जल विद्युत गृहों के निष्पादन का पुनर्विलोकन

REVIEW OF PERFORMANCE OF HYDRO POWER STATIONS

2016-17

भारत सरकार
विद्युत मंत्रालय

Goverment of India
Ministry of Power

केन्द्रीय
विद्युत
प्राधिकरण

CENTRAL
ELECTRICITY
AUTHORITY

विद्युत अधिनियम, 2003 की धारा 73 (आई) व (जे) के तहत के0वि0प्रा0 के सांविधिक दायित्व का निर्वहन करते हुए प्रकाशित

(PUBLISHED IN FULFILMENT OF CEA'S STATUTORY OBLIGATION UNDER SECTION 73 (i) & (j) OF THE ELECTRICITY ACT, 2003)

FUNCTIONS AND DUTIES OF CEA AS PER SECTION-73 OF ELECTRICITY ACT-2003

The Authority shall perform such functions and duties as the Central Government may prescribe or direct, and in particular to –

a) Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate the activities of the planning agencies for the optimal utilization of resources to sub serve the interests of the national economy and to provide reliable and affordable electricity to all consumers;

b) Specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid;

c) Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines;

d) Specify the Grid Standards for operation and maintenance of transmission lines;

e) Specify the conditions for installation of meters for transmission and supply of electricity;

f) Promote and assist in the timely completion of schemes and projects for improving and augmenting the electricity system;

g) Promote measures for advancing the skills of persons engaged in electricity industry;

h) Advise the Central Government on any matter on which its advice is sought or make recommendation to that Government on any matter if, in the opinion of the Authority, the recommendation would help in improving the generation, transmission, trading, distribution and utilization of electricity;

i) Collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters;

j) Make public from time to time the information secured under this Act, and provides for the publication of reports and investigations;

k) Promote research in matters affecting the generation, transmission, distribution and trading of electricity;

l) Carry out, or cause to be carried out, any investigation for the purpose of generating or transmitting or distributing electricity;

m) Advise any State Government, licensees or the generating companies on such matters which shall enable them to operate and maintain the electricity system under their ownership or control in an improved manner and where necessary, in coordination with any other Government, licensee or the generating company owning or having the control of another electricity system;

n) Advise the Appropriate Government and the Appropriate Commission on all technical matters relating to generation, transmission and distribution of electricity; and

o) Discharge such other functions as may be provided under this Act.

केन्द्रीय विद्युत प्राधिकरण

CENTRAL ELECTRICITY AUTHORITY

जल विद्युत गृहों के निष्पादन का पुनर्विलोकन 2016-17

REVIEW OF PERFORMANCE OF HYDRO POWER STATIONS 2016-17

जल परियोजना आयोजन तथा अन्वेषण प्रभाग

HYDRO PROJECT PLANNING & INVESTIGATION DIVISION

नई दिल्ली

NEW DELHI

मार्च-2018

MARCH-2018

(विद्युत अधिनियम, 2003 की धारा 73 (आई) व (जे) के तहत के0वि0प्रा0 के सांविधिक दायित्व का निर्वहन करते हुए प्रकाशित)

(PUBLISHED IN FULFILMENT OF CEA'S STATUTORY OBLIGATION UNDER SECTION 73(i) & (j) OF THE ELECTRICITY ACT, 2003)

प्राक्कथन

जल विद्युत शक्ति हमारे देश में पिछले 100 वर्षों से नवीनीकरण ऊर्जा का सबसे विश्वसनीय स्त्रोत रहा है। जल विद्युत शक्ति केंद्रों की उपलब्धता में सतत् सुधार के उद्देश्य से केन्द्रीय विद्युत प्राधिकरण (के0वि0प्रा0), केन्द्रीय पी0 एस0 यू0 और राज्य व निजी क्षेत्र में विद्युत यूटिलिटियों के निकट सहयोग से उनके वार्षिक निष्पादन की समीक्षा के लिए अध्ययन करता है।

वर्ष 2016-17 के दौरान जल विद्युत शक्ति केन्द्रों के निष्पादन की समीक्षा संबंधी रिपोर्ट विद्युत अधिनियम, 2003 के खंड 73 (आई) और (जे) के तहत सांविधिक दायित्व को आंशिक रूप से पूरा करने में केन्द्रीय विद्युत प्राधिकरण द्वारा किए गए ऐसे प्रकाशनों की श्रृंखला में 30वीं हैं। इस रिपोर्ट में 44478.42 मेगावाट की कुल प्रतिस्थापित क्षमता वाले 200 जल विद्युत केन्द्रों की 695 जल विद्युत इकाइयों के निष्पादन का व्यापक विश्लेषण किया गया है, जिसके लिए केन्द्रीय, राज्य और निजी क्षेत्रों में ऊर्जा उत्पादन यूटिलिटियों द्वारा आउटेज संबंधी आंकड़े उपलब्ध कराए गए हैं।

प्रचालन उपलब्धता संबंधी सूचना पर्याप्त और विश्वसनीय विद्युत आपूर्ति सुनिश्चित करने में काफी महत्वपूर्ण है। अध्ययनों के अनुसार वर्ष 2016-17 के दौरान जल विद्युत केन्द्रों की औसत प्रचालन उपलब्धता 90.24% थी। प्रणोदित (Forced) और योजनाबद्ध कामबन्दी (Planned Outages) के कारण जल विद्युत इकाइयों की औसत गैर-उपलब्धता क्रमश: 3.33% और 6.43% थी। वर्ष 2016-17 के दौरान जल विद्युत केन्द्रों से उत्पादन 122.377 बिलियन यूनिट था, जो 134 बिलियन यूनिट के उत्पादन लक्ष्य से 8.67% कम था।

मुझे विश्वास है कि यह समीक्षा विद्युत केन्द्र प्राधिकारियों को उपयुक्त प्रचालन एंव रखरखाव की (ओ0 एंड एम0) नीति तैयार करके जल विद्युत संयंत्रों की उपलब्धता में और सुधार लाने में उपयोगी मार्गदर्शन प्रदान करेगा। प्रणोदित कामबंदी के कारणों का भी व्यापक विश्लेषण करने की आवश्यकता है ताकि विनिर्माताओं/ओ0 एंड एम0 एजेंसियों द्वारा उचित उपाय किये जायें और इनकी पुनरावृत्ति को कम किया जा सके जिससे प्रचालन उपलब्धता में सुधार किया जा सके।

समीक्षा के लिए कामबन्दी आंकड़े/सूचना उपलब्ध कराने के लिए मैं सभी उर्जा उत्पादन यूटिलिटियों का हार्दिक धन्यवाद करता हूँ। मैं इस रिपोर्ट के लिए अपेक्षित निविष्ट आंकड़ों का विश्लेषण करने में सूचना प्रोद्योगिकी प्रभाग, के0वि0प्रा0 द्वारा प्रदान किए गए सहयोग के लिए उन्हें धन्यवाद देता हूँ।

के के आर्या

नई दिल्ली
मार्च, 2018

(कृष्ण कुमार आर्या)
सदस्य (जल विद्युत), के0वि0प्रा0

FOREWORD

Hydro Electric Power has been the most reliable source of renewable energy for the past over 100 years in our country. In the quest for continuous improvement in availability of Hydro Power Stations, Central Electricity Authority (CEA) carries out studies to review their annual performance in close co-operation with Central PSUs and Power Utilities in State & Private Sector.

The report on 'Review of Performance of Hydro Power Stations during the year 2016-17' is 30th in the series of such publication by Central Electricity Authority in partial fulfilment of the statutory obligations under Section 73(i) & (j) of the Electricity Act, 2003. The report provides exhaustive analysis of performance of 695 hydro-electric units installed at 200 hydro-electric stations having total installed capacity of 44478.42 MW for which outage data has been provided by generation utilities in Central, State and Private sectors.

The information on operation availability is of vital importance in ensuring adequate and reliable power supply. According to the studies, the average operating availability of hydroelectric stations during the year 2016-17 was 90.24%. The average non-availability of hydro units due to forced and planned outages was 3.33% and 6.43% respectively. The generation from hydro stations during 2016-17 was 122.377 Billion Units, which was 8.67% less than the generation target of 134 Billion Units.

I am confident that the review would provide useful guidance to power station authorities in making further improvement in the availability of hydel plants by chalking out suitable O&M strategies. There is also a need to undertake detailed analysis of the reasons of forced outages for devising necessary measures by the manufacturers/O&M agencies so as to minimise the recurrence of the same and to improve the operating availability.

I wish to express my sincere thanks to all the power generating utilities for providing outage data/information for the review. I would also like to put on record the co-operation extended by Information Technology Division, CEA for analysis of the input data required for this report.

KK Arya

New Delhi
March, 2018

(K. K. ARYA)
Member (Hydro), CEA

प्रस्तावना

किसी भी देश के विकास के लिए विद्युत शक्ति महत्वपूर्ण बुनियादी आवश्यकताओं में से एक है । हमारे देश में 100 वर्षों से भी अधिक समय से जल विद्युत सबसे विश्वसनीय नवीकरणीय ऊर्जा का स्रोत रहा है । दिनांक 31.03.2017 को 326849 मेगावाट की कुल प्रतिष्ठापित विद्युत उत्पादन क्षमता में से 44478 मेगावाट (13.61%) (25 मेगावाट से ज्यादा स्टेशन प्रतिष्ठापित क्षमता) की जल विद्युत क्षमता है।

केन्द्रीय विद्युत प्राधिकरण (के. वि. प्रा.) उत्पादन निष्पादन के सतत् प्रबोधन, ब्रेकडाउन के कारणों के विश्लेषण, नवीनीकरण तथा आधुनिकीकरण कार्यों आदि के द्वारा ऊर्जा उत्पादक यूटिलिटीज के सहयोग से जल विद्युत केन्द्रों के निष्पादन में सुधार के लिए सघन प्रयास कर रहा है। यह आवश्यक है कि विद्यमान विद्युत केन्द्रों को विद्युत की कमी को कम करने के लिए तथा विश्वसनीय आपूर्ति करने के लिए अपने उत्पादन तथा उपलब्धता में सुधार अवश्य करना चाहिए।

यह वार्षिक पुनर्वलोकन वर्ष 2016-17 के दौरान देश में जल विद्युत केन्द्रों के निष्पादन का विश्लेषण प्रस्तुत करता है और जिसमें 200 जल विद्युत केन्द्रों पर 695 यूनिटों के निष्पादन का विस्तृत विश्लेषण है। कोई भी एक सूचकांक जल विद्युत केन्द्रों के निष्पादन के लिए पर्याप्त रूप से मापक नहीं हो सकता। जल विद्युत केन्द्रों के निष्पादन को योजनाबद्ध अनुरक्षण, गैर-निर्धारित पूर्ण/ आंशिक कामबंदी, अंतर्प्रवाह की वास्तविक प्रवृत्ति, आदि जैसे घटक प्रभावित करते हैं। अनुरक्षण में आद्यतन पद्धति अपनाने की आवश्यकता है ताकि परिहार्य कामबन्दियों (Planned outages) का निराकरण किया जा सके।

नवीनीकरण तथा आधुनिकीकरण विषय से संबंधित अध्याय इसके लाभों का विस्तार से उल्लेख करता है तथा ऊर्जा उत्पादक यूटिलिटीज को अपने प्रचालाधीन पुरानी यूनिटों में इस प्रकार के कार्य को हाथ में लेने की संभावनाओं को सुनिश्चित करने में प्रोत्साहित करेगा।

इस प्रकाशन का अध्ययन जल परियोजना आयोजन एंव अन्वेषण (एच0पी0पी0&आई0) प्रभाग, के0 वि0 प्रा0 के निदेशक श्री राकेश कुमार के संपूर्ण मार्गदर्शन में किया गया है।

मैं सभी विद्युत राज्य परिषदों, सरकारी/निजी क्षेत्र के उपक्रमों और विद्युत केंद्र के अधिकारियों को पुनर्विलोकन के लिए जरूरी आंकड़े उपलब्ध कराने के लिए हार्दिक धन्यवाद देना चाहता हूँ।

मैं सभी ऊर्जा उत्पादक युटिलिटीज से अनुरोध करूंगा कि जल विद्युत केन्द्रों के संबंध में माहवार निष्पादन तथा कामबंदी आंकड़े तुरंत तथा नियमित रूप से प्रस्तुत करते रहें ताकि भविष्य में भी विश्लेषण तथा निष्पादन पुनर्वलोकनों का प्रकाशन समय से हो सके।

के0वि0प्रा0 इस रिपोर्ट की विषयवस्तु तथा प्रस्तुतीकरण में सुधार के लिए समन्वित प्रयास कर रहा है। इस संबंध में रचनात्मक सुझाव हर्षप्रद तथा सराहनीय होंगे।

(जयदीप सिंह बावा)
मुख्य अभियन्ता(एच0पी0पी0&आई0), के0वि0प्रा0

नई दिल्ली
मार्च, 2018

PREFACE

Electric power is one of the most important infrastructure requirements for the development of any country. Hydel Power has been the most reliable source of renewable energy for the past more than 100 years in our country. As on 31.03.2017, out of a total installed generating capacity of 326849 MW, hydro capacity was 44478 MW (13.61%) (above 25 MW capacity).

Central Electricity Authority (CEA) is making concerted efforts for improving the performance of Hydro Power Stations in cooperation with the generating utilities through close monitoring of generation performance, analysis of causes for breakdowns, Renovation & Modernization works etc. It is imperative that the existing power stations must improve their performance and availability to reduce power shortage and deliver reliable supply.

This Annual Review provides an analysis of performance of Hydro Power Stations in the country during the year 2016-17 and provides an exhaustive analysis of performance of 695 units at 200 H.E. Stations. No single operating index can adequately provide a measuring unit for performance of Hydro Power Stations. The factors that influence the performance of hydro power stations are planned maintenance, unscheduled total/partial outages, pattern of actual inflows, etc. There is a need to adopt state-of-the-art practices in maintenance so that avoidable outages could be obviated.

The chapter on RM&U enumerates the advantages of RM&U and would motivate generating utilities to explore the possibilities of undertaking such works on older units under operation with them.

Studies for this publication have been carried out in Hydro Project Planning & Investigation (HPP&I) Division of CEA under the overall guidance of Shri Rakesh Kumar, Director.

I wish to express my sincere thanks to various State Electricity Boards, Public and Private Sector hydro power utilities and Power Station Authorities for making available the necessary data for the review.

I would urge all generating utilities to continue furnishing month-wise performance & outage data regularly in respect of all Hydro Electric Power Stations for analysis & timely publishing of performance reviews in future also.

CEA has been making concerted efforts to improve the contents and presentation of the report. Constructive suggestions in this regard are welcome and will be appreciated.

New Delhi
March, 2018

(Jaideep Singh Bawa)
Chief Engineer (HPP&I), CEA

आभार

मैं निम्नलिखित अधिकारियों का जल विद्युत गृहों के निष्पादन पुनर्विलोकन 2016-17 के प्रकाशन में सहयोग के लिए धन्यवाद देता हूँ।

मुख्य अभियन्ता (जल विद्युत निष्पादन प्रबोधन प्रभाग), के0वि0प्रा0 को वर्ष 2016-17 के दौरान प्रचालित यूनिटों के टरबाइन तथा जेनरेटर निर्माताओं के विवरण समय पर उपलब्ध कराने के लिये धन्यवाद देता हूँ।

मुख्य अभियन्ता (एच0ई0&आर0एम0 प्रभाग) के0वि0प्रा0 का जल विद्युत यूनिटों के नवीनीकरण एंव आधुनिकीकरण एंव उन्नयन पर अध्याय तैयार करने के लिए धन्यवाद देता हूँ।

मैं सदस्य (जल विद्युत), के0वि0प्रा0 तथा मुख्य अभियन्ता (एच0पी0पी0&आई0) का इस पुनर्विलोकन को इस स्वरूप में लाने में उनके अमूल्य सुझावों तथा मार्ग निर्देशन के लिये आभारी हूँ।

मैं सर्वश्री बलवान कुमार, उप निदेशक, भीम देव नेगी, प्रबंधक, एस0जे0वी0एन0 लि0, राहुल सिंह, सहायक निदेशक व अन्य अधिकारियों तथा कर्मचारियों का भी इस पुनर्विलोकन के प्रकाशन में सहयोग के लिये धन्यवाद देता हूँ।

(राकेश कुमार)
निदेशक (एच0पी0पी0&आई0), के0वि0प्रा0

ACKNOWLEDGEMENT

I express my sincere thanks to the following officers in bringing out this Review of Performance of Hydro Power Stations 2016-17.

Chief Engineer (HPM), CEA for providing the details of turbine and generator manufacturers, date of commissioning and type of turbine etc. for the units commissioned during the year 2016-17.

Chief Engineer (HE&RM), CEA for preparing the chapter on Renovation Modernisation & Uprating of Hydro generating units.

I am grateful to Member (Hydro), CEA and Chief Engineer (HPP&I), CEA, for their valuable suggestions and guidance in preparation of this Review.

I also express my thanks to Shri Balwan Kumar, Deputy Director, Shri Bhim Dev Negi, Manager, SJVNL, Shri Rahul Singh, Assistant Director and other officers/officials for their assistance in making it possible to bring out this Review.

(Rakesh Kumar)
Director (HPP&I), CEA

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SUMMARY

1.0 General

1.1 This review covers the performance of Hydro-Electric (HE) Stations having installed capacity of more than 25 MW. As on 31st March, 2017 there were 695 HE generating units installed in 200 Hydro-Electric Stations with an aggregate installed capacity of 44478.42 MW in operation. Performance of 37 important Reservoir based schemes has also been discussed separately in the report.

1.2 Region-wise summary of the existing HE Stations in operation with installed capacity above 25 MW as on 31.3.2017 in the country vis-à-vis that on 31.3.2016 is given below in **Table S-1.**

TABLE S-1

REGION-WISE SUMMARY OF HYDRO-ELECTRIC STATIONS
(2016-17 VIS-A-VIS 2015-16)

Region	No of Stations as on		No of Units as on		Capacity (MW) as on	
	31.03.17	**31.03.16**	**31.03.17**	**31.03.16**	**31.03.17**	**31.03.16**
Northern	71	68	239	234	18527.27	18302.27
Western	28	28	101	101	7392.00	7392.00
Southern	71	69	252	247	11773.45	11592.45
Eastern	20	19	74	65	5543.70	4254.70
N-Eastern	10	10	29	29	1242.00	1242.00
All India	**200**	**194**	**695**	**676**	**44478.42**	**42783.42**

1.3 The report contains outage data of 200 H.E. Stations (above 25 MW) covering 695 units and having an aggregate installed capacity of 44478.42 MW which was made available by various utilities for the purpose of this Review.

1.4 The performance review also analyses year-wise generation, planned maintenance, forced outages and operating availability for the last 10 years (viz 2007-08 to 2016-17)

1.5 This review covers information in respect of renovation & modernization, uprating and life extension of HE stations in the country for the year 2016-17, achievements during the year 2016-17 and programme for renovation, modernization, life extension and uprating of HE Stations for the year 2017-18.

1.6 The report comprises of nine chapters as under:

Chapter No.	Particulars
1	Hydro Power Potential and Development
2	Generation Performance
3	Major Reservoir Based H.E. Schemes
4	Planned Maintenance of H.E. Units
5	Forced Outage of H.E. Units
6	Operating Availability of H.E. Units
7	Generation Programme for the year 2017-18
8	Renovation & Modernisation of Hydro Electric Power Projects
9	Definitions and Abbreviations

2.0 Generation Performance

The generation from the hydro electric power stations in the country during 2016-17 was 122377.56 MU (excluding import from Bhutan) which was 8.67% less than target of 134000 MU.

2.1 Utility-wise/ Sector-wise Performance of H.E. Stations

The utility-wise/ sector-wise target of energy generation vis-à-vis actual generation and surplus /shortfall in respect of Hydro Electric stations are given below in **Table S-2.**

TABLE S-2

UTILITY-WISE PERFORMANCE OF HYDRO ELECTRIC STATIONS (2016-17 VIS-A-VIS 2015-16)

Utilities	Installed Capacity (MW) (As on 31.03.2017)	Generation					
		Target (MU)		Actual (MU)		Surplus (+)/ Shortfall (-) in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
Central Sector							
BBMB	2866.30	9536	9076	10570	11818.9	10.84	30.22
NHPC	5121.20	22440	21190	22929.8	23403.43	2.18	10.45
SJVNL	1912.02	8595	8000	9011.06	9297.2	4.84	16.22
NTPC LTD	800.00	2800	890	3225.16	2308.6	15.18	159.39
THDC	1400.00	4100	3952	4370.87	4349.05	6.61	10.05
NHDC	1520.00	3100	3315	4748.49	2929.22	53.18	-11.64
DVC	143.20	244	219	255.54	176.51	4.73	-19.4
NEEPCO	755.00	2585	2283	2793.32	2400.24	8.06	5.14
Sub Total	**14517.72**	**53400**	**48925**	**57904.24**	**56683.15**	**8.43**	**15.86**
Private Sector							
MPCL	86	341	341	353.79	341.94	3.75	0.28
TPCL	447	1450	1450	1465.46	1098.49	1.07	-24.24
DLHP	34	65	36	47.12	82.55	-27.51	129.31

Utilities	Installed Capacity (MW) (As on 31.03.2017)	Generation					
		Target (MU)		Actual (MU)		Surplus (+)/ Shortfall (-) in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
EPPL	100	370	370	366.54	354.42	-0.94	-4.21
ADHPL	192	686	700	679.12	724.96	-1	3.57
GBHPPL	70	282	255	261.25	287.85	-7.36	12.88
HBPCL	1300	5500	5676	5715.04	6030.82	3.91	6.25
HSPL*	0	-	245	-	-	-	-
AHPCL	330	1396	1114	1280.75	901.37	-8.26	-19.09
JPPVL	400	1776	1776	2042.05	1210.65	14.98	-31.83
DEPL	96	488	85	705.63	75.06	-16.88	-11.69
GIPL	99	495	475	494.75	421.43	-0.05	-11.28
IAEPL	24	-	-	-	-	-	-
Sub Total	**3178**	**12849**	**12570**	**13122.79**	**11529.54**	**2.13**	**-7.93**
State Sector							
JKSPDCL	1110.00	5144	3634	4789.6	3980.3	-6.89	9.53
HPPCL	195.00	266	-	56.09	-	-78.91	-
HPSEB LTD.	372.00	1465	1062	1237.42	1161.81	-15.53	9.4
RRVUNL	411.00	710	700	965.99	1033.8	36.05	47.69
PSPCL	1051.00	4069	3719	3536.34	4327.84	-13.09	16.37
UPJVNL	501.60	1161	1115	1175.56	935.08	1.25	-16.14
UJVNL	1252.15	4700	4498	4201.44	4762.86	-10.61	5.89
SSNNL	1450.00	3263	3544	3209.21	2170.43	-1.65	-38.76
GSECL	540.00	840	840	734.67	781.42	-12.54	-6.97
MAHAGENCO	2406	4358	3956	4050.98	3519.33	-7.04	-11.04
MPPGCL	875.00	2383	2621	2768.31	1940.6	16.17	-25.96
CSPGCL	120.00	260	250	153.76	323.3	-40.86	29.32
APGENCO	1796.75	3604	3773	2605.99	2511.31	-27.69	-33.44
TSGENCO	2306.60	3132	3606	1279.99	282.33	-59.13	-92.17
KPCL	3585.40	11429	12726	6691.09	7350.01	-41.46	-42.24
KSEBL	1881.50	6834	6751	4067.49	6363.75	-40.48	-5.74
TANGEDCO	2203.20	4901	4962	2397.12	4474.27	-51.09	-9.83
JUUNL	130.00	154	154	30.13	51.24	-80.44	-66.73
OHPC	2027.50	5621	5749	4412.89	4432.83	-21.49	-22.89
TUL	1200.00	552	47	308.42	-	-43.95	-
WBSEDCL	986.00	1596	1596	1560.85	1491.7	-2.2	-6.53
APGCL	100.00	390	390	396.59	408.88	1.69	4.84
MePGCL	282.00	919	859	719.6	860.94	-21.7	0.23
Sub Total	**26782.70**	**67751**	**66552**	**51350.53**	**53164.06**	**-24.21**	**-20.12**
All India	**44478.42**	**134000**	**128000**	**122377.6**	**121376.8**	**-8.67**	**-5.17**

*The project anticipated for commissioning during 2015-16 is now indefinitely delayed.

During the year 2016-17, overall hydro generation was more than the target in respect of BBMB, NHPC Ltd., SJVNL, NTPC, THDC, & NEEPCO in Central Sector and MPCL, HBPCL, JPPVL, DEPL & TPCL in Private Sector. As regards generation by State Electricity Boards/Corporations / Departments, hydro generation was more than the target in respect of RRUVNL, UPJVNL, MPPGCL and APGCL.

2.2 Sector-wise Performance of H.E. Stations

Sector-wise generation performance of H.E. Stations during 2016-17 is given in **Table S-3**. It is seen that there was excess generation as compared to target in Central Sector & Private Sector and lower generation in State Sector.

TABLE S-3

SECTOR-WISE PERFORMANCE OF HYDRO ELECTRIC STATIONS (2016-17 VIS-A-VIS 2015-16)

Sector	Installed Capacity (MW) (As on 31.03.2017)	Energy Generation (MU)					
		Target		Actual		Surplus (+)/ Deficit(-)in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
Central	14517.72	53400	48925	57904.24	56683.15	8.43	15.86
State	26782.70	67751	66552	51350.53	53164.03	-24.21	-20.12
Private	3178.00	12849	12523	13122.79	11529.54	2.13	-7.93
Total	**44478.42**	**134000**	**128000**	**122377.56**	**121376.75**	**-8.67**	**-5.17**

3.0 Outage Analysis

For outage data analysis during 2016-17, outage data of 200 H.E. Stations (above 25 MW capacity) covering 695 units and having an aggregate installed capacity of 44478.42 MW made available by various utilities have been considered for the purpose of this Review. Region-wise details of these 200 hydro power stations are given below in **Table S-4**.

TABLE S-4

REGION-WISE SUMMARY OF HE STATIONS ANALYSED (2016-17 VIS-A-VIS 2015-16)

Region	No. of Stations		No. of Units		Capacity(MW) as on	
	31.03.17	31.03.16	31.03.17	31.03.16	31.03.17	31.03.16
Northern	71	68	239	234	18527.27	18302.27
Western	28	28	101	101	7392.00	7392.00
Southern	71	69	252	247	11773.45	11592.45
Eastern	20	19	74	65	5543.70	4254.70
North Eastern	10	10	29	29	1242.00	1242.00
All India	**200**	**194**	**695**	**676**	**44478.42**	**42783.42**

3.1 Planned Maintenance

The number of H.E. Stations falling under various ranges of non-availability due to planned maintenance during the year 2016-17 vis-à-vis 2015-16 is summarized below in **Table S-5.**

TABLE S-5

NON-AVAILABILITY OF HE STATIONS DUE TO PLANNED OUTAGES (2016-17 VIS-A-VIS 2015-16)

% Non-Availability due to planned maintenance	2016-17				2015-16			
	Stations		Capacity		Stations		Capacity	
	No.	% of Total	MW	% of Total	No.	% of Total	MW	% of Total
≤ 5	116	58.00	26069.87	58.61	94	48.45	21734.12	50.80
>5 to 10	44	22.00	8947.20	20.12	50	25.77	11240.35	26.27
>10 to 15	13	6.50	2461.15	5.53	24	12.37	3434.20	8.03
>15 to 20	16	8.00	4241.40	9.54	11	5.67	2923.75	6.83
>20 to 25	3	1.50	1230.00	2.77	5	2.58	1100.10	2.57
>25 to 30	2	1.00	681.00	1.53	4	2.06	990.00	2.31
above 30	6	3.00	847.80	1.91	6	3.09	1360.60	3.18
Total	**200**	100	**44478.42**	100.00	**194**	100	**42783.4**	**100**

It could be seen from above that 116 nos. (58% of total) non-availability factor less than or equal to 5% due to planned maintenance during 2016-17 as compared to 94 nos. (48.45% of total) hydro-electric stations during 2015-16.

Non-availability due to planned maintenance was more than 30% at 6 nos. (3% of total) H.E. Stations during 2016-17 which is similar to 2015-16. The details of these stations for 2016-17 is given below in **Table S-6.**

TABLE S-6

H.E. STATIONS HAVING HIGH PLANNED MAINTENANCE FOR THE PERIOD: (2016-17)

Sl. No	Name of Station	Capacity (MW)	N.A. due to P.M.*(%)	Remarks
1	Rihand HPS	300.00	55.25	R&MU and stator winding fault
2	Rajghat HPS	45.00	43.93	Annual Maintenance, Capital Maintenance.
3	Ganguwal HPS	77.65	34.85	R&MU works
3	Ganguwal HPS	77.65	34.85	R&MU works
4	Kotla HPS	77.65	34.32	R&MU works
5	Hirakud-I HPS	275.50	32.98	R&MU works
6	Hirakud-II HPS	72.00	37.87	R&MU works

*** N.A.** -Non-Availability, **P.M. -** Planned Maintenance

42% of stations had operational availability lower than 95% on account of planned maintenance alone against the normative design/plan annual availability. The high planned maintenance outages could be on account of ageing, O&M management issues, undertaking of R&M works, etc.

These utilities need to improve their O&M practices to bring down their total outages i.e. planned & forced to less than 5% as per best practices. Further, those stations which are having continuously high planned maintenance outages over past few years may be requiring major repair & maintenance works or Renovation & Modernization (R&M) works for improving the availability, reliability & security of the plant besides providing life extension where the assets have outlived their useful life.

The duration of various types of periodic planned maintenance varied considerably from station to station. Details of average time taken for various types of maintenance are given in **Table S-7**.

TABLE S-7

AVERAGE DURATION OF VARIOUS TYPES OF PLANNED MAINTENANCE FOR THE PERIOD: (2016-17)

Sl. No	Type of Planned maintenance	Average duration at any unit (Hrs)
1	Capital	1794.98
2	Annual	611.16
3	Half Yearly	9.08
4	Quarterly	630.12
5	Monthly	58.09
6	Routine	50.10
7	Renovation & Modernisation & Up rating	886.65
8	Civil Structure	197.98
9	Turbine	78.32
10	Generator	146.7
11	Other Equipments	139.76
12	Miscellaneous	121.12

It has been observed that there were wide variations in the time taken at different hydro units for the same type of periodic maintenance. The reasons for this can be attributed to following factors.

- The nature and the extent of work involved may vary from unit to unit.
- Availability of spare parts could be a constraint at some units.
- The working of the agency entrusted with the maintenance work could be different.
- Administrative and procedural difficulties may be faced at some of the stations.

Summary of planned maintenance carried out on various equipments like generators, turbine and other equipments during 2016-17 vis-à-vis 2015-16 is given below in **Table S-8.**

TABLE S–8

DURATION OF PLANNED MAINTENANCE FOR GENERATOR, TURBINE & OTHER EQUIPMENTS (2016-17 vis-à-vis 2015-16)

S. No.	Equipments	Duration			
		Maximum Hours for any unit		Average Hours	
		2016-17	2015-16	2016-17	2015-16
1	Generator	2797.15	3236.75	146.70	211.54
2	Turbine	2185.75	2171.50	78.32	76.48
3	Other Equipment	2797.15	3236.75	139.76	84.61
4	Civil Structure	2999.13	2640.75	197.98	223.17

It could be seen that the average hours utilized for carrying out various repairs decreased for generator and civil structure during 2016-17 as compared to 2015-16 while they have increased for other equipments.

3.2 Forced Outages

The summary of forced outages caused due to break-down of generator, turbine and other equipments during 2016-17 vis-à-vis 2015-16 is given below in **Table S-9.**

TABLE S–9

FORCED OUTAGES DUE TO GENERATOR, TURBINE & OTHER EQUIPMENT FAULTS (2016-17 VIS-A-VIS 2015-16)

Sl. No.	Equipment	Forced Outage (Hours)		% of total Forced Outage	
		2016-17	2015-16	During 2016-17	Increase/ Decrease vis-à-vis 2015-16
1	Generator	73896.94	101627.4	40.2	-27.29
2	Turbine	39328.84	69945.81	21.4	-43.77
3	Civil Structure	24769.6	59548.33	13.5	-58.40
4	Other Equipments	45861.19	63787.49	24.9	-28.10
	Total	**183856.57**	**294909.03**	**100**	**-37.66**

3.3 Operating Availability

The number of H.E. Stations falling under various ranges of operating availability during the year 2016-17 is summarized below in **Table S-10.**

TABLE S-10

OPERATING AVAILABILITY OF H.E. STATIONS
PERIOD: 2016-17

OPERATING AVAILABILITY (%)	NO. OF STATIONS	% OF TOTAL STATIONS	INSTALLED CAPACITY (MW)	% OF TOTAL INSTALLED CAPACITY
≥95%	85	42.50	18857.00	42.40
>90 to 95	45	22.50	10166.12	22.86
>85 to 90	24	12.00	4462.10	10.03
>80 to 85	16	8.00	4185.00	9.41
< 80	30	15.00	6808.20	15.31
Total	**200**	**100.00**	**44478.42**	**100.00**

Operating availability of 46 nos. HE stations (23% of total HE Stations) was below 85% (10993 MW) due to planned maintenance (capital overhauling, R&MU works, annual maintenance etc.) carried out for long duration and forced outages (turbine vibration, repair of runner/underwater parts, fire at cable gallery etc.) occurred in these HE Stations.

Region-wise planned maintenance, forced outages and operating availability of H.E. Units for 2016-17 is indicated below in **Table S-11.**

TABLE S-11

AVAILABILITY OF UNITS - REGION-WISE
PERIOD: 2016-17

SL. No.	REGION	NO.OF UNITS	INSTALLED CAPACITY (MW)	PLANNED MAINTENANCE (%)	FORCED OUTAGE (%)	OPERATING AVAILABILITY
1	Northern	239	18527.27	8.37	1.97	89.66
2	Western	101	7392	3.86	1.19	94.95
3	southern	246	11658.7	4.14	6.05	89.81
4	Eastern	80	5658.45	8.82	4.19	86.99
5	North eastern	29	1242	3.62	7.01	89.37
	All India	**695**	**44478.42**	**6.43**	**3.33**	**90.24**

On analyzing various types of planned shutdowns, it may be concluded that:

- Generating units installed in Eastern Region accounted for Maximum non-availability due to planned maintenance (8.82%) whereas generating units installed

in North Eastern Region accounted for the least non-availability due to planned maintenance (3.62%) as indicated in **Table S-10** above**.**

3.4 General Overview

General overview indicating generation, planned maintenance (PM), forced outage (FO) and operating availability (OP.AV.) of H.E. Stations during the past 10 years is given below:

OVERVIEW

YEAR	INSTALLED CAPACITY	GENERATION			UNITS ANALYSED		PM	FO	OP.AV
	(MW)	TARGET (MU)	ACTUAL (MU)	VARIA-TION (%)	Nos.	CAP (MW)	%	%	%
2016-17	44478.42	134000	122377.56	(-)7.67	695	44478.42	6.43	3.33	90.24
2015-16	42783.42	128000	121376.75	(-)5.17	676	42783.42	7.21	4.86	87.93
2014-15	41262.42	124267	129244	(+)3.98	659	41262.42	7.21	4.30	88.49
2013-14	40531.41	122263	134848	(+)10.29	653	40531.41	5.97	5.55	88.48
2012-13	39491.40	122045	113720	(-)6.82	634	39491.40	7.56	3.27	89.17
2011-12	38990.40	112050	130510	(+)16.47	620	38990.40	7.43	4.48	88.09
2010-11	37567.40	111352	114257	(+)2.61	609	37567.40	7.23	3.94	88.83
2009-10	36863.40	115468	103916	(-)10.00	589	36203.40	6.19	2.90	90.91
2008-09	36846.40	114841	109840	(-)4.35	572	35312.45	6.38	2.45	91.17
2007-08*	37002.10	109450	123424	(+)12.80	641	31033.00	5.66	2.34	92.00

*For the year 2007-08, station capacity above 3 and 2008-09 onwards station capacity above 25 MW have been considered.

CHAPTER-1

HYDRO-ELECTRIC POTENTIAL AND DEVELOPMENT

CHAPTER-1

HYDRO-ELECTRIC POTENTIAL AND DEVELOPMENT

1.1 Hydro-electric Potential

Reassessment studies of Hydro Electric Potential in various river basins of the country were carried out by Central Electricity Authority during the period 1978-87. As per these studies, total Hydro Electric Power potential in the country was assessed as 84044 MW (at 60% load factor) from a total of 845 number of identified H.E. Schemes which when fully developed would result in an installed capacity of about 148701 MW on the basis of probable average load factor. The total energy potential is assessed as 600 billion units per year. The identified potential of H.E. schemes above 25 MW installed capacity works out to be 145320 MW from a total of 592 H.E. schemes.

As on 31.03.2017, H.E. Schemes having total installed capacity of 39692.82 MW (27.31%) excluding pumped storage stations of capacity of 4785.60 MW have already been developed and the schemes under construction account for capacity of 10848.5 MW (excluding PSS of 1080 MW) (7.47%). As such, about 65% identified capacity is yet to be harnessed. Summary of the status of Hydro Electric Potential development in the country is indicated in **Tables 1.1, and 1.2** respectively as well as shown in **Exhibits 1.1 and 1.2.**

TABLE 1.1

REGION-WISE/STATE-WISE STATUS OF HYDRO ELECTRIC CAPACITY
(In terms of Installed Capacity-above 25 MW as on 31.03.2017)

Region/ State	Identified Capacity as per reassessment study (MW)		Capacity Developed		Capacity Under construction		Capacity yet to be developed	
	Total (MW)	Above 25 MW	(MW)	(%)	(MW)	(%)	(MW)	(%)
NORTHERN								
Jammu & Kashmir	14146	13543	3119	23.03	1265.5	9.34	9158.5	67.63
Himachal Pradesh	18820	18540	9643	52.01	1997.0	10.77	6900.0	37.22
Punjab	971	971	1096.3	100	206.0	21.22	0.00	0.00
Haryana	64	64	0.00	0.00	0.00	0.00	0.00	0.00
Rajasthan	496	483	411.0	85.09	0.00	0.00	0.00	0.00
Uttarakhand	18175	17998	3756.4	20.87	1430.0	7.95	12811.7	71.18
Uttar Pradesh	723	664	501.6	75.54	0.0	0.00	39.0	5.87
Sub Total(NR)	**53395**	**52263**	**18527.3**	**35.45**	**4898.5**	**9.37**	**28837.38**	**55.18**
WESTERN								
Madhya Pradesh	2243	1970	2235.0	100	400.00	20.30	0.00	0.00
Chhattisgarh	2242	2202	120.00	5.45	0.00	0.00	2082.00	94.55
Gujarat	619	590	550.00	100	0.00	0.00	0.00	0.00
Maharashtra	3769	3314	2647.0	79.87	0.00	0.00	667.0	20.13

Region/ State	Identified Capacity as per reassessment study (MW)		Capacity Developed		Capacity Under construction		Capacity yet to be developed	
	Total (MW)	Above 25 MW	(MW)	(%)	(MW)	(%)	(MW)	(%)
Goa	55	55	0.00	0.00	0.00	0.00	55.00	100
Sub Total (WR)	**8928**	**8131**	**5552.00**	**68.28**	**400.00**	**4.92**	**2179.00**	**26.80**
SOUTHERN								
Andhra Pradesh	2366	2341	1610.0	68.77	960.0	41.01	0.00	0.00
Telangana	2058	2019	701.0	34.72	90.0	4.46	1228.0	60.82
Karnataka	6602	6459	3654.4	56.62	0.00	0.00	2801.6	43.38
Kerala	3514	3378	1881.50	55.70	100.00	2.96	1396.50	41.34
Tamil Nadu	1918	1693	1803.2	100	0.00	0.00	0.00	0.00
Sub Total (SR)	**16458**	**15890**	**9653.1**	**60.75**	**1150.0**	**7.24**	**5086.9**	**32.01**
EASTERN								
Jharkhand	753	582	170.00	29.21	0.00	0.00	412.00	70.79
Bihar	70	40	0.00	0.00	0.00	0.00	0.00	0.00
Odisha	2999	2981	2142.3	71.86	0.00	0.00	838.8	28.14
West Bengal	2841	2829	441.2	15.60	120	4.24	2276.8	80.16
Sikkim	4286	4248	1965.0	46.26	1326.0	31.21	957.0	22.53
Sub Total (ER)	**10949**	**10680**	**4718.5**	**44.18**	**1446.0**	**13.54**	**4515.6**	**42.28**
NORTH EASTERN								
Meghalaya	2394	2298	282.00	12.27	40.0	1.74	1976.0	85.99
Tripura	15	0	0.00	0.00	0.00	0.00	0.00	0.00
Manipur	1784	1761	105.00	5.96	0.00	0.00	1656.0	94.04
Assam	680	65	375.00	57.69	0.00	0.00	275.0	42.31
Nagaland	1574	1452	75.00	5.17	0.00	0.00	1377.0	94.83
Arunachal Pradesh	50328	50064	405.00	0.81	2854.0	5.70	46805.0	93.49
Mizoram	2196	2131	0.00	0.00	60.00	2.82	2071.0	97.18
Sub Total (NER)	**58971**	**58356**	**1242.00**	**2.13**	**2954.0**	**5.06**	**54160.0**	**92.81**
ALL INDIA	**148701**	**145320**	**39692.8**	**27.31**	**10848.5**	**7.47**	**94778.7**	**65.22**

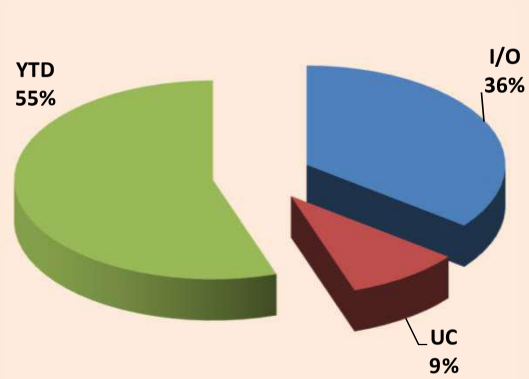
Note:- In addition, 4785.60 MW of PSS are in operation and 1080 MW of PSS are under construction.

REGION-WISE STATUS OF HYDRO ELECTRIC CAPACITY AS ON 31.03.2017

EXHIBIT 1.1

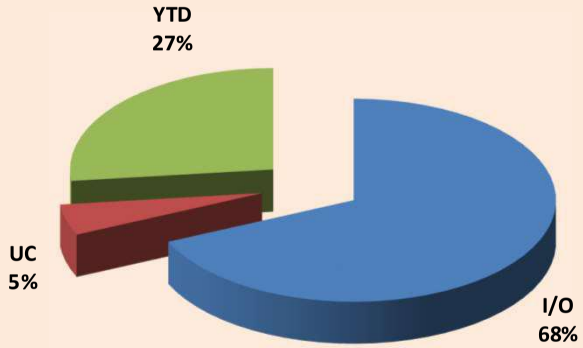
I/O=In Operation UC=Under Construction YTD= Yet to be Developed

NORTHERN REGION



TOTAL ASSESSED (Above 25 MW) : - 52263 MW

WESTERN REGION

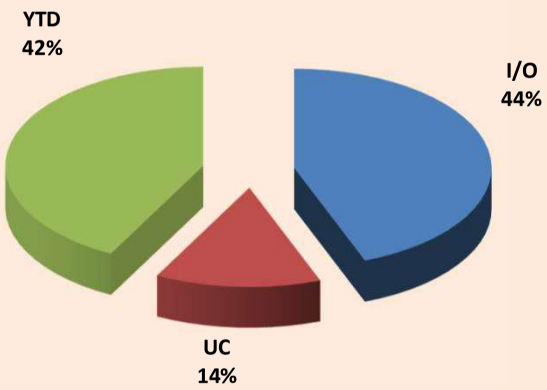


TOTAL ASSESSED (Above 25 MW) : - 8131 MW

SOUTHERN REGION

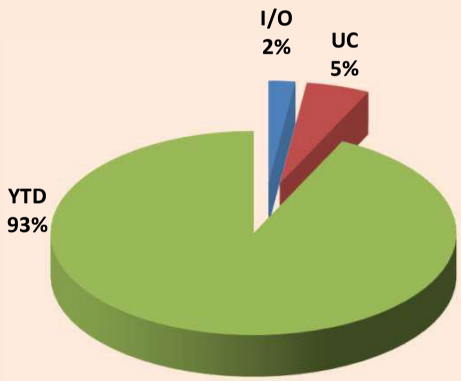
TOTAL ASSESSED (Above 25 MW): - 15890 M

EASTERN REGION



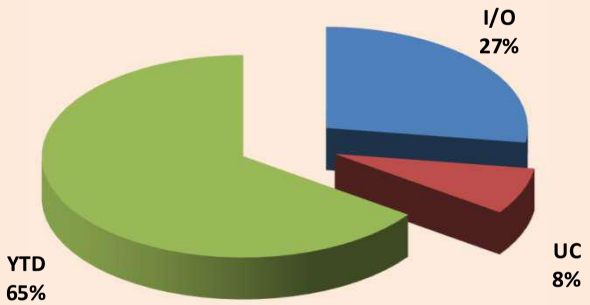
TOTAL ASSESSED (Above 25 MW) : - 10680 MW

NORTH EASTERN



TOTAL ASSESSED (Above 25 MW : - 58356 MW

ALL INDIA



TOTAL ASSESSED (Above 25 MW) : - 145320 MW

EXHIBIT 1.2

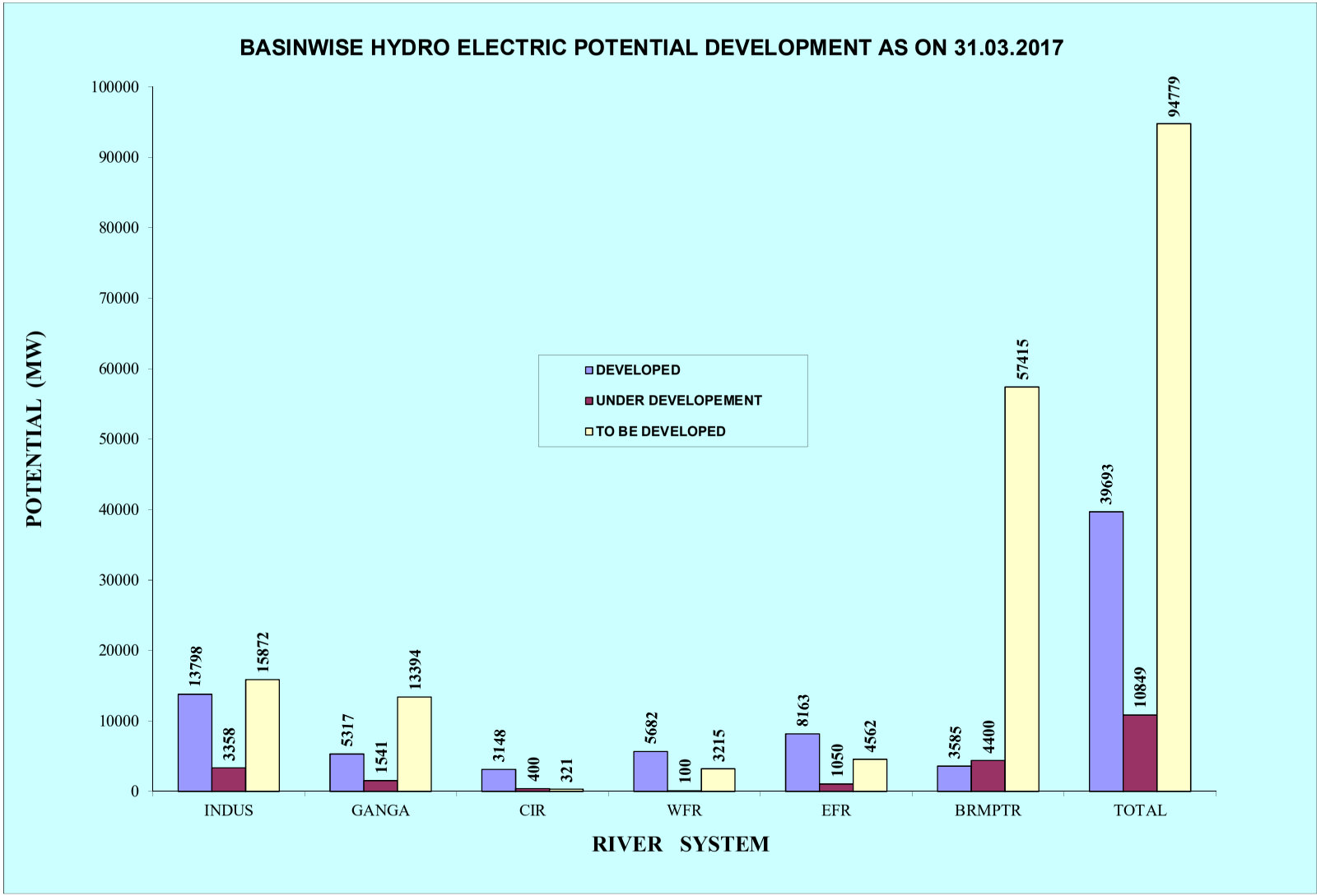

BASINWISE HYDRO ELECTRIC POTENTIAL DEVELOPMENT AS ON 31.03.2017
POTENTIAL (MW)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
DEVELOPED
UNDER DEVELOPEMENT
TO BE DEVELOPED
13798
3358
15872
5317
1541
13394
3148
400
321
5682
100
3215
8163
1050
4562
3585
4400
57415
39693
10849
94779
INDUS
GANGA
CIR
WFR
EFR
BRMPTR
TOTAL
RIVER SYSTEM

TABLE 1.3

HYDRO-ELECTRIC CAPACITY & GENERATION VIS-À-VIS TOTAL CAPACITY & GENERATION

Year	Installed Capacity			Generation		
	Total (MW)	Hydro (MW)	Hydro as % of Total	Total (MU)	Hydro (MU)	Hydro as % of Total
1947	1362	508	37.30	4072	2194	53.88
1950	1713	560	32.63	5106	2519	49.33
1955-56	2886	1061	36.76	9145	4295	46.97
1960-61	4653	1917	41.20	16937	7837	46.27
1962-63	5801	2936	50.61	22365	11805	52.78
1965-66	9027	4124	45.68	32890	15225	46.29
1968-69	12957	5907	45.59	47434	20723	43.69
1973-74	16664	6966	41.80	66689	28972	43.44
1978-79	26680	10833	40.60	102523	47159	46.00
1979-80	28448	11384	40.02	104627	45478	43.47
1984-85	42585	14460	33.96	156859	53948	34.39
1989-90	63636	18307	28.77	245437	62116	25.31
1991-92	69065	19194	27.79	287028	72757	25.35
1996-97	85795	21658	25.24	395889	68901	17.40
1997-98	89203	21904	24.58	421748	74582	17.68
1998-99	92269	22479	24.10	447464	82923	18.53
1999-00	97837	23857	24.37	481128	80755	16.78
2000-01	101450	25153	24.75	499429	74362	14.89
2001-02	105046	26269	25.01	515066	73759	14.32
2002-03	107877	26767	24.81	531607	63834	12.01
2003-04	112684	29507	26.19	558113	73775	13.22
2004-05	118419	30936	26.12	587416	84495	14.38
2005-06	124287	32326	26.01	624631	101293	16.22
2006-07	132321	34662	26.19	659513	113359	17.19
2007-08	143061	37002	25.86	704469	123424	17.52
2008-09*	147917	36846	24.91	714653	109840	15.37
2009-10*	159398	36863	23.13	763429	103916	13.61
2010-11*	173626	37567	21.64	805532	114257	14.18
2011-12*	199877	38990	19.51	871602	130510	14.97
2012-13*	223344	39491	17.68	907262	113720	12.53
2013-14*	243029	40531	16.68	961552	134848	14.02
2014-15*	267637	41267	15.42	1043665	129244	12.38
2015-16*	302088	42783	14.16	1102578	121377	11.01
2016-17*	326849	44478	13.61	1154524	122378	10.60

* Capacity above 25 MW only has been considered.

1.4 Monitored Hydro Installed Capacity

For generation performance, the monitored hydro-electric installed capacity in the country as on 31st March, 2017 was 44478.42 MW (above 25 MW capacity). Region-

TABLE 1.2

STATUS OF H.E. POTENTIAL DEVELOPMENT - BASIN-WISE
(In terms of Installed Capacity-above 25 MW as on 31.03.2017)

River Basin	Identified Capacity as per Reassessment Study (MW)		Capacity Developed		Capacity Under Construction		Capacity Yet to be Developed	
	Total	Above 25	(MW)	(%)	(MW)	(%)	(MW)	(%)
Indus	33832	33028	13798.3	41.78	3357.5	10.17	15872.2	48.06
Ganga	20711	20252	5317.2	26.26	1541.0	7.61	13393.60	66.14
Central Indian River System	4152	3868	3147.5	81.37	400.0	10.34	320.50	8.29
West Flowing Rivers System	9430	8997	5681.7	63.15	100.0	1.11	3215.3	35.74
East Flowing Rivers System	14511	13775	8163.2	59.26	1050.0	7.62	4561.9	33.12
Brahmaputra	66065	65400	3585	5.48	4400.0	6.73	57415.0	87.79
Total	**148701**	**145320**	**39692.8**	**27.31**	**10848.5**	**7.47**	**94778.7**	**65.22**

Note:- 1. In addition, 4785.60 MW of PSS are in operation and 1080 MW of PSS are under construction.

1.2 Growth of Installed Capacity

A small Hydro-Electric Plant (130 KW) established near Darjeeling in 1897 ushered the beginning of hydro-electric power development in the country. Since then, development of hydro-electric power in the country has made rapid strides. The hydel installed capacity which was only 508 MW in 1947 with 12 H.E. Stations, 51 units and the maximum unit size of 22 MW at Bhira H.E. station under Tata, has risen to 44478.42 MW (as on 31.03.2017) from H.E. station above 25 MW capacity. The maximum unit size is now 250 MW at Koyna Stage-IV under MAHAGENCO, Nathpa Jhakri under SJVNL, Tehri under THDC and Kaarcham Wangtoo of HBPCL.

Contribution of electricity generation from Hydro Electric Power Stations has risen from 2.2 BU during 1947 to about 122.4 BU in 2016-17. Hydro generation during 2016-17 was, about 1 BU more than the generation of 121.4 BU during 2015-16.

1.3 Share of Hydro-electric Installed Capacity & Generation

The installed capacity of Hydro-Electric Stations vis-à-vis total capacity, the contribution in generation by hydro electric plants and trend of hydro capacity & generation over the years are indicated in **Table-1.3** and at **Exhibits 1.3, 1.4 and 1.5**. From **Table 1.3**, it may be observed that the overall share of hydro in terms of installed capacity in the country rose from 37.3% at the end of 1947 to 50.6% during 1962-63. However, thereafter the share of hydro progressively declined and is presently 13.6% at the end of 2016-17. The generation from hydro stations during the year 2016-17 accounted for 10.6% of the total energy generation in the country.

