangalore
Investigator-in-Charge: Dr. D.K. Banerjee.
2. Cinchona Department, Government of Madras, Ootacamund
Investigator-in-Charge: Shri A. Y. Swamy.

30. RAIN AND CLOUD PHYSICS RESEARCH UNIT

National Physical Laboratory, Hillside Road, New Delhi-12

Officer-in-Charge

SHRI A. K. ROY

The Unit is engaged in laboratory and field experiments as well as theoretical studies on mechanisms of rain formation in clouds.

ORGANISATIONS IN INDIA DEALING WITH IRRIGATION, FLOOD CONTROL, POWER AND ALLIED SUBJECTS

1. CENTRAL BOARD OF IRRIGATION AND POWER

Set up in 1931, the Central Board of Irrigation and Power consists of Irrigation and Hydro-electric Chief Engineers of all States in India and in the Centre. In addition, Ceylon is also a member of the Board. The total membership at the end of 1961 is 105. The functions of the Board are:—

- (i) to establish contacts with institutions and individuals in India and abroad with a view to the exchange of publications and technical information;
- (ii) to collect and supply information on irrigation, hydro-electric and allied subjects;
- (iii) to co-ordinate research on irrigation, hydro-electric and allied subjects and disseminate results of such research;
- (iv) to contribute information on irrigation, hydro-electric and allied subjects for publication in the press; and
- (v) to publish relevant literature.

Meetings of the Board and the Research Committee set up by the Board are held annually, where research work carried out during each year and other technical papers and problems are discussed and suitable recommendations on different subjects made to the various Governments in India. The Board during the course of a year publishes an Annual Report (Technical), Monthly Journal 'Irrigation and Power', Monthly Abstracts of the current literature received in the Library, Popular Leaflets and special publications on various technical subjects. The Board maintains one of the finest libraries on Irrigation, Hydro-electric and allied subjects in India where enquiries from engineers in India and abroad are dealt with.

The Board is also the National Committee in India for the International Commission on Large Dams and the International Commission on Irrigation and Drainage. It is also a liaison body in India for the International Association for Hydraulic Research and works as Secretariat for the Indian National Society of Soil Mechanics and Foundation Engineering. The office of the Board is situated at Curzon Road, New Delhi-1.

2. CENTRAL WATER AND POWER COMMISSION

The Central Water and Power Commission, set up in April 1945, consisting of a Chairman and four full time Members along with the necessary technical and administrative staff is a strong technical body in the country. The functions of the Commission are:

- (i) to make necessary investigations and prepare schemes and designs for the development of river valleys in respect of hydro-electric

power generation, irrigation, navigation, flood control, and soil conservation *etc.*, on an all-India basis ;

- (ii) to undertake construction work on any river development scheme on behalf of the Government of India and States ;
- (iii) to advise and assist if so required, the State Governments in the investigation and preparation of river valley development schemes;
- (iv) to advise the Government of India in respect of water and water-power rights and disputes as between various States;
- (v) to initiate schemes and arrange for the training of Indian engineers in India and abroad in the many aspects of river valley development;
- (vi) to conduct and co-ordinate research on the various aspects of river valley development schemes; and
- (vii) to collect, co-ordinate the collection of, publish and analyse data relating to water-power, waterways, rainfall, runoff, silting of reservoirs *etc.*, and to act as the Central Bureau of Information in respect of these matters.

3. PLANNING COMMISSION

The need for comprehensive planning based on a careful appraisal of resources and on an objective analysis of all the relevant economic factors had become imperative. With a view to speedy execution of the various development projects on a planned basis the Government of India set up the Planning Commission as a statutory organisation in 1950. The main functions of the Commission are:

- (i) to make an assessment of the material, capital and human resources of the country, including technical personnel, and investigate the possibilities of augmenting such of these resources as are found to be deficient in relation to the nation's requirements ;
- (ii) to formulate a Plan for the most effective and balanced utilisation of the country's resources ;
- (iii) to determine priorities, define the stages in which the Plan should be carried out and propose the allocation of resources for the due completion of each stage ;
- (iv) to indicate the factors which are tending to retard economic development and determine the conditions which in view of the current social and political situation should be established for the successful execution of the Plans;
- (v) to determine the nature of the machinery for securing the successful implementation of each stage of the Plan in all its aspects;
- (vi) to appraise from time to time the progress achieved in the execution of each stage of the Plan and recommend the adjustments of policy and measures that such appraisal may show to be necessary; and

- (vii) to make such interim or ancillary recommendation as appear to be appropriate either for facilitating the discharge of the duties assigned to it, or on a consideration of the prevailing economic conditions, current policies, measures and development programmes, or on an examination of such specific problems as may be referred to it for advice by Central or State Governments.