EXHIBIT 1.3

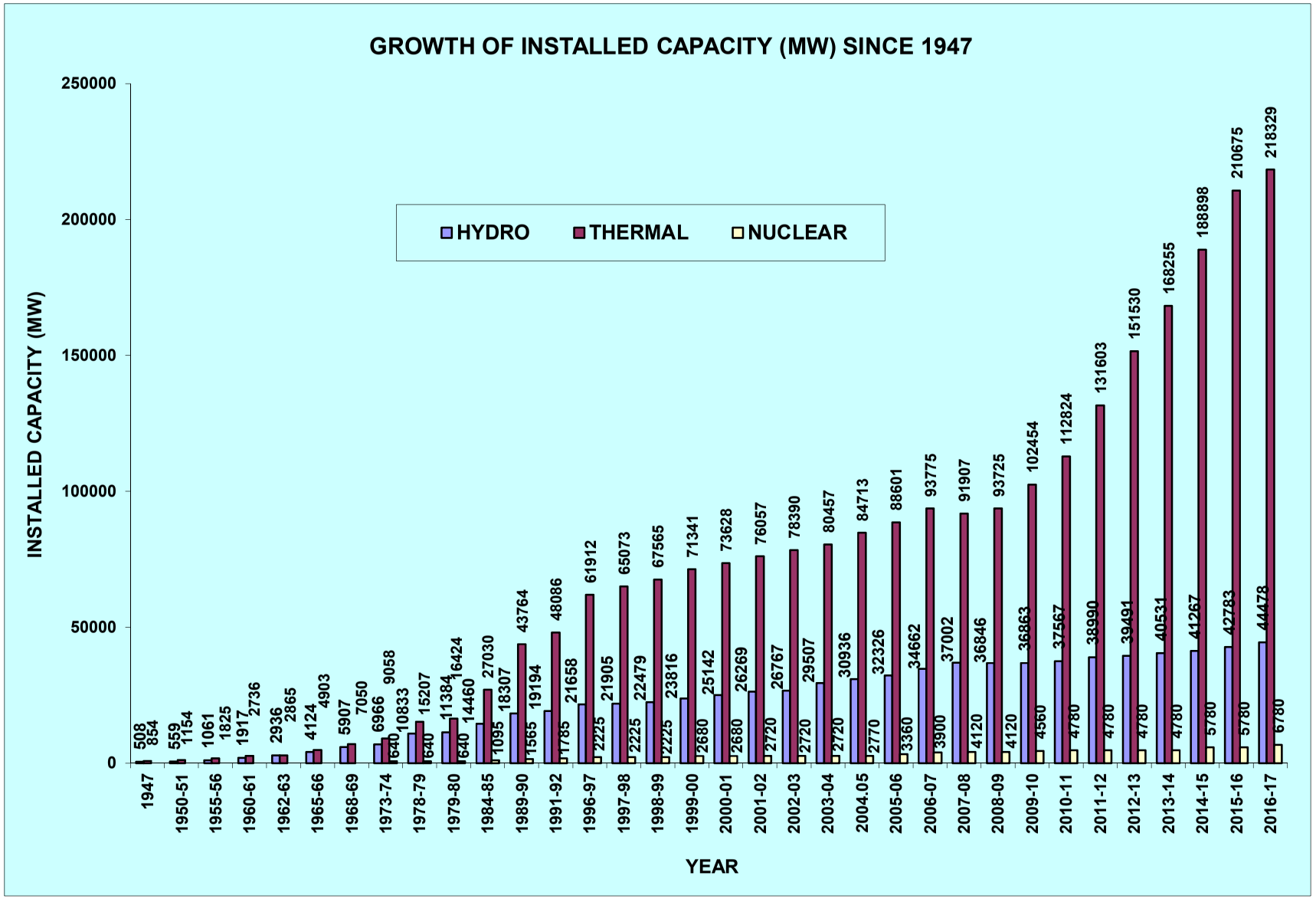

GROWTH OF INSTALLED CAPACITY (MW) SINCE 1947
INSTALLED CAPACITY (MW)
YEAR
HYDRO
THERMAL
NUCLEAR
250000
200000
150000
100000
50000
0
1947 508 854
1950-51 559 1154
1955-56 1061 1825
1960-61 1917 2736
1962-63 2936 2865
1965-66 4124 4903
1968-69 5907 7050
1973-74 6966 9058 640
1978-79 10833 15207 640
1979-80 11384 16424 640 14460
1984-85 27030 1095 18307
1989-90 43764 1565 19194
1991-92 48086 1785 21658
1996-97 61912 2225 21905
1997-98 65073 2225 22479
1998-99 67565 2225 23816
1999-00 71341 2680 25142
2000-01 73628 2680 26269
2001-02 76057 2720 26767
2002-03 78390 2720 29507
2003-04 80457 2720 30936
2004.05 84713 2770 32326
2005-06 88601 3360 34662
2006-07 93775 3900 37002
2007-08 91907 4120 36846
2008-09 93725 4120 36863
2009-10 102454 4560 37567
2010-11 112824 4780 38990
2011-12 131603 4780 39491
2012-13 151530 4780 40531
2013-14 168255 4780 41267
2014-15 188898 5780 42783
2015-16 210675 5780 44478
2016-17 218329 6780

EXHIBIT 1.4

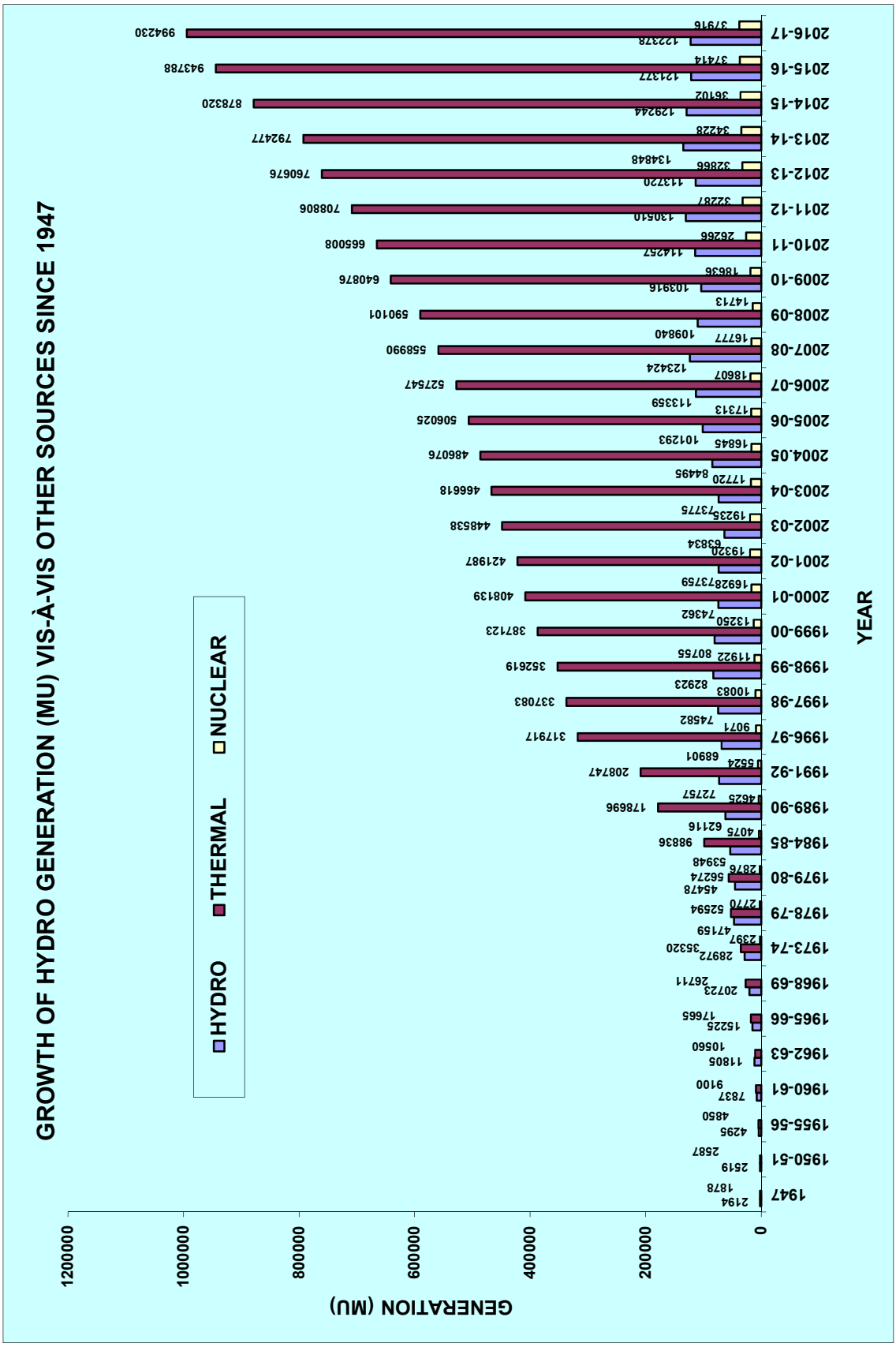
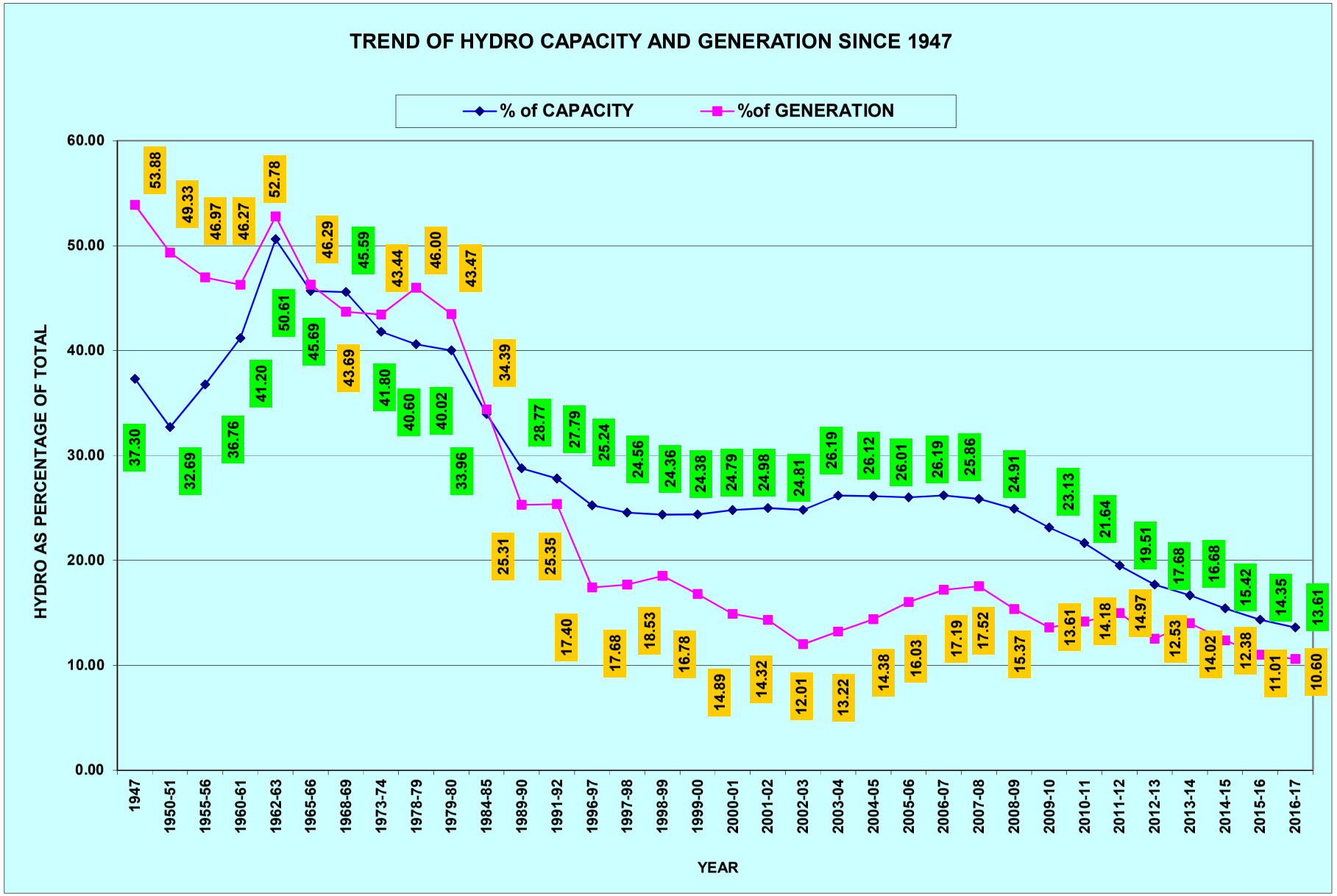

GROWTH OF HYDRO GENERATION (MU) VIS-À-VIS OTHER SOURCES SINCE 1947
HYDRO
THERMAL
NUCLEAR
GENERATION (MU)
YEAR
0
200000
400000
600000
800000
1000000
1200000
1947 2194 1878
1950-51 2619 2587
1955-56 4295 4850
1960-61 7837 9100
1962-63 10560 11805
1965-66 15225 17665
1968-69 20723 26711
1973-74 28972 35320 2397 47159
1978-79 25270 52594
1979-80 45478 56274 28776 53948
1984-85 40750 62116 98836
1989-90 46525 72757 178696
1991-92 55240 68901 208747
1996-97 90710 74582 317917
1997-98 100830 82923 337083
1998-99 119220 80755 352619
1999-00 132500 74362 387123
2000-01 169287 37590 408139
2001-02 193200 63834 421987
2002-03 192350 73775 448538
2003-04 177200 84495 466618
2004.05 168450 101293 486076
2005-06 173130 113590 506025
2006-07 186070 123424 527547
2007-08 167770 109840 558990
2008-09 147130 590101
2009-10 185360 103916 640876
2010-11 26266 114267 665008
2011-12 32287 130510 708806
2012-13 32866 113720 134848 760676
2013-14 34228 792477
2014-15 36102 129244 878320
2015-16 37414 121377 943788
2016-17 37916 122378 994230

EXHIBIT-1.5


TREND OF HYDRO CAPACITY AND GENERATION SINCE 1947
% of CAPACITY
%of GENERATION
HYDRO AS PERCENTAGE OF TOTAL
YEAR
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1947 1950-51 1955-56 1960-61 1962-63 1965-66 1968-69 1973-74 1978-79 1979-80 1984-85 1989-90 1991-92 1996-97 1997-98 1998-99 1999-00 2000-01 2001-02 2002-03 2003-04 2004-05 2005-06 2006-07 2007-08 2008-09 2009-10 2010-11 2011-12 2012-13 2013-14 2014-15 2015-16 2016-17
37.30 32.69 36.76 41.20 50.61 45.69 43.69 41.80 40.60 40.02 33.96 28.77 27.79 25.24 24.56 24.36 24.38 24.79 24.98 24.81 26.19 26.12 26.01 26.19 25.86 24.91 23.13 21.64 19.51 17.68 16.68 15.42 14.35 13.61
53.88 49.33 46.97 46.27 52.78 46.29 45.59 43.44 46.00 43.47 34.39 25.31 25.35 17.40 17.68 18.53 16.78 14.89 14.32 12.01 13.22 14.38 16.03 17.19 17.52 15.37 13.61 14.18 14.97 12.53 14.02 12.38 11.01 10.60

wise summary of the hydel installed capacity is indicated in **Table 1.4**. Region-wise, type-wise and construction-wise categorization of stations is given in **Annex-1.1** while Sector-wise/Utility-wise and station-wise/State-wise details of installed capacity are given in **Annex 1.2 & 1.3** respectively.

TABLE 1.4

REGION-WISE SUMMARY OF HYDRO ELECTRIC INSTALLED CAPACITY
(Above 25 MW capacity as on 31.03.2017)

S. No.	Region	No. of Units	Installed Capacity (MW)
1.	Northern	239	18527.27
2.	Western	101	7392.00
3.	Southern	252	11775.45
4.	Eastern	74	4254.70
5.	North-Eastern	29	1242.00
Total		**695**	**44478.42**

Capacity-wise grouping of H.E. Stations as on 31st March, 2017 is given in **Annex- 1.4**. It is observed that 95 stations with installed capacity between 100-1000 MW constitute more than 75% of the overall hydro capacity.

18 H.E. Generating units having installed capacity of 1659 MW were added during the year 2016-17. Details of these units are given in **Annex-1.5**. Also, Uprating of four units of Bassi HE station by 1.50 MW each and Uprating of three units of Periyar HE station by 7 MW each was achieved. In addition, one unit of 9 MW of Jaldhaka commissioned during 2012-13 was added in 2016-17.

Share of hydro installed capacity and hydro generation vis-a-vis total installed capacity and total generation in the Country as on 31.03.2017 was 13.6% and 10.6% respectively. These details are indicated in **Exhibits 1.6 and 1.7.** Sector-wise distribution of hydro installed capacity in Central, Private and State Sectors were 32.64%, 7.15% and 60.22% respectively. Sector-wise distribution of hydro generation in Central, Private and State sectors were 47.32%, 10.72% and 41.96% respectively. These details are illustrated in **Exhibits 1.8 & 1.9**.

1.5 Hydro Generating Units : Indigenous and imported

As on 31.03.2017, there were 695 hydro generating units in operation at 200 stations comprising of indigenous and imported units as per details given in **Table 1.5** below. The domestic supplier, BHEL, has a share of around 42% of total capacity for both turbines & generators. Whereas other domestic suppliers together have a meagre share of about 6% of total capacity.

Among the imported turbines and generators, Japan, UK and Canada are the top three suppliers of turbines and generators in term of numbers but capacity-wise, Japan, Canada and USSR are the three top suppliers.

TABLE 1.5

HYDRO GENERATING UNITS INDIGENOUS/IMPORTED FROM VARIOUS COUNTRIES AS ON 31-03-2017

Name of the Country	Turbines supplied				Generators supplied			
	Units		Capacity		Units		Capacity	
	No.	% of Total	MW	% of Total	No.	% of Total	MW	% of Total
A-Indigenous								
BHEL	292	42.01	18656.02	41.94	292	42.01	18656.02	41.94
Others*	40	5.76	2635.50	5.93	39	5.61	2634.00	5.92
Sub Total	332	47.77	21291.52	47.87	331	47.63	21290.02	47.87
B-Imported								
Switzerland	22	3.17	815.20	1.83	12	1.73	244.00	0.55
Canada	44	6.33	3132.00	7.04	44	6.33	3132.00	7.04
U.S.A	9	1.29	351.00	0.79	26	3.74	543.15	1.22
USSR	26	3.74	2804.00	6.30	26	3.74	2804.00	6.30
France	33	4.75	2186.40	4.92	17	2.45	1726.00	3.88
U.K	63	9.06	1242.10	2.79	58	8.35	1622.90	3.65
Japan	76	10.94	6344.20	14.26	74	10.65	5829.40	13.11
Other	90	12.95	6312.00	14.19	107	15.40	7286.95	16.38
Sub Total	**363**	**52.23**	**23186.90**	**52.13**	**364**	**52.37**	**23188.40**	**52.13**
Total	**695**	**100**	**44478.42**	**100**	**695**	**100**	**44478.42**	**100**

EXHIBIT-1.6

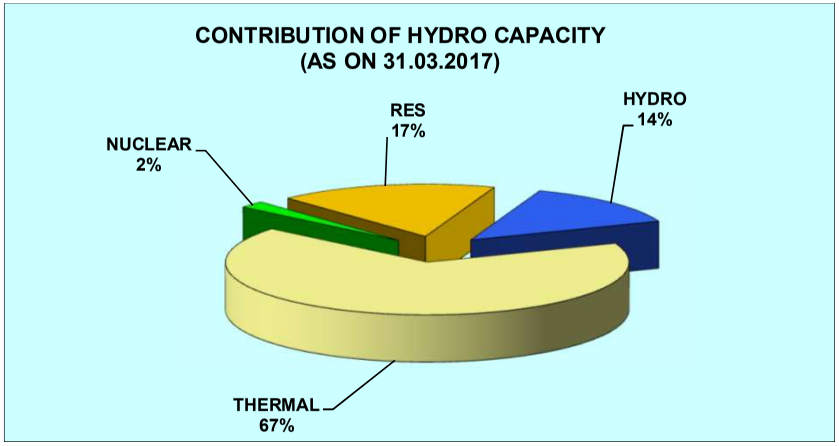


EXHIBIT-1.8

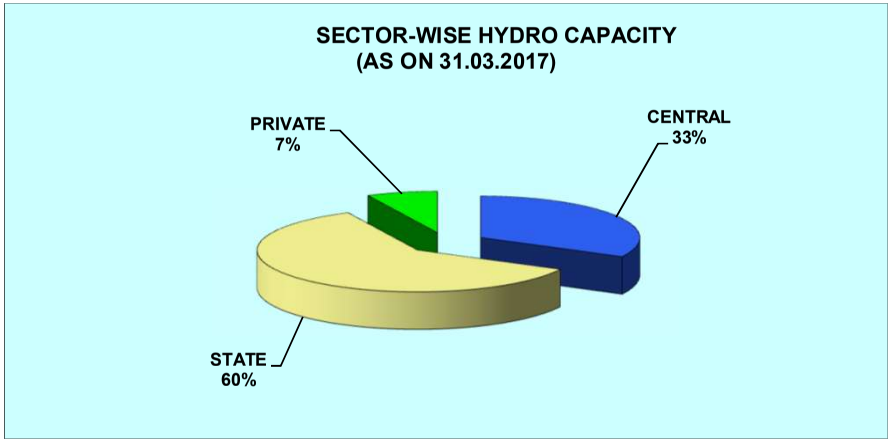


EXHIBIT-1.7

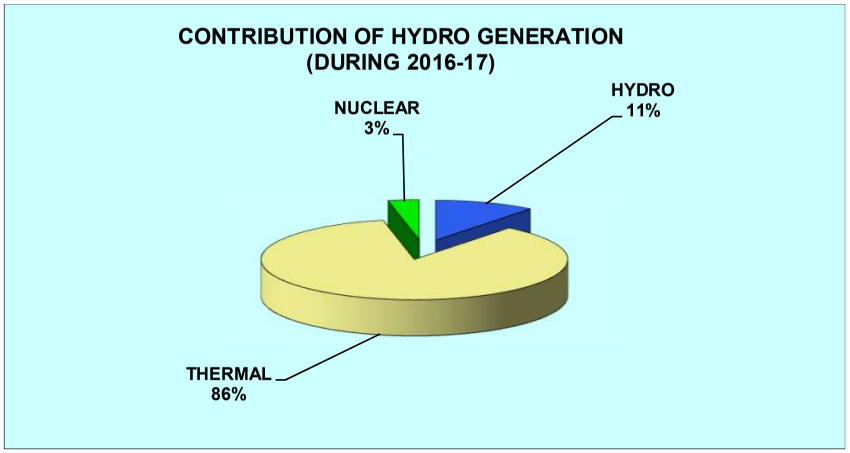
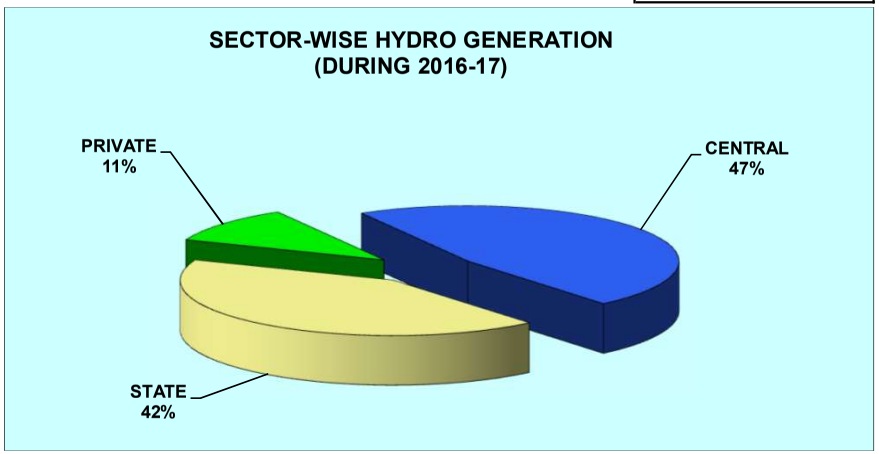


EXHIBIT-1.9



Annexure-1.1

- **Region-wise Installed Capacity of HE Stations in the country (Above 25 MW Capacity)**

(As on 31.03.2017)

Region	Conventional HE Stations			Pumped Storage Schemes (PSS)			Conventional + Pumped Storage Schemes (PSS)		
	No. of Stations	No. of Units	Installed Capacity (MW)	No. of Stations	No. of Units	Installed Capacity (MW)	No. of Stations	No. of Units	Installed Capacity (MW)
Northern	71	239	18527.27	0	0	0.00	71	239	18527.27
Western	24	88	5552.00	4	13	1840.00	28	101	7392.00
Southern	68	235	9767.85	3	17	2005.60	71	252	11773.45
Eastern	20	69	4603.70	2	5	940.00	22	74	5543.70
North-Eastern	10	29	1242.00	0	0	0.00	10	29	1242.00
Total	**193**	**660**	**39692.82**	**9**	**35**	**4785.60**	**202**	**695**	**44478.42**

Note: The total No. of HE Stations are 200 as N J Sagar HE Station (Southern Region) is having 1 conventional unit and remaining 7 units are PSS. Also,1 unit of Panchet HE Station.

- **Categorization of HE Stations (Installed Capacity)**

1. Type-wise

Sector	RoR		RoR (P)		Storage (S)						Total	
					S(P)		S(MPP)		PSS			
	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW
Central	9	2115.52	16	6223.00	5	1690.00	9	4449.20	1	40.00	40	14517.72
State	16	976.15	46	6705.00	35	7044.65	42	7461.30	7	4595.60	146	26782.70
Private	2	496.00	10	2235.00	2	147.00	1	150.00	1	150.00	16	3178.00
Total (Nos./ MW Capacity)*	**27**	**3587.67**	**72**	**15163.00**	**42**	**8881.65**	**52**	**12060.50**	**9**	**4785.60**	**202**	**44478.42**
% of Total	**13.5**	**8.07**	**36**	**34.09**	**21**	**19.97**	**26**	**27.12**	**4.5**	**10.76**	**100**	**100**

2. Construction-wise

Sector	Surface		Underground		Total	
	No.	MW	No.	MW	No.	MW
Central	29	9226.72	11	5291.00	**40**	**14517.72**
State	127	19194.10	19	7588.60	**146**	**26783.70**
Private	12	1328.00	4	1850.00	**16**	**3178.00**
Total (Nos./MW Capacity)*	**168**	**29748.82**	**34**	**14729.60**	**202**	**44478.42**
% of Total	**83**	**66.88**	**17**	**33.12**	**100**	**100**

***** Total number of HE Stations are **200** as NJ Sagar HE Station (Southern Region) is having one Conventional unit and remaining seven units are PSS. Also, one unit of Panchet HE Station (Eastern Region) is Conventional and other unit is PSS.

Abbreviations:
RoR - Run of River type,
RoR(P) – Run of River with Pondage,
S(P) – Storage (Conventional) for Power Generation purpose only,
S(MPP) – Storage (Conventional) for Multipurpose Project
PSS – Pumped Storage Scheme

SECTOR-WISE/UTILITY-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY
(ABOVE 25 MW CAPACITY)

(AS ON 31.03.2017)

Sl. No.	NAME OF THE SECTOR/ UTILITY	NO. OF STATIONS	NO. OF UNITS	INSTALLED CAPACITY (MW)
	CENTRAL SECTOR			
1	BBMB	6	28	2866.30
2	NHPC	20	67	5121.20
3	SJVNL	2	12	1912.02
4	NTPC	1	4	800.00
5	THDC	2	8	1400.00
6	NHDC	2	16	1520.00
7	DVC	2	5	143.20
8	NEEPCO	4	13	755.00
	SUB TOTAL CENTRAL	**39**	**153**	**14517.72**
	PRIVATE SECTOR			
1	MPCL	1	2	86.00
2	EPPL	1	2	100.00
3	GBHPPL	1	2	70.00
4	ADHPL	1	2	192.00
5	HBPCL	2	7	1300.00
6	JPPVL	1	4	400.00
7	AHPC	1	4	330.00
8	IAEPL	1	2	24.00
9	TPCL	4	15	447.00
10	GIPL	1	2	99.00
11	DEPL	1	2	96.00
12	DLHP	1	1	34.00
	SUB TOTAL PRIVATE	**16**	**45**	**3178.00**

SECTOR-WISE/UTILITY-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY
(ABOVE 25 MW CAPACITY)

(AS ON 31.03.2017)

Sl. No.	NAME OF THE SECTOR/ UTILITY	NO. OF STATIONS	NO. OF UNITS	INSTALLED CAPACITY (MW)
	STATE SECTOR			
1	HPSEBL	4	12	372.00
2	HPPCL	2	3	195.00
3	JKSPDCL	4	12	1110.00
4	PSPCL	8	25	1051.00
5	RRVUNL	4	11	411.00
6	UPJVNL	4	15	501.60
7	UJVNL	10	34	1252.15
8	GSECL	2	8	540.00
9	SSNNL	2	11	1450.00
10	MPPGCL	8	23	875.00
11	CSPGC	1	3	120.00
12	MAHAGENCO	8	24	2406.00
13	APGENCO	10	34	1796.75
14	TSGENCO	7	32	2306.60
15	KPCL	14	68	3585.40
16	KSEB	13	48	1881.50
17	TANGEDCO	27	70	2203.20
18	JUUNL	2	2	130.00
19	OHPC	6	31	2027.50
20	WBSEDCL	3	12	986.00
21	TUL	1	6	1200.00
22	APGCL	1	2	100.00
23	MePGCL	4	11	282.00
	SUB TOTAL STATE	**145**	**497**	**26782.70**
	TOTAL	**200**	**695**	**44478.42**

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	CONVENTIONAL H.E. STATIONS				
	NORTHERN				
	BBMB				
	HIMACHAL PRADESH				
1	BHAKRA LEFT	(5X108)	MP	540.00	1960-1961
2	BHAKRA RIGHT	(5X157)	MP	785.00	1966-1968
3	DEHAR	(6X165)	R(P)	990.00	1977-1983
4	PONG	(6X66)	MP	396.00	1978-1983
	SUB-TOTAL BBMB (HP)			**2711.00**	
	PUNJAB				
1	GANGUWAL	(2X24.2)+(1X29.25)	R	77.65	1955-1962
2	KOTLA	(2X24.2)+(1X29.25)	R	77.65	1956-1961
	SUB-TOTAL BBMB (PUNJAB)			**155.30**	
	TOTAL BBMB			**2866.30**	
	NHPC				
	HIMACHAL PRADESH				
1	BAIRA SIUL	(3X60)	R(P)	180.00	1980-1981
2	CHAMERA- I	(3X180)	S(UG)	540.00	1994
3	CHAMERA- II	(3X100)	R(P) (UG)	300.00	2003-2004
4	CHAMERA- III	(3X77)	R(P) (UG)	231.00	2012
5	PARBATI-III	(4X130)	R(P) (UG)	520.00	2014
	SUB-TOTAL HP			**1771.00**	
	JAMMU AND KASHMIR				
1	DULHASTI	(3X130)	R(P) (UG)	390.00	2007
2	SALAL -I	(3X115)	R	345.00	1987
3	SALAL -II	(3X115)	R	345.00	1993-95
4	URI-I	(4X120)	R(UG)	480.00	1996-1997
5	URI-II	(4X60)	R(UG)	240.00	2013-14
6	SEWA-II	(3X40)	R(P)	120.00	2010-11
7	CHUTAK	(4X11)	R	44.00	2012-13
8	NIMOO BAZGO	(3X15)	R(P)	45.00	2013
	SUB-TOTAL J&K			**2009.00**	
	UTTARAKHAND				
1	DHAULI GANGA	(4X70)	R(P) (UG)	280.00	2005
2	TANAKPUR	(3X31.4)	R	94.20	1992
	SUB-TOTAL UTTARAKHAND			**374.20**	
	TOTAL NHPC			**4154.20**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	SJVNL				
	HIMACHAL PRADESH				
1	NATHPA JHAKRI	(6X250)	R(P) (UG)	1500.00	2003-2004
2	RAMPUR	(6X68.67)	R	412.02	2014-15
	TOTAL SJVNL			**1912.02**	
	NTPC LTD.				
1	KOLDAM	(4X200)	S	800.00	2015
	TOTAL NTPC LTD.			**800.00**	
	THDC				
	UTTARAKHAND				
1	TEHRI ST-1	(4X250)	S(UG)	1000.00	2006-2007
2	KOTESHWAR	(4X100)	R(P)	400.00	2010-12
	TOTAL THDC			**1400.00**	
	TOTAL CENTRAL			**11132.52**	
	PRIVATE				
	HIMACHAL PRADESH				
	MPCL				
1	MALANA	(2X43)	R(P)	86.00	2001
	TOTAL MPCL			**86.00**	
	IAEPL				
	CHANJU-I	(2X12)	R(P)	24.00	2017
	TOTAL IAEPL			**24.00**	
	GBHPPL				
1	BUDHIL	(2X35)	R(P)	70.00	2012
	TOTAL GBHPPL			**70.00**	
	EPPL				
1	MALANA-II	(2X50)	R(P)	100.00	2011-12
	TOTAL EPPL			**100.00**	
	ADHPL				
1	ALLAIN DUHANGAN	2X96	R(P)	192.00	2010-11
	TOTAL ADHPL			**192.00**	
	HBPCL				
1	BASPA	(3X100)	R(P) (UG)	300.00	2003
2	KARCHAM WANGTOO	(4X250)	R(P) (UG)	1000.00	2011-12
	TOTAL HBPCL			**1300.00**	
	TOTAL PVT			**1772.00**	
	HPPCL				
1	KASHANG-I	(1X65)	R (UG)	65.00	2017
2	KASHANG-II & III	(2X65)	R (UG)	130.00	2017
	TOTAL HPPCL			**195.00**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	HPSEBL				
1	BASSI	(4X15)	R(P)	66.00	1970-1981
2	GIRI BATA	(2X30)	R(P)	60.00	1978
3	LARJI	(3X42)	R(P) (UG)	126.00	2006
4	SANJAY	(3X40)	R(P) (UG)	120.00	1989
	TOTAL HPSEBL			**372.00**	
	JKSPDC				
	JAMMU AND KASHMIR				
1	BAGLIHAR	(3X150)	R(P)	450.00	2008
2	BAGLIHAR II	(3X150)	R(P)	450.00	2015
3	LOWER JHELUM	(3X35)	R(P)	105.00	1978-1979
4	UPPER SINDH-II	(3X35)	R(P)	105.00	2001-2002
	TOTAL JKSPDC			**1110.00**	
	PSPCL				
	PUNJAB				
1	ANANDPUR SAHIB-I	(2X33.5)	R	67.00	1985
2	ANANDPUR SAHIB-II	(2X33.5)	R	67.00	1985
3	MUKERIAN -I	(3X15)	R	45.00	1983
4	MUKERIAN -II	(3X15)	R	45.00	1988-89
5	MUKERIAN -III	(3X19.5)	R	58.50	1989
6	MUKERIAN -IV	(3X19.5)	R	58.50	1989
7	RANJIT SAGAR	(4X150)	MP	600.00	2000
8	SHANAN	(1X50)+(4X15)	R(P)	110.00	1932-1982
	TOTAL PSPCL			**1051.00**	
	RRVUNL				
	RAJASTHAN				
1	JAWAHAR SAGAR	(3X33)	R(P)	99.00	1972-1973
2	MAHI BAJAJ -I	(2X25)	S	50.00	1986
3	MAHI BAJAJ -II	(2X45)	R(P)	90.00	1989
4	R P SAGAR	(4X43)	S	172.00	1968
	TOTAL RRVUNL			**411.00**	
	UJVNL				
	UTTARAKHAND				
1	CHIBRO (YAMUNA)	(4X60)	R(P) (UG)	240.00	1975-1976
2	CHILLA	(4X36)	R	144.00	1980-1981
3	DHAKRANI	(3X11.25)	R	33.75	1965-1970
4	DHALIPUR	(3X17)	R	51.00	1965-1970
5	KHATIMA	(3X13.8)	R	41.40	1955-1956
6	KHODRI	(4X30)	R(P) (UG)	120.00	1984
7	KULHAL	(3X10)	R	30.00	1975

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
8	MANERI BHALI - I	(3X30)	R(P)	90.00	1984
9	MANERI BHALI - II	(4X76)	R(P)	304.00	2008
10	RAMGANGA	(3X66)	MP	198.00	1975-1977
	TOTAL UJVNL			**1252.15**	
	AHPC				
1	SRINAGAR	(4X82.50)	R(P)	330.00	2015
	JPPVL				
	UTTARAKHAND				
1	VISHNU PRAYAG	(4X100)	R(UG)	400.00	2006
	UPJVNL				
	UTTAR PRADESH				
1	KHARA	(3X24)	R(P)	72.00	1992
2	MATATILLA	(3X10.2)	S	30.60	1965
3	OBRA	(3X33)	S	99.00	1970-1971
4	RIHAND	(6X50)	S	300.00	1961-1965
	TOTAL UPJVNL			**501.60**	
	TOTAL STATE SECTOR			**5622.75**	
	TOTAL NORTHERN REGION			**18527.27**	
	WESTERN				
	NHDC				
	MADHYA PRADESH				
1	INDIRA SAGAR	(8X125)	S	1000.00	2004-2005
2	OMKARESHWAR	(8X65)	S	520.00	2007
	TOTAL NHDC			**1520.00**	
	TOTAL CENTRAL			**1520.00**	
	DODSON-LINDBLOM HYDRO POWER PVT. LTD. (DLHP)				
	MAHARASHTRA				
1	BHANDARDHARA ST-II	(1X34)	R(P)	34.00	1996
	TOTAL DLHP			**34.00**	
	TATA POWER COMPANY (PVT.)				
	MAHARASHTRA				
1	BHIRA	(6X25)	S	150.00	1927-1949
2	BHIVPURI	(3X24) + (2X1.5)	S	75.00	1997-1999
3	KHOPOLI	(3X24)	S	72.00	2001-2003
	TOTAL TPCL			**297.00**	
	TOTAL PVT (MAHARASHTRA)			**331.00**	
	CSPGCL				
	CHHATTISGARH				
1	HASDEOBANGO	(3X40)	MP	120.00	1994-1995
	TOTAL CSPGCL			**120.00**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	GSECL				
	GUJARAT				
1	UKAI	(4X75)	MP	300.00	1974-1976
	TOTAL GSECL			**300.00**	
	MAHAGENCO				
	MAHARASHTRA				
1	BHIRA TAIL RACE	(2X40)	R(P)	80.00	1987-1988
2	KOYNA DPH	(2X18)	S	36.00	1980-1981
3	KOYNA-I&II	(4X70)+(4X80)	S(UG)	600.00	1962-1967
4	KOYNA-III	(4X80)	R(P)	320.00	1975-1978
5	KOYNA-IV	(4X250)	S(UG)	1000.00	1999-2000
6	TILLARI	(1X60)	R(P)	60.00	1986
7	VAITARNA	(1X60)	S(UG)	60.00	1976
	TOTAL MAHAGENCO			**2156.00**	
	MPPGCL				
	MADHYA PRADESH				
1	BANSAGAR TONS-1	(3X105)	R(P)	315.00	1991-1992
2	BANSAGAR TONS-II	(2X15)	R	30.00	2002
3	BANSAGAR TONS-III	(3X20)	MP	60.00	2000-2002
4	BARGI	(2X45)	MP	90.00	1988
5	GANDHI SAGAR	(5X23)	MP	115.00	1960-1966
6	MADHIKHERA	(3X20)	S	60.00	2006-2007
7	PENCH	(2X80)	S(UG)	160.00	1986-1987
8	RAJGHAT	(3X15)	S	45.00	1999
	TOTAL MPPGCL			**875.00**	
	SSNNL				
	GUJARAT				
1	S SAROVAR CHPH	(5X50)	R(P)	250.00	2004
	TOTAL SSNNL			**250.00**	
	TOTAL STATE			**3701.00**	
	TOTAL WESTERN REGION			**5552.00**	
	SOUTHERN				
	APGENCO				
	ANDHRA PRADESH				
1	HAMPI	(4X9)	MP	36.00	1958-1964
2	LOWER SILERU	(4X115)	S	460.00	1976-1978
3	MACHKUND	(3X17)+(3X21.25)	S	114.75	1959
4	NAGARJUN SGR RBC	(2X30)	S	60.00	1983-1990
5	NAGARJUN SGR RBC EXTN.	(1X30)	S	30.00	
6	SRISAILAM	(7X110)	S	770.00	1982-1987

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
7	T B DAM	(4X9)	S	36.00	1957-1964
8	UPPER SILERU -I	(2X60)	S	120.00	1967-1968
9	UPPER SILERU -II	(2X60)	S	120.00	1994-1995
10	NJ SAGAR TPD	(2*25)	R(P)	50.00	2016
	TOTAL APGENCO			**1796.75**	
	TELANGANA				
1	PRIYADARSHNI JURALA	(6X39)	R(P)	234.00	2008-2011
2	POCHAMPAD	(3X9)	MP	27.00	1987-1988
3	NAGARJUN SGR	(1X110)	S	110.00	1978
4	NAGARJUN SGR LBC	(2X30)	R	60.00	1983
5	PULICHINTHALA	(1X30)	R(P)	30.00	2017
6	LOWER JURALA	(6X40)	R(P)	240.00	2015
	TOTAL TSGENCO			**701.00**	
	KPCL				
	KARNATAKA				
1	ALMATTI	(5X55)+(1X15)	S	290.00	2004-2005
2	BHADRA	(2X12)+(1X6)+(1X2)+(1X7.2)	S	39.20	1962-1998
3	GERUSOPPA	(4X60)	R (P)	240.00	2001-2002
4	GHAT PRABHA	(2X16)	MP	32.00	1992
5	JOG	(4X21.6)+(4X13.2)	S	139.20	1949-2002
6	KADRA	(3X50)	S	150.00	1997-1999
7	KALINADI	(3X135)+(3X150)	S	855.00	1979-1984
8	KALINADI SUPA	(2X50)	S	100.00	1985
9	KODASALI	(3X40)	S	120.00	1998-1999
10	LINGNAMAKKI	(2X27.5)	S	55.00	1979-1980
11	MUNIRABAD	(2X9)+(1X10)	MP	28.00	1962-1965
12	SHARAVATHY	(10X103.5)	S	1035.00	1965-1977
13	SIVASAMUNDRUM	(4X6)+(6X3)	R (P)	42.00	1922-1934
14	VARAHI	(4X115)	S(UG)	460.00	1989-2009
	TOTAL KPCL			**3585.40**	
	KSEB				
	KERALA				
1	IDAMALAYAR	(2X37.5)	S	75.00	1987
2	IDUKKI	(6X130)	S(UG)	780.00	1976-1986
3	KAKKAD	(2X25)	R (P)	50.00	1999
4	KUTTIYADI & K EXTN	(3X25)+(1X50)	S	125.00	1972-2001
5	KUTTIYADI ADDN EXTN	(2X50)	S	100.00	2010
6	LOWER PERIYAR	(3X60)	R (P)	180.00	1997
7	NERIAMANGLAM	(3X15+1x25)	S	70.00	1961-63, 2008-09
8	PALLIVASAL	(3X5)+(3X7.5)	S	37.50	1948-2001

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
9	PANNIAR	(2X15)	S	30.00	1963-2001
10	PORINGALKUTTU	(4X8)	S	32.00	1957-1960
11	SABARIGIRI	(6X50)	S	300.00	1960-1967
12	SENGULAM	(4X12)	R (P)	48.00	1954-2001
13	SHOLAYAR	(3X18)	S	54.00	1956-1968
	TOTAL KSEB			**1881.50**	
	TANGEDCO				
	TAMIL NADU				
1	ALIYAR	(1X60)	S	60.00	1970
2	BHAVANI KAT. BARRAGE	(2X15)	R (P)	30.00	2006
3	BHAVANI KAT. BARRAGE II	(2X15)	R (P)	30.00	2013
4	BHAVANI KAT. BARRAGE III	(1X15)	R (P)	30.00	2012
5	KODAYAR -I	(1X60)	S	60.00	1970
6	KODAYAR -II	(1X40)	S	40.00	1971
7	KUNDAH -I	(3X20)	S	60.00	1960-1964
8	KUNDAH -II	(5X35)	S	175.00	1960-1965
9	KUNDAH -III	(3X60)	S	180.00	1965-1978
10	KUNDAH -IV	(2X50)	S	100.00	1966-1978
11	KUNDAH -V	(2X20)	S	40.00	1964-1988
12	LOWER METTUR -I	(2X15)	R (P)	30.00	1988
13	LOWER METTUR -II	(2X15)	R (P)	30.00	1988
14	LOWER METTUR -III	(2X15)	R (P)	30.00	1987-1988
15	LOWER METTUR -IV	(2X15)	R (P)	30.00	1988-1999
16	METTUR DAM	(4X12.5)	S	50.00	1937-1946
17	METTUR TUNNEL	(4X50)	S	200.00	1965-1966
18	MOYAR	(3X12)	S	36.00	1952-1953
19	PAPANASAM	(4X8)	S	32.00	1944-1951
20	PARSON`S VALLEY	(1X30)	S	30.00	2000
21	PERIYAR	(1X35+3X42)	S	161.00	1958-1965
22	PYKARA	(3X7)+(2X13.6)+(1X11)	S	59.20	1932-2005
23	PYKARA ULTMATE	(3X50)	S(UG)	150.00	2005
24	SARKARPATHY	(1X30)	R (P)	30.00	1966
25	SHOLAYAR I&II	(2X35) + (1X25)	S	95.00	1971
26	SURULIYAR	(1X35)	S	35.00	1978
	TOTAL TANGEDCO			**1803.20**	
	TOTAL STATE SECTOR			**9767.85**	
	TOTAL SOUTHERN REGION			**9767.85**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	EASTERN				
	DVC				
	WEST BENGAL				
1	MAITHON	(1X23.2)+(2X20)	S(UG)	63.20	1957-1958
	JHARKHAND				
1	PANCHET	(1X40)	S	40.00	1959
	TOTAL DVC			**103.20**	
	NHPC				
	WEST BENGAL				
1	TEESTA LOW DAM III	(4X33)	R (P)	132.00	2013-14
2	TEESTA LOW DAM IV	(4X40)	R (P)	160.00	2016
	SUB TOTAL NHPC (WB)			**292.00**	
	SIKKIM				
1	RANGIT	(3X20)	R (P)	60.00	2000
2	TEESTA V	(3X170)	R (P) (UG)	510.00	2008
	SUB TOTAL NHPC (SIKKIM)			570.00	
	TOTAL NHPC			**862.00**	
	TOTAL CENTRAL			**965.20**	
	JUUNL				
	JHARKHAND				
1	SUBERNREKHA -I	(1X65)	S	65.00	1977
2	SUBERNREKHA -II	(1X65)	R(P)	65.00	1980
	TOTAL JUUNL			**130.00**	
	OHPC				
	ODISHA				
1	BALIMELA	(6X60)+(2X75)	S	510.00	1973-1977
2	HIRAKUD (BURLA)	(3X37.5)+(2X49.5)+(2X32)	S	275.50	1956-1990
3	HIRAKUD (CHIPLIMA)	(3X24)	R(P)	72.00	1962-1964
4	RENGALI	(5X50)	S	250.00	1985-1992
5	UPPER INDRAVATI	(4X150)	S	600.00	1999-2001
6	UPPER KOLAB	(4X80)	S	320.00	1988-1993
	TOTAL OHPC			**2027.50**	
	WBSEDCL				
	WEST BENGAL				
1	JALDHAKA	(4X9)	R(P)	36.00	1967-1972
2	RAMMAM-II	(4X12.5)	R	50.00	1995-1996
	TOTAL WBSEDCL			**86.00**	
	TOTAL STATE WB			**2243.50**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	SIKKIM				
	STATE SECTOR				
	TEESTA URJA LTD.				
	TEESTA- III	(6*200)	R(P)	1200.00	2016-17
	PRIVATE SECTOR				
	GIPL (GATI INFRA PRIVATE LTD.)				
1	CHUZACHEN	(2*49.5)	R(P)	99.00	2013
	DEPL (DANS ENERGY PVT LTD.)				
1	JORETHANG LOOP	(2*48)	R	96.00	2015
	TOTAL EASTERN REGION			**4603.70**	
	NORTH EASTERN				
	NEEPCO				
	ARUNACHAL PRADESH				
1	RANGANADI	(3X135)	R(P)	405	2002
	SUB-TOTAL Ar.P			**405**	
	ASSAM				
1	KOPILI	(4X50)+(1X25)	S	225.00	1988-2003
2	KHONDONG	(2X25)	S	50.00	1984
	SUB-TOTAL ASSAM			**275.00**	
	NAGALAND				
1	DOYANG	(3X25)	S	75.00	2000
	SUB-TOTAL NAGALAND			**75.00**	
	TOTAL NEEPCO			**755.00**	
	NHPC				
	MANIPUR				
1	LOKTAK	(3X35)	S	105.00	1983
	TOTAL			**105.00**	
	TOTAL CENTRAL			**860.00**	
	APGCL				
	ASSAM				
1	KARBI LANGPI	(2X50)	R(P)	100.00	2007
	TOTAL APGCL			**100.00**	
	MePGCL				
	MEGHALAYA				
1	KYRDEMKULAI	(2X30)	R(P)	60.00	1979
2	UMIAM ST-I	(4X9)	S	36.00	1965
3	UMIAM ST-IV	(2X30)	R(P)	60.00	1992
4	MYNTDU ST-I	(3X42)	R(P)	126.00	2012
	TOTAL MePGCL			**282.00**	
	TOTAL STATE			**382.00**	

STATE-WISE/STATION-WISE INSTALLED CAPACITY OF H.E. STATIONS IN THE COUNTRY

(ABOVE 25 MW CAPACITY)

As on 31.03.2017

SL. NO.	UTILITY/STATIONS	NO. OF UNITS X CAPACITY (MW)	TYPE OF STATION	CAPACITY (MW)	YEAR OF COMMISSIONING
	TOTAL NE REGION			**1242.00**	
	TOTAL CONVENTIONAL			**39692.82**	
	PUMPED STORAGE SCHEMES				
	GUJARAT				
	GSECL				
1	KADANA	(4X60)	**PSS**	240.00	1987-88
	SSNNL				
1	SARDAR SAROVAR- RBPH	(6X200)	**PSS**	1200.00	2004-05, 05-06
	MAHARASHTRA				
	MAHAGENCO				
1	GHATGHAR	(2X125)	**PSS**	250.00	2008
	TATA POWER COMPANY				
1	BHIRA PSS	(1X150)	**PSS**	150.00	1995
	SUB-TOTAL			**1840.00**	
	SOUTHERN REGION				
	TELANGANA				
	TSGENCO				
1	N.J.SAGAR	(7X100.8)	**PSS**	705.60	1978-85
2	SRISAILAM LBPH	(6X150)	**PSS**	900.00	2000-04
	TAMILNADU				
	TANGEDCO				
1	KADAMPARAI	(4X100)	**PSS**	400.00	1987-88
	SUB-TOTAL			**2005.60**	
	EASTERN REGION				
	JHARKHAND				
	DVC				
1	PANCHET	(1X40)	**PSS**	40.00	1990
	WEST BENGAL				
	WBSEDCL				
1	PURULIA	(4X225)	**PSS**	900.00	2007
	SUB-TOTAL			**940.00**	
	TOTA- PSS			**4785.60**	
	TOTAL (CONVENTIONAL+PSS)			**44478.42**	

Note: 1.Uprated/Derated Capacities of units have been incorporated.

Abbreviations:-

R- Run-of-River Type **S- Storage Type** **R(P)- Run-of-River with Pondage**

UG- Underground **MP- Multipurpose**

CAPACITY-WISE GROUPING OF HYDRO-ELECTRIC STATIONS

As on 31.03.2017

STATION CAPACITY	NUMBER OF STATIONS		NUMBER OF UNITS		TOTAL CAPACITY	
RANGE (MW)	**No**	**%**	**No**	**%**	**MW**	**%**
> 25 - 100	101	50.50	270	38.85	5665.35	12.74
>100 - 500	73	36.50	279	40.14	17342.47	38.99
>500 - 1000	22	11.00	118	16.98	16535.6	37.18
>1000	4	2.00	28	4.03	4935	11.10
TOTAL	**200**	**100**	**695**	**100**	**44478.42**	**100**

HYDRO GENERATING UNITS ADDED DURING 2016-17

SL. NO.	NAME OF THE STATION	UTILITY	STATE	UNIT NO.	CAPACITY (MW)	DATE OF COMMISSIONING
CENTRAL SECTOR						
1.	TEESTA LOW DAM IV	NHPC	WEST BENGAL	3	40.00	03.07.2016
2.	TEESTA LOW DAM IV	NHPC	WEST BENGAL	4	40.00	11.08.2016
STATE SECTOR						
1.	KASHANG-I	HPPCL	HIMACHAL PRADESH	1	65.00	10.10.2016
2.	KASHANG-II & III	HPPCL	HIMACHAL PRADESH	1	65.00	28.08.2016
3.	KASHANG-II & III	HPPCL	HIMACHAL PRADESH	2	65.00	02.01.2017
4.	LOWER JURALA	TSGENCO	TELANGANA	5	40.00	20.08.2016
5.	LOWER JURALA	TSGENCO	TELANGANA	6	40.00	29.09.2016
6.	PULICHINTHALA	TSGENCO	TELANGANA	1	30.00	25.09.2016
7.	TEESTA-III	TUL	SIKKIM	1	200.00	15.01.2017
8.	TEESTA-III	TUL	SIKKIM	2	200.00	27.01.2017
9.	TEESTA-III	TUL	SIKKIM	3	200.00	14.01.2017
10.	TEESTA-III	TUL	SIKKIM	4	200.00	16.02.2017
11.	TEESTA-III	TUL	SIKKIM	5	200.00	24.01.2017
12.	TEESTA-III	TUL	SIKKIM	6	200.00	28.01.2017
13.	NJ SAGAR TPD	APGENCO	ANDHRA PRADESH	1	25.00	05.01.2017
14.	NJ SAGAR TPD	APGENCO	ANDHRA PRADESH	2	25.00	28.01.2017
PRIVATE SECTOR						
1.	CHANJU-I	IAEPL	HIMACHAL PRADESH	1	12.00	17.02.2017
2.	CHANJU-I	IAEPL	HIMACHAL PRADESH	2	12.00	01.02.2017
ALL INDIA TOTAL					**1659.00**	

CHAPTER-2

GENERATION PERFORMANCE

CHAPTER-2

GENERATION PERFORMANCE

2.1 Generation from hydro electric power stations (above 25 MW capacity) in the country during 2016-17 was 122.4 BU against the target of 134 BU which was 8.67% less than the target.

2.2 The month-wise and cumulative generation from hydro stations in the country vis-a-vis targets have been shown at **Exhibit-2.1** and are given in **Table 2.1** below.

TABLE 2.1

MONTH-WISE & CUMULATIVE GENERATION VIS-À-VIS TARGET IN MU PERIOD: 2016-17

Month	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
Target	8129	11348	12849	16003	17548	16076	11649	8470	7943	7603	7307	9075
Gen.	7813	10722	12296	15083	17668	14084	10687	6667	6258	6450	6736	7913
Cum. Tar	8129	19477	32326	48329	65877	81953	93602	102072	110015	117618	124925	134000
Cum. Gen.	7813	18535	30831	45914	63582	77666	88354	95021	101279	107729	114465	122378

2.3 Utility-wise/ Sector-wise Performance of H.E. Stations

The utility-wise/ sector-wise target of energy generation vis-à-vis actual generation and surplus /shortfall in respect of Hydro Electric stations during 2016-17 & 2015-16 are given below in **Table 2.2.**

TABLE 2.2

UTILITY-WISE PERFORMANCE OF HYDRO ELECTRIC STATIONS (2016-17 VIS-A-VIS 2015-16)

Utilities	Installed Capacity (MW) (As on 31.03.2017)	Generation					
		Target (MU)		Actual (MU)		Surplus (+)/ Shortfall (-) in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
CENTRAL SECTOR							
BBMB	2866.30	9536	9076	10570.00	11818.90	10.84	30.22
NHPC	5121.20	22440	21190	22929.80	23403.43	2.18	10.45
SJVNL	1912.02	8595	8000	9011.06	9297.20	4.84	16.22
NTPC LTD	800.00	2800	890	3225.16	2308.60	15.18	159.39
THDC	1400.00	4100	3952	4370.87	4349.05	6.61	10.05
NHDC	1520.00	3100	3315	4748.49	2929.22	53.18	-11.64
DVC	143.20	244	219	255.54	176.51	4.73	-19.4
NEEPCO	755.00	2585	2283	2793.32	2400.24	8.06	5.14
SUB TOTAL	**14517.72**	**53400**	**48925**	**57904.24**	**56683.15**	**8.43**	**15.86**

Utilities	Installed Capacity (MW) (As on 31.03.2017)	Generation					
		Target (MU)		Actual (MU)		Surplus (+)/ Shortfall (-) in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
PRIVATE SECTOR							
MPCL	86	341	341	353.79	341.94	3.75	0.28
TPCL	447	1450	1450	1465.46	1098.49	1.07	-24.24
DLHP	34	65	36	47.12	82.55	-27.51	129.31
EPPL	100	370	370	366.54	354.42	-0.94	-4.21
ADHPL	192	686	700	679.12	724.96	-1	3.57
GBHPPL	70	282	255	261.25	287.85	-7.36	12.88
HBPCL	1300	5500	5676	5715.04	6030.82	3.91	6.25
HSPL*	0	-	245	-	-	-	-
AHPCL	330	1396	1114	1280.75	901.37	-8.26	-19.09
JPPVL	400	1776	1776	2042.05	1210.65	14.98	-31.83
DEPL	96	488	85	705.63	75.06	-16.88	-11.69
GIPL	99	495	475	494.75	421.43	-0.05	-11.28
IAEPL	24	-	-	-	-	-	-
SUB TOTAL	**3178**	**12849**	**12570**	**13122.79**	**11529.54**	**2.13**	**-7.93**
STATE SECTOR							
JKSPDCL	1110.00	5144	3634	4789.6	3980.3	-6.89	9.53
HPPCL	195.00	266	-	56.09	-	-78.91	-
HPSEB LTD.	372.00	1465	1062	1237.42	1161.81	-15.53	9.4
RRVUNL	411.00	710	700	965.99	1033.8	36.05	47.69
PSPCL	1051.00	4069	3719	3536.34	4327.84	-13.09	16.37
UPJVNL	501.60	1161	1115	1175.56	935.08	1.25	-16.14
UJVNL	1252.15	4700	4498	4201.44	4762.86	-10.61	5.89
SSNNL	1450.00	3263	3544	3209.21	2170.43	-1.65	-38.76
GSECL	540.00	840	840	734.67	781.42	-12.54	-6.97
MAHAGENCO	2406	4358	3956	4050.98	3519.33	-7.04	-11.04
MPPGCL	875.00	2383	2621	2768.31	1940.6	16.17	-25.96
CSPGCL	120.00	260	250	153.76	323.3	-40.86	29.32
APGENCO	1796.75	3604	3773	2605.99	2511.31	-27.69	-33.44
TSGENCO	2306.60	3132	3606	1279.99	282.33	-59.13	-92.17
KPCL	3585.40	11429	12726	6691.09	7350.01	-41.46	-42.24
KSEBL	1881.50	6834	6751	4067.49	6363.75	-40.48	-5.74
TANGEDCO	2203.20	4901	4962	2397.12	4474.27	-51.09	-9.83
JUUNL	130.00	154	154	30.13	51.24	-80.44	-66.73
OHPC	2027.50	5621	5749	4412.89	4432.83	-21.49	-22.89

Utilities	Installed Capacity (MW) (As on 31.03.2017)	Generation					
		Target (MU)		Actual (MU)		Surplus (+)/ Shortfall (-) in %	
		2016-17	2015-16	2016-17	2015-16	2016-17	2015-16
TUL	1200.00	552	47	308.42	-	-43.95	-
WBSEDCL	986.00	1596	1596	1560.85	1491.7	-2.2	-6.53
APGCL	100.00	390	390	396.59	408.88	1.69	4.84
MePGCL	282.00	919	859	719.6	860.94	-21.7	0.23
SUB TOTAL	**26782.70**	**67751**	**66552**	**51350.53**	**53164.06**	**-24.21**	**-20.12**
ALL INDIA	**44478.42**	**134000**	**128000**	**122377.75**	**121376.75**	**-8.67**	**-5.17**

*Sorang HE project, anticipated for commissioning during 2015-16, has been delayed.

During the year 2016-17, overall hydro generation was more than the target in respect of BBMB, NHPC Ltd., SJVNL, NTPC, THDC, & NEEPCO in Central Sector and MPCL, HBPCL, JPPVL, DEPL & TPCL in Private Sector. As regards generation by State Electricity Boards/Corporations / Departments, hydro generation was more than the target in respect of RRUVNL, UPJVNL, MPPGCL and APGCL.

2.4 Region-wise Performance of H.E. Stations

Region-wise generation performance of hydro-electric stations during 2016-17 is indicated in **Table 2.3.**

TABLE 2.3

GENERATION PERFORMANCE – REGION-WISE (2016-17)

S. No.	Region	Installed Capacity as on 31.03.2017 (MW)	Generation During 2016-17		
			Target (MU)	Actual (MU)	Shortfall (-)/ Surplus (+) Over Target (%)
1	Northern	18527.27	70932	71761.09	1.17
2	Western	7392.00	15719	17178.00	9.28
3	Southern	11773.45	29900	17041.68	(-)43.00
4	Eastern	5543.70	13040	11746.21	(-) 9.92
5	North-Eastern	1242.00	4409	4650.58	5.48
	Total (All India)	**44478.42**	**134000**	**122377.56**	**(-) 8.67**

Note: - Includes 4785.60 MW of Pumped Storage Scheme.

- Hydel generation during 2016-17 has exceeded the target in Northern, Western and North-Eastern Region whereas it was lower than the target in Southern and Eastern Region of the country**.**

- Hydel generation during 2016-17 was 122.4 BU against the target of 134 BU viz lower in generation by 11.6 BU (8.67%). However, actual hydel generation during 2016-17 is more than previous year generation of 121.4 BU by 0.82%.

Region-wise generation targets vis-à-vis achievements are indicated at **Exhibit-2.2**.

2.5 Sector-wise generation performance during the year 2016-17 vis-à-vis targets is given in **Table 2.4**.

Generation from H.E. Stations under Central Sector & Private Sector has been more than the target. However, the generation in State sector is significantly lower than the target by more than 24%.

TABLE 2.4

SECTOR-WISE GENERATION PERFORMANCE
PERIOD: 2016-17

Sl. No.	Sector	Installed Capacity as on 31.03.17 (MW)	Generation		
			Target (MU)	Actual (MU)	Shortfall (-) Surplus (+) Over Target (%)
1	Central	14517.72	53400	57904.24	8.43
2	State	26782.70	67751	51350.53	(-) 24.21
3	Private	3178.00	12849	13122.79	2.13
	Total	**44478.42**	**134000**	**122377.56**	**(-) 8.67**

2.6 Details of actual generation during 2016-17 for all the hydro stations (Above 25 MW capacity) in the country are given in **Annex 2.1**. It is observed that 73 Nos. of stations have exceeded the target level of generation while the generation has been less than targets in case of 127 stations. List of stations where generation exceeded the target during 2016-17 is given in **Table 2.5.**

TABLE 2.5

H.E. STATIONS ACHIEVING HIGHER GENERATION VIS-A-VIS TARGET
PERIOD: 2016-17

S. No.	Actual Generation as % of Target	Hydro Electric Stations		
		No. of Stations	% of total No. of Stations	Name of the Station
1	150 & above	5	2.5	Pong, Chanju, Madhikheda, Indira Sagar, Jog.
2	140 - 150	4	2.0	Koyna DPH, Machkund, Sholayar-I&II, Loktak.

S. No.	Actual Generation as % of Target	Hydro Electric Stations		
		No. of Stations	% of total No. of Stations	Name of the Station
3	130 - 140	9	4.5	Uri-II, Jawahar Sagar, Mahi Bajaj-I&II, R P Sagar, Kadana, Bansagar Tons-I, Omkareshwar, Jaldhaka-I.
4	120 - 130	6	3.0	Baglihar-II, Upper Sindh-II, Gandhi Sagar, Teesta Low Dam-IV, Kopili, Doyang.
5	110 - 120	11	5.5	Koldam, Matatilla, Obra, Rihand, Vishnuprayag, Sardar Sarovar CHPH, Bhira Tail Race, Koyna-I & II, Khopoli, Teesta-V, Khandong.
6	100 - 110	38	19.0	Bhakra Left & Right, Dehar, Ganguwal, Kotla, Parbati III, Nathpa Jhakri, Rampur, Baspa-II, Karcham Wangtoo, Dulhasti, Nimoo Bazgo, Salal-I & II, Uri, Mukerian-I to IV, Khatima, Maneri Bhali II, Tehri, Koteshwar, Bargi, Pench, Koyna-III, Bhira & Bhira PSS, Pochampad, Priyadarshni Jurala, Maithon, Panchet, Rangit, Rammam-II, Teesta Low Dam-III, Ranganadi, Karbi Langpi.

H.E. Stations where generation was less than the target have been listed in **Table 2.6** below:

TABLE 2.6

H.E. STATIONS HAVING SHORTFALL IN GENERATION VIS-A-VIS TARGETS PERIOD: 2016-17

S. No.	Actual Generation as % of Target	Hydro Electric Stations		
		No. of Stations	% of total No. of Stations	Name of the Station
1	90 -100	24	12.0	Baira Siul, Chamera I ,Chamera II, Chamera III, Bassi, Larji, Allain Duhangan, Malana-II, Budhil, Malana, Sewa-II, Anandpur Sahib-I& II, Shanan, Chilla, Srinagar, Tanakpur, Sardar Sarovar RBPH, Bansagar Tons-II, Ghatghar, Vaitarna, Chuzachen, Purulia PSS, Myntdu.
2	80 -90	13	6.5	Chutak, Chibro, Dhakrani, Dhalipur, Khodri, Kulhal, Dhauliganga, Tillari, Balimela, Rengali, Jorethang Loop, Umiam-I, Umiam-IV.

S. No.	Actual Generation as % of Target	Hydro Electric Stations		
		No. of Stations	% of total No. of Stations	Name of the Station
3	70 -80	24	12.0	Giri Bata, Baglihar-I, Lower Jhelum, Ranjit Sagar, Khara, Maneri Bhali-I, Rajghat, Koyna-IV, Bhandardhara-II, Upper Sileru-I & II, Lower Sileru, Almatti, Kuttiadi and Kuttiadi additional Extension, Pallivasal, Sengulam, Sholayar, Kodayar-I & II, Hirakud-I&II, Upper Indravati, Upper Kolab.
4	60 -70	9	4.5	Ramganga, Ukai, Bhivpuri, Srisailam RB, Varahi, Kakkad, Sabarigiri, Kadamparai, Lower Jurala.
5	50 -60	23	11.5	Sanjay Bhaba, Hasdeo Bango, Gerusoppa, Ghatprabha, Kalinadi, Supa, Sharavathy, Shivasamudram, Idukki, Lower Periyar, Neriamangalam, Poringalkuthu, Kundah-I toV, Mettur Dam, Papanasam, Pykara Ultimate, Sarkarpathy, Teesta-III, Kyrdemkulai.
6	40 -50	14	7.0	TB Dam & Hampi, Bhadra, Kadra, Kodasali, Lingnamakki, Idamalayar, Panniar, Aliyar, Bhawani Kattalai Barrage-III, Moyar, Parson's Valley, Suruliyar, Srisailam LB.
7	30 -40	7	3.5	Bansagar Tons III, Munirabad, Bhawani Kattalai Barrage-II, Lower Mettur-I-IV.
8	10 -30	9	4.5	Kashang I, Kashang II&III, Bhawani Kattalai Barrage-I, Mettur Tunnel, Periyar, Pykara, NJ Sagar PSS, Subarnarekha-I&II.
9	0 -10	4	2.0	NJ Sagar TPD, NJ Sagar RBC, NJ Sagar LBC, Pulichintala.

The States/utilities showing excess/shortfall in generation over the target are indicated in **Exhibit- 2.3**.

2.7 Hydro Generation is a function of availability of Water and that of Generating units. Rainfall is the primary source of water, which is highly variable in time and space. However, there could be no direct comparison between the rainfall and the energy generation during these years of data due to different installed capacities. While the rainfall has definite impact on the level of generation, it could also be impacted by the duration of forced and planned outages especially in the case of ROR projects. Region-wise Hydel generation during last five years is given below in **Table 2.7**

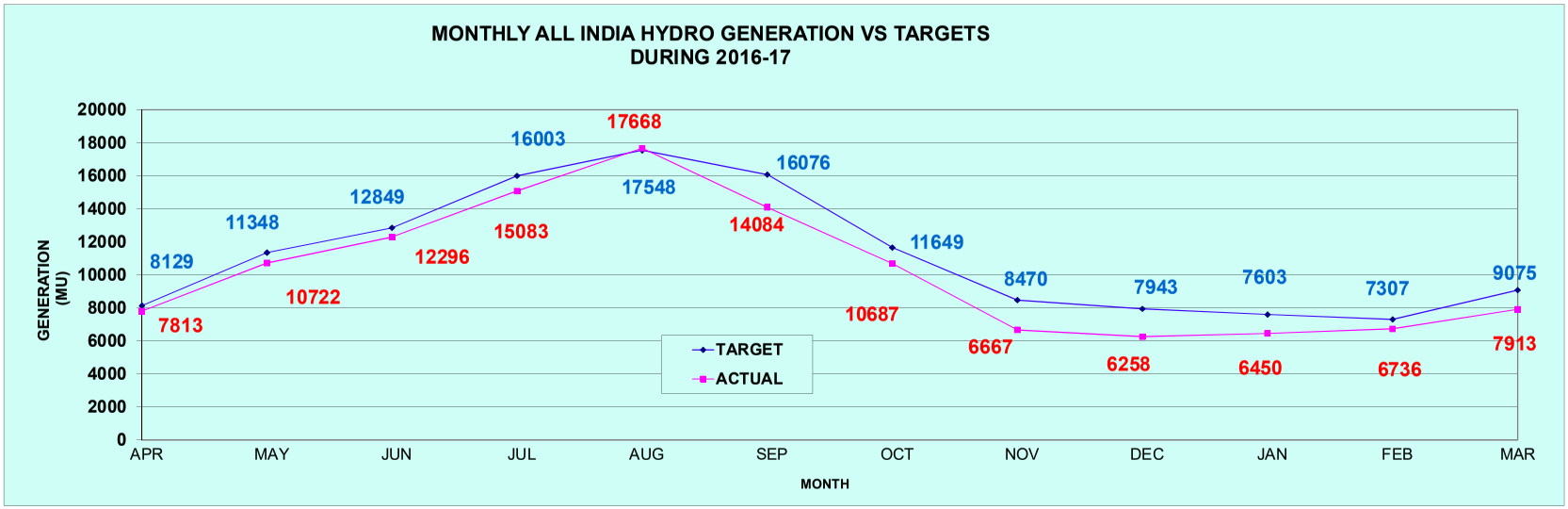
TABLE-2.7

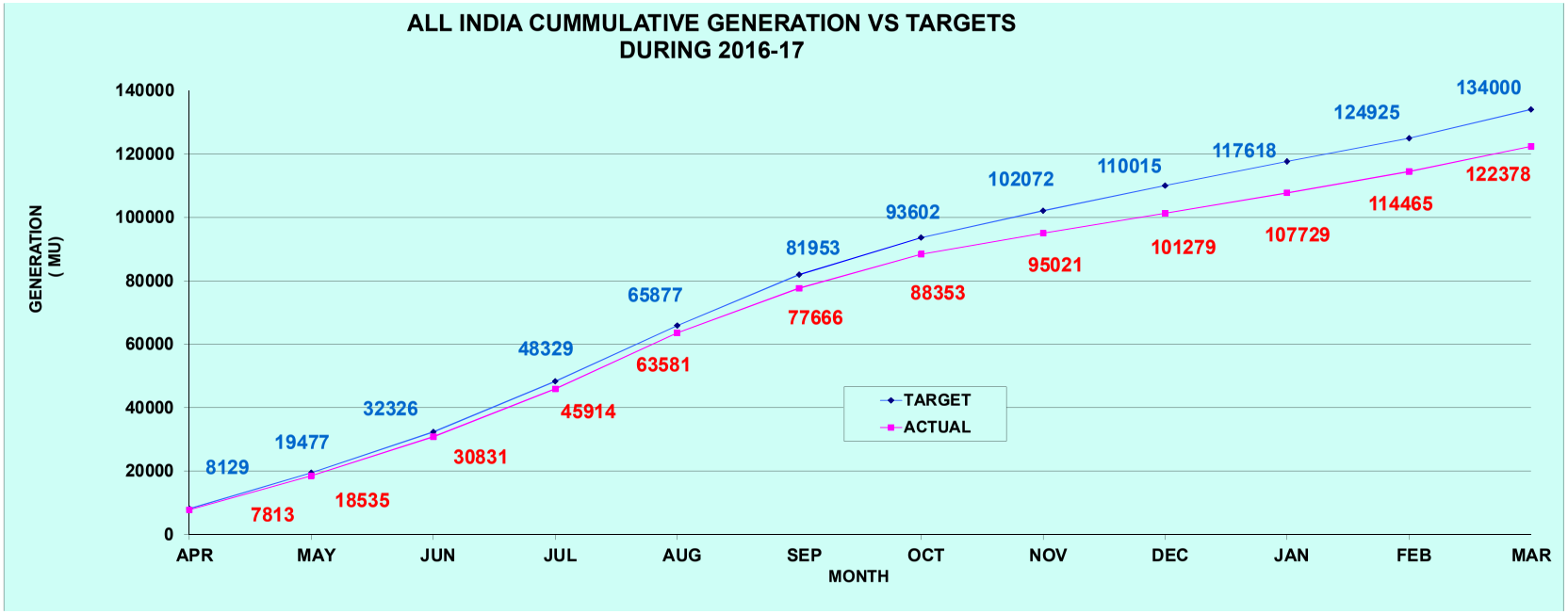
REGION-WISE HYDEL GENERATION AND RAINFALL DURING 2012-13 TO 2016-17

Region	Installed Capacity as on 31.03.2017 (MW)	Generation (BU)				
		2012-13	**2013-14**	**2014-15**	**2015-16**	**2016-17**
Northern	18527.27	62.55	63.47	65.993.25	73.11	71.76
Western	7392.00	17.67	22.83	15.657.40	12.85	17.18
Southern	11773.45	21.15	32.83	31.855.11	20.98	17.04
Eastern	5543.70	8.45	11.65	12.195.82	10.24	11.75
North Eastern	1242.00	3.91	4.06	3.542.11	4.21	4.65
Total	**44478.42**	**113.72**	**134.85**	**129.24**	**121.38**	**122.38**
Rainfall		2012-13 (mm)	2013-14 (mm)	2014-15 (mm)	2014-15 (mm)	2016-17 (mm)
All India		1071.3	1258.3	1061.2	1034.3	1104.7

It can be observed from the above table that maximum hydro generation of 134.85 BUs could be achieved due to unprecedented rainfall during the year 2013-14. The generation during the year 2015-16 was 121.38 BU due to less rainfall of 1034 mm irrespective of higher installed capacity.

EXHIBIT- 2.1


MONTHLY ALL INDIA HYDRO GENERATION VS TARGETS
DURING 2016-17
GENERATION (MU)
MONTH
TARGET
ACTUAL
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
8129
11348
12849
16003
17668
16076
11649
8470
7943
7603
7307
9075
7813
10722
12296
15083
17548
14084
10687
6667
6258
6450
6736
7913


ALL INDIA CUMMULATIVE GENERATION VS TARGETS
DURING 2016-17
GENERATION (MU)
MONTH
TARGET
ACTUAL
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
8129
19477
32326
48329
65877
81953
93602
102072
110015
117618
124925
134000
7813
18535
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63581
77666
88353
95021
101279
107729
114465
122378

EXHIBIT-2.2

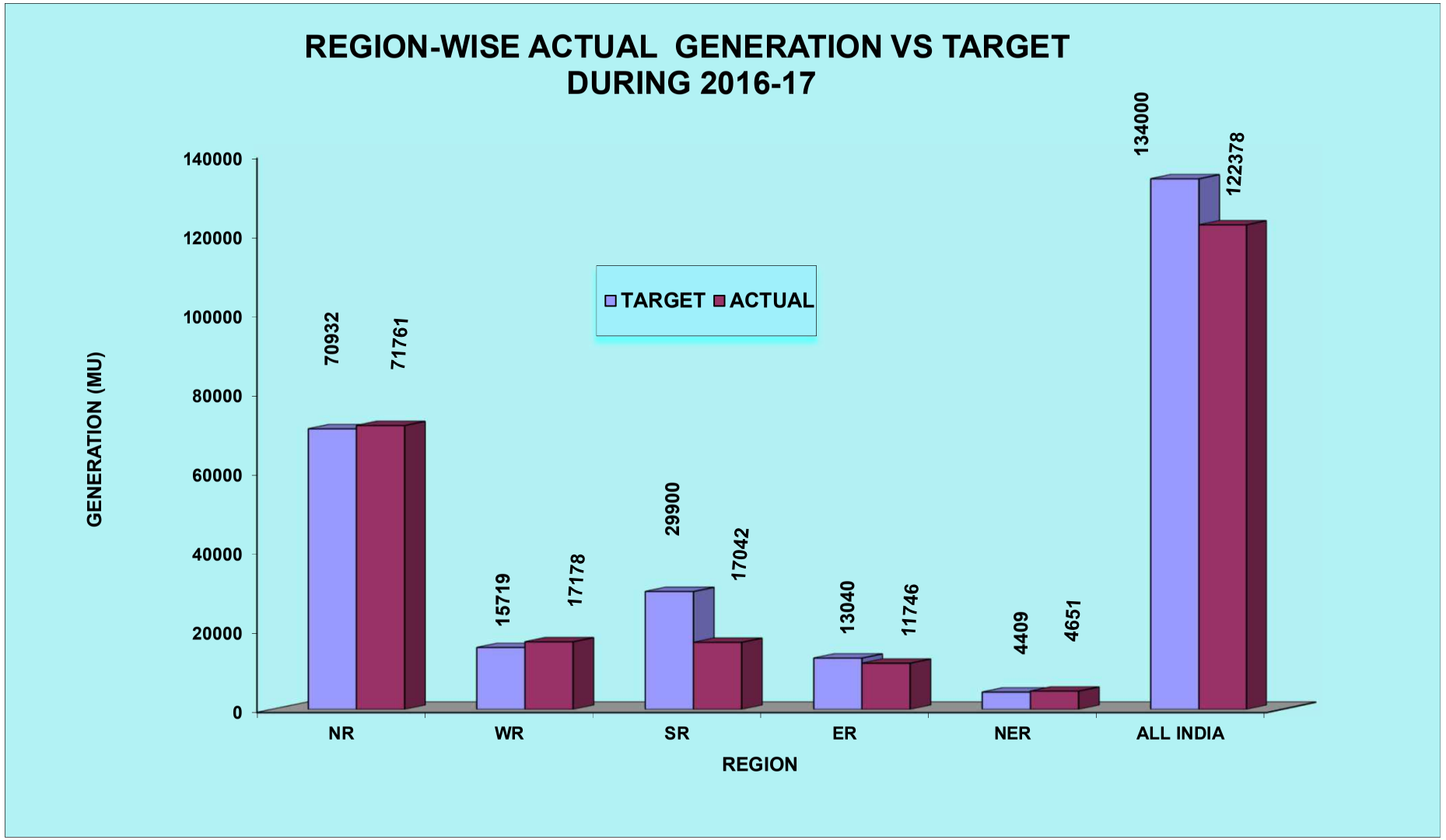
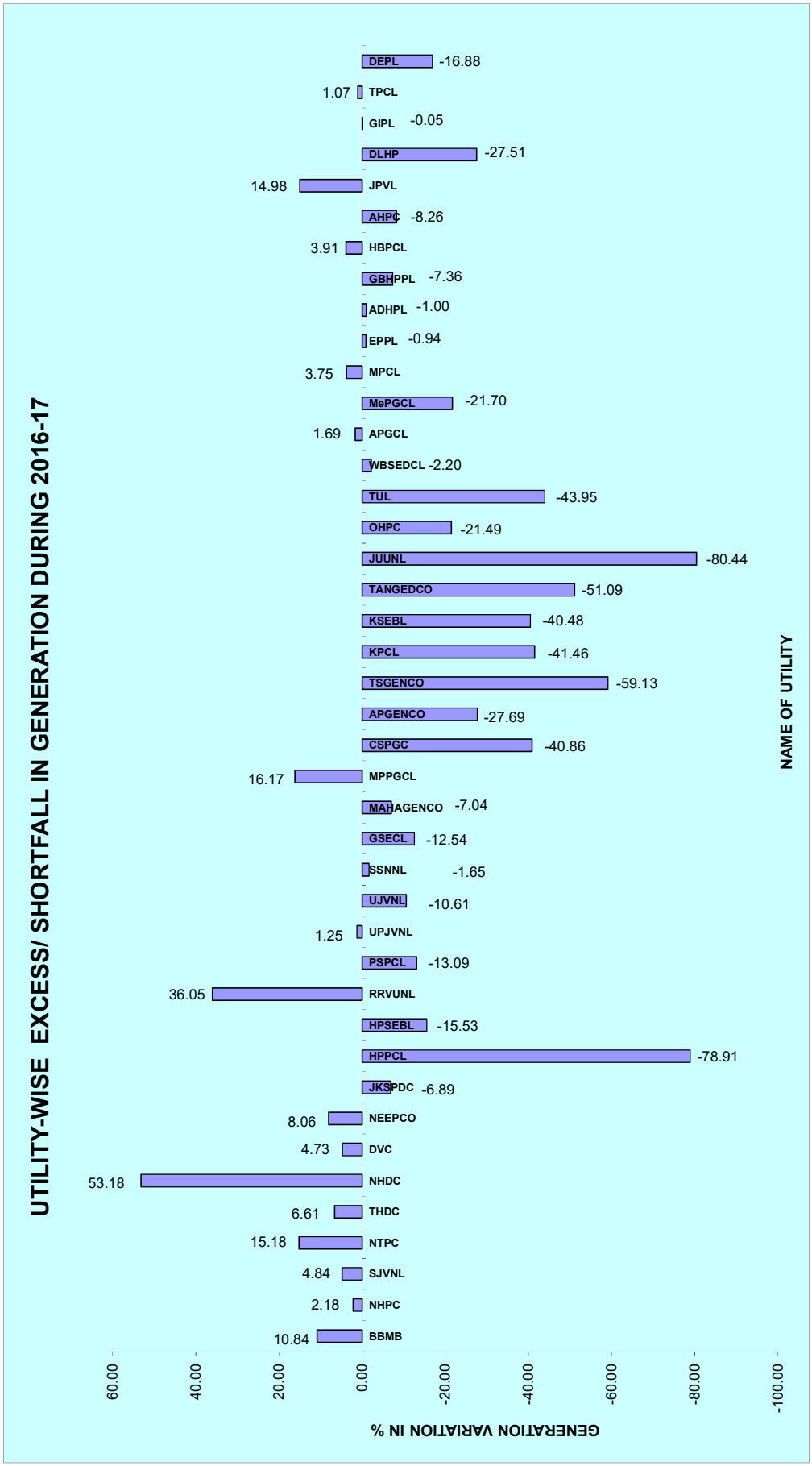

REGION-WISE ACTUAL GENERATION VS TARGET
DURING 2016-17
GENERATION (MU)
140000
120000
100000
80000
60000
40000
20000
0
TARGET
ACTUAL
70932
71761
15719
17178
29900
17042
13040
11746
4409
4651
134000
122378
NR
WR
SR
ER
NER
ALL INDIA
REGION

EXHIBIT 2.3


UTILITY-WISE EXCESS/ SHORTFALL IN GENERATION DURING 2016-17
DEPL -16.88
1.07 TPCL
GIPL -0.05
DLHP -27.51
14.98 JPVL
AHPC -8.26
3.91 HBPCL
GBHPPL -7.36
ADHPL -1.00
EPPL -0.94
3.75 MPCL
MePGCL -21.70
1.69 APGCL
WBSEDCL -2.20
TUL -43.95
OHPC -21.49
JUUNL -80.44
TANGEDCO -51.09
KSEBL -40.48
KPCL -41.46
TSGENCO -59.13
APGENCO -27.69
CSPGC -40.86
16.17 MPPGCL
MAHAGENCO -7.04
GSECL -12.54
SSNNL -1.65
UJVNL -10.61
1.25 UPJVNL
PSPCL -13.09
36.05 RRVUNL
HPSEBL -15.53
HPPCL -78.91
JKSPDC -6.89
8.06 NEEPCO
4.73 DVC
53.18 NHDC
6.61 THDC
15.18 NTPC
4.84 SJVNL
2.18 NHPC
10.84 BBMB
60.00
40.00
20.00
0.00
-20.00
-40.00
-60.00
-80.00
-100.00
GENERATION VARIATION IN %
NAME OF UTILITY

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
NORTHERN	18527.27	70932	71761.09	101.17
WESTERN	7392.00	15719	17178.00	109.28
SOUTHERN	11773.45	29900	17041.68	57.00
EASTERN	5543.70	13040	11746.21	90.08
NORTH EASTERN	1242.00	4409	4650.58	105.48
ALL INDIA	**44478.42**	**134000**	**122377.56**	**91.33**
IMPORT FROM BHUTAN		5000	5617.34	112.35
ALL INDIA (INCLUDING IMPORT FROM BHUTAN)	**44478.42**	**139000**	**127994.90**	**92.08**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
CENTRAL				
BBMB	2866.30	9536	10570.00	110.84
NHPC LTD	5121.20	22440	22929.80	102.18
SJVN LTD	1912.02	8595	9011.06	104.84
NTPC LTD	800.00	2800	3225.16	115.18
THDC LTD	1400.00	4100	4370.87	106.61
NHDC	1520.00	3100	4748.49	153.18
DVC	143.20	244	255.54	104.73
NEEPCO LTD	755.00	2585	2793.32	108.06
TOTAL CENTRAL	**14517.72**	**53400**	**57904.24**	**108.43**
STATE				
JKSPDCL	1110.00	5144	4789.60	93.11
HPPCL	195.00	266.00	56.09	21.09
HPSEBL	372.00	1465	1237.42	84.47
RRVUNL	411.00	710	965.99	136.05
PSPCL	1051.00	4069	3536.34	86.91
UPJVNL	501.60	1161	1175.56	101.25
UJVNL	1252.15	4700	4201.44	89.39
SSNNL	1450.00	3263	3209.21	98.35
GSECL	540.00	840	734.67	87.46
MAHAGENCO	2406.00	4358	4050.98	92.96
MPPGCL	875.00	2383	2768.31	116.17
CSPGCL	120.00	260	153.76	59.14
APGENCO	1796.75	3604	2605.99	72.31
TSGENCO	2306.60	3132	1279.99	40.87
KPCL	3585.40	11429	6691.09	58.54
KSEBL	1881.50	6834	4067.49	59.52
TANGEDCO	2203.20	4901	2397.12	48.91
JUUNL	130.00	154	30.13	19.56
OHPC	2027.50	5621	4412.89	78.51
TUL	1200.00	552	309.42	56.05
WBSEDCL	986.00	1596	1560.85	97.80
APGCL	100.00	390	396.59	101.69
MePGCL	282.00	919	719.60	78.30
TOTAL STATE	**26782.70**	**67751**	**51350.53**	**75.79**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
PRIVATE				
MPCL	86.00	341	353.79	103.75
EPPL	100.00	370	366.54	99.06
ADHPL	192.00	686	679.12	99.00
GBHPPL	70.00	282	261.25	92.64
JSW ENERGY	1300.00	5500	5715.04	103.91
IAEPL	24.00	0.00	11.29	0.00
AHPC LTD	330.00	1396	1280.75	91.74
JPVL	400.00	1776	2042.05	114.98
DLHP	34.00	65	47.12	72.49
GIPL	99.00	495	494.75	99.95
TPCL	447.00	1450	1465.46	101.07
DEPL	96.00	488	405.63	83.12
TOTAL PRIVATE	**3178.00**	**12849**	**13122.79**	**102.13**
TOTAL ALL INDIA	**44478.42**	**134000**	**122377.56**	**91.33**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
NORTHERN REGION				
CENTRAL				
BBMB				
Bhakra L&R	1325.00	4900	5168.27	105.47
Dehar	990.00	2900	3184.68	109.82
Ganguwal	77.65	413	416.54	100.86
Kotla	77.65	413	430.58	104.26
Pong	396.00	910	1369.93	150.54
Total BBMB	**2866.30**	**9536**	**10570.00**	**110.84**
NHPC (HP)				
Baira Siul	180.00	720	669.33	92.96
Chamera-I	540.00	2400	2224.39	92.68
Chamera-II	300.00	1450	1443.93	99.58
Chamera-III	231.00	1052	917.09	87.18
Parbati III	520.00	680	682.48	100.36
Total NHPC (HP)	**1771.00**	**6302**	**5937.22**	**94.21**
SJVN				
Naptha Jhakri	1500.00	6775	7050.64	104.07
Rampur	412.02	1820	1960.42	107.72
Total SJVN	**1912.02**	**8595**	**9011.06**	**104.84**
NTPC				
Kol Dam	800.00	2800	3225.16	115.18
Total NTPC	**800.00**	**2800**	**3225.16**	**115.18**
HPPCL				
Kashang I	65.00	237	56.09	23.67
Kashang II & III	130.00			
Sainj		29	0.00	0.00
Total HPPCL	**195.00**	**266**	**56.09**	**21.09**
HPSEB LTD				
Bassi	66.00	305	297.76	97.63
Giri Bata	60.00	190	140.60	74.00
Larji	126.00	620	611.66	98.65
Sanjay	120.00	350	187.40	53.54
Total HPSEB LTD	**372.00**	**1465**	**1237.42**	**84.47**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
PRIVATE				
ALLAIN DUHANGAN POWER LTD.				
Allain Duhangan	192.00	686	679.12	99.00
EVEREST POWER PRIVATE LTD.				
Malana-II	100.00	370	366.54	99.06
JSW ENERGY LTD				
Baspa-II	300.00	1250	1342.75	107.42
Karcham Wangtoo	1000.00	4250	4372.29	102.88
Total JSWEL (HP)	**1300.00**	**5500**	**5715.04**	**103.91**
GBHPPL				
Budhil	70.00	282	261.25	92.64
IA ENERGY PVT LTD				
Chanju I	24.00		11.29	
MALANA POWER COMPANY LTD.				
Malana	86.00	341	353.79	103.75
Total Private	**1772.00**	**7179**	**7387.03**	**102.90**
Total H.P.	**2339.00**	**8910**	**8680.54**	**97.42**
JAMMU & KASHMIR				
JKSPDC				
Baglihar	450.00	2850	2184.56	76.65
Baglihar II	450.00	1362	1758.98	129.15
Lower Jhelum	105.00	642	483.15	75.26
Upper Sindh II	105.00	290	362.91	125.14
Total JKSPDC	**1110.00**	**5144**	**4789.60**	**93.11**
NHPC (J&K)				
Chutak	44.00	50	44.12	88.24
Dulhasti	390.00	2160	2280.02	105.56
Nimoo Bazgo	45.00	90	95.21	105.79
Salal-I	345.00	3250	3423.09	105.33
Salal-II	345.00			
Sewa-II	120.00	520	470.61	90.50
Uri	480.00	2775	2803.10	101.01
Uri -II	240.00	1100	1471.94	133.81
Kishenganga		238	0.00	0.00
Total NHPC (J&K)	**2009.00**	**10183.00**	**10588.09**	**103.98**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
PUNJAB				
PSPCL				
A.P.Sahib I & II	134.00	720	673.87	93.59
Mukerian I - IV	207.00	1080	1083.51	100.33
Ranjit Sagar	600.00	1750	1306.08	74.63
Shanan	110.00	519	472.88	91.11
Total PSPCL	**1051.00**	**4069**	**3536.34**	**86.91**
RAJASTHAN				
RRVUNL				
Jawahar Sagar	99.00	220	307.55	139.80
Mahi Bajaj I & II	140.00	150	209.66	139.77
R.P. Sagar	172.00	340	448.78	131.99
Total RRVUNL	**411.00**	**710**	**965.99**	**136.05**
UTTAR PRADESH				
UPJVNL				
Khara	72.00	348	268.93	77.28
Matatilla	30.60	108	122.68	113.59
Obra	99.00	190	216.71	114.06
Rihand	300.00	515	567.24	110.14
Total UPJVNL	**501.60**	**1161**	**1175.56**	**101.25**
UTTARAKHAND				
UJVNL				
Chibro (Y.St.II)	240.00	870	714.00	82.07
Chilla	144.00	825	769.35	93.25
Dhakrani (Y.St.I)	33.75	143	120.19	84.05
Dhalipur (Y.St.I)	51.00	215	180.40	83.91
Khatima	41.40	180	180.14	100.08
Khodri (Y.St.II)	120.00	400	333.29	83.32
Kulhal (Y.St.IV)	30.00	147	122.20	83.13
Maneri Bhali-I	90.00	445	349.22	78.48
Maneri Bhali-II	304.00	1175	1251.71	106.53
Ram Ganga	198.00	300	180.94	60.31
Total UJVNL	**1252.15**	**4700**	**4201.44**	**89.39**
AHPC LTD				
Srinagar	330.00	1396	1280.75	91.74

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
JAIPRAKASH POWER VENTURE LIMITED				
Vishnu Prayag	400.00	1776	2042.05	114.98
NHPC (UK)				
Dhauliganga	280.00	1100	956.13	86.92
Tanakpur	94.20	450	430.29	95.62
Total NHPC(UK)	**374.20**	**1550**	**1386.42**	**89.45**
THDC LTD				
Tehri	1000.00	2920	3146.32	107.75
Koteshwar	400.00	1180	1224.55	103.78
Total THDC LTD	**1400.00**	**4100**	**4370.87**	**106.61**
Total N. REGION	**18527.27**	**70932.00**	**71761.09**	**101.17**
WESTERN REGION				
CHHATISGARH				
CSPGC				
Hasdeo Bango	120.00	260	153.76	59.14
Total CSPGC	**120.00**	**260**	**153.76**	**59.14**
GUJARAT				
GSECL				
Kadana PSS	240.00	250	339.01	135.60
Ukai	300.00	590	395.66	67.06
Total GSECL	**540.00**	**840**	**734.67**	**87.46**
SSNNL				
Sardar Sarovar CHPH	250.00	790	876.34	110.93
Sardar Sarovar RBPH	1200.00	2473	2332.87	94.33
Total SSNNL	**1450.00**	**3263**	**3209.21**	**98.35**
Total Gujarat	**1990.00**	**4103**	**3943.88**	**96.12**
MADHYA PRADESH				
MPPGCL				
Bansagar Tons-I	315.00	900	1239.02	137.67
Bansagar Tons-II	30.00	113	109.73	97.11
Bansagar Tons-III	60.00	143	53.48	37.40

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
Bargi	90.00	440	445.47	101.24
Gandhi Sagar	115.00	280	351.00	125.36
Madhikheda	60.00	91	147.21	161.77
Pench	160.00	335	360.14	107.50
Rajghat	45.00	81	62.26	76.86
Total MPPGPCL	**875.00**	**2383**	**2768.31**	**116.17**
CENTRAL/ COMMON				
NHDC				
Indira Sagar	1000.00	2075	3320.79	160.04
Omkareshwar	520.00	1025	1427.7	139.29
TOTAL NHDC	**1520.00**	**3100**	**4748.49**	**153.18**
Total M.P.	**2395.00**	**5483.00**	**7516.80**	**137.09**
MAHARASHTRA				
MAHAGENCO				
Bhira Tail Race	80.00	85	101.58	119.51
Ghatghar PSS	250.00	424	383.87	90.54
Koyna DPH	36.00	110	156.02	141.84
Koyna St.I&II	600.00	1164	1290.21	110.84
Koyna St.III	320.00	588	614.14	104.45
Koyna IV	1000.00	1711	1245.48	72.79
Tillari	60.00	122	106.16	87.02
Vaitarna	60.00	154	153.52	99.69
Total MAHAGENCO	**2406.00**	**4358**	**4050.98**	**92.96**
DODSON-LINDBLOM HYDRO POWER PVT LTD (DLHP)				
Bhandardhara - II	34.00	65	47.12	72.49
Total DLHP	**34.00**	**65**	**47.12**	**72.49**
TATA POWER COMPANY LIMITED				
Bhira	150.00	883	951.63	107.77
Bhira PSS	150.00			
Bhivpuri	75.00	297	206.59	69.56
Khopoli	72.00	270	307.24	113.79
Total TPCL	**447.00**	**1450**	**1465.46**	**101.07**
Total Maharashtra	**2887.00**	**5873**	**5563.56**	**94.73**
Total Western	**7392.00**	**15719**	**17178.00**	**109.28**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
SOUTHERN REGION				
ANDHRA PRADESH				
APGENCO				
N.J.Sagar TPD	50.00	175	7.35	4.20
N.J.Sagar RBC	90.00	148	4.15	2.80
Srisailam RB	770.00	1055	640.61	60.72
Upper sileru I & II	240.00	450	340.41	75.65
T.B.Dam & Hampi	72.00	180	81.26	45.14
Lower Sileru	460.00	1115	831.90	74.61
Machkund	114.75	481	700.31	145.59
Total APGENCO	**1796.75**	**3604.00**	**2605.99**	**72.31**
KARNATAKA				
KPCL				
Almatti Dam	290.00	529	404.05	76.38
Bhadra	39.20	65	27.06	41.63
Gerusoppa	240.00	533	276.60	51.89
Ghatprabha	32.00	93	48.74	52.41
Jog	139.20	183	288.25	157.51
Kadra	150.00	359	176.42	49.14
Kalinadi	855.00	2543	1344.82	52.88
Supa DPH	100.00	410	239.20	58.34
Kodasali	120.00	329	154.16	46.86
Lingnamakki	55.00	248	105.64	42.60
Munirabad	28.00	100	31.49	31.49
Sharavathy	1035.00	4706	2708.77	57.56
Shivasamudram	42.00	258	145.14	56.26
Varahi	460.00	1073	740.75	69.04
Total KPCL	**3585.40**	**11429**	**6691.09**	**58.54**
KERALA				
KSEB LTD				
Idamalayar	75.00	354	171.72	48.51
Idukki	780.00	2505	1380.06	55.09
Kakkad	50.00	206	131.68	63.92
Kuttiadi & Kuttiady Addl.	225.00	676	478.72	70.82
Lower Periyar	180.00	560	307.23	54.86
Neriamangalam	70.00	334	197.30	59.07
Pallivasal	37.50	213	166.05	77.96

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
Panniar	30.00	138	62.33	45.17
Poringalkuthu	32.00	160	91.10	56.94
Sabarigiri	300.00	1312	798.79	60.88
Sengulam	48.00	149	115.66	77.62
Sholayar	54.00	227	166.85	73.50
Total KSEB LTD	**1881.50**	**6834.00**	**4067.49**	**59.52**
TAMIL NADU				
TANGEDCO				
Aliyar	60.00	145	61.73	42.57
Bhawani K Barrage-III	30.00	52	17.47	33.60
Bhawani K Barrage-II	30.00	69	19.83	28.74
Bhawani K Barrage-I	30.00	69	20.59	29.84
Kadamparai PSS	400.00	430	289.39	67.30
Kodayar I&II	100.00	220	169.43	77.01
Kundah I-V	555.00	1606	815.61	50.79
Lower Mettur I-IV	120.00	285	92.27	32.38
Mettur Dam	50.00	87	44.75	51.44
Mettur Tunnel	200.00	379	80.73	21.30
Moyar	36.00	150	61.52	41.01
Papanasam	32.00	115	66.54	57.86
Parson's Valley	30.00	53	23.95	45.19
Periyar	161.00	450	93.91	20.87
Pykara	59.20	69	12.74	18.46
Pykara Ultimate	150.00	360	192.55	53.49
Sarkarpathy	30.00	115	63.29	55.03
Sholayar I&II	95.00	157	228.11	145.29
Suruliyar	35.00	90	42.71	47.46
Total TANGEDCO	**2203.20**	**4901**	**2397.12**	**48.91**
TELANGANA				
TSGENCO				
Lower Jurala	240.00	254	176.34	69.43
N.J.Sagar PSS	815.60	1006	186.15	18.50
N.J.Sagar LBC	60.00	65	0.00	0.00
Pochampad	27.00	68	75.29	110.72
Priyadarshni Jurala	234.00	201	211.99	105.47
Pulichinthala	30.00	160	13.00	8.13

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
Srisailam LB	900.00	1378	617.22	44.79
Total TSGENCO	**2306.60**	**3132**	**1279.99**	**40.87**
Total Southern	**11773.45**	**29900**	**17041.68**	**57.00**
EASTERN REGION				
DVC				
Maithon (WB)	63.20	120	122.03	101.69
Panchet	80.00	124	133.51	107.67
Total DVC	**143.20**	**244**	**255.54**	**104.73**
JHARKHAND				
JUUNL				
Subernarekha I&II	130.00	154	30.13	19.56
Total Jharkhand	**130.00**	**154**	**30.13**	**19.56**
ODISHA				
OHPC				
Balimela	510.00	1186	1001.38	84.43
Hirakud I&II	347.50	993	716.97	72.20
Rengali	250.00	645	553.56	85.82
Upper Indravati	600.00	1963	1521.64	77.52
Upper Kolab	320.00	834	619.34	74.26
Total OHPC	**2027.50**	**5621**	**4412.89**	**78.51**
SIKKIM				
TEESTA URJA LTD				
Teesta III	1200.00	552	309.42	56.05
Total State (Sikkim)	**1200.00**	**552.00**	**309.42**	**56.05**
PRIVATE SECTOR				
DANS ENERGY PVT LTD				
Jorethang Loop	96.00	459	405.63	88.37
Tashiding		29		0.00
Total	**96.00**	**488.00**	**405.63**	**83.12**
GATI INFRASTRUCTURE PVT LTD				
Chuzachen HEP	99.00	495	494.75	99.95
Total Private (Sikkim)	**195.00**	**983.00**	**900.38**	**91.60**

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
NHPC(Sikkim)				
Rangit	60.00	340	347.14	102.10
Teesta-V	510.00	2500	2773.46	110.94
Total NHPC (Sikkim)	**570.00**	**2840**	**3120.60**	**109.88**
WEST BENGAL				
WBSEDCL				
Jaldhaka I	36.00	158	205.46	130.04
Purulia PSS	900.00	1200	1106.97	92.25
Ramman II	50.00	238	248.42	104.38
Total WBSEDCL	**986.00**	**1596**	**1560.85**	**97.80**
NHPC				
Teesta Low Dam-III	132.00	550	553.87	100.70
Teesta Low Dam-IV	160.00	500	602.53	120.51
Total NHPC (WB)	**292.00**	**1050.00**	**1156.40**	**110.13**
Total Eastern	**5543.70**	**13040.00**	**11746.21**	**90.08**
NORTH EASTERN REGION				
ARUNACHAL PRADESH				
NEEPCO				
Ranganadi	405.00	1200	1249.01	104.08
Pare		100		
Sub Total	**405.00**	**1300.00**	**1249.01**	**96.08**
ASSAM				
APGCL				
Karbi Langpi	100.00	390	396.59	101.69
NEEPCO				
Kopili	225.00	900	1088.27	120.92
Khandong	50.00	170	197.10	115.94
Total NEEPCO	**275.00**	**1070.00**	**1285.37**	**120.13**
NHPC				
Loktak (Manipur)	105.00	515	741.07	143.90
MEGHALAYA				
MePGCL				
Kyrdemkulai	60.00	130	65.29	50.22
Myntdu	126.00	428	391.65	91.51

REGION/UTILITY/ STATION-WISE GENERATION PERFORMANCE OF H.E. STATIONS IN THE COUNTRY DURING THE YEAR 2016-17

REGION/UTILITY/ STATION	INSTALLED CAPACITY AS ON 31.03.2017	2016-17		% OF ACTUAL OVER TARGET
		TARGET	ACTUAL	
	MW	MU	MU	
New Umtru		60	0.00	0.00
Umium St.I	36.00	109	96.65	88.67
Umium St.IV	60.00	192	166.01	86.46
Total MePGCL	**282.00**	**919**	**719.60**	**78.30**
NAGALAND				
NEEPCO				
Doyang	75.00	215	258.94	120.44
Total NEEPCO	**75.00**	**215**	**258.94**	**120.44**
Total N.Eastern	**1242.00**	**4409**	**4650.58**	**105.48**
TOTAL ALL INDIA	**44478.42**	**134000**	**122377.56**	**91.33**
IMPORT FROM BHUTAN		**5000**	**5617.34**	**112.35**
TOTAL ALL INDIA (INCLUDING BHUTAN IMPORTS)	**44478.42**	**139000**	**127994.90**	**92.08**

CHAPTER-3

MAJOR RESERVOIR BASED HE STATIONS

CHAPTER – 3

MAJOR RESERVOIR/ STORAGE BASED H.E. STATIONS

3.1 Introduction

Some of the hydro-electric schemes are provided with storage reservoirs. Water during monsoon and/or snowmelt period, is collected in these reservoirs. The regulated discharges from reservoirs are utilized for power generation, irrigation and other purposes. Reservoir based schemes are of two types i.e. single purpose and multipurpose. Single purpose schemes are operated only for power generation. Multipurpose storage schemes are operated for more than one purpose such as flood control, irrigation, water supply, pisciculture, navigation, tourist attraction and other recreational facilities besides power generation. Reservoir based schemes afford greater utilization of the available inflows approaching to long term average inflows resulting in greater firm power benefits. Reservoir based schemes are the source of flexible generation and can be operated as base load or peaking station depending upon the requirement of the Grid System.