The Planning Commission comprises of a Chairman, a Deputy Chairman, four Members, a Secretary and adequate administrative and other staff.

4. INSTITUTION OF ENGINEERS (INDIA)

Incorporated by the Royal Charter in 1935 and with a membership of over 32,000 at present, the Institution of Engineers (India) was brought into being for the purpose of bringing together all qualified professional engineers to promote the general advancement of engineering and engineering services in India and to facilitate the spread of information and ideas on engineering subjects and to diffuse among its members information on all matters affecting engineering, to pool their knowledge and utilise it to the best advantage of the profession and also to encourage, regulate and elevate the technical and general knowledge of persons engaged in engineering. The Institution carries on its activities through the medium of 18 Local Centres in all the States of India and in Pakistan. The headquarters of the Institution are situated at 8, Gokhale Road, Calcutta-20. The Institution of Engineers (India) acts as the Indian National Committee for the World Power Conference.

5. INDIAN NATIONAL SOCIETY OF SOIL MECHANICS AND FOUNDATION ENGINEERING

The Indian National Society of Soil Mechanics and Foundation Engineering was set up in 1948 with a view to encouraging the study of the subject of Soil Mechanics and to devise ways and means to ensure the fullest use of this science in engineering projects. This Society also provides liaison between its members in India and the International Society of Soil Mechanics and Foundation Engineering whose headquarters are in England. At the present, the Indian National Society has a total membership of 418 Individual members, 61 Corporate members and 2 Associate members. The office of the Indian National Society is located in Curzon Road Barracks along with the office of the Central Board of Irrigation and Power.

6. NATIONAL PROJECTS CONSTRUCTION CORPORATION LTD.

The Corporation, an enterprise in the Public sector, sponsored by the Union Ministry of Irrigation and Power, was set up in 1957 with the object of

providing the Central and State Governments with an organisation capable of undertaking the execution of River Valley Projects and allied works requiring high technical skill, mechanised execution, precision and strict adherence to specifications and quality standards. The office of the Corporation is situated in E-2, Jhandewala Estate, New Delhi.

7. INDIAN STANDARDS INSTITUTION

The Indian Standards Institution was set up by the Government of India in 1946 for the preparation of standards to suit Indian conditions. The affairs of the Institution are managed by the General Council representing different Industries and Government departments and other allied institutions. The actual preparation of standards is done by small committees of experts representing various interests such as producers, consumers and technical experts.

ENGINEERING COLLEGES IN INDIA

1. Delhi Polytechnic, Kashmiri Gate, Delhi.
2. Gurumanak Engineering College, Ludhiana.
3. Punjab Engineering College, Chandigarh.
4. Thapar Institute of Engineering and Technology, Patiala.
5. Technological Institute of Textiles, Bhiwani.
6. Department of Chemical Technology, Punjab University, Chandigarh.
7. Birla Engineering College, Pilani.
8. M.B.M. Engineering College, Jodhpur.
9. Birla College, Pilani.
10. College of Engineering and Technology, Muslim University, Aligarh.
11. Engineering College, Banaras Hindu University, Banaras.
12. University of Roorkee, Roorkee.
13. College of Mining and Metallurgy, Banaras Hindu University, Banaras.
14. Engineering College, Dayalbagh, Agra.
15. College of Technology, Banaras Hindu University, Banaras.
16. H. B. Technological Institute, Kanpur.
17. Government Central Textile Institute, Kanpur.
18. National Institute of Sugar Technology, Kanpur.
19. Allahabad Agricultural Institute, Allahabad.
20. Indian Institute of Technology, Kanpur.
21. Regional Engineering College, Srinagar, Kashmir.
22. Assam Engineering College, Gauhati.
23. Government Engineering College, Jorhat, Assam.
24. Bihar College of Engineering, Patna University, Patna.
25. Bihar Institute of Technology, Sindri.
26. Birla Institute of Technology, Ranchi.
27. Muzaffarpur Institute of Technology, Muzaffarpur.
28. Indian School of Mines and Applied Geology, Dhanbad.
29. Regional Institute of Technology, Jamshedpur.
30. College of Engineering, Burla, Orissa.
31. Bengal Engineering College, Shibpore, Howrah.
32. College of Engineering and Technology, Jadavpur.
33. Department of Applied Physics, Calcutta University, Calcutta.
34. Institute of Radio Physics and Electronics, Calcutta University, Calcutta.
35. Indian Institute of Technology, Kharagpur.
36. College of Textile Technology, Serampur.