3.2 Major Reservoir Based Stations

CEA is presently monitoring 43 H. E. Stations in the country on 37 major reservoirs as listed below:

S. No.	H.E. Stations	Installed Capacity (MW)	Utility	State	Reservoirs	
					Name	Multipurpose (MP)/ Storage (S) for Power Only
	Northern Region					
1	Bhakra (L)	540	BBMB	Himachal Pradesh	Bhakra	MP
2	Bhakra (R)	785	BBMB			
3	Pong	396	BBMB		Pong	MP
4	Chamera-I	540	NHPC	Himachal Pradesh	Chamera	S
5	Ranjit Sagar	600	PSPCL	Punjab	Ranjit Sagar	MP
6	Tehri	1000	THDC	Uttarakhand	Tehri	MP
7	Ram Ganga	198	UJVNL	Uttarakhand	Ram Ganga	MP
8	Rihand	300	UPJVNL	Uttar Pradesh	Rihand	MP
9	RP Sagar	172	RRVUNL	Rajasthan	RP Sagar	MP
Sub-Total (NR)		**4531**				

S. No.	H.E. Stations	Installed Capacity (MW)	Utility	State	Reservoirs	
					Name	Multipurpose (MP)/ Storage for Power Only
	Western Region					
10	Ukai	300	GSECL	Gujarat	Ukai	MP
11	Sardar Sarovar (RBPH)	1200	SSNNL	Gujarat	Sardar Sarovar	MP
12	Gandhi Sagar	115	MPPGCL	Madhya Pradesh	Gandhi Sagar	MP
13	Bansagar-III	60	MPPGCL	Madhya Pradesh	Bansagar	MP
14	Indira Sagar	1000	NHDC	Madhya Pradesh	Indira Sagar	MP
15	Koyna-I&II	600	MAHAGENCO	Maharashtra	Koyna	MP
16	Koyna-IV	1000	MAHAGENCO	Maharashtra		
17	Koyna DPH	36	MAHAGENCO	Maharashtra		
18	Pench	160	MPPGCL	Maharashtra	Pench	MP
19	Bhira	150	TPCL	Maharashtra	Bhira	MP
Sub-Total (WR)		**4621**				
	Southern Region					
20	Upper Sileru-I	120	APGENCO	Andhra Pradesh	Sileru	S
21	Upper Sileru-II	120	APGENCO	Andhra Pradesh		
22	Lower Sileru	460	APGENCO	Andhra Pradesh		
23	Srisailam RB	770	APGENCO	Andhra Pradesh	Srisailam	MP
24	NJ Sagar	815.60	TSGENCO	Telangana	Nagarjuna Sagar	MP
25	Sharavathy	1035	KPCL	Karnataka	Sharavathy	**S**
26	Kalinadi	855	KPCL	Karnataka	Supa	**S**
27	Supa DPH	100	KPCL	Karnataka		
28	Almatti	290	KPCL	Karnataka	Almatti	MP
29	Varahi	460	KPCL	Karnataka	Varahi	S
30	Idukki	780	KSEB	Kerala	Idukki	MP
31	Sabarigiri	300	KSEB	Kerala	Sabarigiri	MP
32	Pallivasal	37.50	KSEB	Kerala	Madupetty	S
33	Idamalayar	75	KSEB	Kerala	Idamalayar	MP
34	Mettur Dam	50	TANGEDCO	Tamil Nadu	Mettur	MP

S. No.	H.E. Stations	Installed Capacity (MW)	Utility	State	Reservoirs	
					Name	Multipurpose (MP)/ Storage for Power Only
35	Mettur Tunnel	200	TANGEDCO	Tamil Nadu	Mettur	MP
36	Periyar	140	TANGEDCO	Tamil Nadu	Periyar	MP
Sub-Total (SR)		**6608.10**				
	Eastern and North Eastern Region					
37	Machkund	114.75	APGENCO	Odisha	Machkund	MP
38	Hirakud I&II	347.50	OHPC	Odisha	Hirakud	MP
39	Balimela	510	OHPC	Odisha	Balimela	MP
40	Indravati	600	OHPC	Odisha	Indravati	MP
41	Upper Kolab	320	OHPC	Odisha	Upper Kolab	MP
42	Rengali	250	OHPC	Odisha	Rengali	MP
43	Loktak	105	NHPC	Manipur	Loktak	MP
Sub-Total (ER/NER)		**2247.25**				
Total (All India)		**18007.35**				

Salient details of 37 Nos. major reservoirs are indicated in **Annex-3.1**. These stations constitute about 40.49% (32.11% Multipurpose & 8.38% Storage for power only) of the total hydel installed capacity and generated about 32.95% (25.93% Multipurpose & 7.02% Storage for power only) of the total Hydel generation during 2016-17 as briefly indicated in **Table-3.1.**

TABLE - 3.1

CONTRIBUTION BY IMPORTANT RESERVOIR (STORAGE) BASED H.E. STATIONS

S. No.	Description	Major Reservoir Based Stations		Other Stations	Total
		Multipurpose (MP)	Storage for Power only		
1.	Installed Capacity (MW)	14280	3727	26471	44478
2.	Percentage of Total (%)	32.11	8.38	59.51	100
3.	Energy Generation (MU)	31727	8596	82055	122378
4.	Percentage of Total (%)	25.93	7.02	67.05	100

3.3 Inflows

Inflows to the reservoirs are primarily dependent on rainfall during monsoon in the catchment area of the reservoirs. However, in case of the hydro projects in Himalayan Region including Bhakra, Pong, Ranjit Sagar and Tehri projects etc., snow melt in the

catchment area during summer also contributes to their inflows. The inflows into the reservoirs during 2016-17 vis-à-vis 2015-16 are given at **Exhibit 3.1**. Inflows into the reservoirs and generation during the year 2016-17 vis-à-vis 2015-16 and 10 years average is given below at **Table-3.2.**

TABLE 3.2

HYDRO RESERVOIRS (STORAGE TYPE) - INFLOW & ENERGY GENERATION

S No	STATION	Inflows				Generation			
		10 years Average (MCM)	2015-16 (MCM)	2016-17 (MCM)	2016-17 Inflow as % of 2015-16 inflow	10 years Average (MU)	2015-16 (MU)	2016-17 (MU)	2016-17 generation as compared to 2015-16 (%)
1	2	3	4	5	6= (5/4*100)	7	8	9	10= (9/8*100)
Northern Region									
1	Bhakra	17144	14444	16021	110.92	5425	5893	5168	87.70
2	Pong	8619	8790	7910	89.99	1543	1735	1370	78.96
3	Ranjit Sagar	6192	7389	5428	73.46	1587	1957	1306	66.73
4	Chamera-I*	-	6945	5383	77.51	2356	2624	2224	84.76
5	Tehri	7297	6987	7438	106.45	3149	3101	3146	101.45
6	Ram Ganga	3392	6000	1353	22.55	295	503	181	35.98
7	RP Sagar	4259	7305	5598	76.63	390	518	449	86.68
8	Rihand	5119	3769	8587	227.83	485	375	567	151.20
Sub Total (NR)		**52021**	**61629**	**57718**	**93.65**	**15230**	**16706**	**14411**	**86.26**
Western Region									
9	Ukai	8913	6632	226	3.41	566	492	396	80.49
10	Sardar Sarovar	28497	6821	28985	424.94	2943	1466	2333	159.14
11	Gandhi Sagar	4240	7969	5904	74.09	282	383	351	80.49
12	Bansagar*	-	2247	9319	414.73	78	40	53	132.50
13	Pench*	-	1295	1111	85.79	365	379	360	94.99
14	Indira Sagar	22469	14833	30477	205.47	2671	1974	3321	168.24
15	Koyna	3689	2137	3624	169.58	2722	2443	2692	110.19
16	Bhira	913	547	1054	192.69	348	316	379	119.94
Sub Total (WR)		**68720**	**42481**	**80700**	**189.97**	**9975**	**7493**	**9885**	**131.92**
	Southern Region								
17	Srisailam	21556	1945	49996	2570.49	1217	206	641	310.90
18	Upper Sileru*	-	2571	1659	64.53	440	465	340	73.12

S No	STATION	Inflows				Generation			
		10 years Average (MCM)	2015-16 (MCM)	2016-17 (MCM)	2016-17 Inflow as % of 2015-16 inflow	10 years Average (MU)	2015-16 (MU)	2016-17 (MU)	2016-17 generation as compared to 2015-16 (%)
19	Lower Sileru*	-	4007	2377	59.32	11108	1233	832	67.48
20	N.J. Sagar	77592	1664	66834	4016.47	1300	88	186	211.17
21	Sharavathy	4795	2625	2154	82.06	4747	2665	2709	101.65
22	Supa	2732	1521	1878	123.47	3018	2273	1584	69.69
23	Almatti	14327	3293	18858	572.67	466	145	404	278.62
24	Varahi*	-	-	451	-	1081	752	741	98.54
25	Idukki	1650	1142	807	70.67	2331	2372	1380	58.18
26	Sabarigiri	890	1388	831	59.87	1241	1171	799	68.23
27	Madupetty	214	171	350	204.68	212	219	166	75.80
28	Idamalayar	1209	965	724	75.03	328	273	172	63.00
29	Mettur	5594	4058	1721	42.41	391	341	125	36.66
30	Periyar	622	651	208	31.95	388	505	94	18.61
Sub Total (SR)		**132490**	**65820**	**20676**	**31.41**	**30161**	**12708**	**10173**	**80.05**
Eastern Region									
31	Machkund	1308	1254	1264	100.80	558	477	700	146.75
32	Hirakud	26550	17404	21608	124.16	867	684	717	104.82
33	Balimela	3602	2923	3440	117.69	1108	622	1001	160.93
34	Indravati	3244	1994	1851	92.83	1997	1760	1522	86.48
35	Upper Kolab	1997	1279	1376	107.58	676	767	619	80.70
36	Rengali	10316	7913	8812	111.36	708	599	554	92.49
Sub Total (ER)		**45710**	**31513**	**37087**	**117.69**	**5356**	**4909**	**5113**	**104.16**
North Eastern Region									
37	Loktak	2305	2069	2760	133.40	548	537	741	137.99
Sub Total (NER)		**2305**	**2069**	**2760**	133.40	**548**	**537**	**741**	**137.99**
Total (All India)		**301246**	**270875**	**211323**	**78.01**	**61270**	**42353**	**40323**	**95.21**

*10 years average inflows not available.

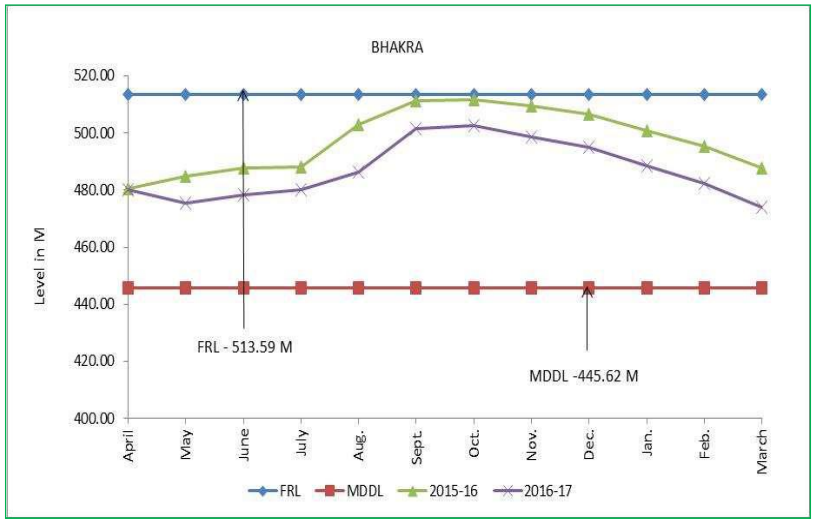
3.4 Reservoir Levels

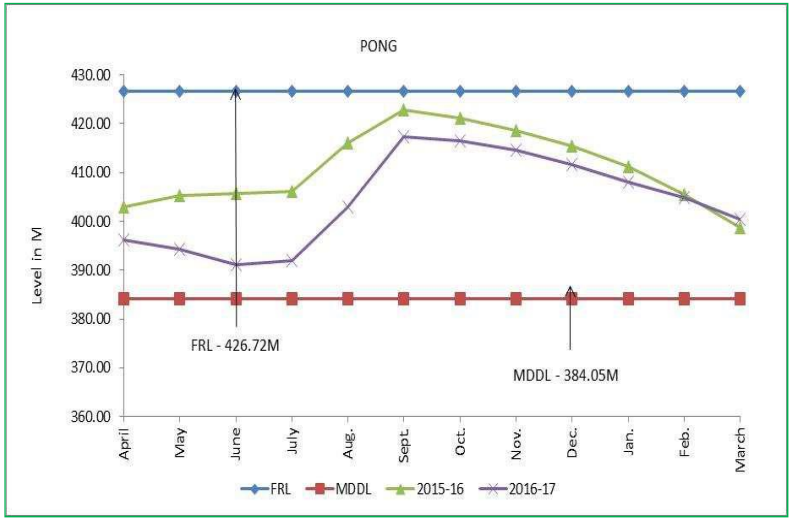
The maximum reservoir level attained during the year depends on the depleted reservoir level in the preceding year, besides the inflows during the current year. Water level touched FRL only at Chamera, Bansagar, Madupetty and Loktak reservoirs during 2016-17. Month-wise maximum levels of major reservoirs during 2016-17 vis-à-vis 2015-16 are indicated at **Exhibits 3.2** to **Exhibits 3.11**.

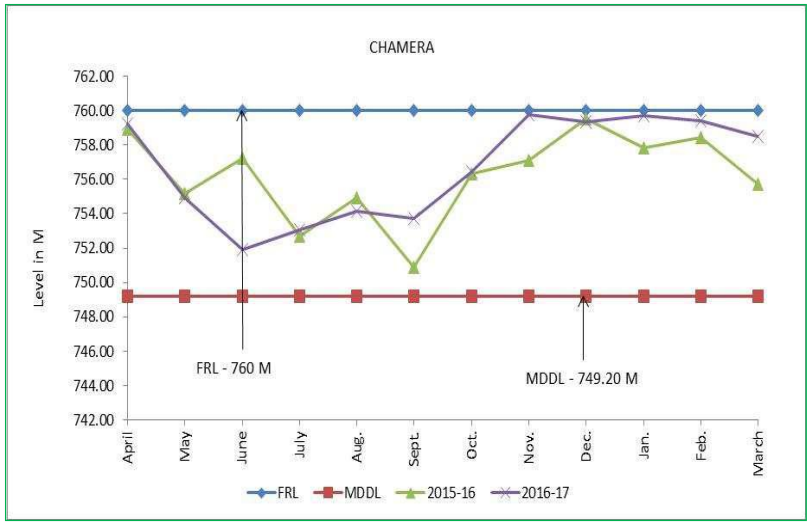
EXHIBIT 3.1
INFLOWS INTO MAJOR RESERVOIRS DURING 2016-17 VIS-A-VIS 2015-16
INFLOW IN MCM
NAME OF RESERVOIR
2016-17
2015-16
80000
70000
60000
50000
40000
30000
20000
10000
0
Bhakra 16021 14444
Pong 7910 8790
Ranjit Sagar 5428 7389
Chamera 5383 6945
Tehri 7438 6987
Ramnagar 1453 6000
RP Sagar 5598 7305
Rihand 3769 8587
Ukai 226 6632
Sardar Sarovar 6821 28985
Gandhi Sagar 5904 7969
Bansagar 2247 9319
Pench 1111 1295
Indira Sagar 14833 30477
Koyna 3624 2137
Bhira 1054 547
Machkund 1264 1254
Upper Sileru 1659 2571
Lower Sileru 2377 4007
Srisailam 1664 49996
NJ Sagar 1945 66834
Sharavathy 2154 2625
Supa 1878 1521
Almatti 3293 18858
Varahi 451
Idukki 807 1142
Sabarigiri 831 1388
Madupetty 350 171
Idamalayar 724 965
Mettur 1721 4058
Periyar 208 651
Hirakud 17404 21608
Balimela 3440 2923
Upper Indravati 1851 1994
Upper Kolab 1376 1279
Rengali 8812 7913
Loktak 2760 2069

EXHIBIT 3.2

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







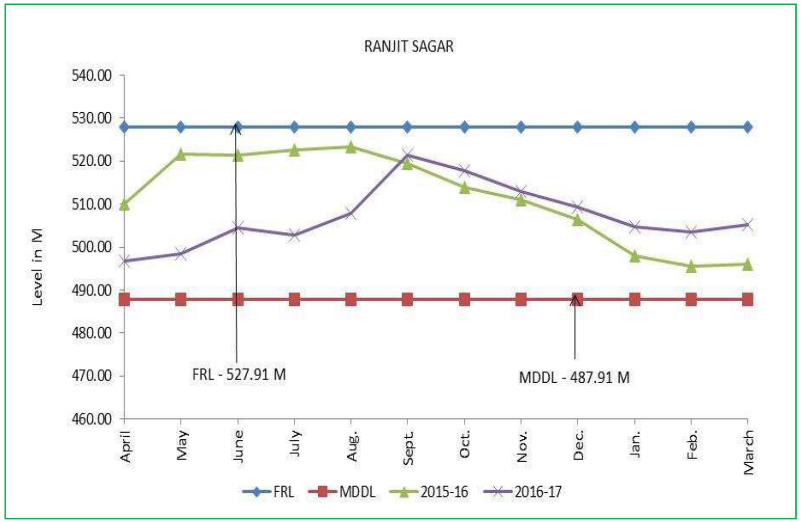
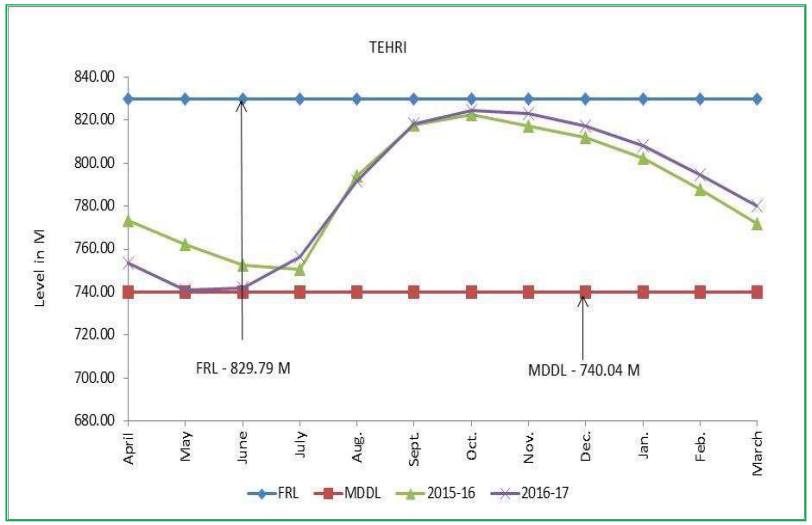
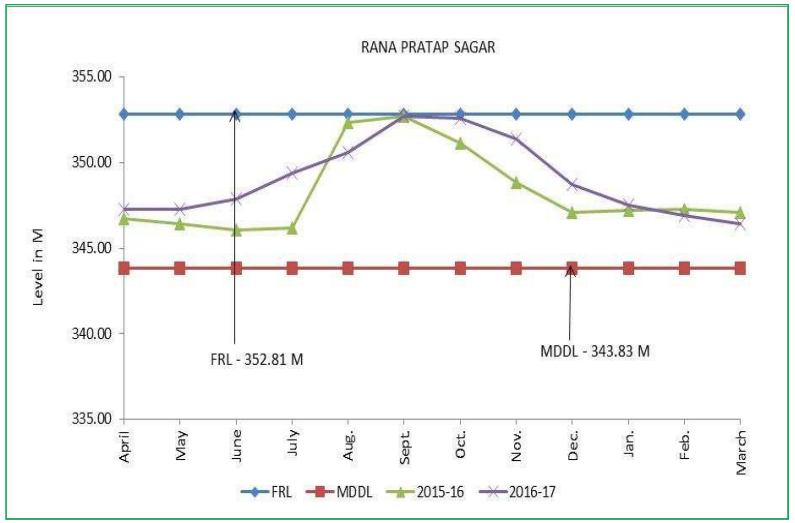
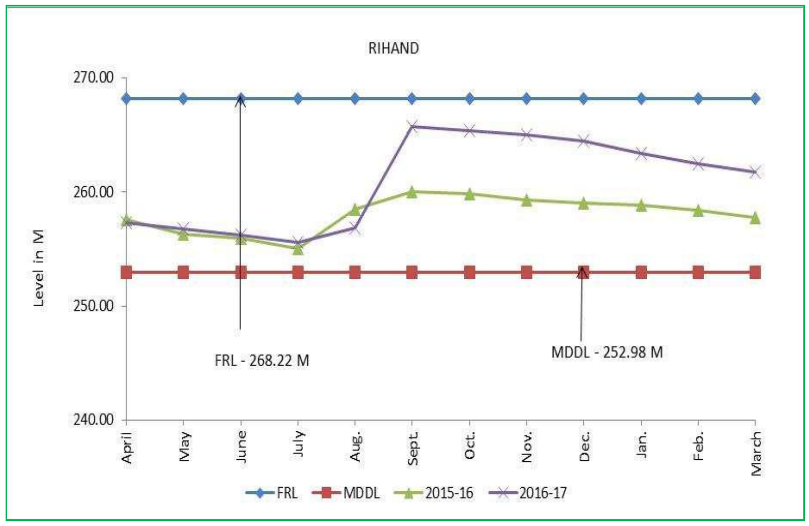


EXHIBIT 3.3

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







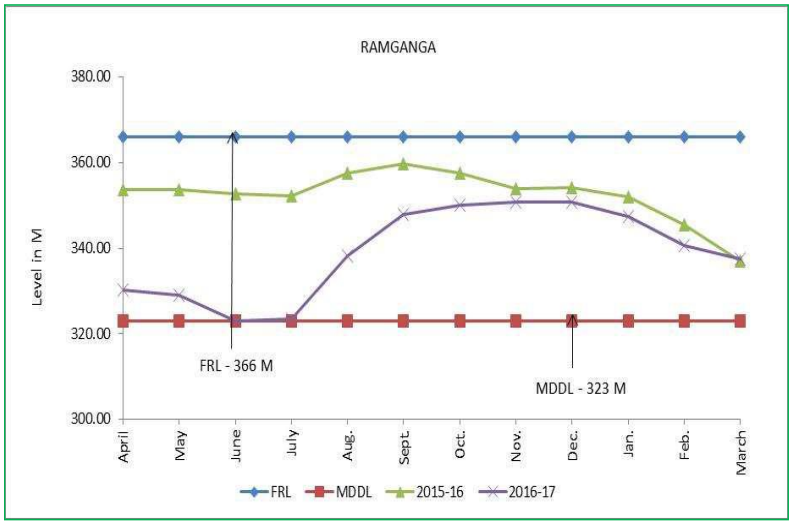
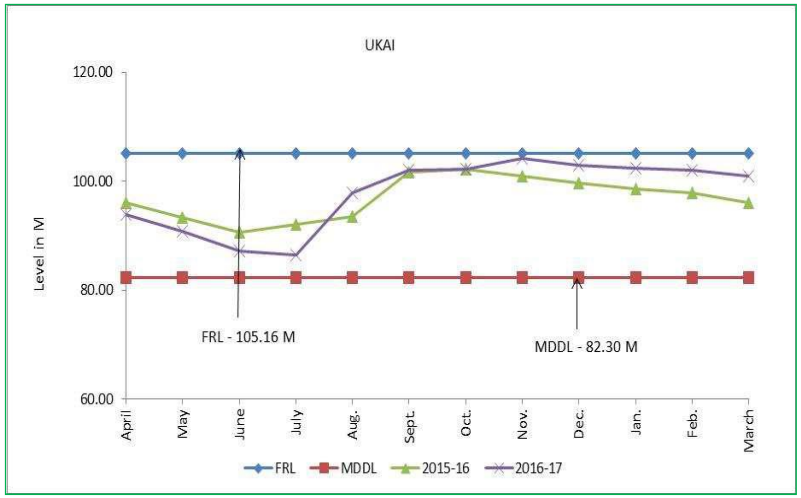
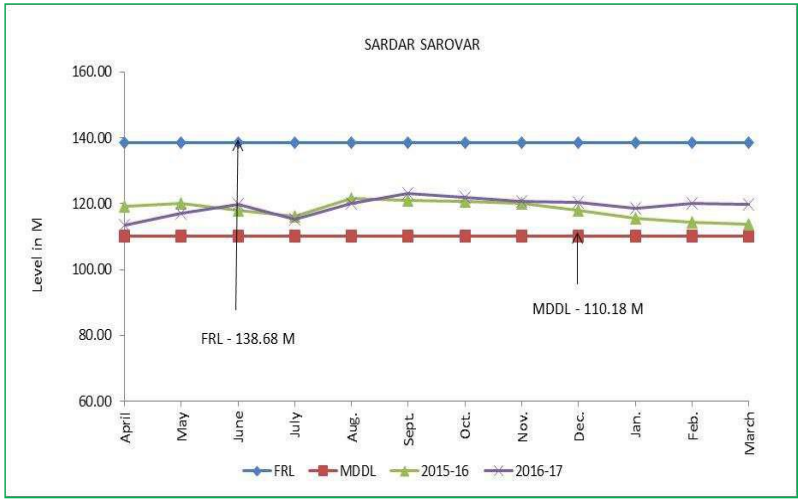
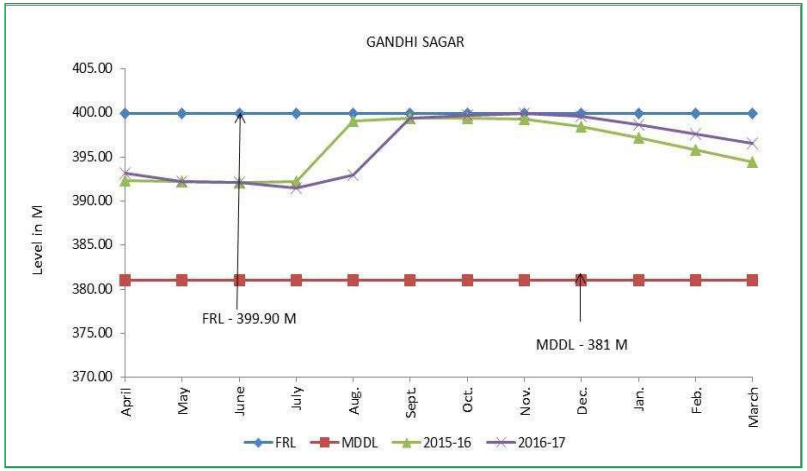


EXHIBIT 3.4

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







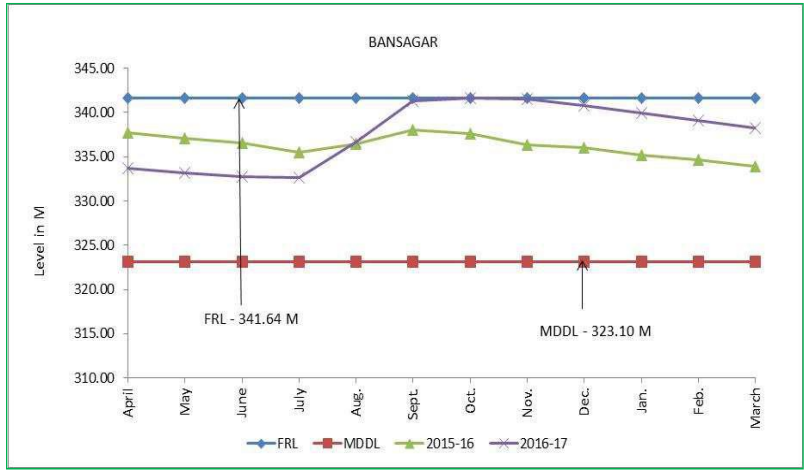
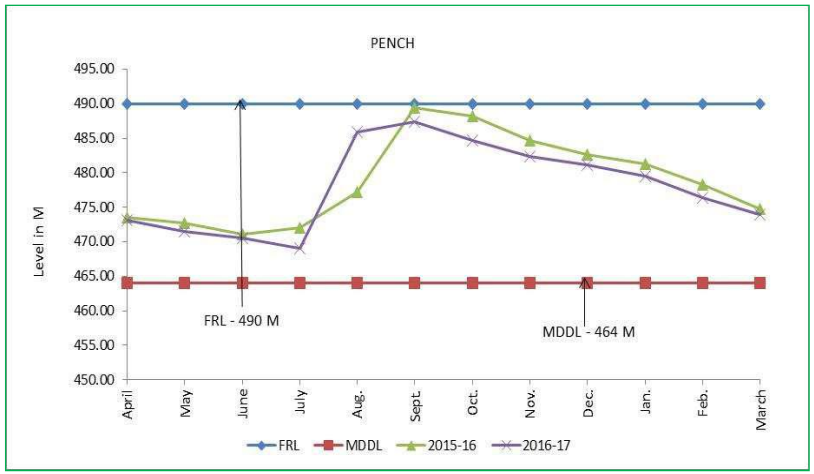
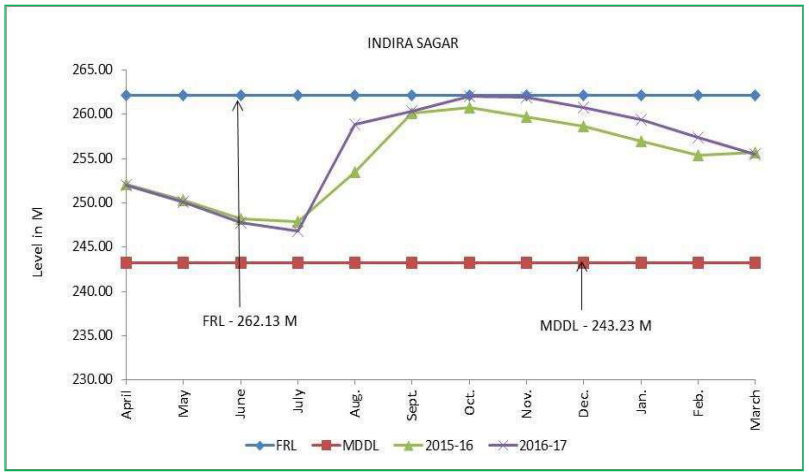
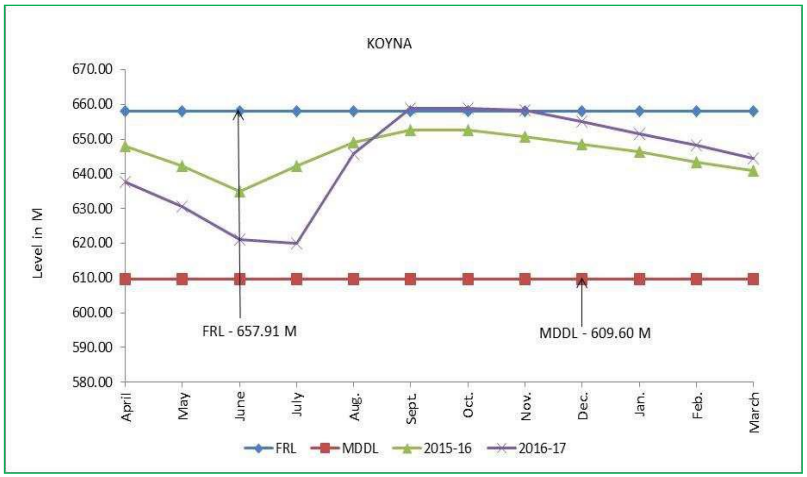


EXHIBIT 3.5

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







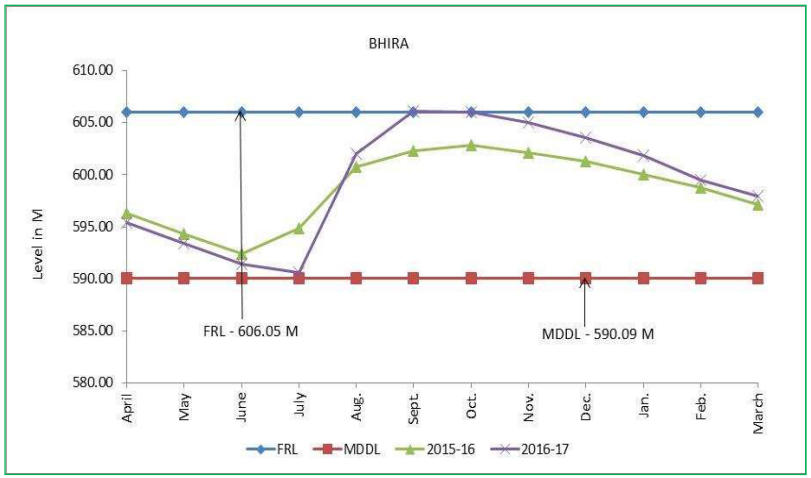
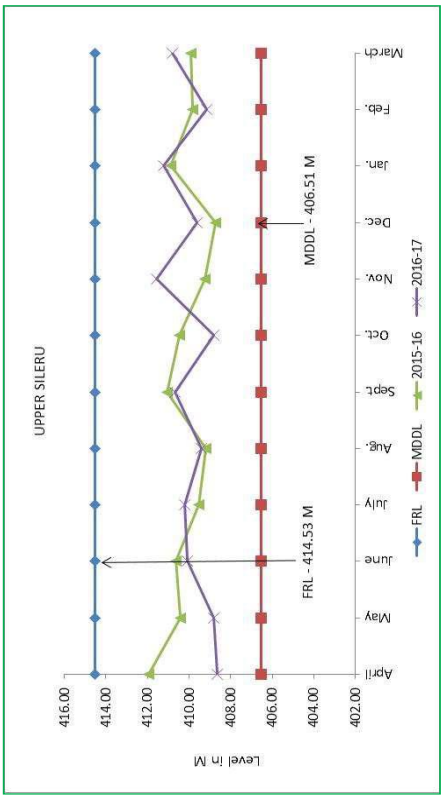
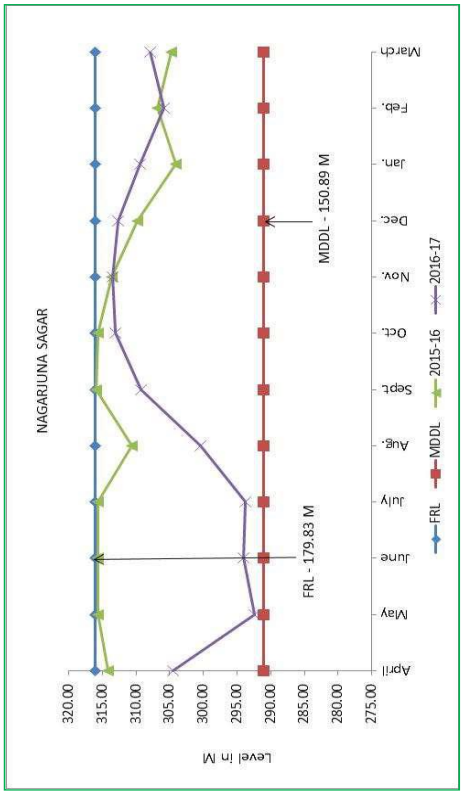
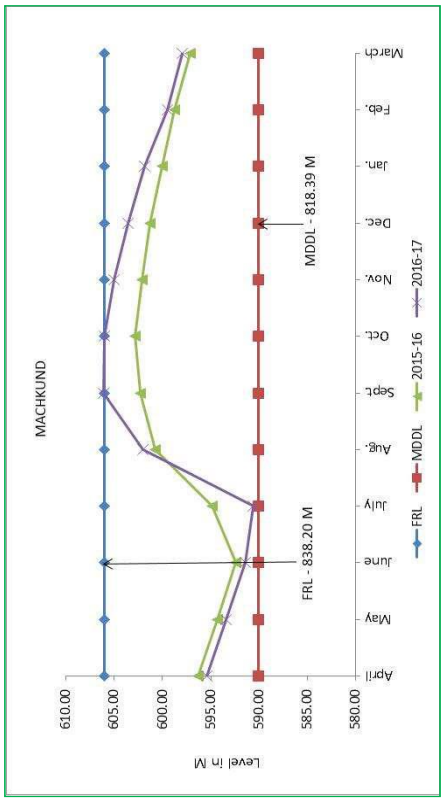


EXHIBIT 3.6

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







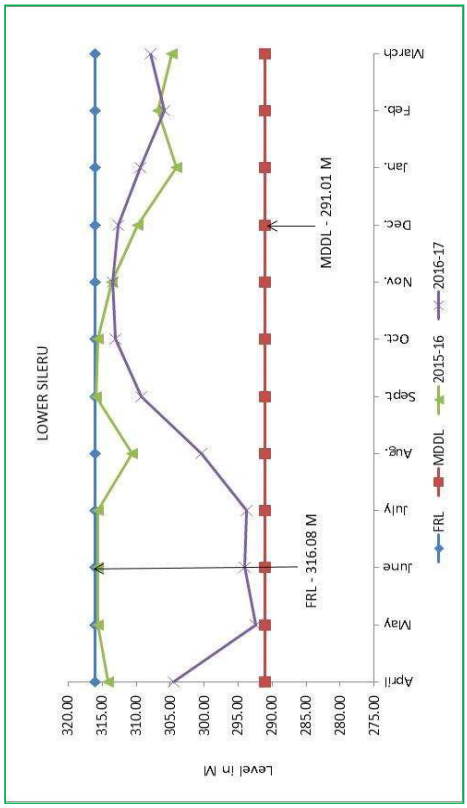
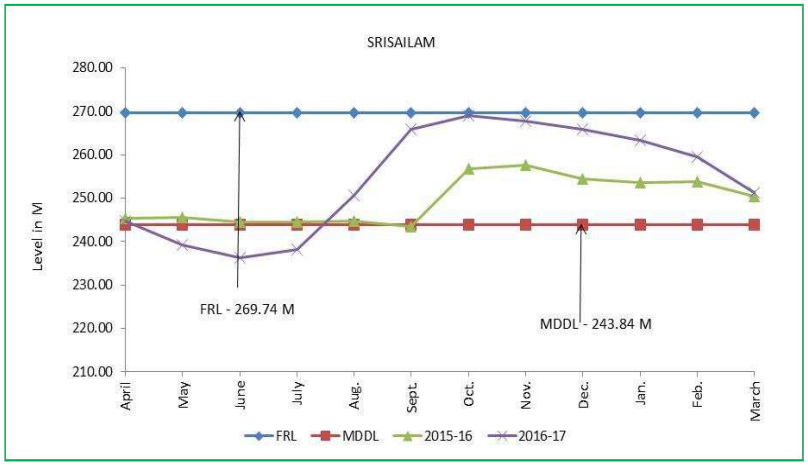
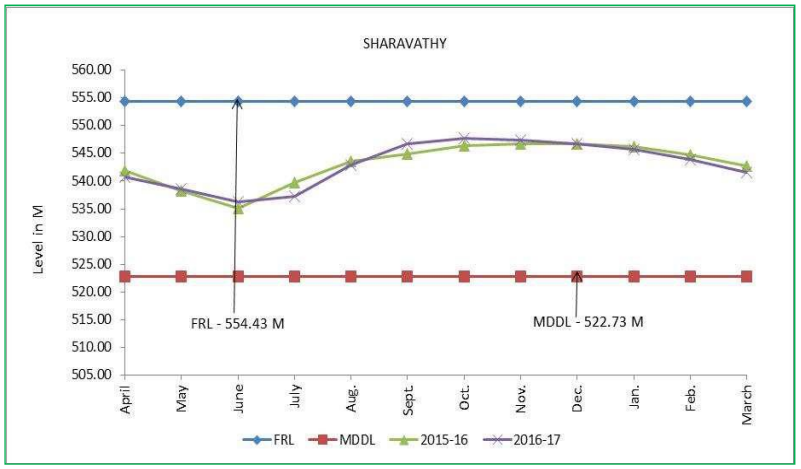
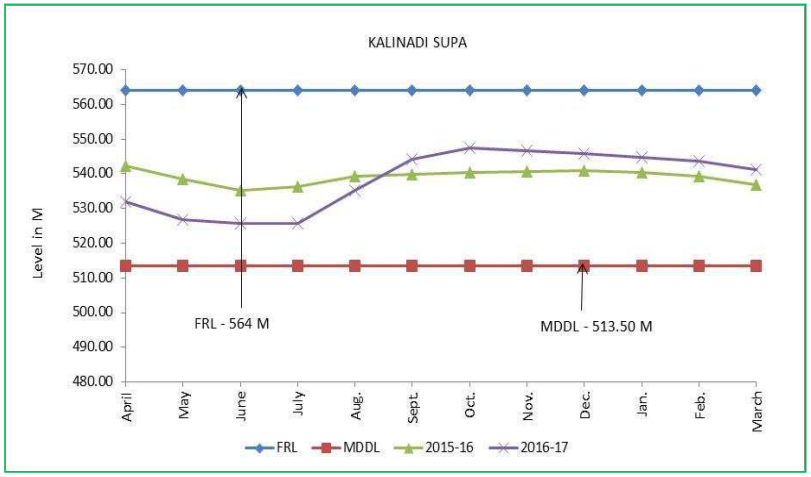


EXHIBIT 3.7

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







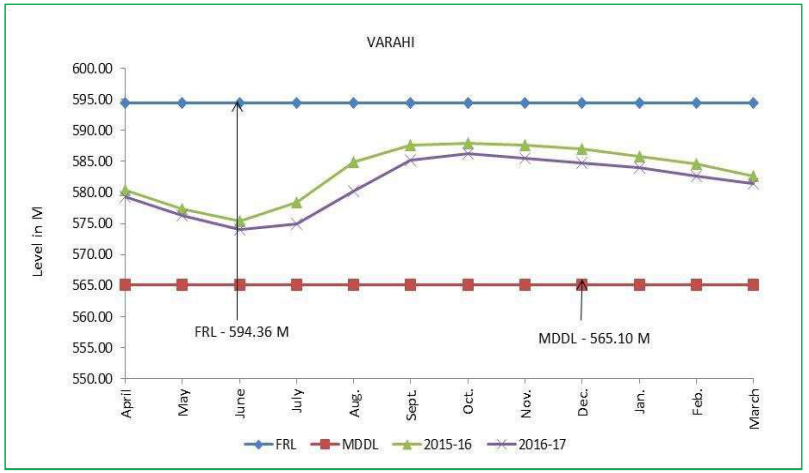
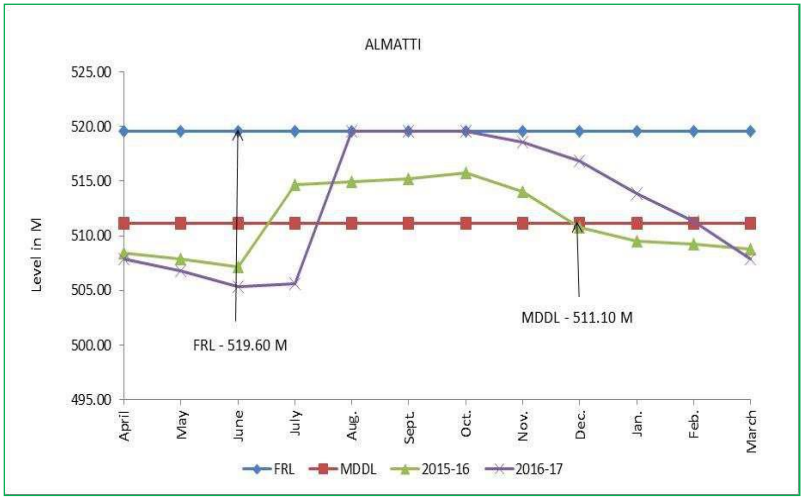
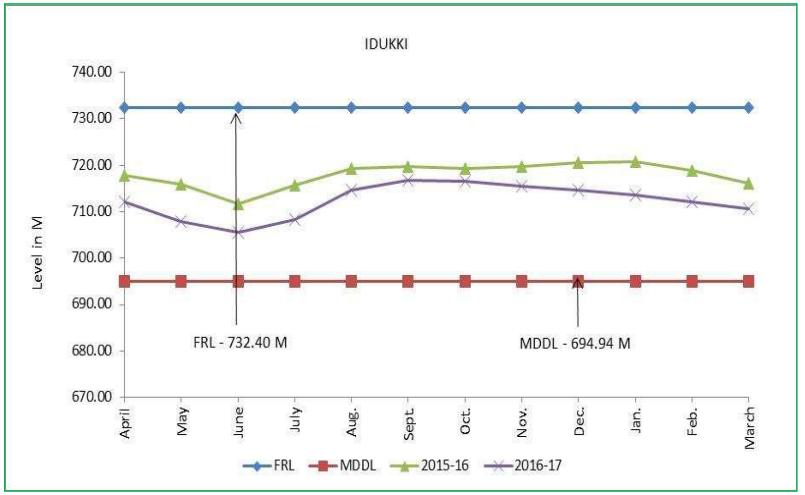
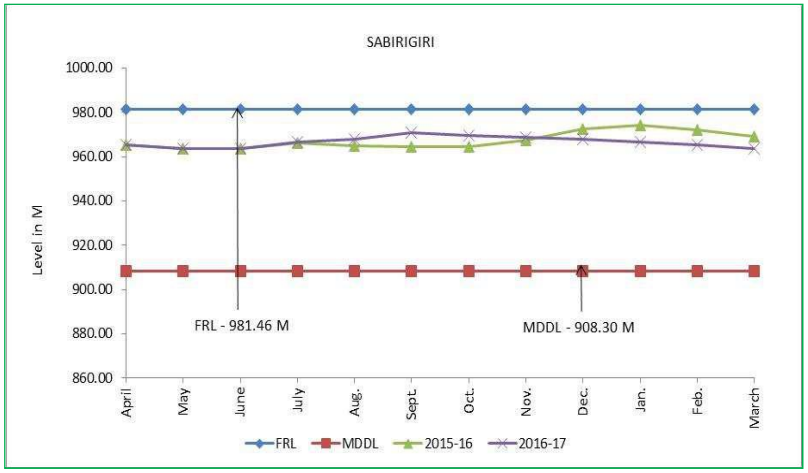


EXHIBIT 3.8

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







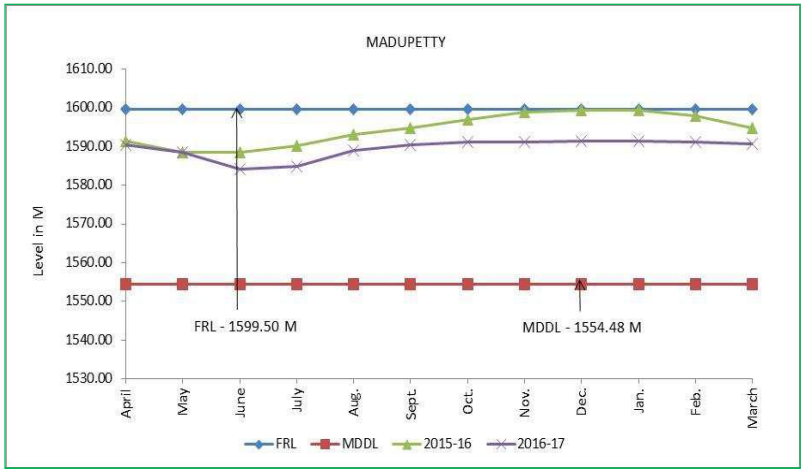
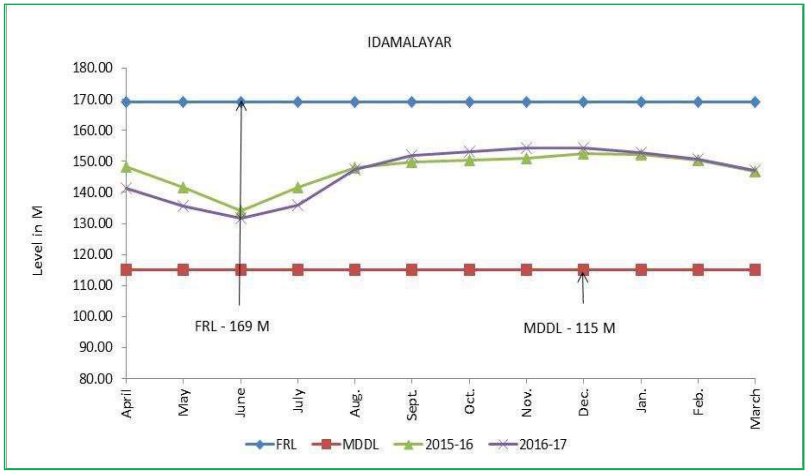
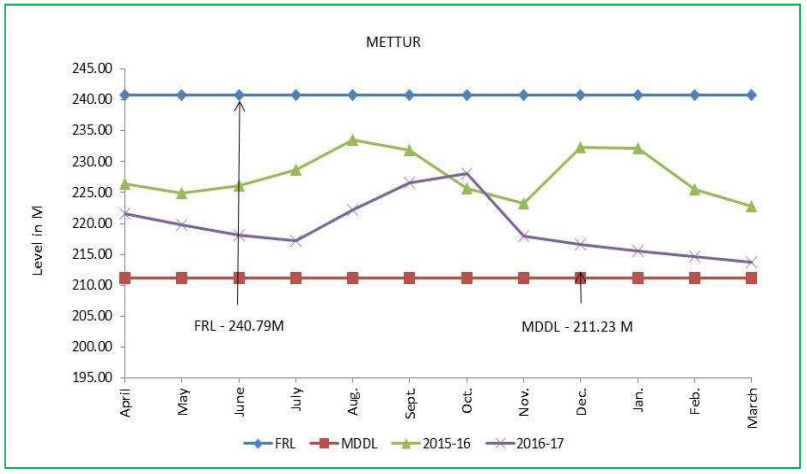
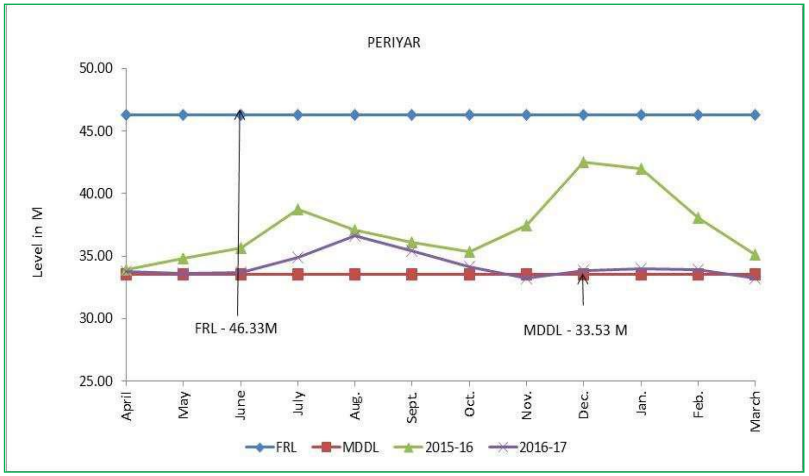


EXHIBIT 3.9

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







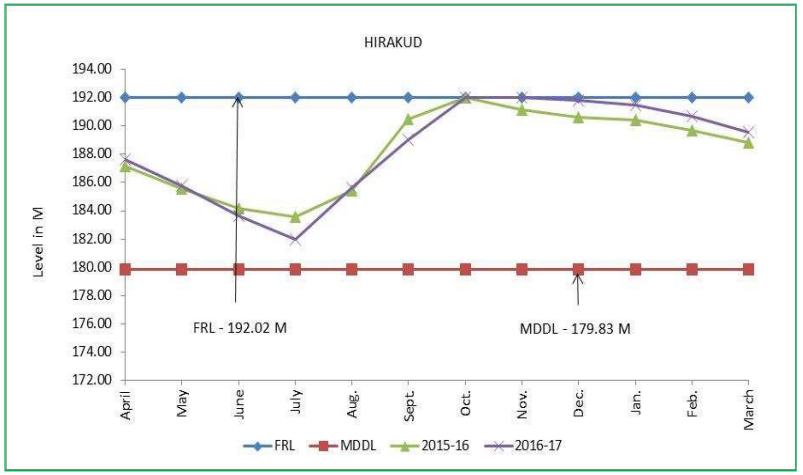
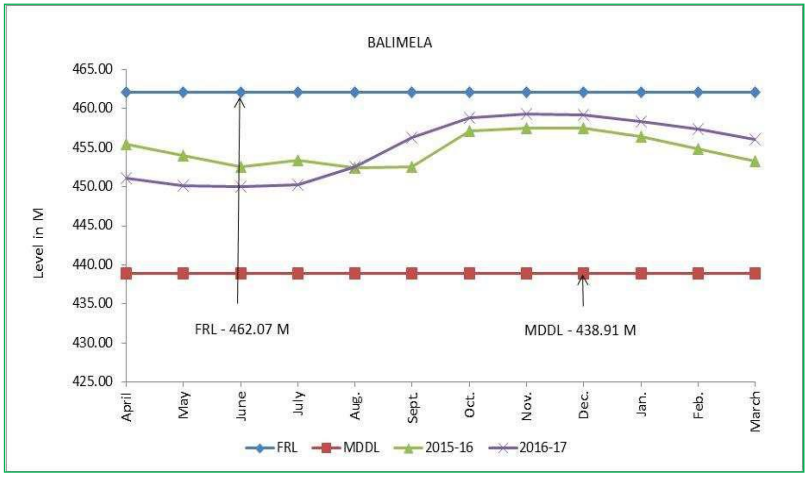
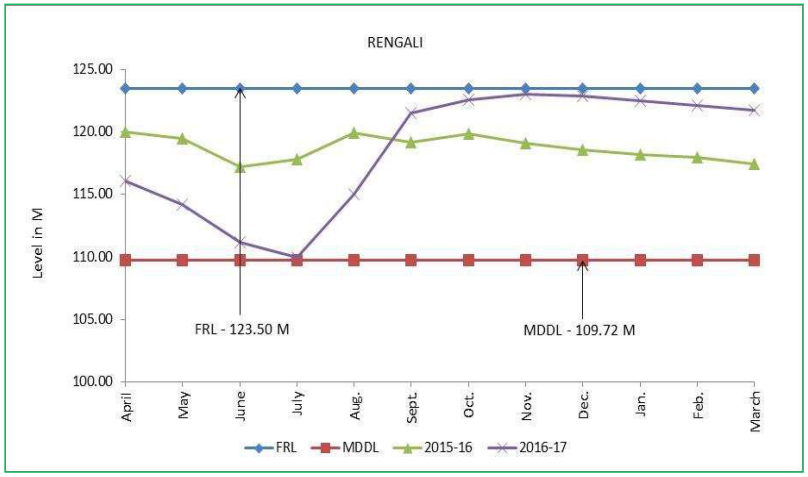
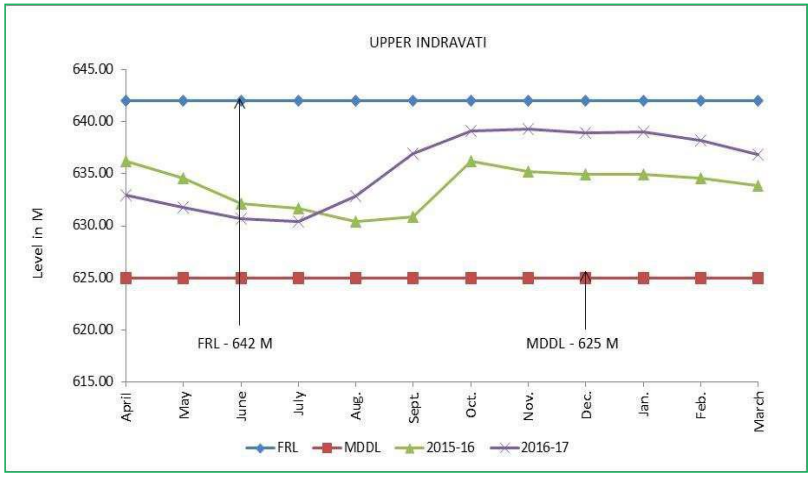


EXHIBIT 3.10

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS







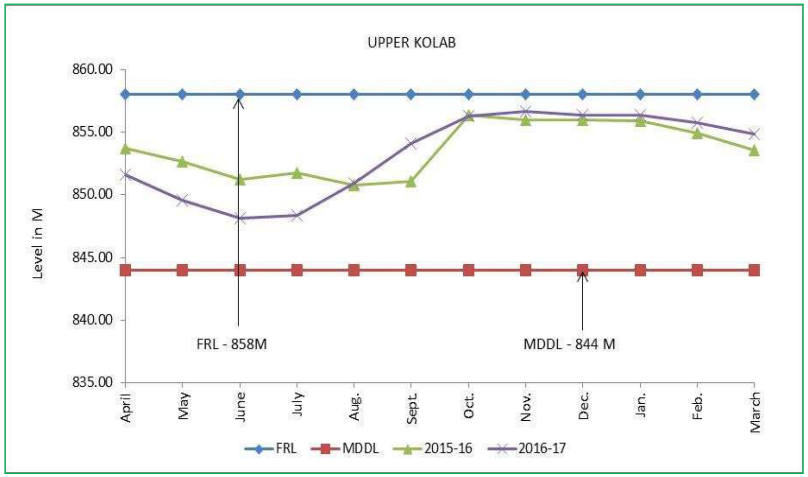
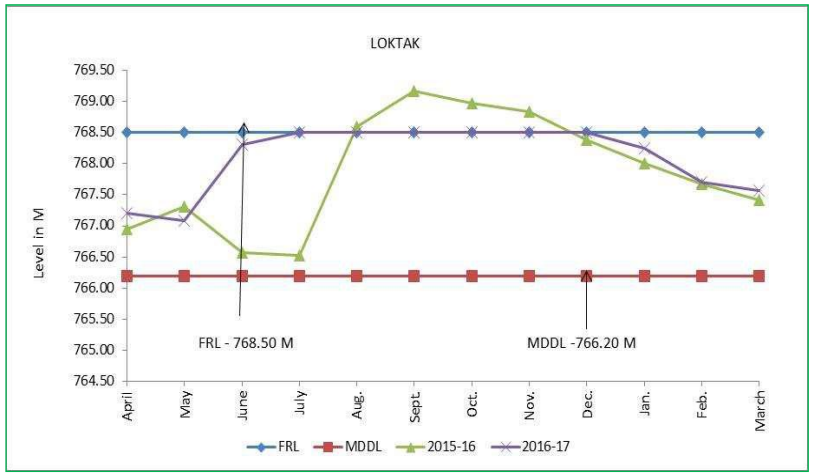


EXHIBIT 3.11

MONTH-WISE MAXIMUM LEVEL OF IMPORTANT RESERVOIRS



3.5 Generation

Generation from reservoir (storage) based H.E. Stations during the year, apart from priorities of releases for other purposes like irrigation, drinking water etc., depends on various factors such as water level of the reservoir at the end of the preceding year, inflows during the year, draw down level by the end of the year, availability of generating units etc. In 12 Nos. out of 37 Nos. reservoir based hydel stations, annual generation during the year 2016-17 was more than the annual generation targets. Generation from 43 H.E. Stations on 37 major reservoirs during the year 2016-17 has been 40323 MU showing decrease in 4.79% over the 2015-16 generation of 42353 MU. Station-wise generation of reservoir stations during the year 2016-17 compared to that of last year 2015-16 is shown in **Table 3.2** above. The reservoir based stations have been grouped in terms of percentage achievement of generation over targets in **Table 3.3** below:

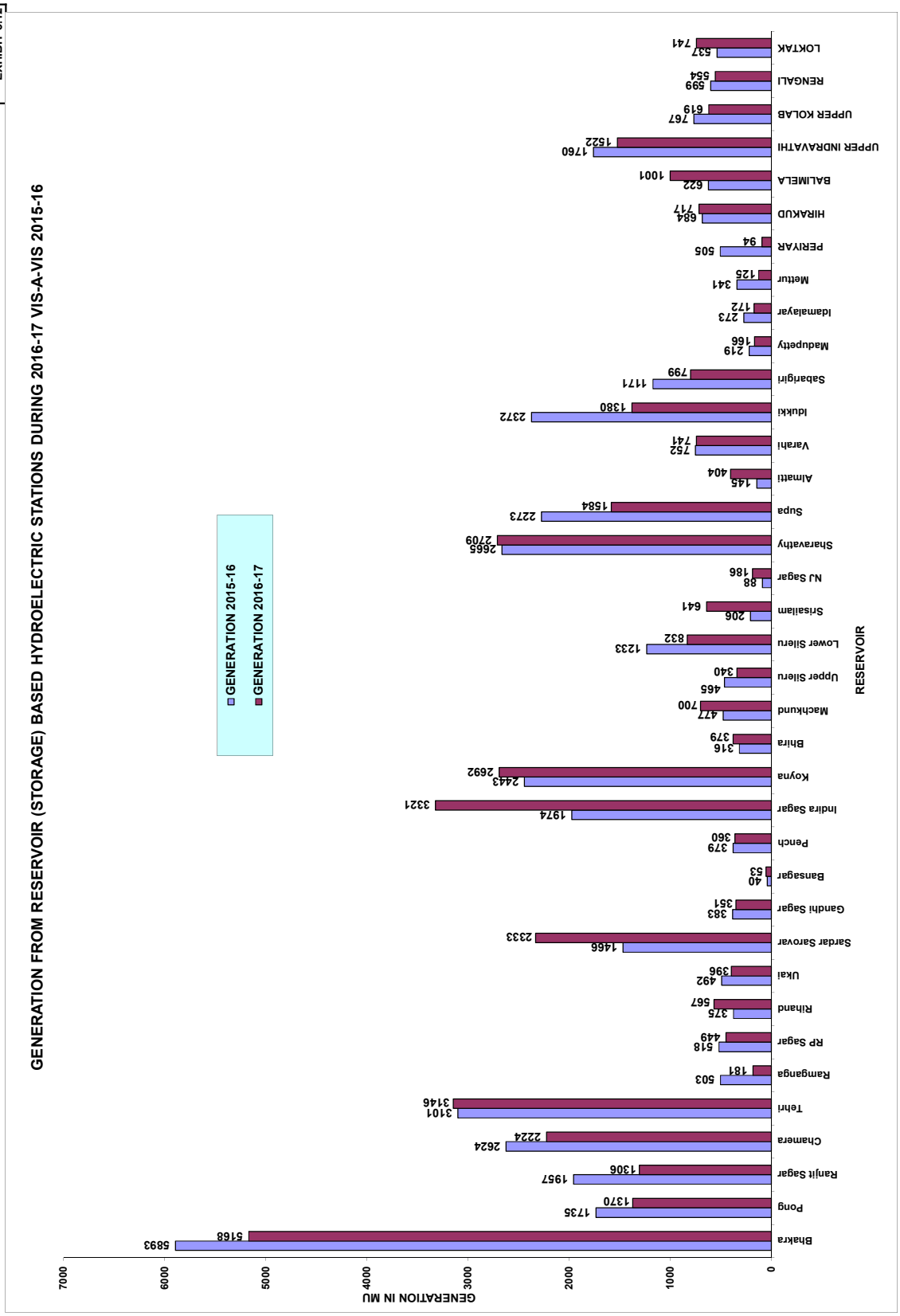
TABLE 3.3

GENERATION PERFORMANCE OF MAJOR RESERVOIR BASED STATIONS

S. No.	% of Actual Generation over Target	Reservoir based Stations		
		No.	% of total Reservoir based Stations	Name
1	120 & Above	7	18.92	Pong, RP Sagar, Gandhi Sagar, Bansagar, Indira Sagar, Machkund, Loktak.
2	110 - 120	1	2.70	Rihand.
3	100 - 110	4	10.81	Bhakra, Tehri, Pench, Bhira.
4	Below 100	25	67.57	Ranjit Sagar, Chamera, Ramganga, Ukai, Sardar Sarovar, Koyna, Upper Sileru, Lower Sileru, NJ Sagar, Srisailam, Sharavathy, Supa, Almatti, Varahi, Idukki, Sabarigiri, Madupetty, Idamalayar, Mettur, Periyar, Hirakud, Balimela, Rengali, Upper Indravati, Upper Kolab.