37. Department of Applied Chemistry, Calcutta University, Calcutta.
38. College of Textile Technology, Berhampur.
39. College of Leather Technology, Calcutta.
40. Regional Engineering College, Durgapur.
41. Engineering College, Poona.
42. Government Engineering College, Aurangabad.
43. Victoria Jubilee Technical Institute, Bombay.
44. Walchand College of Engineering, Sangli.
45. Department of Chemical Technology, Bombay University, Bombay.
46. Laxminarayana Institute of Technology, Nagpur.
47. Indian Institute of Technology, Bombay.
48. Sir J.J. College of Architecture, Bombay.
49. Regional Engineering College, Nagpur.
50. Birla Vishwakarma Mahavidyala, Anand.
51. Faculty of Technology, Baroda University, Baroda.
52. L.D. College of Engineering, Ahmedabad.
53. Lukhdhirji College of Engineering, Morvi.
54. Government Engineering College, Jabalpur.
55. Madhav Engineering College, Gwalior.
56. Shri Govindram Seksaria Technological Institute, Indore.
57. College of Engineering and Technology, Raipur.
58. Maulana Azad College of Technology, Bhopal.
59. College of Engineering, Anantpur.
60. College of Engineering, Kakinada.
61. College of Engineering, Osmania University, Hyderabad.
62. College of Engineering, Andhra University, Waltair.
63. Department of Chemical Technology, Osmania University, Hyderabad.
64. J.V.D. College of Science and Technology, Waltair.
65. Regional Engineering College, Warangal.
66. College of Engineering, Tirupathi.
67. College of Engineering, Trivandrum.
68. Maharaja's College, Ernakulam.
69. Government Engineering College, Trichur.
70. Nair Service Society Engineering College, Palghat.
71. T.K.M. Engineering College, Quilon.
72. A. C. College of Engineering and Technology, Karikudi.
73. College of Engineering, Annamalai University, Annamalainagar.
74. College of Engineering, Guindy.
75. Coimbatore Institute of Technology, Coimbatore.
76. Government College of Technology, Coimbatore.
77. Madras Institute of Technology, Chrompet, Madras.

78. Thiagaraja Engineering College, Madurai.
 79. P.S.G. & Sons' Charities College of Technology, Coimbatore.
 80. Department of Architecture, Madras University, Madras.
 81. Indian Institute A. C. College of Technology, Guindy.
 82. Indian Institute of Technology, Madras.
 83. B.D.T. Engineering College, Davangere, Mysore State.
 84. B.M.S. College of Engineering, Bangalore.
 85. L.V.B. College of Engineering and Technology, Hubli.
 86. College of Engineering, Bangalore.
 87. National Institute of Engineering, Mysore.
 88. Indian Institute of Science, Bangalore.
 89. S.K.S.J. Technological Institute, Bangalore.
 90. Engineering College, Gulbarga.
 91. Engineering College, Manipal.
 92. Regional Engineering College, Mangalore.
 93. Mahad Engineering College, Hassan.
 94. Regional Engineering College, Kozhikode.
 95. Sardar Vallabhai Regional Engineering College of Engineering and Technology, Gujarat.
 96. Motilal Nehru Engineering College, Allahabad.
 97. College of Engineering and Technology, Delhi.
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