Generation of major reservoir based H.E. stations during 2016-17 as compared to the generation during last year i.e. 2015-16 is also depicted at **Exhibit-3.12**.

EXHIBIT-3.12


GENERATION FROM RESERVOIR (STORAGE) BASED HYDROELECTRIC STATIONS DURING 2016-17 VIS-A-VIS 2015-16
GENERATION 2015-16
GENERATION 2016-17
GENERATION IN MU
RESERVOIR
0
1000
2000
3000
4000
5000
6000
7000
Bhakra 5168 5893
Pong 1370 1735
Ranjit Sagar 1306 1957
Chamera 2224 2624
Tehri 3101 3146
Ramganga 181 503
RP Sagar 518 449
Rihand 375 567
Ukai 492 396
Sardar Sarovar 1466 2333
Gandhi Sagar 383 351
Bansagar 40 53
Pench 379 360
Indira Sagar 1974 3321
Koyna 2443 2692
Bhira 316 379
Machkund 477 700
Upper Sileru 465 340
Lower Sileru 1233 832
Srisailam 206 641
NJ Sagar 88 186
Sharavathy 2665 2709
Supa 2273 1584
Almatti 145 404
Varahi 752 741
Idukki 2372 1380
Sabarigiri 1171 799
Madupetty 219 166
Idamalayar 273 172
Mettur 341 125
PERIYAR 505 94
HIRAKUD 717 684
BALIMELA 622 1001
UPPER INDRAVATHI 1760 1522
UPPER KOLAB 767 619
RENGALI 554 599
LOKTAK 537 741

Annex.-3.1

SALIENT DETAILS OF IMPORTANT RESERVOIRS AND ASSOCIATED H.E. STATIONS

S. No	NAME OF RESERVOIR AND ASSOCIATED HE STATIONS	INSTALLED CAPACITY AS ON 31.03.2017	ANNUAL DESIGN ENERGY	FULL RESER-VOIR LEVEL	MINIMUM DRAW DOWN LEVEL	RESERVOIR CAPACITY AT FRL		ENERGY CONTENT AT FRL	LEVELS ATTAINED DURING 2016-17			
						GROSS :	LIVE		Max.	DATE	Minimum	DATE
		(MW)	(MU)	(M)	(M)	(MCM)	(MCM)	(MU)	(M)		(M)	
NORTHERN REGION												
1	Bhakra	1325.00	3924	513.59	445.62	8321	6516	1729.00	503.15	15.09.2016	464.38	31.03.2017
a	Bhakra Left	540.00	3924									
b	Bhakra Right	785.00										
2	Pong	396.00	1123	426.72	384.05	8053	6946	1084.00	418.05	12.09.2016	389.04	09.06.2016
3	Chamera	540.00	1665	760.00	749.20		87		760.00	27.10.2016	750.25	09.07.2016
4	Ranjit Sagar	600.00	1507	527.91	487.91	3292	2191	390.00	521.74	04.09.2016	496.02	15.04.2016
5	Tehri	1000.00	2797	829.79	740.04	3540	2615	1291.49	824.85	03.10.2017	741.00	06.05.2016
6	Ramganga	198.00	334	366	323	2503.96	2109.25	480.80	350.94	11.11.2016	321.96	16.06.2016
7	Rana Pratap Sagar	172.00	459	352.81	343.83	2901	1569	175.66	352.81	10.10.2016	346.13	16.03.2017
8	Rihand	300.00	920	268.22	252.98	10605	5723	1177.00	265.97	05.09.2016	255.48	04.07.2016
	Sub-Total NR	**4531.00**										
WESTERN REGION												
9	Ukai	300.00	1080	105.16	82.30	8515	6615	813.00	104.46	10.12.2016	86.48	30.06.2016
10	Sardar Sarovar	1200.00	3635	138.68	110.18	9460	5760	1817.553	125.89	10.08.2016	114.81	12.07.2016
11	Gandhi Sagar	115.00	420	399.90	381.00	7743	6911	725.00	399.97	09.10.2016	391.42	30.06.2016
12	Bansagar	60.00	143	341.64	323.10		4934		341.64	28.09.2016	332.59	22.06.2016
13	Pench	160.00	315	490.00	464.00		1045		487.57	05.09.2016	469.04	01.07.2016
14	Indira Sagar	1000.00	1980	262.13	243.23	12237	9706	1316.12	262.13	30.10.2016	246.83	02.07.2016
15	Koyna	1636.00	3176	657.91	609.60	2797	2677	3126.00	659.20	18.09.2016	620.00	30.06.2016
a	Koyna-I & II	600.00	3030									
c	Koyna-IV	1000										
d	Koyna DPH	36	146									
16	Bhira*	150	775	606.05	590.09	523	522	619	606.10	19.09.2016	590.18	23.06.2016
	Sub-Total WR	**4621.00**										
SOUTHERN REGION												
17	Upper Sileru	240.00	529	414.53	406.51		88		411.91	31.10.2016	407.37	01.11.2016
18	Lower Sileru	460.00	1070	316.08	291.01		365		313.79	04.11.2016	291.45	21.05.2016
19	Srisailam	770.00	2900	269.74	243.84	8723	7166	1548.00	269.17	07.10.2016	236.23	01.06.2016
20	Nagarjuna Sagar	815.60	2393	179.83	150.89	11560	6538	1398.00	164.96	24.10.2016	153.44	28.07.2016
21	Sharavathy	1035.00	4932	554.43	522.73	5310	4297	4394.00	547.88	15.10.2016	534.85	21.06.2016
22	SUPA	955.00	3927	564.00	513.50	4178	3758	3927.00	547.67	17.10.2016	524.46	23.06.2016
23	Almatti	290.00	483	519.60	511.10	2631.50	2628.00	175.30	519.60	31.07.2016	504.96	31.03.2017

SALIENT DETAILS OF IMPORTANT RESERVOIRS AND ASSOCIATED H.E. STATIONS

S. No	NAME OF RESERVOIR AND ASSOCIATED HE STATIONS	INSTALLED CAPACITY AS ON 31.03.2017	ANNUAL DESIGN ENERGY	FULL RESER-VOIR LEVEL	MINIMUM DRAW DOWN LEVEL	RESERVOIR CAPACITY AT FRL		ENERGY CONTENT AT FRL	LEVELS ATTAINED DURING 2016-17			
						GROSS :	LIVE		Max.	DATE	Minimum	DATE
		(MW)	(MU)	(M)	(M)	(MCM)	(MCM)	(MU)	(M)		(M)	
24	Varahi	460.00	1060	594.36	565.10		881.50		586.43	03.10.2016	572.62	22.06.2016
25	Idukki	780.00	2398	732.40	694.94	1996	1459	2146.00	716.93	04.09.2016	705.37	04.06.2016
26	Sabirigiri	300.00	1338	981.46	908.30	454	447	764.00	970.95	06.09.2016	963.35	31.03.2017
27	Madupetty	37.50	284	1599.50	1554.48		55.32	77.40	1591.55	23.10.2016	1583.00	08.06.2016
28	Idamalayar	75.00	380	169.00	115.00		1017.80	254.45	154.37	14.11.2016	131.12	08.06.2016
29	Mettur	250.00	541	240.79	211.23	2708.80	2645.20	204.00	230.94	20.09.2016	212.62	31.03.2017
30	Periyar	140.00	409	46.33	33.53	443	299	216	36.61	19.07.2016	33.20	31.03.2017
	Sub-Total SR	**6608.10**										
EASTERN REGION												
31	Machkund	114.75	670	838.20	818.39	970	893	552.00	837.53	31.10.2016	826.43	25.06.2016
32	Hirakud	347.50	684	192.02	179.83	4823	4709	372.00	192.09	16.10.2016	181.80	05.07.2016
33	Balimela	510.00	1183	462.07	438.91	3929	2676	898.00	459.76	17.10.2016	449.95	06.06.2016
34	Upper Indravati	600.00	1962	642.00	625.00	2300	1485.50	1213.14	639.75	13.10.2016	629.50	27.06.2016
35	Upper Kolab	320.00	832	858.00	844.00	1215	935.00	540	856.82	14.10.2016	847.30	23.06.2016
36	Rengali	250.00	525	123.50	109.72	3548	3167.81	275	123.10	16.11.2016	109.98	04.07.2016
	Sub-Total ER	**2142.25**										
NORTH EASTERN REGION												
37	Loktak	105	448	768.50	766.20	435.91	396.44	250	768.50	01.07.2016	766.88	16.05.2016
	Sub-Total NER	**105**										
	Total All India	**18007.35**										

Note: *includes DE of PSS also.

CHAPTER-4

PLANNED MAINTENANCE OF HE UNITS

CHAPTER-4

PLANNED MAINTENANCE OF HE UNITS

4.1 For the purpose of studies and analysis of performance in respect of availability of H.E. Stations, outage data of 695 generating units installed in 200 Hydro Electric Stations was made available by various Organizations. The studies indicate that a total of 406944 hours were utilized for carrying out various types of planned maintenance works to facilitate healthy running of generating units. Details of long duration planned outages (50 hours and above) are given in **Annex-4.1**.

4.2 It is observed that capital maintenance was carried out for 34 generating units whereas annual maintenance was carried out for 281 generating units Analysis of various types of planned maintenance indicates that while most of the planned outages were for periodic maintenance, many of these outages were for carrying out certain repairs/modification works also. Details of duration of periodic planned maintenance of generator, turbine, auxiliary equipments and civil structures etc. are indicated below in **Table 4.1**.

TABLE 4.1

DURATION OF PERIODIC PLANNED MAINTENANCE
PERIOD: 2016-17

S. No.	Type of Maintenance	Duration (Hours)	
		Max. for any unit	Average
1	Capital Maintenance	6039.00	1794.98
2	Annual Maintenance	2593.27	611.16
3	Half Yearly Maintenance	13.17	9.08
4	Quarterly Maintenance	1216.00	630.12
5	Monthly Maintenance	1468.33	58.09
6	Routine Maintenance	1029.67	50.10
7	Renovation/ Modernisation & Uprating	8736.00	886.65
8	Civil Structure	2999.13	197.98
9	Turbine	2185.75	78.32
10	Generator	2797.15	146.70
11	Other Equipment	2797.15	139.76
12	Miscellaneous planned maintenance	1296.9	121.12

4.3 There were a total of 1589 planned outages during the Year 2016-17, out of which about 62.11% were of duration up to 24 hours, while 23.67% of the planned outages were of duration for more than 10 days. Details giving duration pattern of planned maintenance is indicated in **Table 4.2** and illustrated in **Exhibit 4.1**.

TABLE 4.2

DURATION PATTERN OF PLANNED OUTAGE
PERIOD: 2016-17

Sl. No.	Duration	Number of Outage	Maintenance % to total number of Outages
1	Less than 6 hours	445	28.01
2	6 to 24 hours	542	34.11
3	1 to 10 days	226	14.22
4	More than 10 days	376	23.66
	Total No. of Outages	**1589**	**100**

4.4 Planned Maintenance age-wise

Planned maintenance carried out for different age groups of hydro generating units during the year 2016-17 is indicated in **Table 4.3**.

TABLE 4.3

PLANNED MAINTENANCE AGE-WISE
PERIOD: 2016-17

Sl. No.	Year of Commissioning	No. of Units	Installed Capacity (MW)	Planned Outages (Hours)	Non-Availability Per Unit (Hours)
1	2016-2017	18	1659.00	216	12.00
2	2015-2016	17	1516.00	1368	80.47
3	2010-11 to 2014-15	62	4417.02	38952	628.26
4	2005-06 to 2009-10	66	7077.00	29328	444.36
5	2000-01 to 2004-05	75	6766.8	33360	444.80
6	1989-90 TO 1999-2000	87	5775.70	43176	496.28
7	1978-79 TO 1988-89	124	7259.10	61800	498.39
8	1967-68 TO 1977-78	82	5304.75	48312	589.17
9	Up to 1966-67	164	4703.05	150432	917.27
	Total	**695**	**44478.42**	**406944**	**585.53**

It is seen that the average non-availability of units due to planned maintenance was maximum in case of units commissioned up to 1966-67 (917.27 hrs. /unit).

4.5 Analysis based on Planned Maintenance of different types of Turbines

The details regarding non-availability of generating units due to planned maintenance for different types of turbines are indicated in **Table 4.4** given below.

TABLE 4.4

PLANNED MAINTENANCE-TURBINE TYPE-WISE
PERIOD: 2016-17

Sl. No.	Type of Turbine	No. of Units	Installed Capacity (MW)	Planned Outages (Hours)	Non-Availability Per Unit (Hours)
1	Bulb	26	684.00	6504	250
2	Francis & Reversible	403	31620.32	256872	637
3	Kaplan	126	4401.20	103296	820
4	Pelton	140	7772.90	40272	288
	Total	**695**	**44478.42**	**406944**	**586**

The average non-availability due to planned maintenance was maximum for Kaplan turbine at 819.81 hrs./unit followed by Pelton units at 287.66 hrs. /unit, while it was minimum for Bulb units at 250.15 hrs. /unit.

4.6 Analysis Based on Make of Generating Units

About 48% of the installed capacity of Hydro has been sourced from indigenous suppliers, with BHEL alone, accounting for about 42% of the capacity. The remaining 52% has been imported from various countries like Japan, Canada, UK and France etc. The non-availability due to planned maintenance has been analyzed for generating units both indigenous and imported based on their make/supplier. The details are given below in **Table 4.5**:

TABLE 4.5

PLANNED MAINTENANCE-SUPPLIER-WISE
PERIOD: 2016-17

Name of Supplier	No. of Units		Installed Capacity		Non- Availability due to Planned Maintenanace	
	No.	% of total	MW	% of total	Total Hours	Hours/Unit
A-Indigenous						
BHEL	292	42.01	18656.02	41.94	184056	630.33
Others	40	5.76	2635.50	5.93	9360	234.00
Sub Total	**332**	**47.77**	**21291.52**	**47.87**	**193416**	**582.58**
B-Imported						
USA	9	1.29	351.00	0.79	6120	680.00
U.K.	63	9.06	1242.10	2.79	54264	861.33
France	33	4.75	2186.40	4.92	9240	280.00
Canada	44	6.33	3132.00	7.04	15384	349.64
USSR	26	3.74	2804.00	6.30	26136	1005.23
Switzerland	22	3.17	815.20	1.83	6576	298.91
Japan	76	10.94	6344.20	14.26	53256	700.74
Other	90	12.95	6312.00	14.19	42552	472.80
Sub Total	**363**	**52.23**	**23186.90**	**52.13**	**213528**	**588.23**
Total	**695**	**100**	**44478.42**	**100**	**406944**	**585.53**

It is observed that during the year 2016-17, average non-availability due to planned maintenance of the units supplied by BHEL was 630.33 hrs./unit.

Among the imported generating units, the average non-availability due to planned maintenance was the least for units supplied by France (280 hrs/unit) and was maximum for units supplied by USSR (1005.23 hrs./unit).

4.7 Planned Maintenance – Region-wise

Region-wise non-availability of units due to planned maintenance in respect of various hydro power stations is indicated below in **Table 4.6**.

TABLE 4.6

REGION-WISE PLANNED MAINTENANCE
PERIOD: 2016-17

S. No.	Region	No. of Units	Installed Capacity (MW)	% Non-availability due to Planned Maintenance
1	Northern	239	18527.27	8.37
2	Western	101	7392.00	3.86
3	Southern	246	11658.70	4.14
4	Eastern	80	5658.45	8.82
5	North Eastern	29	1242.00	3.62
	All India	**695**	**44478.42**	**6.43**

The non-availability of generating unit due to planned maintenance was least in North-Eastern Region (3.62%) followed by Western Region at 3.86%, whereas it was maximum in Eastern Region (8.82 %) followed by Northern Region (8.37%).

The average non-availability of hydro electric units due to planned maintenance during the year 2016-17 was 6.43% as compared to 7.21% during the year 2015-16.

4.8 Planned Maintenance – Station-wise

The number of H.E. Stations falling under various ranges of non-availability due to planned maintenance during the year 2016-17 vis-à-vis 2015-16 is summarized below in **Table 4.7.**

TABLE 4.7

NON-AVAILABILITY OF HE STATIONS DUE TO PLANNED OUTAGES
(2016-17 VIS-A-VIS 2015-16)

% Non-Availability due to planned maintenance	2016-17				2015-16			
	Stations		Capacity		Stations		Capacity	
	No.	% of Total	MW	% of Total	No.	% of Total	MW	% of Total
≤ 5	116	58.00	26069.87	58.61	94	48.45	21734.12	50.80
>5 to 10	44	22.00	8947.20	20.12	50	25.77	11240.35	26.27
>10 to 15	13	6.50	2461.15	5.53	24	12.37	3434.20	8.03
>15 to 20	16	8.00	4241.40	9.54	11	5.67	2923.75	6.83
>20 to 25	3	1.50	1230.00	2.77	5	2.58	1100.10	2.57
>25 to 30	2	1.00	681.00	1.53	4	2.06	990.00	2.31
above 30	6	3.00	847.80	1.91	6	3.09	1360.60	3.18
Total	**200**	100	**44478.42**	100.00	**194**	100	**42783.4**	**100**

It could be seen from above that 116 nos. (58% of total) non-availability factor less than or equal to 5% due to planned maintenance during 2016-17 as compared to 94 nos. (48.45% of total) hydro-electric stations during 2015-16.

Non-availability due to planned maintenance was more than 30% at 6 nos. (3% of total) H.E. Stations during 2016-17 which is similar to 2015-16. The details of these stations for 2016-17 is given below in **Table 4.8.**

TABLE 4.8

H.E. STATIONS HAVING HIGH PLANNED MAINTENANCE FOR THE PERIOD: (2016-17)

Sl. No	Name of Station	Capacity (MW)	N.A. due to P.M.* (%)	Reasons
1	Rihand HPS	300.00	55.25	R&MU and stator winding fault
2	Rajghat HPS	45.00	43.93	Annual Maintenance, Capital Maintenance.
3	GanguwalL HPS	77.65	34.85	R&MU works
4	Kotla HPS	77.65	34.32	R&MU works
5	Hirakud-I HPS	275.50	32.98	R&MU works
6	Hirakud-II HPS	72.00	37.87	R&MU works

*** N.A.** -Non availability, **P.M.-** Planned Maintenance

42% of stations had operational availability lower than 95% on account of planned maintenance alone against the normative design/plan annual availability of 95% total during the entire station life. These utilities need to improve their O&M practices to bring down their total outages i.e. planned & forced to less than 5% as per best practices.

It is observed from above that stations may be having high planned maintenance outages on account of ageing, O&M management issues, undertaking of R&M works, etc. Further, those stations which are having continuously high planned maintenance outages over past few years may be requiring major repair & maintenance works or Renovation & Modernisation (R&M) works for improving the availability, reliability & security of the plant besides providing life extension where the assets have outlived their useful life.

4.9 Planned Maintenance – Utility-wise/Sector-wise

Performance of hydro electric units under various utilities in Central Sector, State Sector, and Private Sector with respect to non-availability due to planned maintenance is indicated in **Table 4.9**.

In case of Central Sector, non-availability due to planned maintenance was maximum under BBMB (1578.86 hrs./unit).

In case of State Sector, non-availability due to planned maintenance was maximum under UPVJNL (2273.60 hrs./unit).

In case of Private Sector, non-availability due to planned maintenance was maximum under GBHPPL (1632 hrs./unit).

It is also observed that the average duration of planned maintenance in respect of H.E. Stations in Central Sector, State Sector and Private Sector is 773.02 hrs./Unit 563.01 hrs./Unit and 196.80 hrs./Unit respectively.

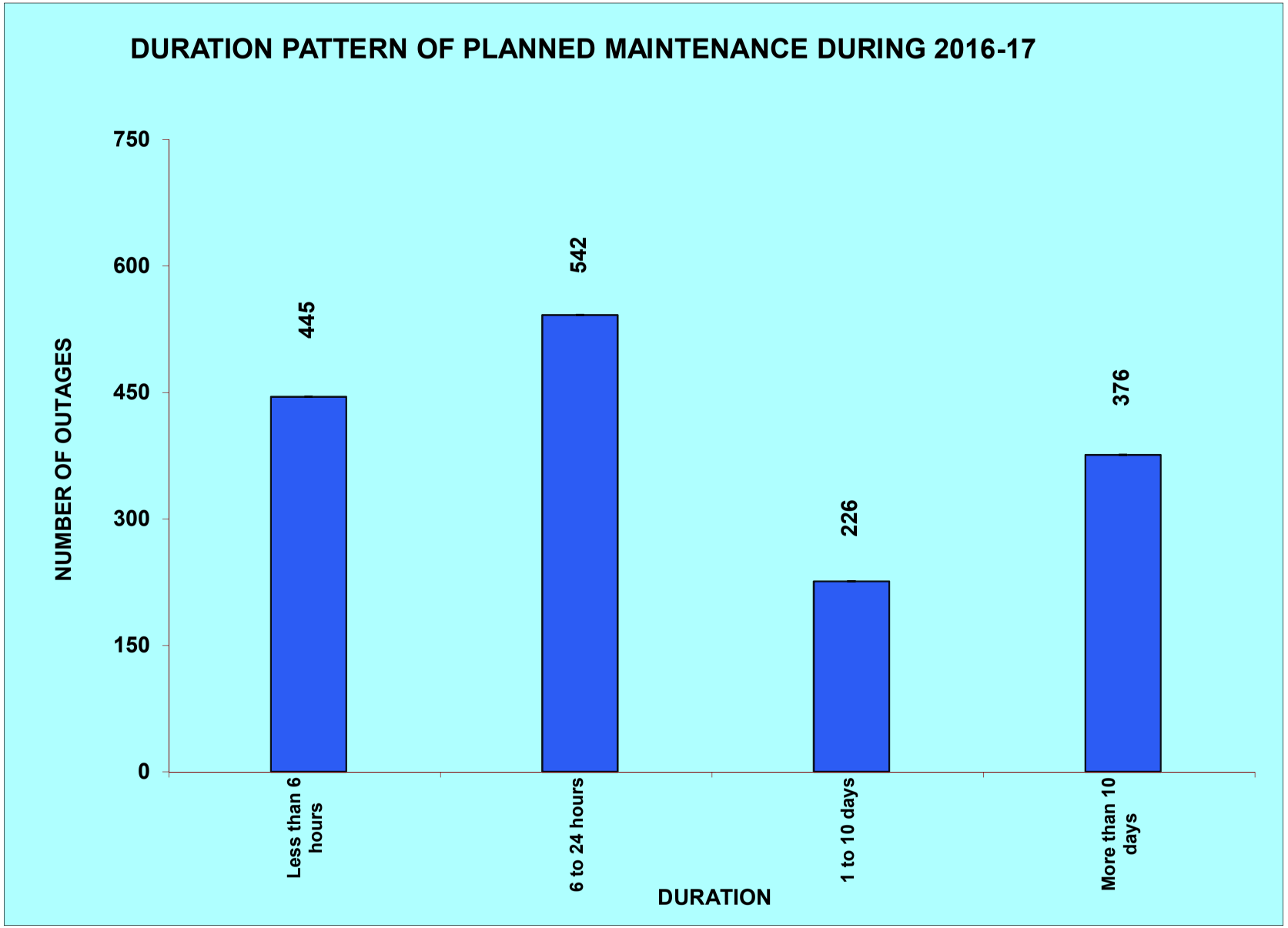
TABLE 4.9

SECTOR-WISE/ UTILITY-WISE PERFORMANCE PLANNED MAINTENANCE
PERIOD: 2016-17

Sl. No.	Organization	No. of Units	Installed Capacity (MW)	Planned Maintenance (Hours)	Planned Maintenance per Unit (Hours)
(A)	**Central Sector**				
1	BBMB	28	2866.30	44208	1578.86
2	DVC	5	143.20	4080	816.00
3	NEEPCO.	13	755.00	7248	557.54
4	NHDC	16	1520.00	5064	316.50
5	NHPC	67	5121.20	50904	759.76
6	NTPC LTD.	4	800.00	216	54.00
7	SJVNL	12	1912.02	2088	174.00
8	THDC	8	1400.00	4464	558.00
Sub Total (CS)		**153**	**14517.72**	**118272**	**773.02**
(B)	**Private Sector**				
1	ADHPL	2	192.00	1104	552.00
2	AHPC (GVK)	4	330.00	24	6.00
3	DEPL	2	96.00	0	0.00
4	DLHP	1	34.00	0	0.00
5	E.P.P.L.	2	100.00	1344	672.00
6	GBHPPL	2	70.00	3264	1632.00
7	GISL	2	99.00	1200	600.00
8	HBPCL	7	1300.00	288	41.14

Sl. No.	Organization	No. of Units	Installed Capacity (MW)	Planned Maintenance (Hours)	Planned Maintenance per Unit (Hours)
9	IAEPL	2	24.00	0	0.00
10	JPPVL	4	400.00	240	60.00
11	MPCL	2	86.00	0	0.00
12	TATA MAH.	15	447.00	1392	92.80
Sub Total (Pvt.)		**45**	**3178.00**	**8856**	**196.80**
(C)	**State Sector**				
1	APGENCO	30	1336.75	8064	268.80
2	APGPCL	2	100.00	0	0.00
3	CSPGCL	3	120.00	0	0.00
4	GSECL	8	540.00	0	0.00
5	HPPCL	3	195.00	24	8.00
6	HPSEB	12	372.00	552	46.00
7	JKSPDC	12	1110.00	120	10.00
8	JUUNL	2	130.00	0	0.00
9	KPCL	68	3585.40	24312	357.53
10	KSEB	48	1881.50	29544	615.50
11	MAHAGENCO	24	2406.00	6096	254.00
12	MEECL	11	282.00	4392	399.27
13	MPPGCL	23	875.00	19968	868.17
14	OHPC	31	2027.50	44184	1425.29
15	PSPCL	25	1051.00	15936	637.44
16	RRVUNL	11	411.00	4704	427.64
17	SSNNL	11	1450.00	5424	493.09
18	TNGDCL	70	2203.20	30720	438.86
19	TSGENCO	36	2766.60	4848	134.67
20	TUL	6	1200.00	0	0.00
21	UJVNL	34	1252.15	39792	1170.35
22	UPJVNL	15	501.60	34104	2273.60
23	WBSEDCL	12	986.00	7032	586.00
Sub Total (State)		**497**	**26782.70**	**279816**	**563.01**
All India		**695**	**44478.42**	**406944**	**585.53**

EXHIBIT-4.1


DURATION PATTERN OF PLANNED MAINTENANCE DURING 2016-17
NUMBER OF OUTAGES
750
600
450
300
150
0
445
542
226
376
Less than 6 hours
6 to 24 hours
1 to 10 days
More than 10 days
DURATION

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
NORTHERN REGION							
ADHPL							
1	ALLAIN DUHANGAN HPS	1	96	02/01/2017	23/01/2017	512.47	ANNUAL MAINTENANCE
		2	96	01/12/2016	25/12/2016	584.92	ANNUAL MAINTENANCE
BBMB							
2	BHAKRA H P S	1	108	28/12/2016	16/01/2017	466.08	ANNUAL MAINTENANCE
		1	108	12/05/2016	26/05/2016	351.77	TRI/TRC/DRAFT TUBE
		10	157	23/01/2017	10/02/2017	441.03	ANNUAL MAINTENANCE
		2	108	21/03/2017	31/03/2017	231.67	ANNUAL MAINTENANCE
		6	157	07/11/2016	31/03/2017	3447.58	CAPITAL/3 YEARLY MTCE.
		8	157	27/12/2016	29/12/2016	56.17	TURBINE MISC/GOVERNOR
		9	157	22/02/2017	15/03/2017	511.25	CAPITAL/3 YEARLY MTCE.
		9	157	30/12/2016	14/01/2017	367.27	ANNUAL MAINTENANCE
3	DEHAR H P S	2	165	21/03/2017	31/03/2017	240	CAPITAL/3 YEARLY MTCE.
		4	165	26/11/2016	19/12/2016	560.87	ANNUAL MAINTENANCE
4	GANGUWAL HPS	1	29.25	20/03/2017	23/03/2017	79	PLANNED MAINTENANCE
		1	29.25	19/12/2016	29/12/2016	241.87	ANNUAL MAINTENANCE
		1	29.25	20/06/2016	24/06/2016	102.58	PLANNED MAINTENANCE
		2	24.20	01/04.2016	31/03/2017	8760	RENOVATION/MODERNISATION
		3	24.20	25/07/2016	28/07/2016	80.92	PLANNED MAINTENANCE
		3	24.20	21/01/2017	24/01/2017	78.33	PLANNED MAINTENANCE
		3	24.20	24/10/2016	29/10/2016	122.17	PLANNED MAINTENANCE
		3	24.20	18/04/2016	25/04/2016	178.83	ANNUAL MAINTENANCE
5	KOTLA HPS	1	29.25	02/05/2016	04/05/2016	57.33	PLANNED MAINTENANCE
		1	29.25	08/08/2016	12/08/2016	108.83	PLANNED MAINTENANCE
		1	29.25	15/02/2017	22/02/2017	176.68	ANNUAL MAINTENANCE
		2	24.20	16/05/2016	22/05/2016	140.58	PLANNED MAINTENANCE
		2	24.20	26/02/2017	01/03/2017	80.18	PLANNED MAINTENANCE
		2	24.20	28/11/2016	07/12/2016	218.2	ANNUAL MAINTENANCE
		3	24.20	01/04.2016	31/03/2017	8760	RENOVATION/MODERNISATION
6	PONG H P S	1	66	02/03/2017	18/03/2017	388.75	ANNUAL MAINTENANCE
		3	66	20/03/2017	31/03/2017	256	ANNUAL MAINTENANCE
		5	66	14/02/2017	01/03/2017	368.42	ANNUAL MAINTENANCE
EPPL							
7	MALANA-II HPS	1	50	07/12/2016	04/01/2017	695.05	ANNUAL MAINTENANCE
		2	50	07/12/2016	04/01/2017	692.95	ANNUAL MAINTENANCE
GBHPPL							
8	BUDHIL HPS	1	35	13/12/2016	27/03/2017	2512.53	ANNUAL MAINTENANCE
		2	35	01/04/2016	02/05/2016	758	ANNUAL MAINTENANCE
HBPCL							
9	BASPA HPS	1	100	25/03/2017	28/03/2017	72.25	ROUTINE MAINTENANCE
		2	100	25/03/2017	28/03/2017	72.25	ROUTINE MAINTENANCE
		3	100	01/03/2017	04/03/2017	87	ANNUAL MAINTENANCE
		3	100	25/03/2017	28/03/2017	72.25	ROUTINE MAINTENANCE
HPSEB							
10	SANJAY HPS	2	40	16/12/2016	27/12/2016	270.83	MONTHLY MAINTENANCE
		3	40	16/12/2016	27/12/2016	270.83	PLANNED MAINTENANCE
JKSPDC							
11	BAGLIHAR HPS	2	150	09/04/2016	11/04/2016	58.17	AUXILIARY SYSTEM
JPPVL							
12	VISHNU PRAYAG HPS	3	100	21/12/2016	25/12/2016	102.28	ANNUAL MAINTENANCE
		4	100	21/11/2016	25/11/2016	106.07	ANNUAL MAINTENANCE
NHPC							

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
13	BAIRA SIUL HPS	1	60	21/06/2016	27/06/2016	145.32	TURBINE
		1	60	19/12/2016	06/01/2017	441.52	ANNUAL MAINTENANCE
		2	60	16/11/2016	15/12/2016	693.67	CAPITAL/3 YEARLY MTCE.
		3	60	16/01/2017	04/02/2017	466.43	ANNUAL MAINTENANCE
14	CHAMERA- I HPS	1	180	26/12/2016	05/01/2017	247	ANNUAL MAINTENANCE
		2	180	05/12/2016	16/12/2016	261.43	ANNUAL MAINTENANCE
		3	180	16/12/2016	24/12/2016	206.4	ANNUAL MAINTENANCE
15	CHAMERA- II HPS	1	100	28/11/2016	06/12/2016	200.07	ANNUAL MAINTENANCE
		2	100	09/12/2016	04/01/2017	615.95	CAPITAL/3 YEARLY MTCE.
		3	100	15/11/2016	25/11/2016	250.83	ANNUAL MAINTENANCE
16	CHAMERA-III HPS	1	77	01/02/2017	31/03/2017	1392	HRI/HRC/POWER CHANNEL
		2	77	01/02/2017	31/03/2017	1392	HRI/HRC/POWER CHANNEL
		3	77	01/02/2017	31/03/2017	1392	HRI/HRC/POWER CHANNEL
17	CHUTAK HPS	1	11	23/01/2017	16/02/2017	579.92	ANNUAL MAINTENANCE
		2	11	01/10/2016	22/11/2016	1256.55	ANNUAL MAINTENANCE
		3	11	30/12/2016	21/01/2017	534.27	ANNUAL MAINTENANCE
		4	11	05/11/2016	29/12/2016	1286.73	ANNUAL MAINTENANCE
18	DHAULI GANGA HPS	1	70	23/05/2016	01/06/2016	220.58	TURBINE
		3	70	08/12/2016	27/12/2016	463.82	ANNUAL MAINTENANCE
		4	70	15/11/2016	05/12/2016	475.97	PLANNED MAINTENANCE
19	DULHASTI HPS	1	130	02/01/2017	14/01/2017	297.57	ANNUAL MAINTENANCE
		2	130	20/01/2017	02/02/2017	322.68	ANNUAL MAINTENANCE
		3	130	08/12/2016	27/12/2016	445.65	ANNUAL MAINTENANCE
20	NIMMO BAZGO HPS	1	15	12/12/2016	27/12/2016	360.92	ANNUAL MAINTENANCE
		3	15	25/09/2016	14/10/2016	476.42	ANNUAL MAINTENANCE
21	PARBATI-III HPS	1	130	01/04/2016	26/07/2016	2797.15	STATOR
		1	130	23/03/2017	31/03/2017	192	PRESSURE SHAFT/PENSTOCK
		2	130	23/03/2017	31/03/2017	192	PRESSURE SHAFT/PENSTOCK
		2	130	17/12/2016	07/01/2017	513.5	ANNUAL MAINTENANCE
		3	130	18/05/2016	10/06/2016	549.68	MISCELLANEOUS
		3	130	09/11/2016	14/03/2017	2999.13	PRESSURE SHAFT/PENSTOCK
		3	130	11/05/2016	13/05/2016	67.88	TURBINE
		4	130	09/01/2017	21/03/2017	1718.33	ANNUAL MAINTENANCE
		4	130	06/06/2016	08/06/2016	53.15	TURBINE
		4	130	11/11/2016	17/12/2016	874.93	ANNUAL MAINTENANCE
22	SALAL HPS	1	115	10/10/2016	19/12/2016	1689.5	ANNUAL MAINTENANCE
		2	115	01/10/2016	25/01/2017	2780.98	CAPITAL/3 YEARLY MTCE.
		3	115	03/02/2017	20/02/2017	425.37	ANNUAL MAINTENANCE
		4	115	21/10/2016	06/12/2016	1107.7	ANNUAL MAINTENANCE
		5	115	08/12/2016	26/01/2017	1187.33	ANNUAL MAINTENANCE
		6	115	21/12/2016	31/03/2017	2388.5	CAPITAL/3 YEARLY MTCE.
23	SEWA-II HPS	1	40	18/11/2016	01/12/2016	331.42	ANNUAL MAINTENANCE
		2	40	06/12/2016	21/12/2016	369.17	ANNUAL MAINTENANCE
		3	40	30/12/2016	05/01/2017	162.1	ANNUAL MAINTENANCE
24	TANAKPUR HPS	1	31.4	01/04/2016	10/06/2016	1696.92	CAPITAL/3 YEARLY MTCE.
		1	31.4	27/03/2017	31/03/2017	86	PLANNED MAINTENANCE
		2	31.4	10/12/2016	24/03/2017	2505.72	ANNUAL MAINTENANCE
		3	31.4	01/12/2016	06/01/2017	864.47	ANNUAL MAINTENANCE
25	URI-I HPS	1	120	08/11/2016	24/11/2016	390.4	ANNUAL MAINTENANCE
		2	120	03/01/2017	15/01/2017	295.2	PLANNED MAINTENANCE
		3	120	19/01/2017	16/02/2017	671.5	CAPITAL/3 YEARLY MTCE.
		4	120	25/11/2016	03/01/2017	921.12	CAPITAL/3 YEARLY MTCE.
26	URI-II HPS	1	60	13/11/2016	05/12/2016	534.4	ANNUAL MAINTENANCE

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		3	60	16/12/2016	28/12/2016	305.97	ANNUAL MAINTENANCE
		4	60	28/12/2016	16/01/2017	466.73	ANNUAL MAINTENANCE
NTPC Ltd.							
27	KOLDAM HPS	2	200	25/04/2016	28/04/2016	77.75	GENERATOR
		3	200	01/04/2016	06/04/2016	125.2	GENERATOR
PSPCL							
28	MUKERIAN HPS	1	15	24/03/2017	31/03/2017	164.5	ANNUAL MAINTENANCE
		1	15	04/04/2016	23/04/2016	459.75	ANNUAL MAINTENANCE
		10	19.5	10/03/2017	31/03/2017	493.83	RENOVATION/MODERNISATION
		10	19.5	27/05/2016	18/06/2016	538.67	ANNUAL MAINTENANCE
		11	19.5	04/04/2016	06/05/2016	779.92	ANNUAL MAINTENANCE
		12	19.5	24/03/2017	31/03/2017	159.33	ANNUAL MAINTENANCE
		12	19.5	07/05/2016	26/05/2016	459.67	ANNUAL MAINTENANCE
		2	15	11/05/2016	11/06/2016	759.83	ANNUAL MAINTENANCE
		3	15	24/04/2016	13/05/2016	470.42	ANNUAL MAINTENANCE
		4	15	02/05/2016	27/05/2016	612.42	ANNUAL MAINTENANCE
		5	15	04/04/2016	01/05/2016	649	ANNUAL MAINTENANCE
		6	15	24/03/2017	31/03/2017	159.67	ANNUAL MAINTENANCE
		6	15	13/06/2016	30/06/2016	402.37	ANNUAL MAINTENANCE
		7	19.5	04/04/2016	07/05/2016	802.22	PLANNED MAINTENANCE
		8	19.5	09/05/2016	22/05/2016	323.42	PLANNED MAINTENANCE
		9	19.5	26/05/2016	16/06/2016	505.33	PLANNED MAINTENANCE
		9	19.5	15/03/2017	31/03/2017	370.9	ANNUAL MAINTENANCE
29	RANJIT SAGAR HPS	1	150	01/10/2016	08/11/2016	917.08	ANNUAL MAINTENANCE
		1	150	21/11/2016	14/01/2017	1292.17	SWITCHING EQUIPMENT
		2	150	09/11/2016	03/01/2017	1319.58	PLANNED MAINTENANCE
		2	150	20/04/2016	29/04/2016	223.67	TRI/TRC/DRAFT TUBE
		3	150	04/04/2016	19/04/2016	366.83	ANNUAL MAINTENANCE
		3	150	09/01/2017	30/03/2017	1924	PLANNED MAINTENANCE
		4	150	04/04/2016	25/05/2016	1227.92	ANNUAL MAINTENANCE
30	SHANAN HPS	1	15	03/02/2017	11/02/2017	193.67	SWITCHING EQUIPMENT
		1	15	26/06/2016	28/06/2016	51.25	MONTHLY MAINTENANCE
		5	50	01/04/2016	14/04/2016	323.67	ANNUAL MAINTENANCE
RRVUNL							
31	JAWAHAR SAGAR HPS	1	33	16/05/2016	23/06/2016	911.5	ANNUAL MAINTENANCE
		2	33	20/06/2016	06/07/2016	389.58	ANNUAL MAINTENANCE
		3	33	06/04/2016	13/05/2016	891.83	PLANNED MAINTENANCE
32	R P SAGAR HPS	1	43	24/05/2016	22/06/2016	702.33	ANNUAL MAINTENANCE
		2	43	28/04/2016	23/05/2016	604.1	ANNUAL MAINTENANCE
		3	43	01/04/2016	27/04/2016	625.25	ANNUAL MAINTENANCE
		4	43	23/06/2016	18/07/2016	608.03	ANNUAL MAINTENANCE
SJVNL							
33	RAMPUR HPS	1	68.67	12/02/2017	15/02/2017	75.78	B.F.VALVE
		1	68.67	09/03/2017	27/03/2017	440.98	ANNUAL MAINTENANCE
		2	68.67	26/02/2017	09/03/2017	272.92	PLANNED MAINTENANCE
		2	68.67	12/02/2017	15/02/2017	68.65	B.F.VALVE
		3	68.67	26/12/2016	09/01/2017	342.5	ANNUAL MAINTENANCE
		4	68.67	14/01/2017	23/01/2017	224.98	ANNUAL MAINTENANCE
		5	68.67	08/02/2017	22/02/2017	333.3	ANNUAL MAINTENANCE
		6	68.67	09/02/2017	12/02/2017	55.25	B.F.VALVE
		6	68.67	30/01/2017	07/02/2017	210.78	ANNUAL MAINTENANCE
THDC							
34	KOTESHWAR HPS	1	100	01/04/2016	14/04/2016	326.75	ANNUAL MAINTENANCE

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		2	100	21/04/2016	22/05/2016	746	ANNUAL MAINTENANCE
		3	100	26/09/2016	24/10/2016	679.5	ANNUAL MAINTENANCE
		4	100	20/03/2017	31/03/2017	254	ANNUAL MAINTENANCE
35	TEHRI ST-1 HPS	1	250	01/04/2016	27/04/2016	638.75	CAPITAL/3 YEARLY MTCE.
		2	250	27/03/2017	31/03/2017	87	PLANNED MAINTENANCE
		3	250	10/05/2016	15/06/2016	869.5	ANNUAL MAINTENANCE
		4	250	09/05/2016	15/06/2016	896.5	ANNUAL MAINTENANCE
UJVNL							
36	CHIBRO (YAMUNA) HPS	2	60	05/01/2017	31/03/2017	2016.5	CAPITAL/3 YEARLY MTCE.
		3	60	12/12/2016	06/01/2017	606.92	ANNUAL MAINTENANCE
		4	60	01/04/2016	17/06/2016	1869.08	CAPITAL/3 YEARLY MTCE.
37	CHILLA HPS	1	36	01/04/2016	19/04/2016	452.92	ANNUAL MAINTENANCE
		2	36	01/02/2017	28/02/2017	663.17	ANNUAL MAINTENANCE
		3	36	04/11/2016	31/12/2016	1377.75	ANNUAL MAINTENANCE
		4	36	06/03/2017	30/03/2017	599.42	ANNUAL MAINTENANCE
38	DHAKRANI HPS	1	11.25	11/11/2016	21/01/2017	1707.33	ANNUAL MAINTENANCE
		2	11.25	23/01/2017	11/03/2017	1136.92	ANNUAL MAINTENANCE
		3	11.25	01/04/2016	26/04/2016	611.67	ANNUAL MAINTENANCE
		3	11.25	14/03/2017	31/03/2017	391.25	ANNUAL MAINTENANCE
39	DHALIPUR HPS	1	17	21/11/2016	31/03/2017	3105.5	CAPITAL/3 YEARLY MTCE.
		2	17	06/03/2017	31/03/2017	590.42	PLANNED MAINTENANCE
		3	17	01/04/2016	22/05/2016	1247.75	ANNUAL MAINTENANCE
40	KHATIMA HPS	2	13.8	01/04/2016	28/04/2016	659.92	RENOVATION/MODERNISATION
		3	13.8	01/04/2016	31/07/2016	2927.98	RENOVATION/MODERNISATION
41	KHODRI HPS	1	30	10/04/2016	14/04/2016	99.08	B.F.VALVE
		1	30	21/03/2017	31/03/2017	229.08	ANNUAL MAINTENANCE
		2	30	03/05/2016	05/06/2016	803	ANNUAL MAINTENANCE
		2	30	03/01/2017	31/03/2017	2077.92	CAPITAL/3 YEARLY MTCE.
		2	30	10/04/2016	13/04/2016	79.83	B.F.VALVE
		3	30	01/04/2016	04/04/2016	91.33	ANNUAL MAINTENANCE
		3	30	04/11/2016	08/12/2016	815.75	ANNUAL MAINTENANCE
		4	30	05/12/2016	24/01/2017	1196.58	ANNUAL MAINTENANCE
42	KULHAL HPS	1	10	01/01/2017	31/03/2017	2120.83	CAPITAL/3 YEARLY MTCE.
		2	10	23/03/2017	31/03/2017	181.5	ANNUAL MAINTENANCE
		3	10	23/03/2017	31/03/2017	181.5	ANNUAL MAINTENANCE
43	MANERI BHALI - I HPS	1	30	01/04/2016	16/04/2016	381.75	CAPITAL/3 YEARLY MTCE.
		1	30	07/09/2016	12/09/2016	141.17	MISCELLANEOUS
		1	30	27/08/2016	31/08/2016	107.15	MISCELLANEOUS
		2	30	07/08/2016	31/08/2016	581.9	MISCELLANEOUS
		2	30	01/09/2016	24/09/2016	553.5	MISCELLANEOUS
		2	30	01/08/2016	07/08/2016	154.58	MISCELLANEOUS
		3	30	01/08/2016	07/08/2016	154.58	MISCELLANEOUS
		3	30	23/12/2016	31/03/2017	2342.5	ANNUAL MAINTENANCE
		3	30	07/08/2016	31/08/2016	587.15	MISCELLANEOUS
		3	30	01/09/2016	15/09/2016	340.5	MISCELLANEOUS
44	MANERI BHALI - II HPS	1	76	20/03/2017	31/03/2017	264	ANNUAL MAINTENANCE
		1	76	01/04/2016	25/04/2016	595.25	ANNUAL MAINTENANCE
		2	76	12/12/2016	28/01/2017	1145.17	ANNUAL MAINTENANCE
		3	76	01/04/2016	05/04/2016	113.02	ANNUAL MAINTENANCE
		4	76	12/12/2016	27/02/2017	1846.67	ANNUAL MAINTENANCE
45	RAMGANGA HPS	1	66	27/07/2016	20/09/2016	1320.08	ANNUAL MAINTENANCE
		2	66	16/09/2016	17/11/2016	1487.9	ANNUAL MAINTENANCE
UPJVNL							

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
46	KHARA HPS	1	24	05/01/2017	13/02/2017	935.92	ANNUAL MAINTENANCE
		2	24	01/04/2016	10/04/2016	235.33	ANNUAL MAINTENANCE
		3	24	06/03/2017	31/03/2017	589	ANNUAL MAINTENANCE
47	OBRA HPS	1	33	01/04/2016	19/04/2016	443.92	PLANNED MAINTENANCE
		2	33	26/04/2016	31/05/2016	848.92	ANNUAL MAINTENANCE
48	RIHAND HPS	4	50	07/12/2016	31/03/2017	2736	STATOR
WESTERN REGION							
MAHAGENCO							
49	KOYNA-II HPS	4	80	29/06/2016	10/07/2016	272	TURBINE
50	KOYNA-III HPS	1	80	14/02/2017	26/02/2017	289.08	ANNUAL MAINTENANCE
		2	80	01/04/2016	21/09/2016	4166.92	CAPITAL/3 YEARLY MTCE.
51	KOYNA-IV HPS	1	250	17/03/2017	31/03/2017	325.25	ANNUAL MAINTENANCE
		1	250	29/06/2016	15/07/2016	391.33	TRI/TRC/DRAFT TUBE
52	TILLARI HPS	1	60	09/06/2016	30/06/2016	526	PLANNED MAINTENANCE
MPPGCL							
53	BANSAGAR TONS-1 HPS	1	105	31/05/2016	12/07/2016	1020.5	PLANNED MAINTENANCE
		2	105	17/04/2016	30/05/2016	1042.25	ANNUAL MAINTENANCE
54	BANSAGAR TONS-II HPS	2	15	01/04/2016	17/04/2016	387.5	ANNUAL MAINTENANCE
55	BANSAGAR TONS-III HPS	1	20	04/05/2016	23/05/2016	468.5	ANNUAL MAINTENANCE
		2	20	07/04/2016	01/05/2016	588.08	ANNUAL MAINTENANCE
		3	20	11/04/2016	30/04/2016	468.42	ANNUAL MAINTENANCE
56	BARGI HPS	1	45	01/04/2016	21/04/2016	488.92	ANNUAL MAINTENANCE
		2	45	10/06/2016	22/07/2016	1015.08	CAPITAL/3 YEARLY MTCE.
57	GANDHI SAGAR HPS	3	23	23/05/2016	28/06/2016	864.5	ANNUAL MAINTENANCE
		5	23	29/06/2016	14/07/2016	361.5	ANNUAL MAINTENANCE
58	MADHIKHERA HPS	1	20	26/04/2016	12/05/2016	382.75	ANNUAL MAINTENANCE
		2	20	13/04/2016	01/05/2016	438.17	ANNUAL MAINTENANCE
		3	20	01/04/2016	16/04/2016	370.5	PLANNED MAINTENANCE
59	PENCH HPS	1	80	01/05/2016	26/05/2016	612.1	ANNUAL MAINTENANCE
60	RAJGHAT HPS	1	15	10/08/2016	31/03/2017	5585	CAPITAL/3 YEARLY MTCE.
		1	15	28/04/2016	18/07/2016	1947.17	ANNUAL MAINTENANCE
		2	15	03/05/2016	15/07/2016	1744.9	ANNUAL MAINTENANCE
		2	15	01/11/2016	23/11/2016	529.92	NEW UNIT RESIDUAL WORKS
		3	15	03/05/2016	14/07/2016	1713.28	ANNUAL MAINTENANCE
NHDC							
61	INDIRA SAGAR HPS	1	125	01/03/2017	11/03/2017	248.5	ANNUAL MAINTENANCE
		2	125	01/04/2016	13/04/2016	302.5	ANNUAL MAINTENANCE
		2	125	14/03/2017	26/03/2017	297	ANNUAL MAINTENANCE
		3	125	29/04/2016	16/05/2016	418	ANNUAL MAINTENANCE
		4	125	28/03/2017	31/03/2017	62	ANNUAL MAINTENANCE
		5	125	16/04/2016	27/04/2016	273	ANNUAL MAINTENANCE
		6	125	18/05/2016	28/05/2016	249	ANNUAL MAINTENANCE
		7	125	30/05/2016	16/06/2016	417.5	ANNUAL MAINTENANCE
		8	125	18/06/2016	27/06/2016	226.5	ANNUAL MAINTENANCE
62	OMKARESHWAR HPS	1	65	29/04/2016	14/05/2016	373.07	ANNUAL MAINTENANCE
		2	65	14/05/2016	28/05/2016	343.57	ANNUAL MAINTENANCE
		3	65	31/05/2016	15/06/2016	362	ANNUAL MAINTENANCE
		4	65	17/06/2016	01/07/2016	337	ANNUAL MAINTENANCE
		5	65	16/04/2016	28/04/2016	302.17	ANNUAL MAINTENANCE
		6	65	01/04/2016	13/04/2016	297	ANNUAL MAINTENANCE
		7	65	21/03/2017	30/03/2017	224	ANNUAL MAINTENANCE
		8	65	01/03/2017	20/03/2017	463.25	ANNUAL MAINTENANCE
SSNNL							

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
63	S SAROVAR CHPH HPS	1	50	01/03/2017	17/03/2017	386.42	ANNUAL MAINTENANCE
		1	50	01/04/2016	04/04/2016	87.75	ANNUAL MAINTENANCE
		2	50	18/03/2017	31/03/2017	302.5	ANNUAL MAINTENANCE
		2	50	01/04/2016	04/04/2016	87.75	ANNUAL MAINTENANCE
		3	50	05/04/2016	21/04/2016	390	ANNUAL MAINTENANCE
		4	50	11/05/2016	25/05/2016	345	ANNUAL MAINTENANCE
		5	50	22/04/2016	09/05/2016	413.25	ANNUAL MAINTENANCE
64	S SAROVAR RBPH HPS	1	200	15/03/2017	31/03/2017	375	ANNUAL MAINTENANCE
		3	200	20/01/2017	10/02/2017	510	ANNUAL MAINTENANCE
		3	200	12/04/2016	21/05/2016	940.25	ANNUAL MAINTENANCE
		4	200	01/04/2016	08/04/2016	186	ANNUAL MAINTENANCE
		4	200	13/02/2017	05/03/2017	476	ANNUAL MAINTENANCE
		5	200	01/12/2016	21/12/2016	491.58	ANNUAL MAINTENANCE
		6	200	26/12/2016	16/01/2017	512.75	ANNUAL MAINTENANCE
TATA MAH.							
65	BHIRA HPS	5	25	06/11/2016	14/11/2016	208.35	CAPITAL/3 YEARLY MTCE.
66	BHIVPURI HPS	3	24	01/04/2016	21/05/2016	1216	QUATERLY MAINTENANCE
SOUTHERN REGION							
APGENCO							
67	HAMPI HPS	1	9	01/10/2016	03/10/2016	61.08	PAINTING OTHERS
		1	9	18/04/2016	22/04/2016	97.42	OTHER EQUIPMENT
		1	9	01/07/2016	05/07/2016	113.25	OTHER EQUIPMENT
		1	9	01/01/2017	06/01/2017	132.92	ANNUAL MAINTENANCE
		1	9	30/04/2016	18/05/2016	432.75	GENERATOR
		1	9	29/12/2016	31/12/2016	61.15	ANNUAL MAINTENANCE
		2	9	08/07/2016	13/07/2016	119.33	OTHER EQUIPMENT
		2	9	07/01/2017	10/01/2017	74.67	ANNUAL MAINTENANCE
		2	9	01/01/2017	03/01/2017	59.5	OTHER EQUIPMENT
		2	9	07/04/2016	11/04/2016	99.17	OTHER EQUIPMENT
		3	9	16/06/2016	29/06/2016	312.83	OTHER EQUIPMENT
		3	9	28/04/2016	30/04/2016	52.42	OTHER EQUIPMENT
		4	9	20/05/2016	23/05/2016	79.75	OTHER EQUIPMENT
		4	9	26/06/2016	29/06/2016	74.42	OTHER EQUIPMENT
		4	9	01/06/2016	25/06/2016	595.08	PAINTING OTHERS
		4	9	05/01/2017	11/01/2017	145.92	ANNUAL MAINTENANCE
68	NAGARJUN SGR RBC HPS	1	30	06/02/2017	28/02/2017	540.73	CAPITAL/3 YEARLY MTCE.
69	SRISAILAM HPS	1	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
		2	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
		4	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
		5	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
		6	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
		7	110	25/07/2016	31/07/2016	146	TRI/TRC/DRAFT TUBE
70	T B DAM HPS	1	9	01/04/2016	05/04/2016	117	OTHER EQUIPMENT
		1	9	02/05/2016	14/05/2016	288.5	GENERATOR
		1	9	09/03/2017	31/03/2017	517.77	ANNUAL MAINTENANCE
		1	9	07/10/2016	16/10/2016	222.17	TURBINE MISC/GOVERNOR
		1	9	11/07/2016	16/07/2016	122.42	OTHER EQUIPMENT
		2	9	23/01/2017	27/01/2017	97.5	ANNUAL MAINTENANCE
		2	9	01/07/2016	16/07/2016	362.25	OTHER EQUIPMENT
		2	9	01/04/2016	20/06/2016	1933	SWITCHING EQUIPMENT
		3	9	20/04/2016	30/04/2016	239.42	TURBINE MISC/GOVERNOR
71	UPPER SILERU HPS	2	60	21/02/2017	26/02/2017	124.83	SWITCHING EQUIPMENT
KPCL							

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
72	ALMATTI DPH HPS	1	15	17/03/2017	22/03/2017	122.17	GENERATOR
		1	15	10/05/2016	13/05/2016	76.5	ANNUAL MAINTENANCE
		2	55	01/05/2016	10/05/2016	227	ANNUAL MAINTENANCE
		2	55	08/03/2017	13/03/2017	120.92	ANNUAL MAINTENANCE
		2	55	02/06/2016	23/06/2016	503.92	ANNUAL MAINTENANCE
		2	55	20/03/2017	31/03/2017	252.5	ANNUAL MAINTENANCE
		3	55	20/03/2017	31/03/2017	252.5	ANNUAL MAINTENANCE
		3	55	08/03/2017	13/03/2017	120.92	ANNUAL MAINTENANCE
		3	55	01/05/2016	10/05/2016	227	ANNUAL MAINTENANCE
		3	55	02/06/2016	23/06/2016	503.42	ANNUAL MAINTENANCE
		3	55	06/04/2016	11/04/2016	130.75	ANNUAL MAINTENANCE
		4	55	20/03/2017	31/03/2017	252.5	ANNUAL MAINTENANCE
		4	55	08/03/2017	13/03/2017	120.92	ANNUAL MAINTENANCE
		4	55	23/04/2016	28/04/2016	120.75	ANNUAL MAINTENANCE
		4	55	01/05/2016	10/05/2016	227	ANNUAL MAINTENANCE
		4	55	02/06/2016	23/06/2016	503.42	ANNUAL MAINTENANCE
		4	55	01/04/2016	18/04/2016	418.83	ANNUAL MAINTENANCE
		5	55	20/03/2017	31/03/2017	252.5	ANNUAL MAINTENANCE
		5	55	01/03/2017	17/03/2017	407.98	ANNUAL MAINTENANCE
		5	55	23/04/2016	28/04/2016	120.75	ANNUAL MAINTENANCE
		5	55	18/04/2016	21/04/2016	71.75	ANNUAL MAINTENANCE
		5	55	02/06/2016	23/06/2016	503.42	ANNUAL MAINTENANCE
		5	55	23/05/2016	27/05/2016	96.08	ANNUAL MAINTENANCE
		5	55	01/05/2016	10/05/2016	227	ANNUAL MAINTENANCE
		5	55	01/04/2016	06/04/2016	130.42	ANNUAL MAINTENANCE
		6	55	02/06/2016	23/06/2016	503.42	ANNUAL MAINTENANCE
		6	55	01/03/2017	31/03/2017	720	ANNUAL MAINTENANCE
		6	55	21/04/2016	30/04/2016	215.25	ANNUAL MAINTENANCE
73	BHADRA HPS	2	12	01/01/2017	31/01/2017	743.98	RENOVATION/MODERNISATION
74	GERUSUPPA HPS	1	60	21/12/2016	02/01/2017	299.78	ANNUAL MAINTENANCE
		2	60	08/12/2016	20/12/2016	290.6	ANNUAL MAINTENANCE
		3	60	23/11/2016	06/12/2016	313.32	ANNUAL MAINTENANCE
		4	60	08/11/2016	21/11/2016	321.9	ANNUAL MAINTENANCE
75	GHAT PRABHA HPS	1	16	14/04/2016	10/08/2016	2828.17	MISCELLANEOUS
76	JOG HPS	1	13.2	05/11/2016	08/11/2016	69.33	SWITCHING EQUIPMENT
		1	13.2	14/07/2016	18/07/2016	106.5	MISCELLANEOUS
		2	13.2	01/11/2016	03/11/2016	64.42	SWITCHING EQUIPMENT
		2	13.2	27/10/2016	31/10/2016	109.15	SWITCHING EQUIPMENT
		3	13.2	08/11/2016	11/11/2016	71.25	SWITCHING EQUIPMENT
		3	13.2	27/07/2016	18/09/2016	1268.33	SWITCHING EQUIPMENT
		5	21.6	07/12/2016	17/12/2016	238.92	GENERATOR
		5	21.6	17/10/2016	26/10/2016	216.92	SWITCHING EQUIPMENT
		6	21.6	09/02/2017	15/02/2017	143.87	B.F.VALVE
		6	21.6	01/08/2016	22/08/2016	513.33	SWITCHING EQUIPMENT
		6	21.6	01/09/2016	22/09/2016	513.33	SWITCHING EQUIPMENT
		6	21.6	01/11/2016	17/11/2016	372.33	TURBINE MISC/GOVERNOR
		7	21.6	15/07/2016	27/07/2016	290.77	SWITCHING EQUIPMENT
		7	21.6	01/08/2016	31/08/2016	743.98	ANNUAL MAINTENANCE
		8	21.6	16/09/2016	20/09/2016	95.75	TURBINE
		8	21.6	10/06/2016	27/06/2016	411.58	OTHER EQUIPMENT
77	KALINADI HPS	5	150	09/10/2016	27/10/2016	438.52	PLANNED MAINTENANCE
		6	150	09/10/2016	02/11/2016	586.72	PLANNED MAINTENANCE
78	KODASALI HPS	1	40	16/05/2016	19/05/2016	72.92	MISCELLANEOUS

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		3	40	19/05/2016	28/05/2016	220.83	MISCELLANEOUS
79	LIGANAMAKKI HPS	1	27.5	17/12/2016	31/12/2016	351.48	TURBINE
		1	27.5	01/01/2017	20/01/2017	475.67	TURBINE MISC/GOVERNOR
		1	27.5	23/06/2016	26/06/2016	63.33	TURBINE MISC/GOVERNOR
		2	27.5	23/06/2016	26/06/2016	74.67	TURBINE MISC/GOVERNOR
80	SHARAVATHI HPS	1	103.5	23/01/2017	26/01/2017	82.48	AUXILIARY SYSTEM
		10	103.5	01/01/2017	04/01/2017	81.27	SWITCHING EQUIPMENT
		10	103.5	28/12/2016	31/12/2016	85.48	PRESSURE SHAFT/PENSTOCK
		10	103.5	09/03/2017	12/03/2017	75.45	OTHER EQUIPMENT
		2	103.5	01/12/2016	06/12/2016	138.72	TURBINE MISC/GOVERNOR
		2	103.5	28/01/2017	30/01/2017	59.98	SWITCHING EQUIPMENT
		3	103.5	01/02/2017	04/02/2017	88.3	PRESSURE SHAFT/PENSTOCK
		5	103.5	13/01/2017	16/01/2017	77.07	PRESSURE SHAFT/PENSTOCK
		5	103.5	14/02/2017	16/02/2017	50.68	OTHER EQUIPMENT
		6	103.5	07/02/2017	11/02/2017	97.38	SWITCHING EQUIPMENT
		6	103.5	01/01/2017	14/01/2017	327.73	MISCELLANEOUS
		6	103.5	16/12/2016	31/12/2016	372.38	NEW UNIT RESIDUAL WORKS
		7	103.5	10/12/2016	30/12/2016	469.52	NEW UNIT RESIDUAL WORKS
		7	103.5	09/01/2017	15/01/2017	139.98	TURBINE MISC/GOVERNOR
		8	103.5	21/02/2017	25/02/2017	104.48	OTHER EQUIPMENT
		8	103.5	20/03/2017	23/03/2017	79.12	GENERATOR
		9	103.5	01/03/2017	08/03/2017	185.92	OTHER EQUIPMENT
		9	103.5	02/07/2016	04/07/2016	57.43	OTHER EQUIPMENT
81	VARAHI HPS	1	115	23/06/2016	18/08/2016	1352.53	ANNUAL MAINTENANCE
		3	115	26/09/2016	30/09/2016	103.5	MISCELLANEOUS
		3	115	01/11/2016	15/11/2016	353	MISCELLANEOUS
KSEB							
82	IDAMALAYAR HPS.	1	37.5	23/06/2016	29/07/2016	871	ANNUAL MAINTENANCE
		2	37.5	13/10/2016	16/11/2016	808.23	PLANNED MAINTENANCE
83	IDUKKI HPS.	1	130	09/06/2016	08/07/2016	689.42	ANNUAL MAINTENANCE
		1	130	01/12/2016	03/12/2016	64.58	PRESSURE SHAFT/PENSTOCK
		2	130	11/07/2016	10/08/2016	730.95	ANNUAL MAINTENANCE
		2	130	01/12/2016	04/12/2016	88.5	PRESSURE SHAFT/PENSTOCK
		3	130	26/09/2016	26/10/2016	720	ANNUAL MAINTENANCE
		4	130	24/11/2016	26/11/2016	58.83	ANNUAL MAINTENANCE
		4	130	06/12/2016	30/12/2016	582.1	ANNUAL MAINTENANCE
		5	130	25/10/2016	23/11/2016	711.85	ANNUAL MAINTENANCE
		6	130	10/08/2016	08/09/2016	701.5	ANNUAL MAINTENANCE
84	KAKKAD HPS.	1	25	05/02/2017	01/03/2017	565.38	ANNUAL MAINTENANCE
		1	25	01/04/2016	06/04/2016	140.27	ANNUAL MAINTENANCE
85	KUTTIYADI HPS.	1	25	17/11/2016	26/11/2016	225.43	ANNUAL MAINTENANCE
		3	25	01/01/2017	16/01/2017	369.95	ANNUAL MAINTENANCE
		4	50	01/06/2016	11/06/2016	246.25	ANNUAL MAINTENANCE
86	KUTTIYADI ADDL. EXTN. HPS	5	50	01/04/2016	04/05/2016	811.62	ANNUAL MAINTENANCE
		6	50	04/05/2016	30/05/2016	635.52	PLANNED MAINTENANCE
		6	50	26/09/2016	30/09/2016	104.42	MONTHLY MAINTENANCE
87	LOWER PERIYAR HPS.	1	60	22/03/2017	31/03/2017	193.35	ANNUAL MAINTENANCE
		1	60	07/01/2017	19/01/2017	290.98	B.F.VALVE
88	NARIAMANGLAM HPS	4	25	30/01/2017	26/02/2017	643.63	ANNUAL MAINTENANCE
89	PALLIVASAL HPS.	1	5	20/05/2016	05/06/2016	388.73	ANNUAL MAINTENANCE
		2	5	14/03/2017	31/03/2017	399.2	PLANNED MAINTENANCE
		4	7.5	16/12/2016	09/02/2017	1329.38	ANNUAL MAINTENANCE
		5	7.5	28/06/2016	30/06/2016	57	MISCELLANEOUS

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17 (OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		5	7.5	08/04/2016	12/04/2016	91.88	MONTHLY MAINTENANCE
90	PANNIAR HPS.	1	15	03/04/2016	03/05/2016	715.13	ANNUAL MAINTENANCE
		1	15	20/05/2016	28/06/2016	948.27	B.F.VALVE
		2	15	20/05/2016	30/06/2016	1002.65	B.F.VALVE
		2	15	27/01/2017	28/02/2017	764.42	ANNUAL MAINTENANCE
91	PORINGALKUTTU HPS.	1	8	15/12/2016	16/01/2017	780.13	ANNUAL MAINTENANCE
		2	8	05/06/2016	21/06/2016	372.08	MISCELLANEOUS
		3	8	05/05/2016	31/05/2016	631.58	ANNUAL MAINTENANCE
		4	8	04/04/2016	30/04/2016	616	ANNUAL MAINTENANCE
		4	8	05/06/2016	21/06/2016	373.55	MISCELLANEOUS
92	SABARIGIRI HPS.	1	50	07/01/2017	08/02/2017	774.75	ANNUAL MAINTENANCE
		2	50	03/08/2016	06/10/2016	1542.15	ANNUAL MAINTENANCE
		3	50	11/10/2016	08/12/2016	1389.93	ANNUAL MAINTENANCE
		4	50	01/06/2016	19/06/2016	428.8	ANNUAL MAINTENANCE
		4	50	08/07/2016	22/07/2016	348.55	PLANNED MAINTENANCE
		4	50	11/11/2016	15/11/2016	91.98	B.F.VALVE
		5	50	22/06/2016	28/07/2016	869.73	ANNUAL MAINTENANCE
		6	50	09/12/2016	05/01/2017	656.17	ANNUAL MAINTENANCE
93	SENGULAM HPS.	1	12	17/05/2016	02/06/2016	396.35	ANNUAL MAINTENANCE
		3	12	03/01/2017	01/02/2017	707.22	ANNUAL MAINTENANCE
		3	12	01/04/2016	15/05/2016	1069.65	ANNUAL MAINTENANCE
		4	12	02/02/2017	28/02/2017	633.73	ANNUAL MAINTENANCE
94	SHOLAYAR HPS.	3	18	01/04/2016	22/06/2016	1990.58	DESILING CHAMBER
TNGDCL							
95	BHAWANI BARRAGE III HPS	1	15	29/01/2017	31/03/2017	1455	CAPITAL/3 YEARLY MTCE.
		2	15	29/01/2017	31/03/2017	1455	CAPITAL/3 YEARLY MTCE.
96	BHAWANI KATTAL HPS	1	15	02/02/2017	31/03/2017	1368	ANNUAL MAINTENANCE
		1	15	01/04/2016	16/04/2016	377.92	CAPITAL/3 YEARLY MTCE.
		2	15	27/03/2017	31/03/2017	86.42	ANNUAL MAINTENANCE
97	KODAYAR HPS.	1	60	31/07/2016	08/08/2016	201.12	TURBINE
		1	60	23/06/2016	07/07/2016	341.08	ANNUAL MAINTENANCE
		2	40	23/04/2016	25/04/2016	58.25	MONTHLY MAINTENANCE
		2	40	06/07/2016	13/07/2016	174.25	ANNUAL MAINTENANCE
98	KUNDAH HPS.	1	20	01/06/2016	15/06/2016	348	ANNUAL MAINTENANCE
		13	50	05/06/2016	21/06/2016	394.17	ANNUAL MAINTENANCE
		7	35	07/06/2016	25/06/2016	446.82	ANNUAL MAINTENANCE
		9	60	26/11/2016	15/12/2016	462.67	ANNUAL MAINTENANCE
		9	60	26/04/2016	28/04/2016	57.83	MONTHLY MAINTENANCE
99	LOWER METTUR HPS.	1	15	21/03/2017	31/03/2017	231.17	ANNUAL MAINTENANCE
		3	15	02/03/2017	21/03/2017	472	ANNUAL MAINTENANCE
		4	15	23/03/2017	31/03/2017	184.5	ANNUAL MAINTENANCE
		7	15	27/03/2017	31/03/2017	87.5	ANNUAL MAINTENANCE
		7	15	01/03/2017	06/03/2017	135	ANNUAL MAINTENANCE
		8	15	27/03/2017	31/03/2017	87.5	ANNUAL MAINTENANCE
		8	15	07/03/2017	26/03/2017	472.67	ANNUAL MAINTENANCE
100	METTUR DAM HPS.	2	12.5	01/02/2017	28/02/2017	663.38	ANNUAL MAINTENANCE
		4	12.5	01/03/2017	27/03/2017	638.88	ANNUAL MAINTENANCE
101	METTUR TUNNEL HPS.	1	50	01/02/2017	20/02/2017	464	CAPITAL/3 YEARLY MTCE.
		1	50	01/03/2017	31/03/2017	720	ANNUAL MAINTENANCE
		2	50	21/02/2017	12/03/2017	465.67	CAPITAL/3 YEARLY MTCE.
		3	50	02/03/2017	31/03/2017	696	ANNUAL MAINTENANCE
		4	50	02/03/2017	31/03/2017	696	ANNUAL MAINTENANCE
102	MOYAR HPS	1	12	10/05/2016	13/05/2016	80.67	STATOR

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		1	12	26/10/2016	18/11/2016	570.17	ANNUAL MAINTENANCE
		3	12	10/05/2016	13/05/2016	80.67	STATOR
103	PAPANASAM HPS.	1	8	04/04/2016	02/05/2016	666.92	CAPITAL/3 YEARLY MTCE.
104	PERIYAR HPS.	1	42	03/06/2016	10/06/2016	173.25	RENOVATION/MODERNISATION
		1	42	01/04/2016	13/04/2016	304.5	ANNUAL MAINTENANCE
		1	42	01/03/2017	30/03/2017	701.75	ANNUAL MAINTENANCE
		2	42	20/03/2017	31/03/2017	253.75	ANNUAL MAINTENANCE
		2	42	10/04/2016	09/05/2016	702.5	ANNUAL MAINTENANCE
		3	42	20/04/2016	26/05/2016	871	ANNUAL MAINTENANCE
		4	35	30/07/2016	31/03/2017	5838.98	CAPITAL/3 YEARLY MTCE.
		4	35	01/04/2016	30/06/2016	2177	RENOVATION/MODERNISATION
105	PYKARA ULTMATE HPS.	2	50	26/10/2016	25/11/2016	743.98	MONTHLY MAINTENANCE
		2	50	26/11/2016	29/11/2016	92.58	ANNUAL MAINTENANCE
106	SARKARPATHY HPS.	1	30	06/05/2016	28/06/2016	1280.85	ANNUAL MAINTENANCE
	SHOLAYAR HPS.	1	35	24/04/2016	24/05/2016	728	ANNUAL MAINTENANCE
		2	35	01/06/2016	24/06/2016	550.75	ANNUAL MAINTENANCE
		3	25	17/04/2016	27/05/2016	968	ANNUAL MAINTENANCE
107	SURULIYAR HPS.	1	35	30/05/2016	01/07/2016	771	ANNUAL MAINTENANCE
TSGENCO							
108	LOWER SILERU HPS	2	115	13/09/2016	15/09/2016	57.08	TURBINE MISC/GOVERNOR
		3	115	10/08/2016	09/11/2016	2185.75	TURBINE MISC/GOVERNOR
		4	115	19/12/2016	13/01/2017	603	TURBINE MISC/GOVERNOR
109	NAGARJUN SGR HPS	3	100.8	09/05/2016	07/06/2016	693.42	ANNUAL MAINTENANCE
		4	100.8	05/03/2017	31/03/2017	615.42	ANNUAL MAINTENANCE
		8	100.8	01/04/2016	30/04/2016	708	ANNUAL MAINTENANCE
EASTERN REGION							
DVC							
110	MAITHON HPS.	1	23.2	25/05/2016	31/05/2016	149.48	ANNUAL MAINTENANCE
		1	23.2	01/02/2017	28/02/2017	671.98	INTAKE STRU/TRASH RACK
		1	23.2	01/06/2016	17/06/2016	401	ANNUAL MAINTENANCE
		2	20	01/03/2017	31/03/2017	720	INTAKE STRU/TRASH RACK
		2	20	21/05/2016	23/05/2016	54.5	ANNUAL MAINTENANCE
		3	20	01/05/2016	31/05/2016	743.98	ANNUAL MAINTENANCE
		3	20	27/04/2016	30/04/2016	85.98	ANNUAL MAINTENANCE
		3	20	01/06/2016	30/06/2016	719.98	ANNUAL MAINTENANCE
		3	20	01/07/2016	28/07/2016	664.83	ANNUAL MAINTENANCE
GISL							
111	CHUZACHEN HPS	1	49.5	01/02/2017	02/03/2017	702.27	ANNUAL MAINTENANCE
		2	49.5	01/02/2017	22/02/2017	513.72	ANNUAL MAINTENANCE
NHPC							
112	RANGIT HPS	1	20	18/04/2016	21/04/2016	75.92	B.F.VALVE
		1	20	18/01/2017	10/02/2017	560.82	ANNUAL MAINTENANCE
		2	20	18/04/2016	21/04/2016	75.42	B.F.VALVE
		2	20	19/12/2016	17/01/2017	717.17	ANNUAL MAINTENANCE
		3	20	18/04/2016	21/04/2016	78.33	B.F.VALVE
		3	20	14/02/2017	10/03/2017	594.92	ANNUAL MAINTENANCE
113	TEESTA LOW DAM-III HPS	1	33	23/01/2017	31/01/2017	191.82	SWITCHING EQUIPMENT
		2	33	03/01/2017	18/01/2017	358.13	PLANNED MAINTENANCE
		2	33	23/01/2017	31/01/2017	191.98	SWITCHING EQUIPMENT
		2	33	01/04/2016	16/04/2016	381.87	SWITCHING EQUIPMENT
		3	33	01/02/2017	16/02/2017	372.98	ANNUAL MAINTENANCE
		3	33	23/01/2017	31/01/2017	191.88	SWITCHING EQUIPMENT
		4	33	18/01/2017	01/02/2017	334.88	ANNUAL MAINTENANCE

DETAILS OF LONG DURATION PLANNED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-17
(OUTAGE DURATION 50 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
114	TEESTA LOW DAM-IV HPS	1	40	27/01/2017	18/02/2017	535.02	ANNUAL MAINTENANCE
		2	40	16/04/2016	22/04/2016	144.95	TURBINE MISC/GOVERNOR
		2	40	20/02/2017	10/03/2017	441.43	ANNUAL MAINTENANCE
		2	40	16/12/2016	19/12/2016	87	MISCELLANEOUS
		4	40	07/11/2016	15/11/2016	186.83	TURBINE
115	TEESTA V HPS	1	170	30/11/2016	18/12/2016	429.12	ANNUAL MAINTENANCE
		2	170	20/12/2016	07/01/2017	427.7	ANNUAL MAINTENANCE
OHPC							
116	BALIMELA HPS.	4	60	15/03/2017	31/03/2017	376	ANNUAL MAINTENANCE
		5	60	02/11/2016	26/11/2016	578.92	ANNUAL MAINTENANCE
117	HIRAKUD HPS	10	24	01/04/2016	31/03/2017	8736	RENOVATION/MODERNISATION
		2	49.5	22/07/2016	31/03/2017	6039	CAPITAL/3 YEARLY MTCE.
		7	37.5	05/07/2016	23/07/2016	439.17	ANNUAL MAINTENANCE
		8	24	15/05/2016	16/06/2016	769.25	HRI/HRC/POWER CHANNEL
		9	24	01/06/2016	15/06/2016	355.5	HRI/HRC/POWER CHANNEL
118	RENGALI HPS.	1	50	09/01/2017	31/01/2017	543.9	ANNUAL MAINTENANCE
		3	50	01/05/2016	03/05/2016	59.75	ANNUAL MAINTENANCE
		5	50	26/05/2016	29/05/2016	79.75	MONTHLY MAINTENANCE
119	UPPER INDRAVATI HPS.	1	150	19/12/2016	19/01/2017	747.75	ANNUAL MAINTENANCE
		2	150	02/02/2017	05/03/2017	748	ANNUAL MAINTENANCE
		3	150	01/04/2016	01/08/2016	2946.33	CAPITAL/3 YEARLY MTCE.
		4	150	04/11/2016	10/12/2016	868.18	PLANNED MAINTENANCE
120	UPPER KOLAB HPS.	1	80	01/11/2016	28/11/2016	660.95	MONTHLY MAINTENANCE
		1	80	01/04/2016	13/06/2016	1768.83	CAPITAL/3 YEARLY MTCE.
		3	80	24/01/2017	01/03/2017	866.17	ANNUAL MAINTENANCE
WBSEDCL							
121	PURULIA PSS HPS.	3	225	01/04/2016	04/10/2016	4481.5	TURBINE
		4	225	21/11/2016	05/02/2017	1836	CAPITAL/3 YEARLY MTCE.
122	RAMMAM HPS.	1	12.5	27/12/2016	27/01/2017	751.68	ANNUAL MAINTENANCE
NORTH EASTERN REGION							
MeECL							
123	MYNTDU(LESHKA) St-1 HPS	2	42	01/04/2016	18/04/2016	421	ANNUAL MAINTENANCE
124	UMIAM HPS ST-I	1	9	01/04/2016	13/05/2016	1012	ROUTINE MAINTENANCE
		2	9	17/02/2017	24/02/2017	169.33	ANNUAL MAINTENANCE
		4	9	20/04/2016	20/06/2016	1468.33	MONTHLY MAINTENANCE
125	UMIAM HPS ST-IV	7	30	11/03/2017	26/03/2017	368	NEW UNIT RESIDUAL WORKS
		8	30	11/03/2017	31/03/2017	471	NEW UNIT RESIDUAL WORKS
NEEPCO.							
126	DOYANG HPS.	1	25	04/04/2016	21/04/2016	421.5	ANNUAL MAINTENANCE
		1	25	18/02/2017	24/03/2017	823.33	ANNUAL MAINTENANCE
		2	25	28/03/2017	31/03/2017	72	ANNUAL MAINTENANCE
127	KHONDONG HPS.	1	25	03/03/2017	31/03/2017	662.95	ANNUAL MAINTENANCE
		1	25	01/04/2016	22/05/2016	1242.95	ANNUAL MAINTENANCE
		2	25	10/02/2017	18/03/2017	879.83	ANNUAL MAINTENANCE
128	KOPILI HPS.	2	50	27/01/2017	31/03/2017	1512	ANNUAL MAINTENANCE
		5	25	11/12/2016	24/01/2017	1076.92	ANNUAL MAINTENANCE
129	RANGANADI HPS.	1	135	17/01/2017	25/01/2017	214.57	ANNUAL MAINTENANCE
		2	135	01/12/2016	10/12/2016	239.58	ANNUAL MAINTENANCE
		3	135	21/02/2017	02/03/2017	224.92	ANNUAL MAINTENANCE
NHPC							
130	LOKTAK HPS.	1	35	16/01/2017	30/01/2017	341.95	ANNUAL MAINTENANCE
		2	35	01/02/2017	14/02/2017	324.2	ANNUAL MAINTENANCE
		3	35	07/08/2016	11/08/2016	104.35	OTHER EQUIPMENT
		3	35	16/02/2017	27/02/2017	274.53	ANNUAL MAINTENANCE

CHAPTER-5

FORCED OUTAGES OF HE UNITS

CHAPTER-5

MISCELLANEOUS & FORCED OUTAGES OF HE UNITS

5.1 Forced outages of generating units are due to various problems in generating equipments, auxiliary systems, civil structures. The miscellaneous outages, on the other hand are due to external reasons not attributable to the power plant equipment/civil structures etc. The non-availability of water, transmission constraints, system disturbances, flood and also due to high silt in the river, etc. constitutes the miscellaneous outages. The miscellaneous outages during 2016-17 are summarised below in **Table 5.1.**

TABLE 5.1

MISCELLANEOUS OUTAGES
FOR PERIOD: 2016-17

S. No.	Causes of Miscellaneous Outage	Duration of Outage (Hours)	% of Total Outage
	NOT ASSOCIATED WITH THE EQUIPMENT AND CIVIL STRUCTURE		
1	Water Constraint	322728.02	92.68
2	Grid Constraint	18088.81	5.19
3	Other Miscellaneous	7416.67	2.13
	TOTAL	**348233.49**	**100**

5.2 Based on the analysis carried out for 695 hydro generating units installed in 200 Hydro Electric Power Stations, non-availability of hydro-electric units in the country due to forced outages during the year 2016-17 (excluding the causes not attributable to the power plant) was 3.33% as compared to 4.86% during 2015-16.

Unit-wise details of forced outages of duration 24 hours and above are given in **Annex- 5.1**.

During 2016-17, the generator and turbine faults accounted for 40.19% and 21.39% of the forced outages respectively whereas forced outages due to other equipment & civil structure faults accounted for 24.94% & 13.47% respectively of the forced outages. Category-wise forced outages of hydro generating units are given in **Table 5.2** below.

TABLE 5.2

EQUIPMENT/SYSTEM WISE FORCED OUTAGES
FOR PERIOD: 2016-17

S. No.	Causes of Forced Outage	Duration of Outage (Hours)	% of Total Outage
	Related with Equipment and Civil Structure		
1	Generator Faults	73896.94	40.19
2	Turbine Faults	39328.84	21.39
3	Civil Structure Faults	24769.60	13.47
4	Other Equipment Faults	45861.19	24.94
	TOTAL	**183856.57**	**100**

5.3 FORCED OUTAGE DUE TO GENERATOR COMPONENTS

5.3.1 The longest forced outage duration was on account of Stator Fault (16.1%). Vibration/Sound/ Alignment Fault (12.55%) and Generator Cooling System Fault (12.38%) and other miscellaneous faults accounted for more than the 62% of the forced outages due to generator components. The fault in Rotor accounted for another 4.64% of the forced outages.

The details of forced outages due to various generator faults and associated systems are given in **Table 5.3** below:

TABLE 5.3

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF
GENERATOR COMPONENTS
PERIOD: 2016-17

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
1	Stator	11898.72	16.1
2	Rotor	3431.47	4.64
3	Excitation System	4555.34	6.16
4	Automatic Voltage Regulator	241.70	0.33
5	Protection System	1516.47	2.05

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
6	Generator Cooling System	9146.97	12.38
7	Thrust Bearing	2493.80	3.37
8	Upper Guide Bearing	1173.13	1.59
9	Lower Guide Bearing	1260.00	1.71
10	Vibration/ Sound / Alignment	9273.02	12.55
11	Brake and Jacks	899.42	1.22
12	Miscellaneous Generator Components	28006.92	37.90
	TOTAL	**73896.94**	**100**

5.3.2 Performance of generating units has been analyzed for failure of generator components under different categories based on their unit size. These are listed in **Table 5.4** for unit size up to 50 MW, in **Table 5.5** for unit size above 50 MW & up to 100 MW and in **Table 5.6** for unit size above 100 MW.

TABLE 5.4

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF GENERATOR COMPONENTS (UNIT SIZE UP TO 50 MW) PERIOD: 2016-17

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
1	Stator	27.75	0.25
2	Rotor	295.75	2.66
3	Excitation System	190.68	1.72
4	Automatic Voltage Regulator	51.93	0.47
5	Protection System	222.88	2.01
6	Generator Cooling System	8752.48	78.74
7	Thrust Bearing	44.58	0.40
8	Upper Guide Bearing	186.90	1.68
9	Lower Guide Bearing	299.53	2.69
10	Vibration/ Sound / Alignment	491.85	4.42
11	Brake and Jacks	0.00	0.00
12	Miscellaneous Generator Components	551.72	4.96
	TOTAL	**11116.07**	**100.00**

TABLE 5.5

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF GENERATOR COMPONENTS (UNIT SIZE ABOVE 50 MW AND UP TO 100 MW) PERIOD: 2016-17

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
1	Stator	5008.57	33.76
2	Rotor	2374.48	16.01
3	Excitation System	3439.63	23.19
4	Automatic Voltage Regulator	106.93	0.72
5	Protection System	212.22	1.43
6	Generator Cooling System	31.17	0.21
7	Thrust Bearing	1323.23	8.92
8	Upper Guide Bearing	416.83	2.81
9	Lower Guide Bearing	65.62	0.44
10	Vibration/ Sound / Alignment	0.10	0.00
11	Brake and Jacks	12.63	0.09
12	Miscellaneous Generator Components	1842.22	12.42
	TOTAL	**14833.64**	**100.00**

TABLE 5.6

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF GENERATOR COMPONENTS (UNIT SIZE ABOVE 100 MW) PERIOD: 2016-17

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
1	Stator	6862.40	14.31
2	Rotor	761.23	1.59
3	Excitation System	925.02	1.93
4	Automatic Voltage Regulator	82.83	0.17
5	Protection System	1081.37	2.26
6	Generator Cooling System	363.32	0.76

S. No.	Components of Generator	Outage Hours	% of Total No. of Hours
7	Thrust Bearing	1125.98	2.35
8	Upper Guide Bearing	569.40	1.19
9	Lower Guide Bearing	894.85	1.87
10	Vibration/ Sound / Alignment	8781.07	18.31
11	Brake and Jacks	886.78	1.85
12	Miscellaneous Generator Components	25612.98	53.42
	TOTAL	**47947.24**	**100.00**

From the tables above, the major reason for forced outage due to the generator components is summarized below unit size-wise:

Unit Size	Major Reasons	% of Total No. of Hours
Up to 50 MW	Generator Cooling System	78.74
50-100 MW	Stator	33.76
Above 100 MW	Miscellaneous Generator Components	53.52

5.4 FORCED OUTAGE DUE TO TURBINE COMPONENTS

5.4.1 Faults in Governing System (28.58%), Main Inlet Valve (23.27%), Other Miscellaneous (19.92%) and Runner/Underwater Parts (15.99%) are the major reasons of forced outages on account of turbine components.

The details of forced outages due to various turbine faults and associated system are given in **Table 5.7** below:

TABLE 5.7

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF TURBINE COMPONENTS
PERIOD: 2016-17

S. No.	Components of Turbine	Outage Hours	% of Total No. of Hours
1	Bearing	1823.31	4.64
2	Runner/Underwater Parts	6287.50	15.99

S. No.	Components of Turbine	Outage Hours	% of Total No. of Hours
3	Main Inlet Valve	9152.62	23.27
4	Governor System	11239.68	28.58
5	Guide Vanes	1988.85	5.06
6	Shaft Vibration / ALIGNMENT /SOUND	1001.75	2.55
7	Miscellaneous Turbine Components	7835.13	19.92
	TOTAL	**39328.84**	**100.00**

5.4.2 Performance of generating units has been analyzed for failure of various turbine components under different categories based on their unit size. These are listed in **Table 5.8** for unit size up to 50 MW, in **Table 5.9** for unit size above 50 MW & up to 100 MW and in **Table 5.10** for unit size above 100 MW.

TABLE 5.8

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF TURBINE COMPONENTS (UNIT SIZE UP TO 50 MW) PERIOD: 2016-17

S. No.	Components of Turbine	Outage Hours	% of Total No. of Hours
1	Bearing	649.53	23.43
2	Runner/Underwater Parts	97.43	3.52
3	Main Inlet Valve	265.42	9.58
4	Governor System	1266.61	45.70
5	Guide Vanes	64.53	2.33
6	Shaft Vibration / Alignment /Sound	14.08	0.51
7	Miscellaneous Turbine Components	414.08	14.94
	TOTAL	**2771.69**	**100.00**

TABLE 5.9

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF TURBINE COMPONENTS (UNIT SIZE ABOVE 50 MW AND UP TO 100 MW) PERIOD: 2016-17

S. No.	Components of Turbine	Outage Hours	% of Total No. of Hours
1	Bearing	8.32	0.10
2	Runner/Underwater Parts	2962.82	36.92
3	Main Inlet Valve	318.32	3.97
4	Governor System	1126.68	14.04
5	Guide Vanes	118.20	1.47
6	Shaft Vibration / Alignment /Sound	11.60	0.14
7	Miscellaneous Turbine Components	3477.95	43.34
	TOTAL	**8023.88**	**100.00**

TABLE 5.10

FORCED OUTAGE HOURS DUE TO BREAKDOWN OF TURBINE COMPONENTS (UNIT SIZE ABOVE 100 MW) PERIOD: 2016-17

S. No.	Components of Turbine	Outage Hours	% of Total No. of Hours
1	Bearing	1165.46	4.08
2	Runner/Underwater Parts	3227.25	11.31
3	Main Inlet Valve	8568.88	30.03
4	Governor System	8846.38	31.00
5	Guide Vanes	1806.12	6.33
6	Shaft Vibration / Alignment /Sound	976.07	3.42
7	Miscellaneous Turbine Components	3943.10	13.82
	TOTAL	**28533.27**	**100.00**

From the tables above, the major reason for forced outage due to the turbine components unit size-wise are summarized below:

Unit Size	Major Reasons	% of Total No. of Hours
Up to 50 MW	Governor System	45.70
50-100 MW	Miscellaneous Turbine Components	43.34
Above 100 MW	Governor System	31.00

5.5 ANALYSIS BASED ON TYPE OF TURBINE

The analysis of forced outages due to turbine components as per type of turbines is given in **Table 5.11**. Forced outage rate was observed to be the highest in case of Francis & Reversible turbines (69.39 hrs./unit) followed by Kaplan turbines (42.57 hrs./unit), Pelton turbines (42.49 hrs./unit) and lowest in case of Bulb turbines (2.10 hrs./unit)

TABLE 5.11

FORCED OUTAGES-TURBINE TYPE-WISE
PERIOD: 2016-17

S. No.	Type of Turbine	Number of Units	Installed Capacity MW	Forced Outage Hours	Avg. Forced Outage Hours per Unit
1	Bulb	26	684.00	54.65	2
2	Francis & Reversible	403	31620.32	27962.55	69
3	Kaplan	126	4401.20	5363.56	43
4	Pelton	140	7772.90	5948.08	43
	TOTAL	**695**	**44478.42**	**39328.84**	**57**

5.6 ANALYSIS BASED ON MAKE OF UNITS

The comparative performance of generating units of different makes is indicated in **Table 5.12**. The outage figures in the table relate to faults in turbine and generator only.

TABLE 5.12

FORCED OUTAGES DUE TO FAULT IN TURBINE & GENERATOR (SUPPLIER-WISE) PERIOD: 2016-17

S. No.	Name of Supplier/ Country of Make	No. of Units	Installed Capacity (MW)	Total No. of Forced Outages Hours)	Average Forced Outages due to Generating Units (Hours/Unit)	Performance Ranking in Term of Lowest Average Outage Hours/Unit
A-Indigenous						
1	BHEL	292	18656.02	41429.64	141.88	5TH
2	Others	40	2635.50	10082.90	252.07	7TH
	SUB TOTAL	**332**	**21291.52**	**51512.54**	**155.16**	
B-Imported						
1	U.S.A	9	351.00	4629.53	514.39	10TH
2	U.K	63	1242.10	9578.26	152.04	6TH
3	FRANCE	33	2186.40	3057.94	92.66	2ND
4	CANADA	44	3132.00	11319.62	257.26	8TH
5	USSR	26	2804.00	12806.27	492.55	9TH
6	SWITZERLAND	22	815.20	990.55	45.02	1ST
7	JAPAN	76	6344.20	8579.22	112.88	3RD
8	Other	90	6312.00	10751.86	119.47	4TH
	SUB-TOTAL	**363**	**23186.90**	**61713.25**	**170.01**	
	TOTAL	**695**	**44478.42**	**113225.78**	**162.91**	

It is observed that the imported generating units from Switzerland (45.02 hrs./unit) followed by units from France (92.66 hrs./unit) have exhibited the best performance. Further, the average forced outages due to faults in Indigenous generating units are lower than that of imported units.

5.7 ANALYSIS AGE-WISE

Details of forced outages of generating units commissioned during different years are indicated in **Table 5.13**. Forced outages caused by equipment failure i.e. the fault relating to generator, turbine, and auxiliary system equipments have been taken into account for the purpose of computation.

TABLE - 5.13

FORCED OUTAGES DUE TO EQUIPMENT BREAKDOWN (AGE-WISE) PERIOD: 2016-17

S. No.	Year of Commissioning	No. of Units	Installed Capacity (MW)	Forced Outage (Hours)	Non-availability per Unit (Hours)
1	2016-2017	18	1659	76.12	4.23
2	2015-2016	17	1516.00	369.92	21.76
3	2010-11 to 2014-15	62	4417.02	9715.29	156.70
4	2005-06 to 2009-10	66	7077.00	4421.11	66.99
5	2000-01 to 2004-05	75	6766.80	5929.34	79.06
6	1989-90 TO 1999-2000	87	5775.70	34788.76	399.87
7	1978-79 TO 1988-89	124	7259.10	28761.05	231.94
8	1967-68 TO 1977-78	82	5304.75	36929.87	450.36
9	Up to 1966-67	164	4703.05	29359.53	179.02
	Total	**695**	**44478.42**	**150350.99**	**216.33**

It is observed that the per unit forced outage rate was maximum in the case of units commissioned during 1967-68 to 1977-78 (450.36 hrs./unit).

5.8 REGION-WISE PERFORMANCE

The region-wise summary of performance of the hydel generating units is indicated in **Table 5.14**. For the purpose of computation, all types of forced outages/tripping due to faults in generator, turbine, auxiliary system & other equipments and civil structure faults (excluding misc.) have been included.

TABLE 5.14

FORCED OUTAGES – REGION-WISE PERIOD: 2016-17

S. No.	Region	No. of Units	Installed Capacity (MW)	% Non-availability due to Forced Outages
1	Northern	239	18527.27	1.97
2	Western	101	7392.00	1.19
3	Southern	246	11658.70	6.05
4	Eastern	80	5658.45	4.19
5	North Eastern	29	1242.00	7.01
	All India	**695**	**44478.42**	**3.33**

Performance of hydro generating equipments installed in Northern Region was the best as the non-availability due to forced outages was least (1.97%). The average non-availability of the units in the North Eastern Region (7.01) and in the Southern Region (6.05%) observed to be on the higher side.

5.9 FORCED OUTAGE – UTILITY-WISE

The forced outages of hydro electric units under various Central Sector Utilities, Private Sector and State Power Generation Corporations are indicated in **Table 5.15**.

All types of forced outages/tripping due to problems in generating units, auxiliary equipments and civil structure have been taken into account for the analysis.

Table 5.15

FORCED OUTAGES- BOARD /CORPORATION WISE
PERIOD: 2016-17

S. No.	Organisation	No. of Units	Installed Capacity (MW)	Forced Outage (Hours)	Forced Outage/Unit (Hours)
Central Sector					
1	BBMB	28	2866.30	876.53	31.30
2	DVC	5	143.20	10094.78	2018.96
3	NEEPCO	13	755.00	7764.98	597.31
4	NHDC	16	1520.00	107.10	6.69
5	NHPC	67	5121.20	8242.47	123.02
6	NTPC LTD.	4	800.00	6.53	1.63
7	SJVNL	12	1912.02	1502.52	125.21
8	THDC	8	1400.00	137.18	17.15
	Sub Total	**153**	**14517.72**	**28732.11**	**187.79**
Private Sector					
9	ADHPL	2	192.00	247.78	123.89
10	AHPC (GVK)	4	330.00	63.75	15.94
11	DEPL	2	96.00	1.10	0.55
12	DLHP	1	34.00	1.15	1.15
13	E.P.P.L.	2	100.00	72.50	36.25
14	GBHPPL	2	70.00	409.65	204.83
15	GISL	2	99.00	63.05	31.53
16	HBPCL	7	1300.00	101.25	14.46
17	IAEPL	2	24.00	0.00	0.00
18	JPPVL	4	400.00	75.00	18.75
19	MPCL	2	86.00	0.40	0.20
20	TATA MAH.	15	447.00	155.90	10.39
	Sub Total	**45**	**3178.00**	**1191.53**	**26.48**

S. NO.	ORGANISATION	NO. OF UNITS	INSTALLED CAPACITY (MW)	FORCED OUTAGE (HOURS)	FORCED OUTAGE PER UNIT (HOURS)
State Sector					
21	APGENCO	30	1336.75	9058.63	301.95
22	APGPCL	2	100.00	1703.93	851.97
23	CSPGCL	3	120.00	17.25	5.75
24	GSECL	8	540.00	453.68	56.71
25	HPPCL	3	195.00	24.48	8.16
26	HPSEB	12	372.00	16104.67	1342.06
27	JKSPDC	12	1110.00	1265.55	105.46
28	JUUNL	2	130.00	12557.50	6278.75
29	KPCL	68	3585.40	32412.82	476.66
30	KSEB	48	1881.50	8573.43	178.61
31	MAHAGENCO	24	2406.00	4016.87	167.37
32	MeGPCL	11	282.00	17228.48	1566.23
33	MPPGCL	23	875.00	3358.30	146.01
34	OHPC	31	2027.50	10574.23	341.10
35	PSPCL	25	1051.00	2266.12	90.64
36	RRVUNL	11	411.00	124.22	11.29
37	SSNNL	11	1450.00	5.53	0.50
38	TNGDCL	70	2203.20	12241.25	174.88
39	TSGENCO	36	2766.60	12278.75	341.08
40	TUL	6	1200.00	0.00	0.00
41	UJVNL	34	1252.15	2761.80	81.23
42	UPJVNL	15	501.60	4953.10	330.21
43	WBSEDCL	12	986.00	1952.35	162.70
	Sub Total	**497**	**26782.70**	**153932.95**	**309.72**
	All India	**695**	**44478.42**	**183856.59**	**264.54**

It is observed that the per unit forced outages for generating units was maximum in respect of hydro-electric stations under JUUNL (6278.75 hrs./unit). On the other hand, the hydro generating units of IAEPL, TUL, MPCL, SSNNL, DELP, DLHP and NTPC etc. have reported relatively nil/ minimum forced outage free operation.

5.10 DURATION OF FORCED OUTAGES

There were total 3697 forced outages/tripping during the year 2016-17. Duration of individual outage varied widely from a few minutes to the maximum of full year.

The duration pattern of forced outages is indicated in **Table 5.16** and **Exhibit 5.1**. It could be seen that about 59.51% of the total forced shutdown were of duration less than 6 hours while 26.24% of outages were of duration varying from 6 to 24 hours and only 3.08% of shutdowns persisted for more than 10 days.

TABLE 5.16

DURATION PATTERN OF FORCED OUTAGES
PERIOD: 2016-17

S. No.	Duration of Hours	Number of Outages	% of Total of Outages
1	Less than 6 hour	2200	59.51
2	6 to 24 hours	970	26.24
3	1 to 10 days	413	11.17
4	More than 10 days	114	3.08
	Total No. of Outages	**3697**	**100.00**

5.11 FORCED OUTAGES - STATION-WISE

The number of H.E. Stations falling under various ranges of non-availability due to forced outages during the year 2016-17 vis-à-vis 2015-16 is summarized below in **Table 5.17.**

TABLE 5.17

NON-AVAILABILITY OF HE STATIONS DUE TO FORCED OUTAGES
(2016-17 VIS-A-VIS 2015-16)

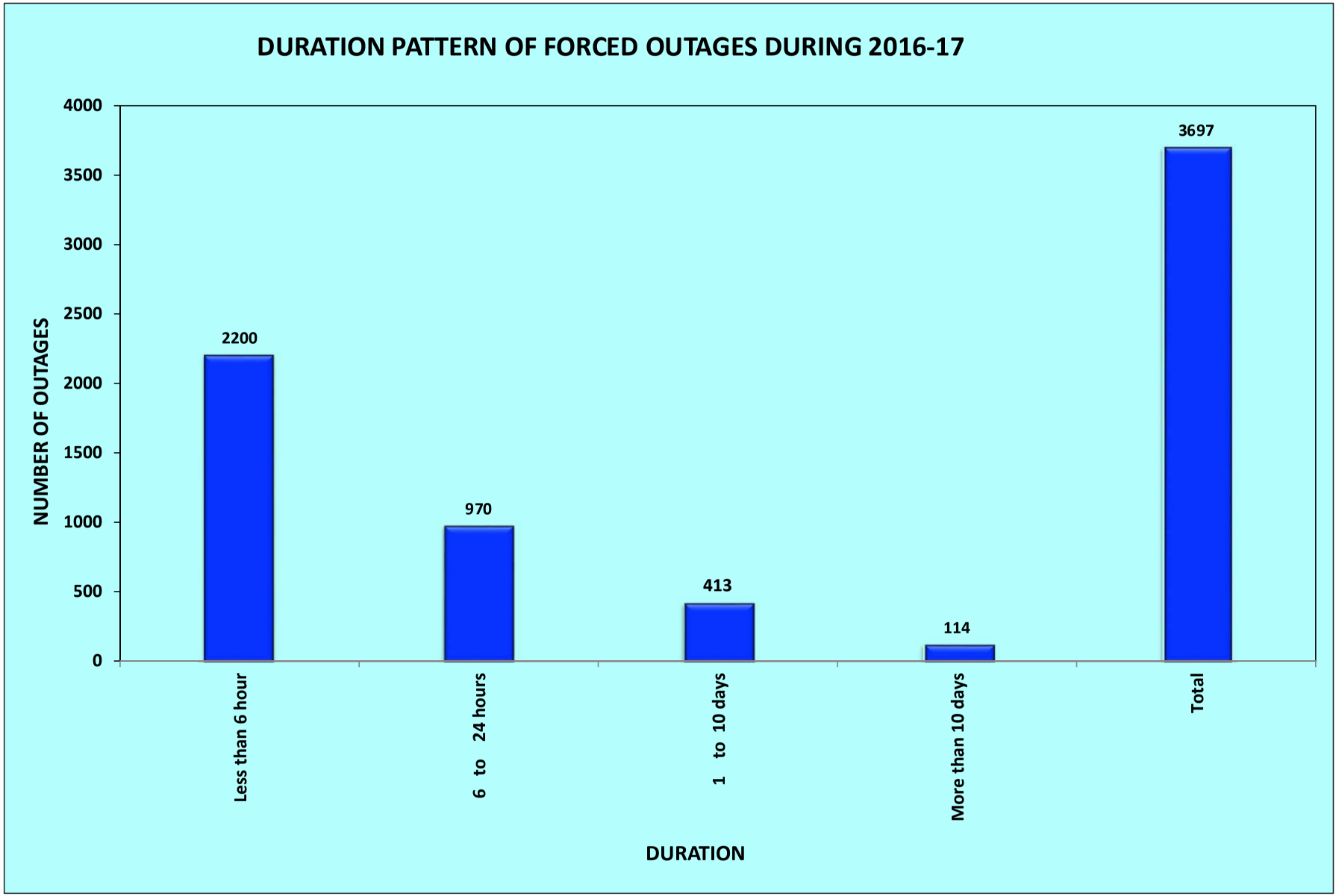
% Non-Availability due to Forced Outages	2016-17				2015-16			
	Stations		Capacity		Stations		Stations	
	No.	% of Total	MW	% of Total	No.	% of Total	MW	% of Total
0	23	11.50	5151.00	11.58	14	7.22	2162	5.05
>0 to 1	87	43.50	20248.95	45.53	76	39.18	18330.15	42.84
>1 to 2	29	14.50	6279.70	14.12	28	14.43	6050.20	14.14
>2 to 3	10	5.00	1613.22	3.63	12	6.19	2398.02	5.61
>3 to 4	10	5.00	1603.00	3.60	12	6.19	1914.00	4.47
>4 to 5	3	1.50	687.50	1.55	4	2.06	1493.00	3.49
>5	38	19.00	8795.05	19.77	48	24.74	10436.05	24.39
Total	**200**	**100**	**44478.42**	**100**	**194**	**100**	**42783.42**	**100**

It could be seen from above that there was no forced outage at 23 nos. (11.50% of total) hydro-electric stations during 2016-17 as compared to 14 nos. (5.05% of total) hydro-electric stations during 2015-16.

19% of stations had operational availability lower then 95% on account of forced outages alone against the normative design/planned annual availability of 95% during the entire station life. These utilities need to improve their O&M practices to bring down their total outages i.e. planned & forced to less then 5% as per best practices.

It is observed from above that stations may be having high forced outages on account of ageing, O&M management issues, undertaking of R&M works, etc. Further, those stations which are having continuously high planned maintenance outages over past few years may be requiring major repair and maintenance works or Renovation & Modernisation (R&M) works for improving the availability, reliability & security of the plant besides providing life extension where the assets have outlived their useful life.

EXHIBIT 5.1


DURATION PATTERN OF FORCED OUTAGES DURING 2016-17
NUMBER OF OUTAGES
4000
3500
3000
2500
2000
1500
1000
500
0
2200
970
413
114
3697
Less than 6 hour
6 to 24 hours
1 to 10 days
More than 10 days
Total
DURATION

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
NORTHERN REGION							
ADHPL							
1	ALLAIN DUHANGAN HPS	1	96	10/02/2017	12/02/2017	48.23	POWER HOUSE MISC
		2	96	12/02/2017	13/02/2017	24.53	POWER HOUSE MISC
		2	96	14/04/2016	15/04/2016	36.2	POLE FAILURE
BBMB							
2	BHAKRA H P S	7	157	19/08/2016	20/08/2016	26.17	EXCITATION OTHERS
		7	157	06/02/2017	16/02/2017	240.02	EXCITATION OTHERS
3	DEHAR H P S	1	165	20/12/2016	24/03/2017	2257.58	PENSTOCK REPAIR WORKS
		1	165	18/06/2016	23/06/2016	130.45	T.B.OIL SYSTEM PROBLEM
		1	165	06/06/2016	08/06/2016	43.27	OIL PROBLEMS
		1	165	29/06/2016	01/07/2016	60.63	OIL PROBLEMS
		1	165	09/07/2016	13/07/2016	101.28	OIL PROBLEMS
		2	165	30/07/2016	31/07/2016	32.85	OTHERS
		2	165	20/12/2016	20/03/2017	2172.82	PENSTOCK REPAIR WORKS
		4	165	19/03/2017	21/03/2017	37.75	STATOR EARTH FAULT
		5	165	10/12/2016	12/12/2016	41.18	ROTOR
		5	165	30/12/2016	01/01/2017	54.78	LGB OIL SYSTEMS PROBLEMBS
		5	165	21/02/2017	23/02/2017	56.2	THRUST BEARING
		5	165	24/07/2016	26/07/2016	62.33	THRUST BEARING PADS.
4	GANGUWAL HPS	1	29.25	12/05/2016	15/05/2016	77.42	STATOR EARTH FAULT
5	KOTLA HPS	1	29.25	04/12/2016	06/12/2016	52	FORCED OUTAGE
6	PONG H P S	2	66	25/08/2016	31/08/2016	144.95	STATOR EARTH FAULT
		2	66	18/11/2016	27/11/2016	212.72	STATOR EARTH FAULT
		2	66	23/01/2017	03/02/2017	278.25	STATOR EARTH FAULT
		5	66	02/03/2017	03/03/2017	24.67	EHG/GOV. FAULTS, MISC.
		5	66	28/12/2016	30/12/2016	50	GEN./TR.BREAKER
		5	66	21/09/2016	22/09/2016	29.5	ROTOR
GBHPPL							
7	BUDHIL HPS	1	35	16/06/2016	01/07/2016	359.23	SPEED RUNAWAY/OVER /UNDER
		2	35	05/02/2017	06/02/2017	25.52	DAM/SPILL WAYS
HBPCL							
8	BASPA HPS	3	100	02/08/2016	03/08/2016	24.92	HRI/HRC/SURGF SHAFT PROPS
9	KARCHAM WANGTOO HPS	1	250	23/08/2016	24/08/2016	42.28	HEAVY DOWN POUR/RAIN WATER LEAKAGE/ FLOOD IN RIVER
HPSEB							
10	BASSI HPS	1	16.5	03/06/2016	05/06/2016	54.58	POWER HOUSE MISC
		1	16.5	13/06/2016	17/06/2016	102.75	POWER HOUSE MISC
		4	16.5	01/06/2016	02/06/2016	25.58	POWER HOUSE MISC
11	GIRI BATA HPS	1	30	10/04/2016	22/05/2016	1008	TRT/TRC/SURGE CHAMBER PROBLEM
		2	30	10/04/2016	30/05/2016	1202.67	TRT/TRC/SURGE CHAMBER PROBLEM
12	LARJI HPS	1	42	11/08/2016	12/08/2016	30.33	INTAKE STRICT./TRASH RACK

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		2	42	22/10/2016	05/11/2016	325.33	GEN./TR.BREAKER
		2	42	11/08/2016	12/08/2016	30.33	INTAKE STRICT./TRASH RACK
		3	42	11/08/2016	13/08/2016	65.5	INTAKE STRICT./TRASH RACK
13	SANJAY HPS	2	40	25/09/2016	04/10/2016	232.42	POWER HOUSE MISC
JKSPDC							
14	BAGLIHAR HPS	2	150	19/04/2016	20/04/2016	39.5	SHAFT VIBRS./ALIGNM/SOUND
		2	150	22/04/2016	24/04/2016	48.78	SHAFT VIBRS./ALIGNM/SOUND
15	BAGLIHAR II HPS	2	150	21/04/2016	22/04/2016	24.03	SHAFT VIBRS./ALIGNM/SOUND
		2	150	18/04/2016	20/04/2016	41.78	SHAFT VIBRS./ALIGNM/SOUND
		2	150	22/04/2016	24/04/2016	64.08	SHAFT VIBRS./ALIGNM/SOUND
16	LOWER JHELUM HPS	2	35	21/06/2016	22/06/2016	25.9	UPPER GUIDE BEARING
17	UPPER SINDH-II HPS	3	35	09/05/2016	22/05/2016	310.42	TURBINE OTHERS
		4	35	04/08/2016	05/08/2016	28.67	TURBINE OTHERS
		4	35	02/06/2016	05/06/2016	66.08	TURBINE OTHERS
		5	35	27/06/2016	29/06/2016	39.08	DRAINAGE DEWATERING SYSTEM
		5	35	30/07/2016	02/08/2016	81.75	TURBINE SHAFT SEAL WORK/REPLACMEENT
		5	35	02/05/2016	09/05/2016	174.17	TURBINE SHAFT SEAL WORK/REPLACMEENT
NHPC							
18	BAIRA SIUL HPS	3	60	05/02/2017	16/02/2017	271.7	GENERATOR FAULTS
19	CHAMERA- I HPS	2	180	06/11/2016	08/11/2016	45.98	GENEARTOR MISC.
20	DHAULI GANGA HPS	1	70	04/06/2016	05/06/2016	39.9	VIBRATION/SOUND/ ALIGNMENT
		1	70	25/01/2017	21/03/2017	1320.12	PR. SHAFT/PENSTOCK/B.F.V
		2	70	17/01/2017	20/03/2017	1476.43	PR. SHAFT/PENSTOCK/B.F.V
		2	70	22/08/2016	12/09/2016	506.23	GENEATOR TRANSFORMER MISC.
		3	70	31/07/2016	12/08/2016	299.72	SHAFT VIBRS./ALIGNM/SOUND
21	DULHASTI HPS	2	130	30/06/2016	12/07/2016	292.32	RUNNER/UNDER WATER PARTS
		2	130	23/06/2016	27/06/2016	90.7	TURBINE SHAFT SEAL WORK/REPLACMEENT
		2	130	15/06/2016	17/06/2016	61.55	TURBINE SHAFT SEAL WORK/REPLACMEENT
22	PARBATI-III HPS	1	130	24/01/2017	27/01/2017	70.42	SYNCHORNISING PROBLEMS
		1	130	24/08/2016	02/09/2016	215.43	UPPER GUIDE BEARING
		1	130	26/12/2016	30/12/2016	98.28	UPPER GUIDE BEARING
		3	130	19/08/2016	20/08/2016	28.32	SHEAR PIN
		3	130	28/04/2016	06/05/2016	196.58	TURBINE FAULTS
		3	130	18/07/2016	20/07/2016	48.47	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		3	130	21/09/2016	24/09/2016	75.32	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		3	130	03/10/2016	04/10/2016	24.17	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		4	130	05/10/2016	07/10/2016	47.13	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		4	130	30/08/2016	31/08/2016	24.5	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		4	130	19/08/2016	21/08/2016	59.1	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
23	SALAL HPS	4	115	01/08/2016	03/08/2016	38.75	TURBINE SHAFT SEAL WORK/REPLACMEENT
		6	115	11/07/2016	13/07/2016	33.12	BRAKE AND JACKS

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
24	TANAKPUR HPS	1	31.4	05/07/2016	07/07/2016	25.78	EXCITATION OTHERS
		2	31.4	05/05/2016	08/05/2016	66.6	SHEAR PIN
		2	31.4	18/10/2016	19/10/2016	32.62	ROTOR
		3	31.4	01/08/2016	08/08/2016	183.43	GOVERNOR SYSTM
25	URI-II HPS	2	60	27/09/2016	18/02/2017	3463.13	POWER HOUSE MISC
		3	60	01/04/2016	03/04/2016	50.7	SHEAR PIN
		3	60	30/05/2016	01/06/2016	59.6	EHG/GOV. FAULTS, MISC.
PSPCL							
26	ANANDPUR SAHIB HPS	3	33.5	21/11/2016	30/11/2016	220.92	EXCITATION PROBLEMS
		4	33.5	04/06/2016	13/06/2016	207.5	STATOR EARTH FAULT
27	MUKERIAN HPS	2	15	08/08/2016	09/08/2016	25.75	GENEATOR TRANSFORMER /BUSHING OIL LEAKAGE
		3	15	01/08/2016	02/08/2016	24.33	SHEAR PIN
		4	15	10/11/2016	11/11/2016	36.72	ROTOR
		8	19.5	25/01/2017	27/01/2017	52.08	SHAFT SEAL
		8	19.5	26/09/2016	28/09/2016	50.75	ALIGNMENT
		9	19.5	02/07/2016	09/07/2016	170.6	GENERATOR FAULTS
28	RANJIT SAGAR HPS	2	150	10/09/2016	20/09/2016	240.58	TRANSFORMER PROTECTION
		3	150	02/05/2016	04/05/2016	51	COOLING WATER SYSTEM
29	SHANAN HPS	5	50	28/04/2016	18/06/2016	1211.17	RUNNER/UNDER WATER PARTS
RRVUNL							
30	JAWAHAR SAGAR HPS	3	33	27/07/2016	08/08/2016	292.75	GENERATOR MAINTENANCE WORK
		3	33	03/11/2016	04/11/2016	27	GENERATOR FAULTS
31	MAHI BAJAJ HPS	2	25	27/02/2017	28/02/2017	29.67	STATOR EARTH FAULT
		2	25	21/09/2016	23/09/2016	48.67	STATOR EARTH FAULT
32	R P SAGAR HPS	2	43	10/11/2016	12/11/2016	45.75	GENEATOR TRANSFORMER /BUSHING OIL LEAKAGE
SJVNL							
33	NATHPA JHAKRI HPS	1	250	10/08/2016	11/08/2016	33.62	GENEATOR TRANSFORMER /BUSHING OIL LEAKAGE
34	RAMPUR HPS	1	68.67	09/10/2016	11/10/2016	33.92	GEN./TR.BREAKER
		1	68.67	27/03/2017	31/03/2017	76.48	EHT/ISOLATOR
		3	68.67	21/11/2016	22/11/2016	28.98	GENRATOR OTHERS
		4	68.67	21/11/2016	22/11/2016	28.98	GENRATOR OTHERS
		4	68.67	10/04/2016	12/04/2016	59.55	ABNORMAL SOUND
		4	68.67	06/01/2017	09/01/2017	73.97	BUS COUPLER BREAKER
		5	68.67	09/05/2016	11/05/2016	62.82	TURBINE BEARING PROBLEMS
THDC							
35	TEHRI ST-1 HPS	1	250	06/06/2016	08/06/2016	52	GEN./TR.BREAKER
		2	250	04/06/2016	05/06/2016	32	GEN./TR.BREAKER
		3	250	29/01/2017	30/01/2017	28.5	GENEREATOR COOLING SYSTEM
UJVNL							
36	CHIBRO (YAMUNA) HPS	3	60	06/03/2017	07/03/2017	37.33	ROTOR
		4	60	23/06/2016	28/06/2016	117.75	LGB PADS

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
37	CHILLA HPS	2	36	20/07/2016	21/07/2016	30.75	EHG/GOV. FAULTS, MISC.
		2	36	12/08/2016	14/08/2016	49.92	TURBINE SHAFT SEAL WORK/REPLACMEENT
		3	36	11/08/2016	13/08/2016	54.5	TURBINE SHAFT SEAL WORK/REPLACMEENT
		4	36	27/04/2016	28/04/2016	25.83	SHEAR PIN
		4	36	07/08/2016	08/08/2016	34.75	TURBINE SHAFT SEAL WORK/REPLACMEENT
38	DHALIPUR HPS	1	17	07/07/2016	11/07/2016	109.08	UGB ALIGNMENT/MISC.
		2	17	28/08/2016	04/09/2016	162	U.G.B. PADS
		3	17	22/03/2017	31/03/2017	214.92	HRI/HRC/SURGF SHAFT PROPS
39	KHODRI HPS	3	30	13/02/2017	26/02/2017	321.58	SWITCHYARD MISC.
		4	30	28/02/2017	08/03/2017	197.83	FIRE /CO2 SYSTEM
		4	30	30/05/2016	01/06/2016	44	REPLACEMENT OF TRASH RACK
40	MANERI BHALI - I HPS	2	30	30/07/2016	31/07/2016	30.23	TURBINE SHAFT SEAL WORK/REPLACMEENT
		2	30	19/07/2016	26/07/2016	168.83	TURBINE SHAFT SEAL WORK/REPLACMEENT
		2	30	04/07/2016	06/07/2016	37.42	TURBINE SHAFT SEAL WORK/REPLACMEENT
		2	30	01/06/2016	17/06/2016	386.33	GENERATOR FAULTS
		3	30	22/06/2016	26/06/2016	96.08	SPEED RUNAWAY/OVER /UNDER
41	MANERI BHALI - II HPS	1	76	23/01/2017	25/01/2017	59.33	OTHER (D/T,GUIDE/STAY VANES
		2	76	06/07/2016	07/07/2016	27.92	PENSTOCK
		3	76	14/04/2016	23/04/2016	215.85	TURBINE VIBRATION HIGH
		3	76	26/01/2017	31/01/2017	104.08	LINE BREAKER
		4	76	13/08/2016	14/08/2016	33.83	TURBINE SHAFT SEAL WORK/REPLACMEENT
		4	76	07/10/2016	08/10/2016	29	TURBINE SHAFT SEAL WORK/REPLACMEENT
		4	76	17/04/2016	19/04/2016	48.08	GENEATOR TRANSFORMER /BUSHING OIL LEAKAGE
UPJVNL							
42	KHARA HPS	1	24	25/02/2017	26/02/2017	31	EXCITATION SYSTEM FAILURE
		1	24	04/04/2016	08/07/2016	2281.08	POLE FAILURE
		1	24	22/03/2017	31/03/2017	216	POWER CHANNEL REPAIR
		1	24	22/10/2016	26/10/2016	91.67	GEN.TR.BREAKER MECH.PROBLEM
		2	24	21/03/2017	31/03/2017	217.33	POWER CHANNEL REPAIR
		3	24	13/07/2016	15/07/2016	55.48	GEN.TR.BREAKER MECH.PROBLEM
		3	24	26/11/2016	27/11/2016	40.75	GEN.TR.BREAKER MECH.PROBLEM
43	MATATILA HPS	2	10.2	19/08/2016	22/08/2016	71.33	EHG/GOV. FAULTS, MISC.
		3	10.2	10/07/2016	13/07/2016	91.58	EXCITATION OTHERS
44	OBRA HPS	3	33	15/12/2016	27/12/2016	288.33	EXCITATION SYSTEM FAILURE
		3	33	03/06/2016	01/09/2016	2168	INTAKE STRICT./TRASH RACK
		3	33	07/09/2016	30/11/2016	2027	STATOR EARTH FAULT
WESTERN REGION							
GSECL							
45	KADANA HPS	2	60	28/08/2016	30/08/2016	58.88	EHT/CT/PT/FAULT /BROBLEM
		2	60	12/08/2016	14/08/2016	37	PENSTOCK RUPTURE
		3	60	12/08/2016	23/08/2016	256	PENSTOCK RUPTURE

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		4	60	12/08/2016	15/08/2016	77.47	PENSTOCK RUPTURE
MAHAGENCO							
46	BHIRA TAIL RACE HPS	1	40	20/04/2016	07/05/2016	410.17	THRUST BEARING
		2	40	01/07/2016	06/07/2016	139.92	TRANSFORMER PROTECTION
47	GHATGHAR PSS HPS	1	125	25/12/2016	28/12/2016	72	GENEREATOR COOLING SYSTEM
		1	125	09/12/2016	10/12/2016	25.83	LT AC PANELS
		2	125	09/12/2016	10/12/2016	26.42	LT AC PANELS
48	KOYNA-I HPS	4	70	04/02/2017	05/02/2017	39.92	THRUST BRG. OIL COOLERS PROBLEM /LEAGE
49	KOYNA-II HPS	1	80	03/06/2016	09/06/2016	151.17	NEEDLE PROBLEM
		3	80	10/02/2017	20/03/2017	913.5	GENERATOR BUS DUCT PROBLEM
		3	80	11/11/2016	12/11/2016	36.17	GENRATOR OTHERS
		4	80	19/08/2016	19/10/2016	1465.92	SHAFT VIBRS./ALIGNM/SOUND
		4	80	01/02/2017	05/02/2017	118.83	TRANSFORMER PROTECTION
50	KOYNA-III HPS	1	80	10/09/2016	18/09/2016	203.25	LT AC PANELS
		3	80	01/11/2016	01/12/2016	720	GENERATOR FAULTS
51	KOYNA-IV HPS	1	250	19/01/2017	29/01/2017	235.58	GUIDE VANES DAMAGED
		4	250	07/12/2016	09/12/2016	56.08	LEAKAGE OIL VENT PIPE
		4	250	17/06/2016	23/06/2016	148.25	OIL PROBLEMS
52	TILLARI HPS	1	60	08/04/2016	12/04/2016	97.33	COOLING WATER SYSTEM
		1	60	03/10/2016	04/10/2016	36	EHG/GOV. FAULTS, MISC.
		1	60	16/03/2017	31/03/2017	360	INTAKE STRICT./TRASH RACK
		1	60	06/08/2016	08/08/2016	55	GENERATING UNIT SHUT DOWN OTHER REASONS
		1	60	03/07/2016	04/07/2016	31	EXCITATION SYSTEM FAILURE
		1	60	03/08/2016	05/08/2016	61.33	EXCITATION SYSTEM FAILURE
MPPGCL							
53	BANSAGAR TONS-1 HPS	1	105	15/11/2016	21/11/2016	140.58	POLE FAILURE
		2	105	11/07/2016	13/07/2016	36.25	ROTOR EARTH FAULT
		2	105	08/07/2016	09/07/2016	28.33	ROTOR EARTH FAULT
54	BANSAGAR TONS-II HPS	1	15	05/07/2016	09/07/2016	94.42	EXCITATION OTHERS
		1	15	01/06/2016	04/06/2016	84	OTHER (D/T,GUIDE/STAY VANES
		2	15	01/10/2016	11/10/2016	244.42	TURBINE SHAFT SEAL LEAK/BOLTS BROKEN
		2	15	28/09/2016	30/09/2016	71.57	TURBINE SHAFT SEAL LEAK/BOLTS BROKEN
55	BARGI HPS	1	45	03/06/2016	08/06/2016	126.67	TURBINE SHAFT SEAL LEAK/BOLTS BROKEN
56	MADHIKHERA HPS	1	20	22/12/2016	23/12/2016	40.83	POLE FAILURE
57	PENCH HPS	1	80	21/02/2017	23/02/2017	55.5	MIV LEAKAGE
		1	80	18/12/2016	19/12/2016	34.42	MIV LEAKAGE
		1	80	01/08/2016	03/09/2016	789.63	GENERATOR STATOR DAMAGED
		2	80	20/02/2017	23/02/2017	78	OTHER (D/T,GUIDE/STAY VANES
		2	80	18/12/2016	19/12/2016	35.42	LT AC PANELS
		2	80	08/10/2016	09/10/2016	32.25	MIV LEAKAGE
58	RAJGHAT HPS	3	15	21/08/2016	29/10/2016	1657.5	DRAINAGE DEWATERING SYSTEM

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Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		3	15	26/01/2017	28/01/2017	46.47	PROTECTION OPERATION
NHDC							
59	INDIRA SAGAR HPS	7	125	20/02/2017	22/02/2017	54.72	LGB ALIGNMENT/MISC
TATA MAH.							
60	BHIRA HPS	5	25	15/01/2017	21/01/2017	147.5	ABNORMAL SOUND
SOUTHERN REGION							
APGENCO							
61	HAMPI HPS	1	9	05/10/2016	09/10/2016	101.32	OTHER EQUIPMENT FAULTS
		2	9	01/08/2016	10/08/2016	218.83	LOWER GUIDE BEARING
		3	9	28/07/2016	29/07/2016	27.17	SHEAR PIN
62	T B DAM HPS	2	9	28/08/2016	29/08/2016	27.58	GOVERNOR SYSTM
63	UPPER SILERU HPS	1	60	01/08/2016	10/08/2016	218.83	LOWER GUIDE BEARING
		2	60	25/10/2016	28/10/2016	68.88	GENEATOR TRANSFORMER MISC.
		2	60	01/04/2016	28/04/2016	657.17	GEN./TR.BREAKER
		3	60	12/05/2016	17/06/2016	868.48	LINE BREAKER
		4	60	02/02/2017	09/02/2017	160.75	LUBRICATION
		4	60	23/05/2016	09/06/2016	407.13	PROTECTION OPERATION
KPCL							
64	ALMATTI DPH HPS	2	55	26/07/2016	29/07/2016	67.25	BUS PROTECTION TRIP
		2	55	15/02/2017	27/02/2017	289.15	GENERATOR MISCELLANEOUS
		3	55	14/01/2017	16/01/2017	64.42	GEN./TR.BREAKER
		5	55	07/02/2017	28/02/2017	527.98	GENERATOR TRANSFORMER
		6	55	22/02/2017	28/02/2017	156.15	GENERATOR TRANSFORMER
65	BHADRA HPS	1	2	11/07/2016	13/07/2016	45.08	GEN./TR.BREAKER
		1	2	07/07/2016	10/07/2016	78.25	GEN./TR.BREAKER
66	GERUSUPPA HPS	1	60	28/01/2017	31/01/2017	75.92	PROTECTION OPERATION
		2	60	07/02/2017	09/02/2017	48.92	PROTECTION OPERATION
67	JOG HPS	6	21.6	01/10/2016	31/10/2016	743.98	DEFLECTOR MECH. PROBLEM/OIL LEAKAGE
		8	21.6	01/02/2017	28/02/2017	671.98	GENERATOR FAULTS
68	KADRA HPS	1	50	08/07/2016	10/07/2016	45.58	GEN.TR.BREAKER MECH.PROBLEM
		1	50	11/07/2016	13/07/2016	45.08	GEN.TR.BREAKER MECH.PROBLEM
		2	50	23/07/2016	25/07/2016	35.5	GEN.TR.BREAKER MECH.PROBLEM
		2	50	10/07/2016	12/07/2016	35.08	GEN.TR.BREAKER MECH.PROBLEM
		2	50	18/07/2016	20/07/2016	45.33	GEN.TR.BREAKER MECH.PROBLEM
		3	50	08/07/2016	09/07/2016	31.83	GEN.TR.BREAKER MECH.PROBLEM
		3	50	09/07/2016	12/07/2016	57.83	GEN.TR.BREAKER MECH.PROBLEM
		3	50	22/07/2016	25/07/2016	69.33	GEN.TR.BREAKER MECH.PROBLEM
		3	50	02/06/2016	07/06/2016	109.17	PENSTOCK GATE PROBLEM
		3	50	11/06/2016	13/06/2016	31.17	PENSTOCK GATE PROBLEM
		3	50	13/06/2016	14/06/2016	30.42	PENSTOCK GATE PROBLEM
		3	50	18/06/2016	20/06/2016	32.58	PENSTOCK GATE PROBLEM

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		3	50	20/06/2016	22/06/2016	42.92	PENSTOCK GATE PROBLEM
		3	50	25/06/2016	27/06/2016	44.92	PENSTOCK GATE PROBLEM
		3	50	22/06/2016	24/06/2016	56.83	PENSTOCK GATE PROBLEM
69	KALINADI HPS	3	135	03/06/2016	09/08/2016	1599.75	MIV LEAKAGE
		4	150	03/06/2016	03/08/2016	1454.8	MIV LEAKAGE
70	KODASALI HPS	1	40	21/07/2016	23/07/2016	45.92	GEN.TR.BREAKER MECH.PROBLEM
		1	40	18/07/2016	20/07/2016	47.67	GEN.TR.BREAKER MECH.PROBLEM
		1	40	02/07/2016	03/07/2016	24.08	GEN.TR.BREAKER MECH.PROBLEM
		2	40	10/07/2016	12/07/2016	39.6	GEN.TR.BREAKER MECH.PROBLEM
		2	40	18/07/2016	20/07/2016	35.92	GEN.TR.BREAKER MECH.PROBLEM
		2	40	08/07/2016	10/07/2016	46.83	GEN.TR.BREAKER MECH.PROBLEM
		2	40	13/12/2016	31/12/2016	445.48	GEN.TR.BREAKER MECH.PROBLEM
		2	40	23/07/2016	25/07/2016	46.67	GEN.TR.BREAKER MECH.PROBLEM
		2	40	30/06/2016	05/07/2016	138.25	GEN.TR.BREAKER MECH.PROBLEM
		3	40	13/02/2017	28/02/2017	372.82	PENSTOCK GATE PROBLEM
		3	40	01/07/2016	03/07/2016	56.17	GEN.TR.BREAKER MECH.PROBLEM
		3	40	04/07/2016	06/07/2016	33.17	GEN.TR.BREAKER MECH.PROBLEM
		3	40	23/07/2016	25/07/2016	55.83	GEN.TR.BREAKER MECH.PROBLEM
		3	40	20/07/2016	22/07/2016	41.58	GEN.TR.BREAKER MECH.PROBLEM
		3	40	12/07/2016	14/07/2016	30.75	GEN.TR.BREAKER MECH.PROBLEM
		3	40	09/07/2016	12/07/2016	58.08	GEN.TR.BREAKER MECH.PROBLEM
		3	40	08/07/2016	09/07/2016	26.67	GEN.TR.BREAKER MECH.PROBLEM
71	LIGANAMAKKI HPS	2	27.5	23/11/2016	24/11/2016	33.5	T.B.OIL SYSTEM PROBLEM
72	MUNIRABAD HPS	1	9	23/06/2016	24/06/2016	28.75	GENEATOR TRANSFORMER OIL PROBLEMS/TOPPING
		2	9	26/06/2016	27/06/2016	28.17	GENEATOR TRANSFORMER OIL PROBLEMS/TOPPING
		3	10	01/06/2016	14/06/2016	318.42	GENEATOR TRANSFORMER OIL PROBLEMS/TOPPING
73	SHARAVATHI HPS	10	103.5	09/07/2016	12/07/2016	90.85	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		2	103.5	07/12/2016	08/12/2016	25.08	GENEATOR PROTECTION MISC/BACK UP PROT
		3	103.5	06/09/2016	07/09/2016	28.28	LT AC PANELS
		4	103.5	06/09/2016	08/09/2016	43.45	COOLING WATER SYSTEM
		4	103.5	06/12/2016	08/12/2016	38.7	AUTO. VOLTAGE REGULATOR
		6	103.5	16/01/2017	17/01/2017	27.67	EHG/GOV. FAULTS, MISC.
		7	103.5	08/01/2017	09/01/2017	38.28	PROTECTION OPERATION
		8	103.5	15/01/2017	16/01/2017	30.08	STATOR WINDING TEMP HIGH
		8	103.5	01/05/2016	03/05/2016	66.87	POWER HOUSE MISC.
		8	103.5	01/04/2016	03/04/2016	66.87	POWER HOUSE MISC.
		8	103.5	23/07/2016	27/07/2016	103.92	PENSTOCK REPAIR WORKS
		9	103.5	12/07/2016	13/07/2016	39	PROTECTION OPERATION
74	VARAHI HPS	2	115	03/06/2016	04/06/2016	38.53	GENEREATOR COOLING SYSTEM
		3	115	01/07/2016	07/07/2016	146.65	SWITCHYARD MISC.
		4	115	13/09/2016	14/09/2016	37.3	LT AC PANELS

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		4	115	04/04/2016	09/05/2016	849.72	TURBINE OTHERS
KSEB LTD.							
75	IDAMALAYAR HPS.	1	37.5	07/10/2016	09/10/2016	58	PENSTOCK GATE PROBLEM
76	IDUKKI HPS.	1	130	14/02/2017	22/02/2017	207.85	GOVERNOR SYSTM
		2	130	19/09/2016	24/09/2016	124.2	VIBRATION/SOUND/ ALIGNMENT
		3	130	30/11/2016	04/12/2016	111.33	PENSTOCK REPAIR WORKS
77	KAKKAD HPS.	1	25	04/05/2016	02/06/2016	702.75	STATOR EARTH FAULT
78	KUTTIYADI HPS.	4	50	06/11/2016	14/12/2016	907.58	MIV CONTROL PROBLEM
		4	50	02/02/2017	11/02/2017	221	LGB ALIGNMENT/MISC
79	LOWER PERIYAR HPS.	1	60	16/02/2017	03/03/2017	349.78	TRANSFORMER PROTECTION
80	NARIAMANGLAM HPS	3	15	10/06/2016	30/06/2016	475.17	PENSTOCK LEAKAGE
		3	15	13/10/2016	16/10/2016	68.08	MIV SERVO MOTOR PROBLEM
		4	25	17/10/2016	18/10/2016	24.18	SHAFT VIBRS./ALIGNM/SOUND
		4	25	28/08/2016	30/08/2016	51.75	COOLING WATER SYSTEM
		4	25	15/01/2017	17/01/2017	44.62	GENERATOR FAULTS
		4	25	02/11/2016	03/11/2016	24.77	LOWER GUIDE BEARING
81	PALLIVASAL HPS.	5	7.5	13/04/2016	28/04/2016	359.95	VIBRATION/SOUND/ ALIGNMENT
		5	7.5	08/05/2016	12/05/2016	98.5	VIBRATION/SOUND/ ALIGNMENT
		6	7.5	15/04/2016	20/04/2016	126.7	POWER HOUSE MISC.
		6	7.5	10/11/2016	15/12/2016	849.13	AIR PR./OIL PR. PROBLEM
82	PORINGALKUTTU HPS.	2	8	18/11/2016	21/11/2016	67.38	PROTECTION OPERATION
		2	8	18/04/2016	27/04/2016	232.37	MAIN INLET VALVE PROBLEM
		3	8	05/06/2016	21/06/2016	372.48	GENEREATOR COOLING SYSTEM
		4	8	24/05/2016	31/05/2016	175.2	UGB ALIGNMENT/MISC.
83	SABARIGIRI HPS.	1	50	17/05/2016	20/05/2016	83.45	POWER HOUSE MISC.
		1	50	29/06/2016	05/07/2016	146.43	T.B.OIL SYSTEM PROBLEM
		4	50	14/05/2016	16/05/2016	41.58	POWER HOUSE MISC.
		5	50	24/12/2016	25/12/2016	45.63	PENSTOCK REPAIR WORKS
		5	50	09/06/2016	22/06/2016	305.78	WATER CONDCUTOR SYSTEM
		6	50	20/06/2016	23/06/2016	69.37	PENSTOCK REPAIR WORKS
84	SENGULAM HPS.	1	12	31/10/2016	02/11/2016	45.35	EXCITATION SYSTEM FAILURE
		1	12	29/10/2016	30/10/2016	24.17	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		4	12	21/03/2017	22/03/2017	41.93	POWER HOUSE MISC.
85	SHOLAYAR HPS.	3	18	09/02/2017	09/03/2017	680.8	THRUST BEARING
		3	18	26/06/2016	30/06/2016	107.32	THRUST BEARING PADS.
TNGDCL							
86	ALIYAR HPS.	1	60	11/08/2016	13/08/2016	46.83	AUTO. VOLTAGE REGULATOR
87	KADAMPARI HPS.	1	100	01/08/2016	09/08/2016	213.42	GENERATOR FAULTS
		1	100	20/05/2016	14/06/2016	611.5	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		1	100	09/11/2016	31/01/2017	1993.33	RUNNER/UNDER WATER PARTS
		2	100	20/05/2016	14/06/2016	611.5	SHEAR PIN BROKEN/FAILURE/REPLACEMENT

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		3	100	22/10/2016	31/03/2017	3831.25	MIV SERVO MOTOR PROBLEM
		3	100	01/08/2016	16/08/2016	368.92	MIV SERVO MOTOR PROBLEM
		3	100	22/08/2016	24/08/2016	43.58	MIV SERVO MOTOR PROBLEM
		3	100	14/06/2016	30/06/2016	386.88	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		3	100	20/05/2016	14/06/2016	611.5	SHEAR PIN BROKEN/FAILURE/REPLACEMENT
		4	100	20/04/2016	28/04/2016	206.17	ROTOR MISC. FAULTS
		4	100	20/05/2016	14/06/2016	611.5	GENERATING UNIT SHUT DOWN OTHER REASONS
88	KODAYAR HPS.	1	60	08/09/2016	12/09/2016	82.35	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		1	60	23/08/2016	24/08/2016	29.37	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		1	60	11/11/2016	12/11/2016	25.05	LOWER GUIDE BEARING
		1	60	05/12/2016	07/12/2016	45.23	GENERATOR MAINTENANCE WORK
		1	60	13/11/2016	17/11/2016	91.53	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		1	60	24/09/2016	27/10/2016	787.53	TURBINE VIBRATION HIGH
		1	60	27/05/2016	31/05/2016	102.48	RUNNER/UNDER WATER PARTS
		1	60	14/01/2017	26/01/2017	288.22	COOLING WATER SYSTEM
		1	60	06/11/2016	08/11/2016	52.37	MAIN INLET VALVE PROBLEM
		1	60	11/03/2017	14/03/2017	72.22	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		2	40	03/04/2016	07/04/2016	99.25	RUNNER/UNDER WATER PARTS
89	KUNDAH HPS.	10	60	21/01/2017	22/01/2017	31.18	DESILTING SYSTEM
		11	60	21/01/2017	22/01/2017	32.75	DESILTING SYSTEM
		3	20	29/04/2016	06/05/2016	167	EXCITATION PROBLEMS
		4	35	21/01/2017	22/01/2017	34.05	DESILTING SYSTEM
		5	35	09/11/2016	10/11/2016	27.38	PENSTOCK LEAKAGE
		5	35	03/11/2016	09/11/2016	144.75	GUIDE VANE SERVOMOTOR LEAKAGE
		5	35	21/01/2017	22/01/2017	33.77	DESILTING CHAMBER PROBLEM
		6	35	21/01/2017	22/01/2017	33.33	DESILTING CHAMBER PROBLEM
		6	35	16/11/2016	18/11/2016	54.33	PENSTOCK EXP. JOINT PROBLEM
		7	35	21/01/2017	22/01/2017	32.22	DESILTING CHAMBER PROBLEM
		8	35	21/01/2017	22/01/2017	31.72	DESILTING CHAMBER PROBLEM
		8	35	28/05/2016	30/05/2016	53.22	PENSTOCK EXP. JOINT PROBLEM
		8	35	21/11/2016	24/11/2016	78.6	PENSTOCK EXP. JOINT PROBLEM
		9	60	21/01/2017	22/01/2017	32.33	DESILTING CHAMBER PROBLEM
90	MOYAR HPS	2	12	26/03/2017	31/03/2017	109.75	PROTECTION OPERATION
91	PAPANASAM HPS.	2	8	30/09/2016	14/11/2016	1075.03	OTHER (D/T,GUIDE/STAY VANES
		2	8	27/05/2016	12/09/2016	2597.92	OTHER (D/T,GUIDE/STAY VANES
92	PYKARA HPS.	1	7	27/12/2016	30/12/2016	83.5	PENSTOCK LEAKAGE
		3	7	06/05/2016	08/05/2016	54.75	PENSTOCK EXP. JOINT PROBLEM
		3	7	24/01/2017	25/01/2017	39.32	PENSTOCK EXP. JOINT PROBLEM
		5	13.6	24/01/2017	25/01/2017	39.32	PENSTOCK EXP. JOINT PROBLEM
		5	13.6	06/05/2016	08/05/2016	54.75	PENSTOCK EXP. JOINT PROBLEM
		5	13.6	11/05/2016	12/05/2016	25.17	PENSTOCK EXP. JOINT PROBLEM

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		6	11	09/05/2016	10/05/2016	25.25	PENSTOCK EXP. JOINT PROBLEM
93	PYKARA ULTMATE HPS.	1	50	26/04/2016	27/04/2016	34.25	PROTECTION OPERATION
94	SHOLAYAR HPS.	2	35	28/09/2016	01/10/2016	88.08	EHG/GOV. FAULTS, MISC.
		3	25	01/06/2016	09/06/2016	192.67	EHT/ISOLATOR
95	SURULIYAR HPS.	1	35	28/09/2016	04/10/2016	139.28	PENSTOCK EXP. JOINT PROBLEM
		1	35	30/04/2016	03/05/2016	59.08	PENSTOCK EXP. JOINT PROBLEM
TSGENCO							
96	LOWER SILERU HPS	2	115	10/08/2016	12/08/2016	42	GENEATOR TRANSFORMER MISC.
97	NAGARJUN SGR HPS	2	100.8	10/06/2016	15/06/2016	123.92	POWER HOUSE MISC.
		3	100.8	07/06/2016	23/07/2016	1116.17	INTAKE STRICT./TRASH RACK
		5	100.8	02/07/2016	30/07/2016	680.35	INTAKE STRICT./TRASH RACK
		6	100.8	02/07/2016	30/07/2016	680.35	INTAKE STRICT./TRASH RACK
		7	100.8	15/09/2016	23/09/2016	198.07	THRUST BEARING
		7	100.8	02/07/2016	30/07/2016	680.35	INTAKE STRICT./TRASH RACK
		8	100.8	19/01/2017	28/02/2017	963.75	REPLACEMENT OF TRASH RACK
98	PRIYADARSHNI JURALA HPS	6	39	23/09/2016	25/09/2016	39.75	POWER HOUSE MISCELLANEOUS
		6	39	07/10/2016	08/10/2016	24.17	POWER HOUSE MISCELLANEOUS
EASTERN REGION							
APGENCO							
99	MACHKUND HPS	1	17	11/08/2016	20/08/2016	214.78	THRUST BEARING
		3	17	01/09/2016	30/09/2016	719.98	EHG/GOV. FAULTS, MISC.
		3	17	01/08/2016	31/08/2016	743.98	EHG/GOV. FAULTS, MISC.
		3	17	01/12/2016	31/12/2016	738.72	UNIT AUXILIARY SOURCE CHANGEOVER
		3	17	01/01/2017	19/01/2017	455.98	GOVERNOR SLUGGISH/HUNTING /FAIL/TROUBLE
		3	17	01/02/2017	31/07/2016	671.98	GOVERNOR SLUGGISH/HUNTING /FAIL/TROUBLE
		4	21.25	31/05/2016	06/06/2016	147.25	EXCITATION SYSTEM FAILURE
		4	21.25	18/07/2016	19/07/2016	32.42	OPU OIL PUMP/MOTOR TROUBLE FAILURE
		4	21.25	04/04/2016	12/04/2016	194.78	GEN./TR.BREAKER
		5	21.25	21/02/2017	22/02/2017	25.25	TURBINE FAULTS
		6	21.25	01/04/2016	10/04/2016	227.67	EXCITATION PROBLEMS
		6	21.25	12/04/2016	27/04/2016	370.75	LT AC PANELS
DVC							
100	MAITHON HPS.	1	23.2	19/09/2016	21/09/2016	51.58	EHG/GOV. FAULTS, MISC.
		1	23.2	20/06/2016	30/06/2016	242.4	GOVERNOR SYSTM
		1	23.2	08/04/2016	14/04/2016	137.33	GENEATOR TRANSFORMER MISC.
		1	23.2	10/08/2016	16/08/2016	144.47	EHG/GOV. FAULTS, MISC.
		2	20	30/08/2016	31/08/2016	32.92	PROTECTION OPERATION
		2	20	11/08/2016	14/08/2016	77.62	PROTECTION OPERATION
		2	20	01/09/2016	04/09/2016	92.92	GENEATOR CONTROL PROBLEM
		2	20	04/04/2016	08/04/2016	106.83	GENEATOR TRANSFORMER MISC.
		2	20	28/10/2016	30/12/2016	719.98	GENERATOR BEARINGS

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
101	PANCHET HPS.	1	40	13/07/2016	17/07/2016	88.83	GEN./TR.BREAKER
		1	40	21/09/2016	31/03/2017	4569.48	STATOR EARTH FAULT
		2	40	18/01/2017	31/01/2017	317.98	POWER HOUSE MISC
JUUVN							
102	SUBERNREKHA HPS.	1	65	22/10/2016	31/03/2017	3821.5	GENERATOR FAULTS
NHPC							
103	RANGIT HPS	1	20	06/07/2016	12/07/2016	144.75	UPPER GUIDE BEARING
104	TEESTA LOW DAM-III HPS	1	33	12/09/2016	13/09/2016	24.98	TURBINE SHAFT SEAL LEAK/BOLTS BROKEN
		1	33	11/05/2016	13/05/2016	71.6	SHAFT VIBRS./ALIGNM/SOUND
		1	33	13/04/2016	14/04/2016	36.57	GEN./TR.BREAKER
		1	33	01/04/2016	02/04/2016	41.93	GEN./TR.BREAKER
		1	33	17/05/2016	09/06/2016	560.07	HRI/HRC/SURGF SHAFT PROPS
		2	33	11/09/2016	13/09/2016	37.57	GENRATOR OTHERS
		3	33	10/08/2016	11/08/2016	30.12	TURBINE SHAFT SEAL LEAK/BOLTS BROKEN
		3	33	01/04/2016	02/04/2016	43.9	GEN./TR.BREAKER
		3	33	13/04/2016	14/04/2016	36.67	GEN./TR.BREAKER
		4	33	13/04/2016	14/04/2016	36.57	GEN./TR.BREAKER
		4	33	01/04/2016	02/04/2016	39.9	GEN./TR.BREAKER
105	TEESTA LOW DAM-IV HPS	2	40	13/05/2016	14/05/2016	24.45	GEN./TR.BREAKER
		2	40	08/07/2016	09/07/2016	24.12	MISCELLANEOUS ELECTRICAL WORKS
106	TEESTA V HPS	1	170	24/06/2016	30/06/2016	129.25	TURBINE OTHERS
OHPC							
107	BALIMELA HPS.	1	60	01/04/2016	31/08/2016	3671.98	GENEARTOR MISC.
		8	75	26/04/2016	29/04/2016	79.75	TURBINE OTHERS
		8	75	07/11/2016	30/11/2016	558.15	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
		8	75	01/01/2017	31/01/2017	743.98	EXCT. FAIL/LOSS OF EXCITATION /MISC. PROB.
108	HIRAKUD HPS	1	49.5	10/09/2016	12/09/2016	58.33	INTAKE STRICT./TRASH RACK
		1	49.5	13/09/2016	14/09/2016	29.17	GUIDE VANES
		1	49.5	10/11/2016	18/11/2016	189.5	COMPRESSED AIR SYSTEM
		1	49.5	28/11/2016	24/12/2016	634.42	GENEATOR TRANSFORMER /BUSHING OIL LEAKAGE
		1	49.5	12/08/2016	20/08/2016	193.08	INTAKE STRICT./TRASH RACK
		2	49.5	26/04/2016	27/06/2016	1489.67	EHG/GOV. FAULTS, MISC.
		5	37.5	19/09/2016	24/09/2016	115.58	LUB.OIL SYSTEM PROBLEM
		5	37.5	06/07/2016	08/07/2016	43.25	DRAINAGE DEWATERING SYSTEM
		7	37.5	30/09/2016	03/10/2016	75.25	OIL PROBLEMS
		7	37.5	26/04/2016	27/04/2016	30	OIL PROBLEMS
109	RENGALI HPS.	1	50	02/11/2016	05/11/2016	75.17	LGB OIL SYSTEMS PROBLEMBS
		4	50	28/07/2016	30/07/2016	49.5	EHT/L.A.
		5	50	17/06/2016	18/06/2016	25	GENERATOR FAULTS
110	UPPER INDRAVATI HPS.	2	150	15/06/2016	20/06/2016	108.75	GENEREATOR COOLING SYSTEM
		4	150	06/03/2017	07/03/2017	33.83	BUS COUPLER BREAKER
111	UPPER KOLAB HPS.	4	80	13/01/2017	14/01/2017	33.3	GUIDE VANES

DETAILS OF LONG DURATION FORCED OUTAGES IN HYDRO - ELECTRIC UNITS DURING 2016-2017
(OUTAGE DURATION 24 HOURS AND ABOVE)

Sl. No.	STATION	UNIT	CAPACITY (MW)	DATE OF OUTAGE	DATE OF RETURN	OUTAGE HOURS	REASONS
		4	80	11/04/2016	30/04/2016	465.73	VIBRATION/SOUND/ ALIGNMENT
WBSEDCL							
112	JALDHAKA HPS ST-I	3	9	03/05/2016	08/05/2016	130.57	GOVERNOR SYSTM
		3	9	15/07/2016	16/07/2016	28.58	COOLING WATER SYSTEM
		4	9	09/08/2016	02/09/2016	590.5	OIL PROBLEMS
113	RAMMAM HPS.	3	12.5	07/11/2016	09/11/2016	35.25	GEN.TRIPPED HEAVY JERK
		4	12.5	26/11/2016	15/12/2016	465.67	GEN.TRIPPED HEAVY JERK
		4	12.5	25/10/2016	03/11/2016	220.48	POLE FAILURE
NORTH EASTERN REGION							
APGPCL							
114	KARBI LANGPI HPS.	1	50	06/12/2016	09/12/2016	77.3	OTHER (D/T,GUIDE/STAY VANES
		1	50	09/04/2016	14/06/2016	1586.42	GENERATOR FAULTS
MePGCL							
115	KYRDEMKULAI HPS.	1	30	18/08/2016	20/08/2016	62.3	THRUST BEARING
		2	30	16/04/2016	17/04/2016	30.9	EXCITATION OTHERS
		2	30	31/05/2016	24/09/2016	2761.08	RUNNER/UNDER WATER PARTS
116	MYNTDU(LESHKA) St-1 HPS	1	42	01/03/2017	08/03/2017	175	LT AC PANELS
		1	42	25/04/2016	03/05/2016	193	GENEATOR TRANSFORMER MISC.
		2	42	01/03/2017	08/03/2017	175	SWITCHYARD MISC.
		3	42	22/04/2016	24/05/2016	778.43	BRAKE AND JACKS
		3	42	19/04/2016	20/04/2016	35.43	PROTECTION OPERATION
		3	42	01/03/2017	08/03/2017	175	SWITCHYARD MISC.
117	UMIAM HPS ST-IV	7	30	26/05/2016	28/05/2016	41.75	OTHER (D/T,GUIDE/STAY VANES
		7	30	06/04/2016	09/04/2016	78	LT AC PANELS
		8	30	09/04/2016	30/04/2016	511	LT AC PANELS
NEEPCO.							
118	DOYANG HPS.	1	25	03/10/2016	10/10/2016	157.5	EHG/GOV. FAULTS, MISC.
119	KHONDONG HPS.	1	25	27/06/2016	29/06/2016	44.92	ROTOR EARTH FAULT
		1	25	09/09/2016	10/09/2016	32.28	EHG/GOV. FAULTS, MISC.
		1	25	18/10/2016	01/11/2016	347.37	PENSTOCK LEAKAGE
		1	25	25/08/2016	26/08/2016	27.55	PENSTOCK LEAKAGE
		2	25	18/10/2016	01/11/2016	346.37	PENSTOCK LEAKAGE
		2	25	09/08/2016	10/08/2016	34.63	LOWER GUIDE BEARING
120	KOPILI HPS.	1	50	27/01/2017	10/02/2017	353.07	OTHER (D/T,GUIDE/STAY VANES
		2	50	22/08/2016	24/08/2016	55.63	OIL PROBLEMS
		2	50	16/09/2016	17/09/2016	24.22	GENRATOR OTHERS
		2	50	18/07/2016	20/07/2016	55.17	U.G.B.OIL SYSTEM
		4	50	20/02/2017	21/02/2017	24.3	LOWER GUIDE BEARING
		4	50	13/02/2017	16/02/2017	71.88	THRUST BEARING PADS.
		5	25	12/06/2016	14/06/2016	56.63	TURBINE FAULTS
121	RANGANADI HPS.	3	135	28/03/2017	31/03/2017	63	TURBINE
		3	135	04/06/2016	05/06/2016	28.42	BUS COUPLER BREAKER
		3	135	11/05/2016	25/05/2016	350.5	GEN./TR.BREAKER

CHAPTER-6

OPERATING AVAILABILITY OF HE UNITS

CHAPTER-6

OPERATING AVAILABILITY OF HE UNITS

6.1 Based on the analysis of data received from the utilities regarding planned maintenance undertaken and forced outages at 695 Hydro Generating units of 200 HE Stations comprising of 44478.42 MW, operating availability of various units and stations has been computed. During the year 2016-17, the average operating availability of hydro generating units on all India basis was 90.24% as compared to 87.93% during 2015-16.

The station-wise/unit-wise non-availability due to Planned Maintenance (P.M) and Forced Outages (F.O) and overall operating availability of various H.E. Stations in the country is indicated in **Annex-6.1**. Station-wise details are shown in **Exhibits from 6.1 to 6.14**.

6.2 The number of H.E. Stations falling under various ranges of operating availability during the year 2016-17 is summarized below in **Table 6.1.**

TABLE 6.1

OPERATING AVAILABILITY OF H.E. STATIONS (PERIOD: 2016-17)

Operating Availability (%)	No. of Stations	% of total Stations	Installed Capacity (MW)	% of total Installed Capacity
≥95%	85	42.50	18857.00	42.40
≥90 to 95	45	22.50	10166.12	22.86
≥85 to 90	24	12.00	4462.10	10.03
≥80 to 85	16	8.00	4185.00	9.41
< 80	30	15.00	6808.20	15.31
Total	**200**	**100.00**	**44478.42**	**100.00**

6.3 OPERATING AVAILABILITY – REGION-WISE

Region-wise operating availability of hydro-electric units during 2016-17 is indicated in **Table 6.2**.

TABLE 6.2

AVAILABILITY OF UNITS - REGION-WISE
PERIOD: 2016-17

Sl. No.	Region	No. of Units	Installed Capacity (MW)	Planned Maintenance %	Forced Outage %	Operating Availability (%)
1	Northern	239	18527.27	8.37	1.97	89.66
2	Western	101	7392	3.86	1.19	94.95
3	Southern	246	11658.7	4.14	6.05	89.81
4	Eastern	80	5658.45	8.82	4.19	86.99
5	N- Eastern	29	1242	3.62	7.01	89.37
	All India	**695**	**44478.42**	**6.43**	**3.33**	**90.24**

It is seen that the operating availability of hydel generating units in Western Region was the highest (94.95%). The operating availability was the lowest in case of units in Eastern Region (86.99%) due to high planned maintenance and forced outages.

6.4 OPERATING AVAILABILITY: AGE-WISE

The average operating availability during 2016-17 of hydro units commissioned in various years has been indicated in **Table 6.3**. It is observed that units commissioned during 2016-17 and 2015-16 have achieved the operating availability of more than 99%. Operating availability was less than 90% for the units commissioned up to 1988-89. Operating availability was more than 90% for all the other years.

TABLE - 6.3

OPERATING AVAILABILITY – AGE-WISE
PERIOD: 2016-17

Sl. No.	Year of Commissioning	No. of Units	Installed Capacity (MW)	Operating Availability (%)
1	2016-2017	18	1659.00	99.92
2	2015-2016	17	1516.00	99.18
3	2010-11 to 2014-15	62	4417.02	91.15
4	2005-06 to 2009-10	66	7077.00	92.45
5	2000-01 to 2004-05	75	6766.8	94.75
6	1989-90 TO 1999-2000	87	5775.70	90.55
7	1978-79 TO 1988-89	124	7259.10	88.92
8	1967-68 TO 1977-78	82	5304.75	84.69
9	Up to 1966-67	164	4703.05	81.69
	Total	**695**	**44478.42**	90.24

6.5 OPERATING AVAILABILITY – UTILITY-WISE

Sector wise/State Electricity Board/Power Generating Corporation-wise operating availability of HE units is indicated in **Table 6.4**.

It has been observed that the operating availability of generating units of Private Sector was the highest (97.73%) followed by Central Sector (90.05%) and State Sector (89.44%).

TABLE 6.4

SECTOR-WISE OPERATING AVAILABILITY & MISCELLANEOUS NON-AVILABILITY OF UTILITIES FOR PERIOD: 2016-17

S. No.	Organisation	No. of Units	Installed Capacity	Planned Maintenance	Forced Outage	Operating Availability per Unit
			(MW)	(%)	(%)	(%)
Central						
1	BBMB	28	2866.30	15.59	3.72	80.69
2	DVC	5	143.20	6.80	27.90	65.30
3	NEEPCO	13	755.00	4.35	6.15	89.50
4	NHDC	16	1520.00	3.56	0.05	96.39
5	NHPC	67	5121.20	9.41	1.88	88.71
6	NTPC Ltd.	4	800.00	0.63	0.02	99.35
7	SJVNL	12	1912.02	0.87	0.70	98.42
8	THDC	8	1400.00	6.66	0.20	93.14
Sub Total (CS)		**153**	**14517.72**	**7.85**	**2.10**	**90.05**
State						
1	APGENCO	30	1336.75	1.51	2.15	96.34
2	APGPCL	2	100.00	0.00	10.00	90.00
3	CSPGCL	3	120.00	0.00	0.07	99.93
4	GSECL	8	540.00	0.00	0.58	99.42
5	HPPCL	3	195.00	0.09	0.09	99.82
6	HPSEB	12	372.00	0.68	18.91	80.41
7	JKSPDC	12	1110.00	0.19	0.66	99.15
8	JUUVNL	2	130.00	0.00	71.95	28.05
9	KPCL	68	3585.40	4.13	9.44	86.43
10	KSEBL	48	1881.50	7.60	2.97	89.43
11	MAHAGENCO	24	2406.00	2.88	2.71	94.41
12	MPPGCL	23	875.00	7.72	2.11	90.17
13	MePGCL	11	282.00	2.86	10.86	86.28
14	OHPC	31	2027.50	13.96	3.99	82.05
15	PSPCL	25	1051.00	13.59	1.38	85.03
16	RRVUNL	11	411.00	5.01	0.88	94.11
17	SSNNL	11	1450.00	6.22	0.00	93.78
18	TNGDCL	70	2203.20	5.03	5.83	89.14

S. No.	ORGANISATION	No. of Units	Installed Capacity	Planned Maintenance	Forced Outage	Operating Availability per Unit
			(MW)	(%)	(%)	(%)
19	TSGENCO	36	2766.60	2.18	6.01	91.81
20	TUL	6	1200.00	0.00	0.00	100.00
21	UJVNL	34	1252.15	12.61	1.01	86.38
22	UPJVNL	15	501.60	36.44	5.04	58.52
23	WBSEDCL	12	986.00	16.49	0.27	83.24
Sub Total (State)		**497**	**26782.70**	**6.24**	**4.32**	**89.44**
Private						
1	ADHPL	2	192.00	6.30	0.82	92.88
2	AHPC (GVK)	4	330.00	0.07	0.14	99.79
3	DEPL	2	96.00	0.00	0.01	99.99
4	DLHP	1	34.00	0.00	0.01	99.99
5	E.P.P.L.	2	100.00	7.67	0.27	92.06
6	GBHPPL	2	70.00	18.63	2.19	79.18
7	GISL	2	99.00	6.85	0.41	92.74
8	HBPCL	7	1300.00	0.25	1.33	98.42
9	IAEPL	2	24.00	0.00	0.00	100.00
10	JPPVL	4	400.00	0.79	0.39	98.82
11	MPCL	2	86.00	0.03	0.01	99.96
12	TATA MAH.	15	447.00	0.86	0.11	99.03
Sub Total (Pvt.)		**45**	**3178.00**	**1.56**	**0.71**	**97.73**
Grand Total		**695**	**44478.42**	**6.43**	**3.33**	**90.24**

6.6 MISCELLANEOUS NON-AVAILABILITY

Non-availability of hydel generating units due to reasons other than planned maintenance and forced outages of unit components, auxiliary and other equipments and civil structures has been defined as **"**Miscellaneous Non-Availability**"**. This may be due to shortage of water, high silt content in the river, electrical grid disturbance, low system demand, disaster/natural calamity, reserve shutdown, transmission constraints & power evacuation problems, low head or high tailrace level, strikes and other miscellaneous reasons etc. It was highest (46.02%) in case of SJVN. The station-wise details of miscellaneous non-availability is given at **Annex-6.2**.

6.7 OPERATING AVAILABILITY BELOW 90%- STATION-WISE

It is observed that 33 nos. of stations had operating availability below 90% continuously for last 3 years. The details of these stations is given below in **Table 6.5.** As normative availability factor for entire useful life of station considered during planning stage is 95%, the stations/utilities having lower operating availability factor need to improve their O&M practices to bring down the outages as per best practices.

TABLE-6.5

OPERATING AVAILABILITY OF H. E. STATIONS CONTINUOUSLY LESS THAN 90% DURING LAST THREE YEARS (2014-15 TO 2016-17)

Sl. No.	Name of the Stations	Installed Capacity (MW)	Operating Availability (%)		
			2014-15	2015-16	2016-17
1	Dehar	990.00	81.64	81.38	72.00
2	Ganguwal	77.65	66.44	66.25	64.66
3	Kotla	77.65	65.88	64.88	65.40
4	Chutak	44.00	87.33	56.56	89.44
5	Dhauliganga	280.00	68.56	86.73	85.97
6	Parbati-iii	520.00	42.56	51.91	68.29
7	Salal-I	345.00	82.02	80.29	81.33
8	Salal-II	345.00	79.97	81.14	81.57
9	Tanakpur	94.20	79.07	86.54	79.04
10	Uri-II	240.00	69.54	70.33	85.56
11	Ranjit Sagar	600.00	81.08	71.96	78.28
12	Chibro (Yamuna)	240.00	83.32	85.48	86.39
13	Dhakrani	33.75	88.37	84.55	85.16
14	Dhalipur	51.00	84.99	87.43	79.04
15	Khatima	41.40	59.67	48.19	85.84
16	Maneri Bhali - I	90.00	78.15	76.58	76.61
17	Maneri Bhali - II	304.00	75.08	73.44	86.74
18	Rihand	300.00	45.21	52.80	44.72
19	Rajghat	45.00	83.33	80.28	49.38
20	T B Dam	36.00	71.08	81.60	87.97
21	Almatti dph	290.00	72.03	78.05	81.06
22	Idamalayar	75.00	88.75	86.60	88.35
23	Poringalkuttu	32.00	69.47	79.44	75.21
24	Sabarigiri	300.00	81.18	89.41	85.97
25	Kadampari	400.00	82.30	67.61	72.85
26	Machkund	114.75	65.79	59.83	88.71
27	Maithon	63.20	79.93	89.46	74.11
28	Panchet	80.00	83.52	79.92	56.69
29	Balimela	510.00	75.79	74.20	83.81
30	Hirakud - I	275.50	59.65	65.93	66.94
31	Hirakud - II	72.00	65.59	58.96	62.09
32	Kyrdemkulai	60.00	43.59	49.88	64.73
33	Kopili	225.00	56.26	65.91	77.86

EXHIBIT 6.1

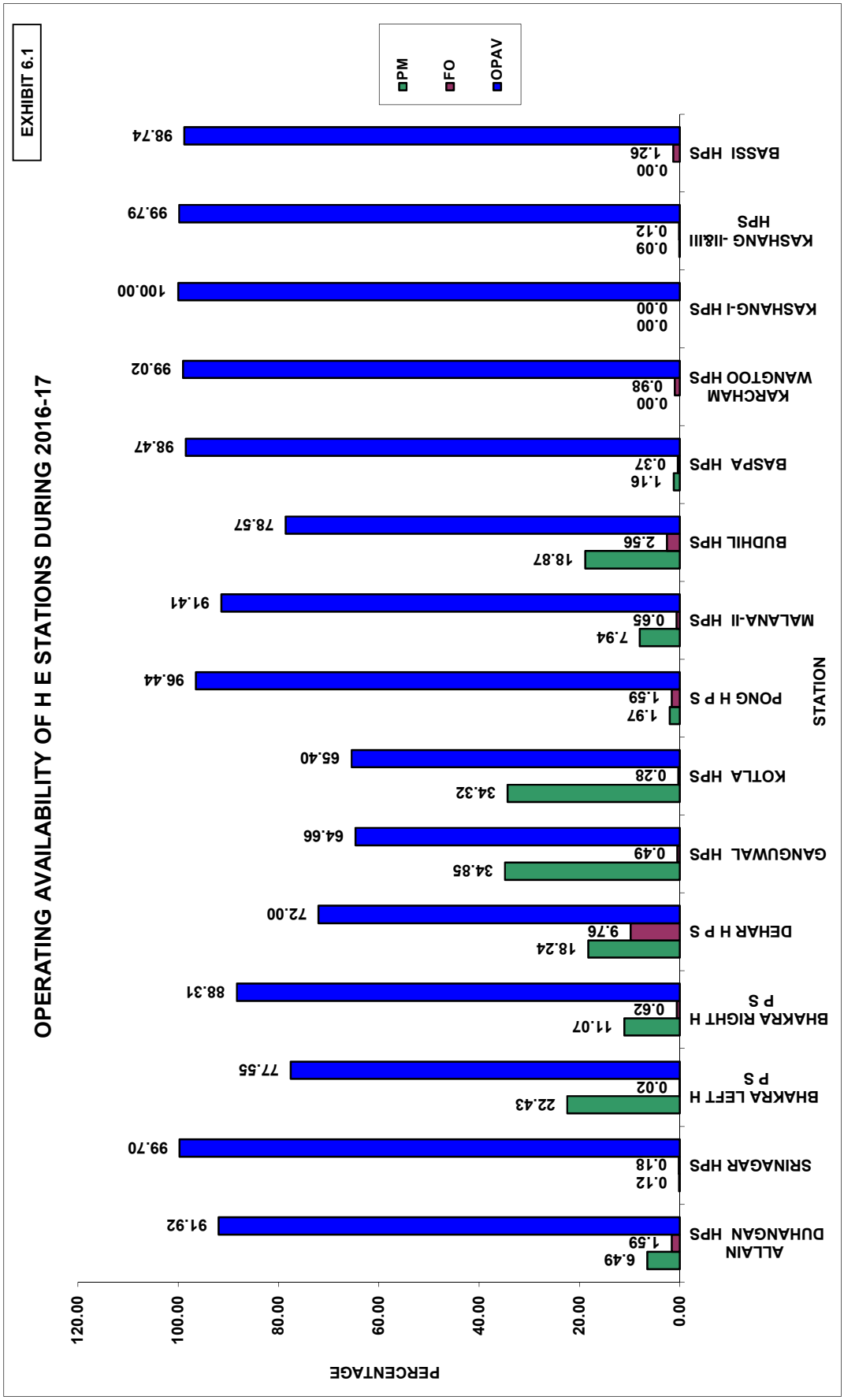

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
ALLAIN DUHANGAN HPS
6.49
1.59
91.92
SRINAGAR HPS
0.12
0.18
99.70
BHAKRA LEFT H P S
22.43
0.02
77.55
BHAKRA RIGHT H P S
11.07
0.62
88.31
DEHAR H P S
18.24
9.76
72.00
GANGUWAL HPS
34.85
0.49
64.66
KOTLA HPS
34.32
0.28
65.40
PONG H P S
1.97
1.59
96.44
MALANA-II HPS
7.94
0.65
91.41
BUDHIL HPS
18.87
2.56
78.57
BASPA HPS
1.16
0.37
98.47
KARCHAM WANGTOO HPS
0.00
0.98
99.02
KASHANG-I HPS
0.00
0.00
100.00
KASHANG -II&III HPS
0.09
0.12
99.79
BASSI HPS
0.00
1.26
98.74

EXHIBIT 6.2

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
GIRI BATA HPS
0.05
16.43
83.52
LARJI HPS
0.00
3.49
96.51
SANJAY HPS
2.22
48.69
49.09
CHANJU-I HPS
0.00
0.00
100.00
BAGLIHAR HPS
0.43
0.52
99.05
BAGLIHAR II HPS
0.18
0.57
99.25
LOWER JHELUM HPS
0.00
0.38
99.62
UPPER SINDH-II HPS
0.10
3.62
96.28
VISHNU PRAYAG HPS
0.79
0.37
98.84
MALANA HPS
0.03
0.01
99.96
BAIRA SIUL HPS
6.65
1.21
92.14
CHAMERA- I HPS
2.72
0.39
96.89
CHAMERA- II HPS
4.06
0.07
95.87
CHAMERA-III HPS
16.16
0.04
83.80
CHUTAK HPS
10.49
0.06
89.45

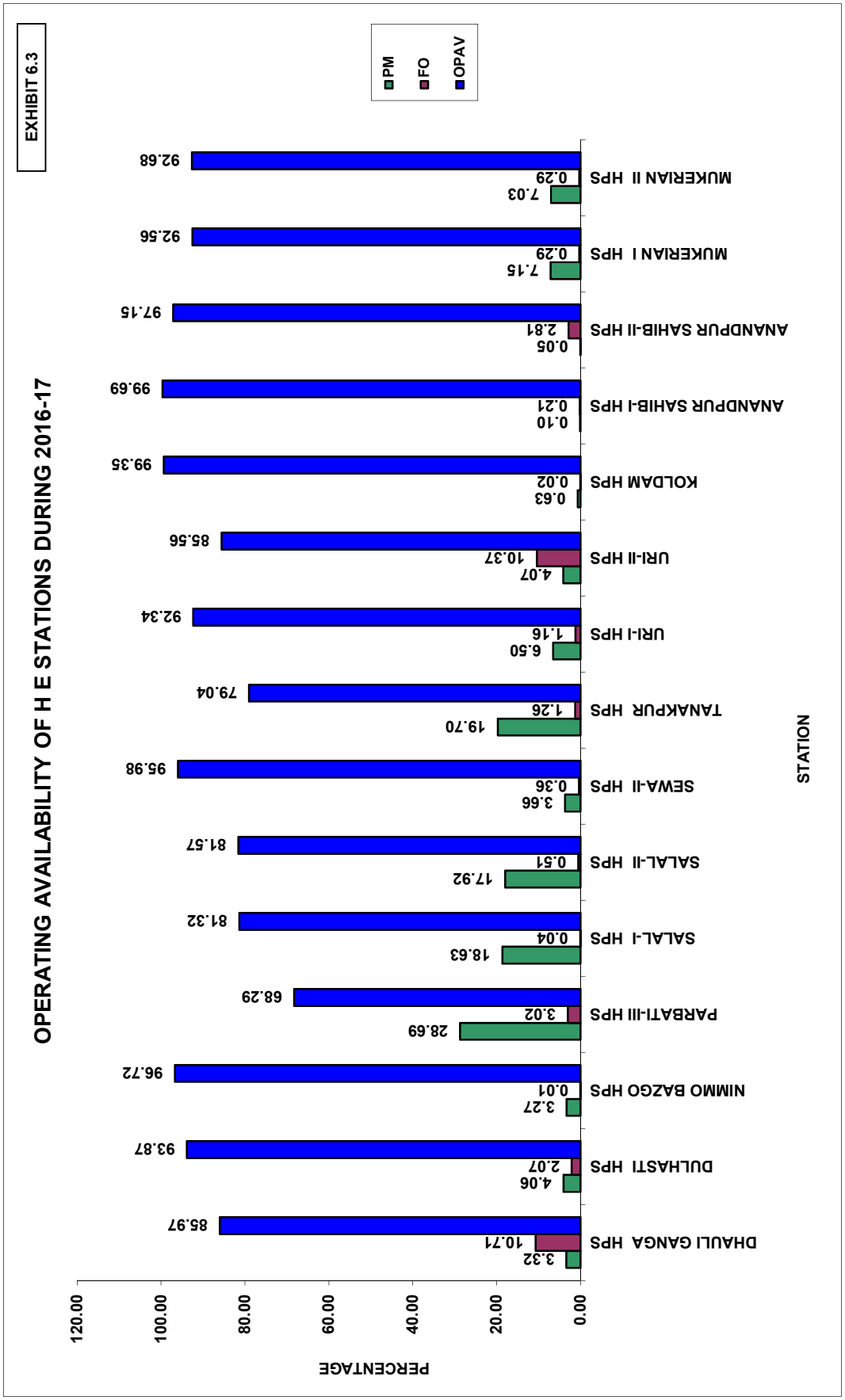


EXHIBIT 6.3
OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
DHAULI GANGA HPS
3.32
10.71
85.97
DULHASTI HPS
4.06
2.07
93.87
NIMMO BAZGO HPS
3.27
0.01
96.72
PARBATI-III HPS
28.69
3.02
68.29
SALAL-I HPS
18.63
0.04
81.32
SALAL-II HPS
17.92
0.51
81.57
SEWA-II HPS
3.66
0.36
95.98
TANAKPUR HPS
19.70
1.26
79.04
URI-I HPS
6.50
1.16
92.34
URI-II HPS
4.07
10.37
85.56
KOLDAM HPS
0.63
0.02
99.35
ANANDPUR SAHIB-I HPS
0.10
0.21
99.69
ANANDPUR SAHIB-II HPS
0.05
2.81
97.15
MUKERIAN I HPS
7.15
0.29
92.56
MUKERIAN II HPS
7.03
0.29
92.68

EXHIBIT 6.4

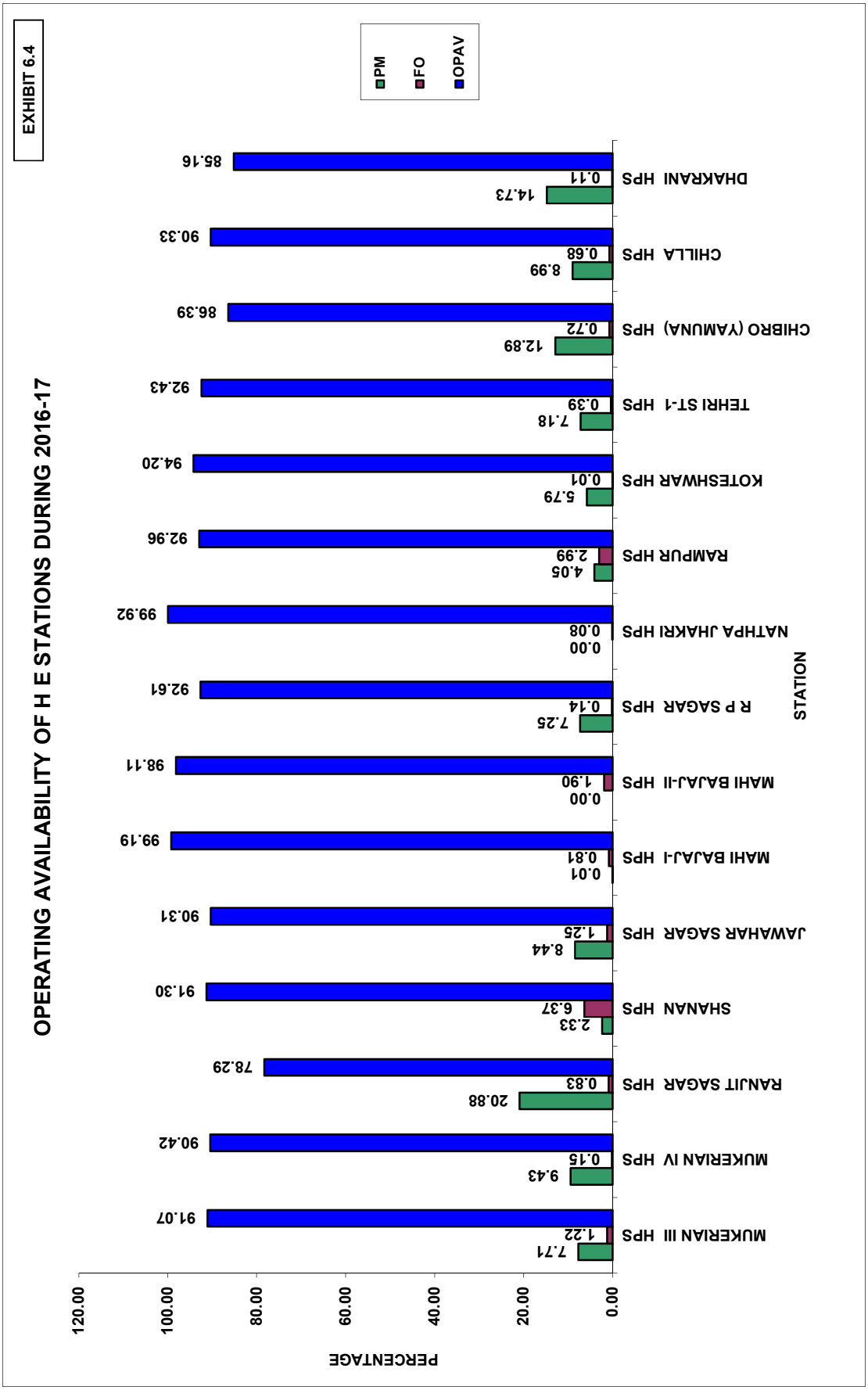

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
MUKERIAN III HPS
7.71
1.22
91.07
MUKERIAN IV HPS
9.43
0.15
90.42
RANJIT SAGAR HPS
20.88
0.83
78.29
SHANAN HPS
2.33
6.37
91.30
JAWAHAR SAGAR HPS
8.44
1.25
90.31
MAHI BAJAJ-I HPS
0.01
0.81
99.19
MAHI BAJAJ-II HPS
0.00
1.90
98.11
R P SAGAR HPS
7.25
0.14
92.61
NATHPA JHAKRI HPS
0.00
0.08
99.92
RAMPUR HPS
4.05
2.99
92.96
KOTESHWAR HPS
5.79
0.01
94.20
TEHRI ST-1 HPS
7.18
0.39
92.43
CHIBRO (YAMUNA) HPS
12.89
0.72
86.39
CHILLA HPS
8.99
0.68
90.33
DHAKRANI HPS
14.73
0.11
85.16

EXHIBIT 6.5

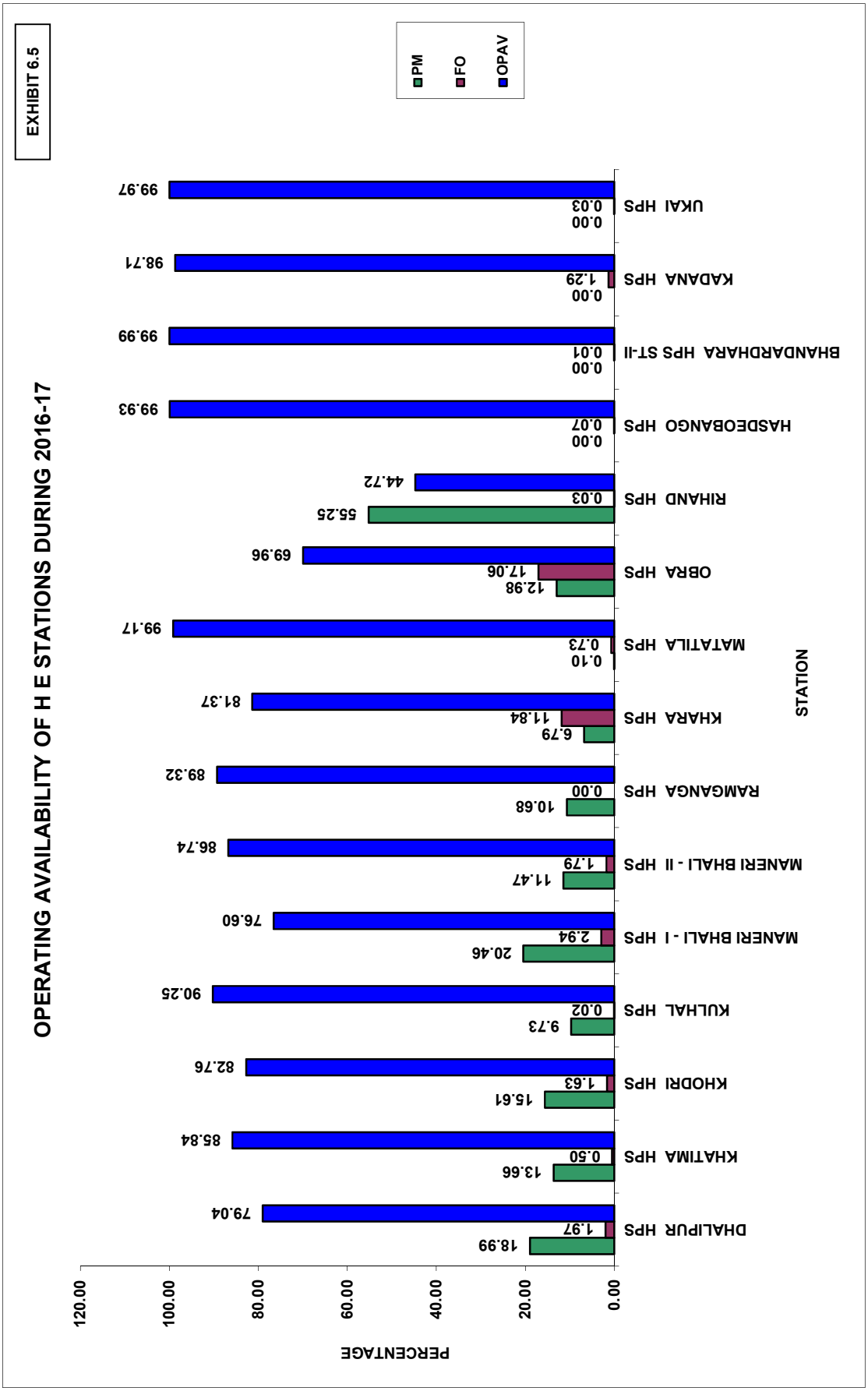

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
DHALIPUR HPS
18.99
1.97
79.04
KHATIMA HPS
13.66
0.50
85.84
KHODRI HPS
15.61
1.63
82.76
KULHAL HPS
9.73
0.02
90.25
MANERI BHALI - I HPS
20.46
2.94
76.60
MANERI BHALI - II HPS
11.47
1.79
86.74
RAMGANGA HPS
10.68
0.00
89.32
KHARA HPS
6.79
11.84
81.37
MATATILA HPS
0.10
0.73
99.17
OBRA HPS
12.98
17.06
69.96
RIHAND HPS
55.25
0.03
44.72
HASDEOBANGO HPS
0.00
0.07
99.93
BHANDARDHARA HPS ST-II
0.00
0.01
99.99
KADANA HPS
0.00
1.29
98.71
UKAI HPS
0.00
0.03
99.97

EXHIBIT 6.6

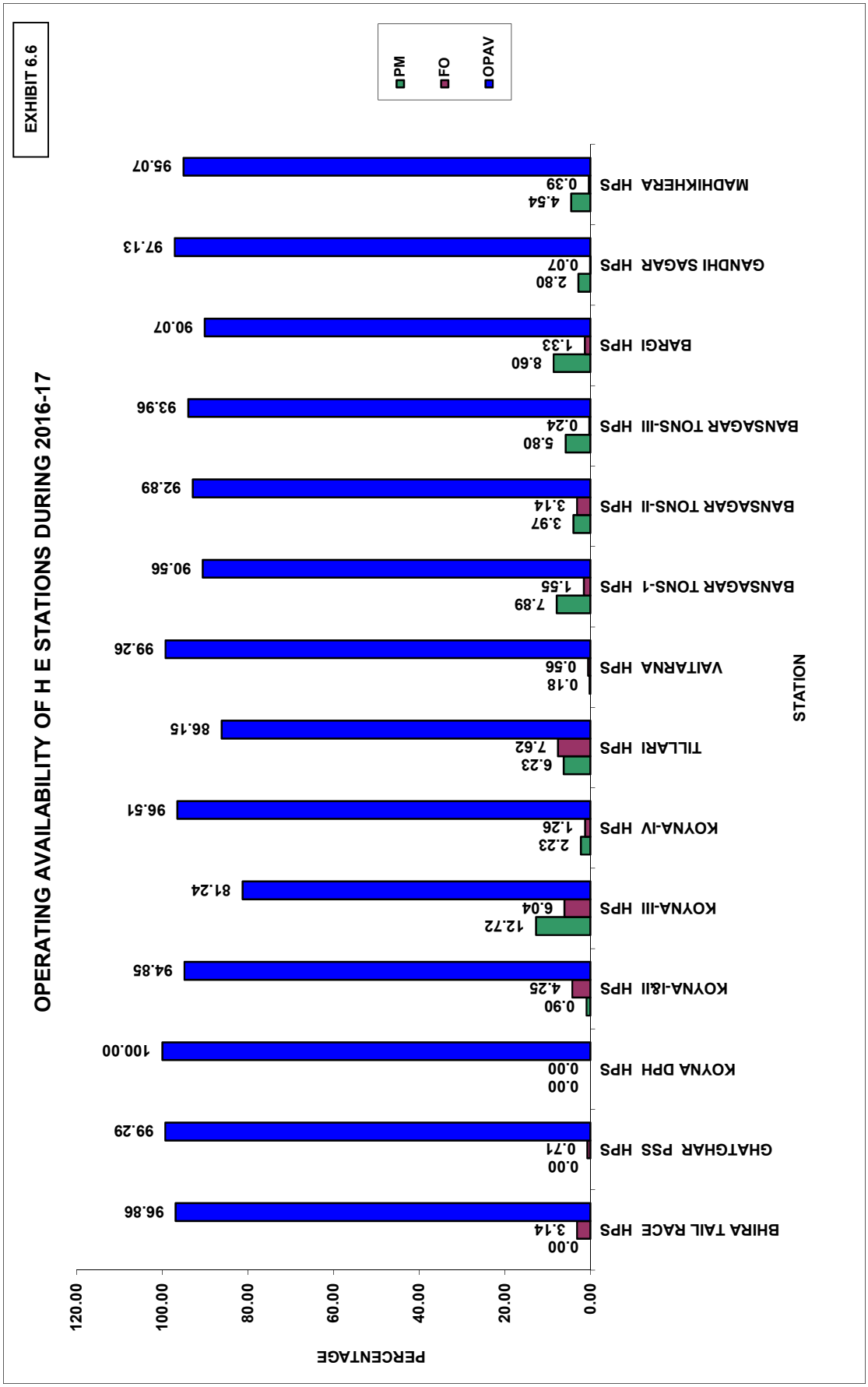

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
BHIRA TAIL RACE HPS
0.00
3.14
96.86
GHATGHAR PSS HPS
0.00
0.71
99.29
KOYNA DPH HPS
0.00
0.00
100.00
KOYNA-I&II HPS
0.90
4.25
94.85
KOYNA-III HPS
12.72
6.04
81.24
KOYNA-IV HPS
2.23
1.26
96.51
TILLARI HPS
6.23
7.62
86.15
VAITARNA HPS
0.18
0.56
99.26
BANSAGAR TONS-1 HPS
7.89
1.55
90.56
BANSAGAR TONS-II HPS
3.97
3.14
92.89
BANSAGAR TONS-III HPS
5.80
0.24
93.96
BARGI HPS
8.60
1.33
90.07
GANDHI SAGAR HPS
2.80
0.07
97.13
MADHIKHERA HPS
4.54
0.39
95.07

EXHIBIT 6.7

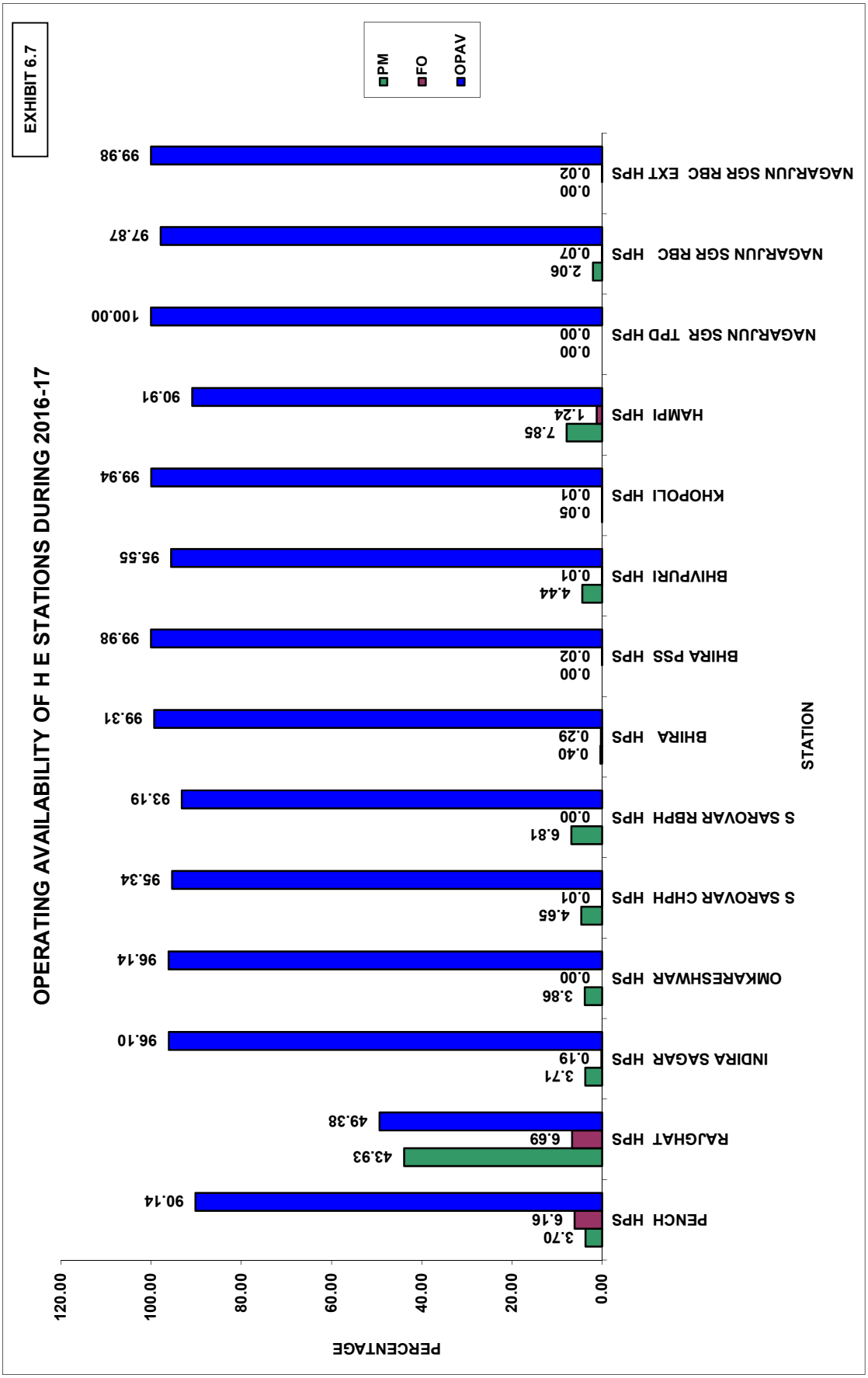

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
PENCH HPS
3.70
6.16
90.14
RAJGHAT HPS
43.93
6.69
49.38
INDIRA SAGAR HPS
3.71
0.19
96.10
OMKARESHWAR HPS
3.86
0.00
96.14
S SAROVAR CHPH HPS
4.65
0.01
95.34
S SAROVAR RBPH HPS
6.81
0.00
93.19
BHIRA HPS
0.40
0.29
99.31
BHIRA PSS HPS
0.00
0.02
99.98
BHIVPURI HPS
4.44
0.01
95.55
KHOPOLI HPS
0.05
0.01
99.94
HAMPI HPS
7.85
1.24
90.91
NAGARJUN SGR TPD HPS
0.00
0.00
100.00
NAGARJUN SGR RBC HPS
2.06
0.07
97.87
NAGARJUN SGR RBC EXT HPS
0.00
0.02
99.98

EXHIBIT 6.8

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17

EXHIBIT 6.9

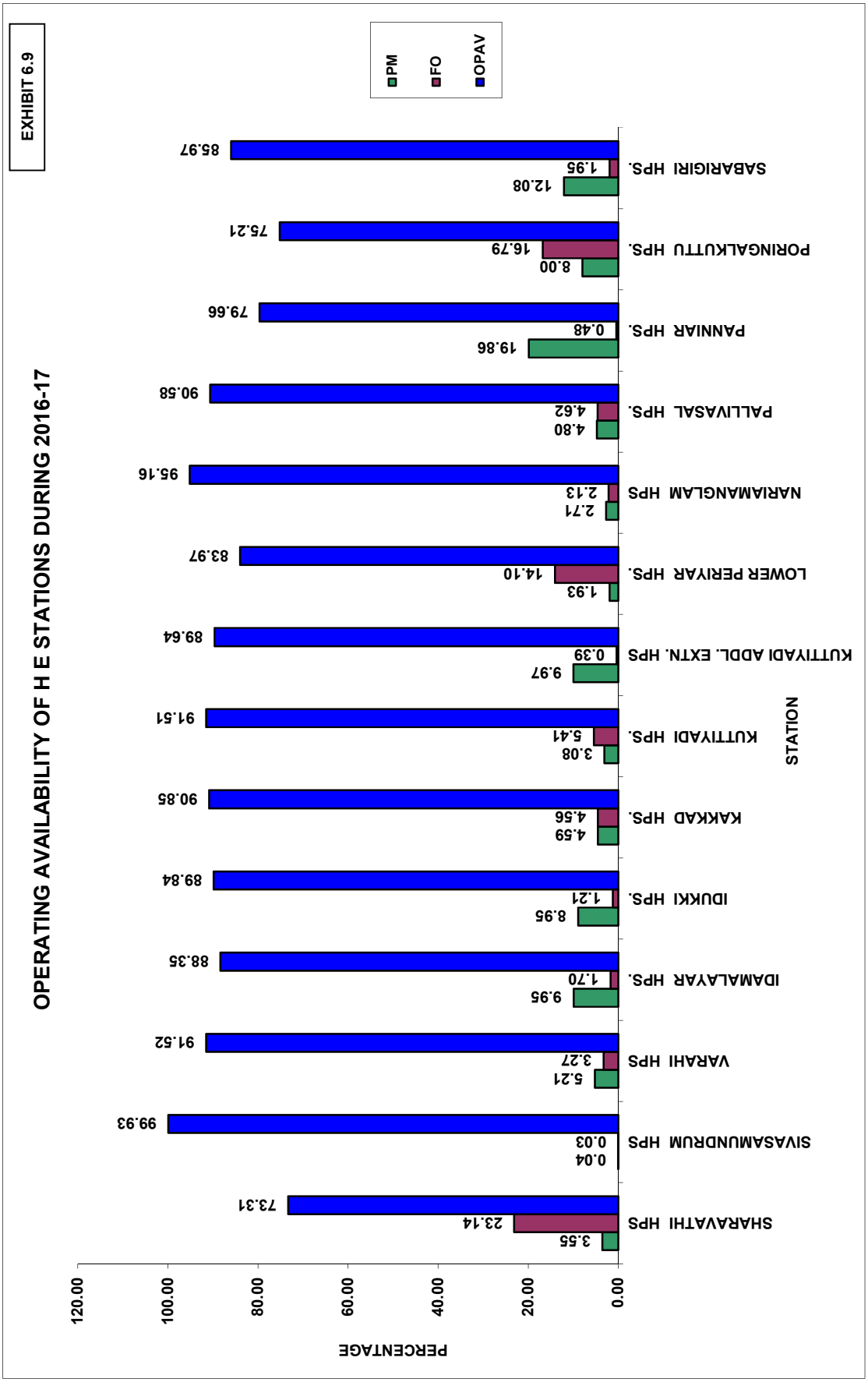

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
SHARAVATHI HPS
3.55
23.14
73.31
SIVASAMUNDRUM HPS
0.04
0.03
99.93
VARAHI HPS
5.21
3.27
91.52
IDAMALAYAR HPS.
9.95
1.70
88.35
IDUKKI HPS.
8.95
1.21
89.84
KAKKAD HPS.
4.59
4.56
90.85
KUTTIYADI HPS.
3.08
5.41
91.51
KUTTIYADI ADDL. EXTN. HPS
9.97
0.39
89.64
LOWER PERIYAR HPS.
1.93
14.10
83.97
NARIAMANGLAM HPS
2.71
2.13
95.16
PALLIVASAL HPS.
4.80
4.62
90.58
PANNIAR HPS.
19.86
0.48
79.66
PORINGALKUTTU HPS.
8.00
16.79
75.21
SABARIGIRI HPS.
12.08
1.95
85.97

EXHIBIT 6.10

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
SENGULAM HPS.
8.17
0.87
90.96
SHOLAYAR HPS.
7.68
3.69
88.63
ALIYAR HPS.
0.20
0.53
99.27
BHAWANI BARRAGE III HPS
17.20
0.01
82.79
BHAWANI BARRAGE-II HPS
0.17
1.01
98.82
BHAWANI KATTAL HPS
10.73
0.00
89.27
KADAMPARI HPS.
0.00
27.15
72.85
KODAYAR-I HPS.
6.66
18.72
74.62
KODAYAR-II HPS.
2.84
1.74
95.42
KUNDAH-I HPS.
1.85
0.75
97.40
KUNDAH-II HPS.
1.05
1.29
97.65
KUNDAH-III HPS.
2.24
0.37
97.39
KUNDAH-IV HPS.
2.69
0.00
97.32

EXHIBIT 6.11

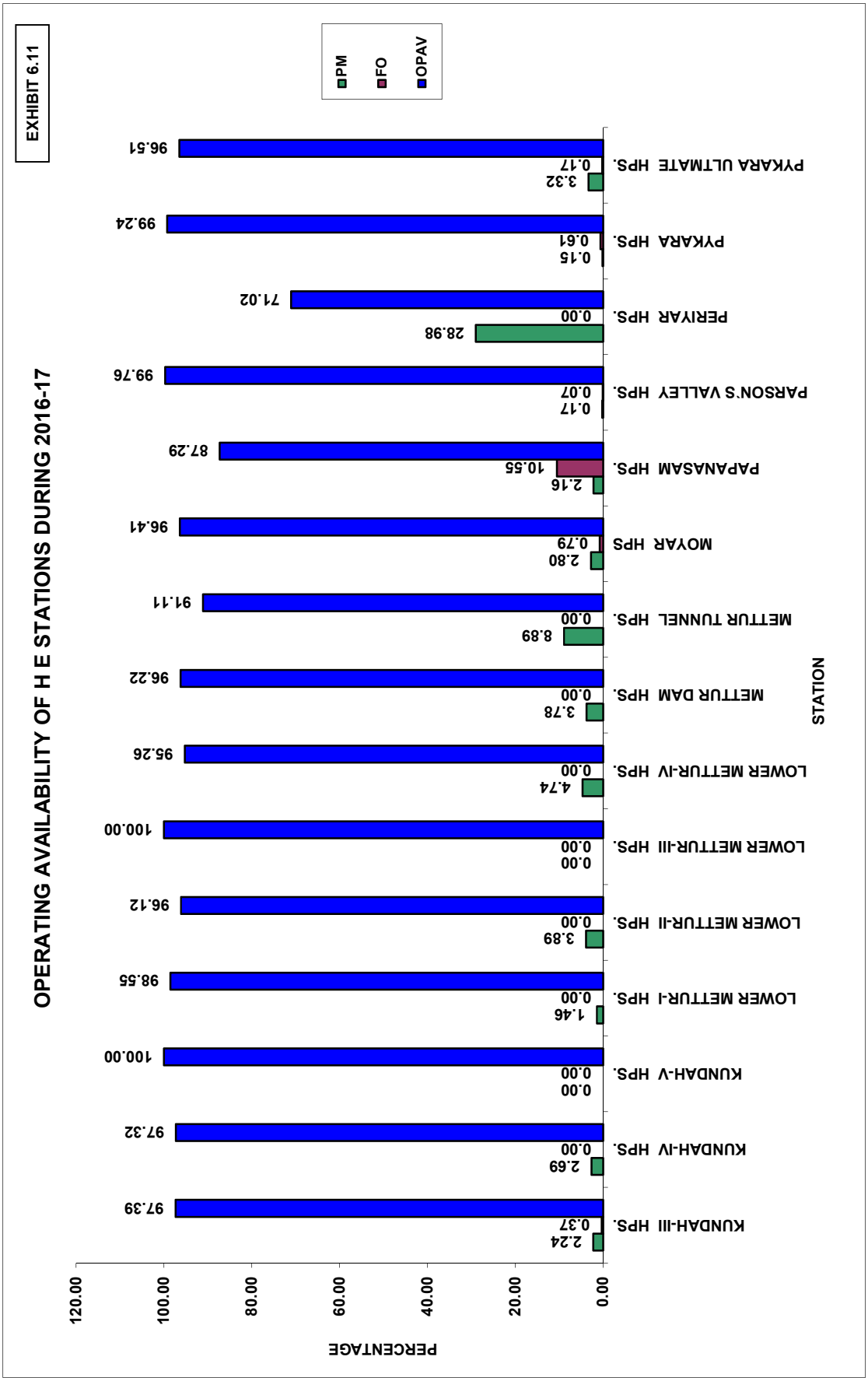

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
KUNDAH-III HPS.
2.24
0.37
97.39
KUNDAH-IV HPS.
2.69
0.00
97.32
KUNDAH-V HPS.
0.00
0.00
100.00
LOWER METTUR-I HPS.
1.46
0.00
98.55
LOWER METTUR-II HPS.
3.89
0.00
96.12
LOWER METTUR-III HPS.
0.00
0.00
100.00
LOWER METTUR-IV HPS.
4.74
0.00
95.26
METTUR DAM HPS.
3.78
0.00
96.22
METTUR TUNNEL HPS.
8.89
0.00
91.11
MOYAR HPS
2.80
0.79
96.41
PAPANASAM HPS.
2.16
10.55
87.29
PARSON'S VALLEY HPS.
0.17
0.07
99.76
PERIYAR HPS.
28.98
0.00
71.02
PYKARA HPS.
0.15
0.61
99.24
PYKARA ULTMATE HPS.
3.32
0.17
96.51

EXHIBIT 6.12

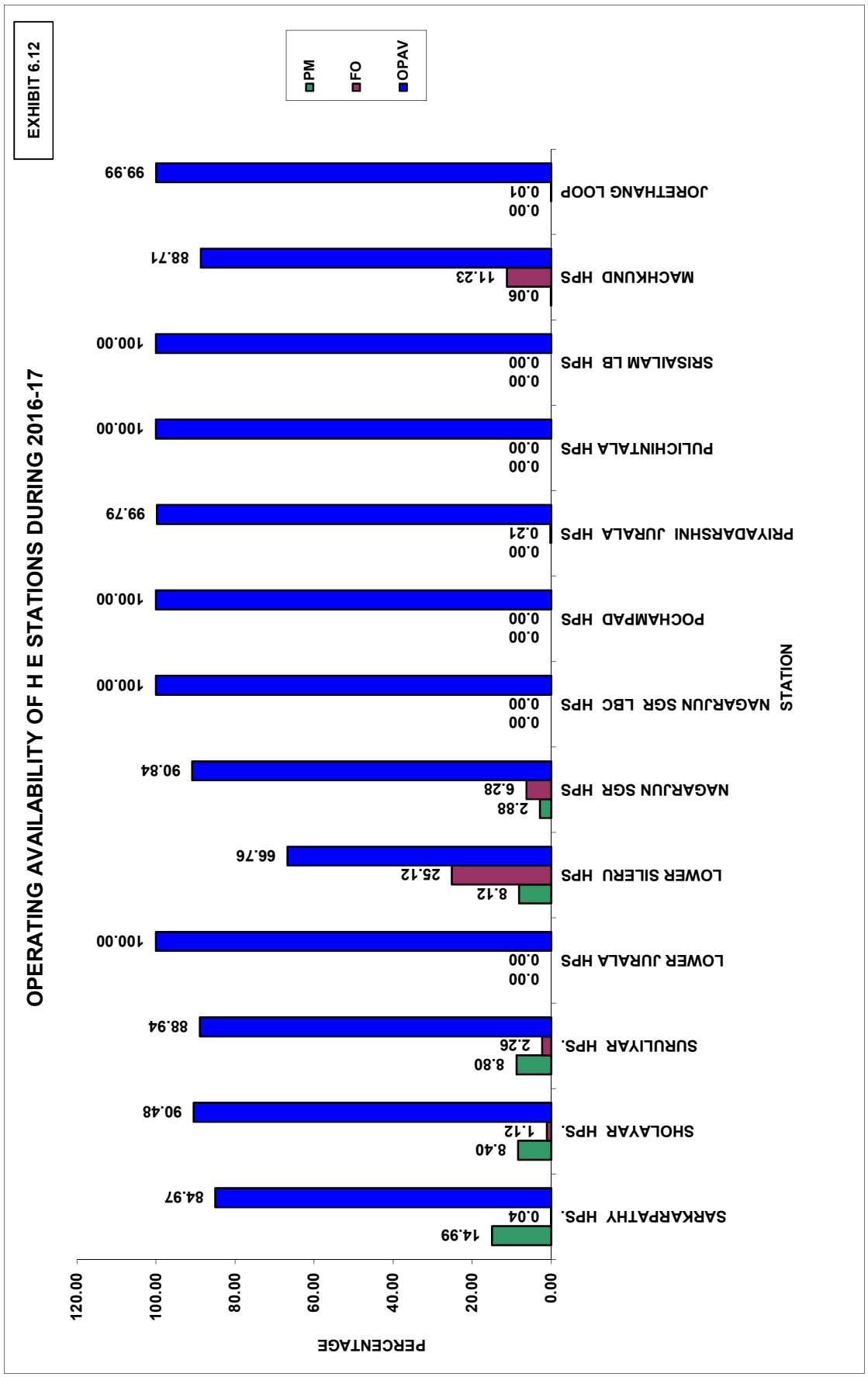

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
SARKARPATHY HPS.
0.04
14.99
84.97
SHOLAYAR HPS.
1.12
8.40
90.48
SURULIYAR HPS.
2.26
8.80
88.94
LOWER JURALA HPS
0.00
0.00
100.00
LOWER SILERU HPS
25.12
8.12
66.76
NAGARJUN SGR HPS
6.28
2.88
90.84
NAGARJUN SGR LBC HPS
0.00
0.00
100.00
POCHAMPAD HPS
0.00
0.00
100.00
PRIYADARSHNI JURALA HPS
0.21
0.00
99.79
PULICHINTALA HPS
0.00
0.00
100.00
SRISAILAM LB HPS
0.00
0.00
100.00
MACHKUND HPS
11.23
0.06
88.71
JORETHANG LOOP
0.01
0.00
99.99

EXHIBIT 6.13

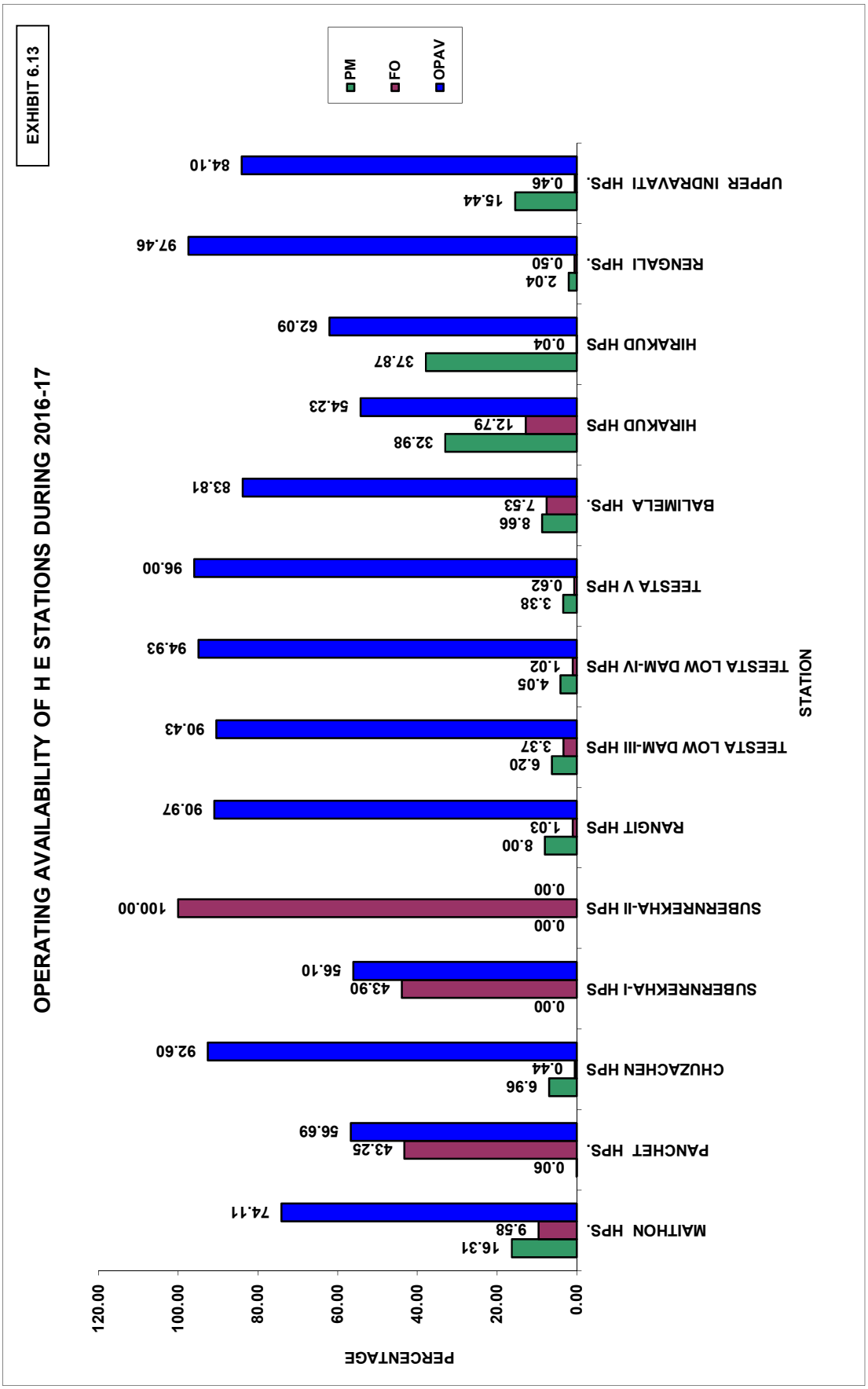
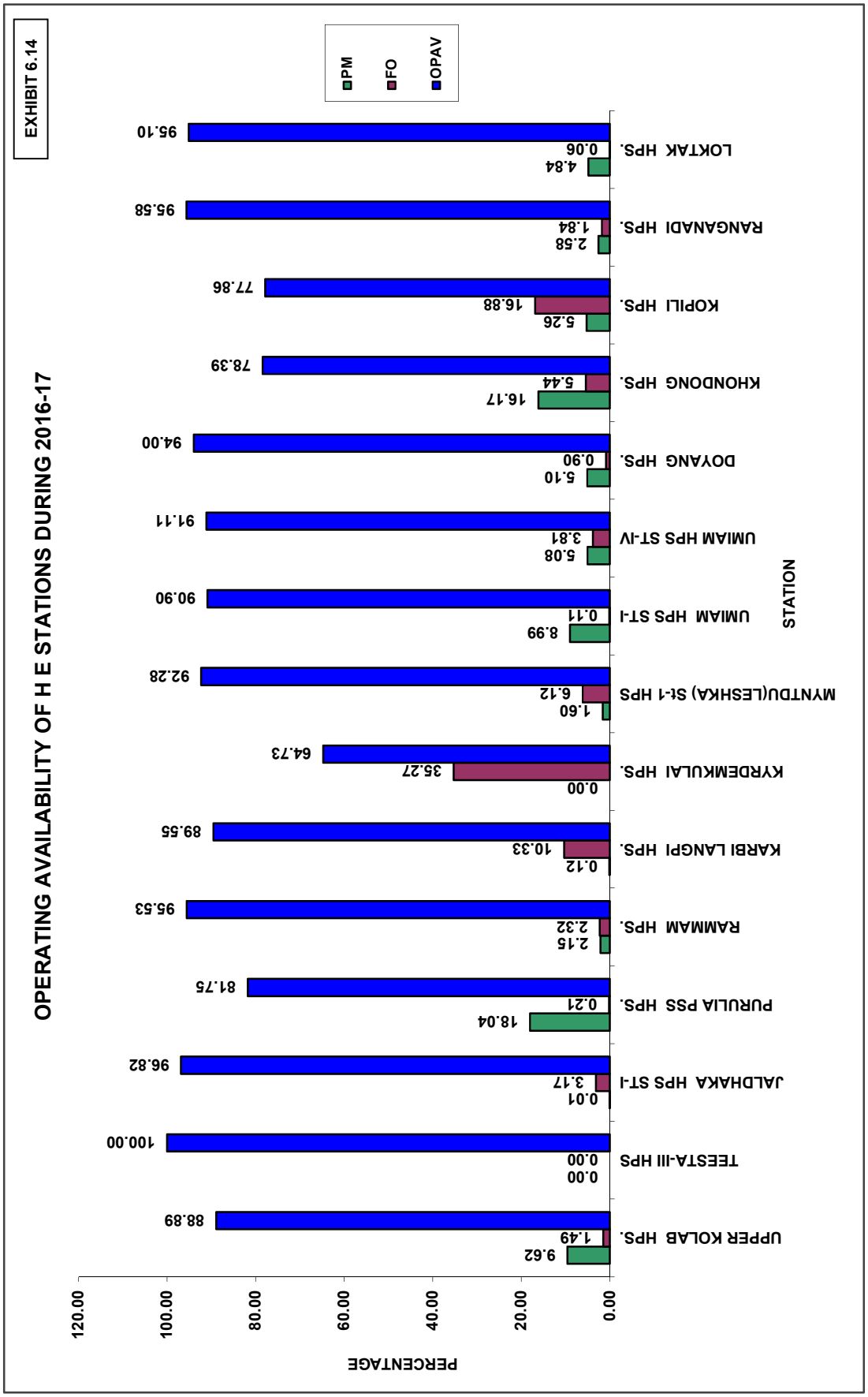

OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
MAITHON HPS.
16.31
9.58
74.11
PANCHET HPS.
0.06
43.25
56.69
CHUZACHEN HPS
6.96
0.44
92.60
SUBERNREKHA-I HPS
0.00
43.90
56.10
SUBERNREKHA-II HPS
0.00
100.00
0.00
RANGIT HPS
8.00
1.03
90.97
TEESTA LOW DAM-III HPS
6.20
3.37
90.43
TEESTA LOW DAM-IV HPS
4.05
1.02
94.93
TEESTA V HPS
3.38
0.62
96.00
BALIMELA HPS.
8.66
7.53
83.81
HIRAKUD HPS
32.98
12.79
54.23
HIRAKUD HPS
37.87
0.04
62.09
RENGALI HPS.
2.04
0.50
97.46
UPPER INDRAVATI HPS.
15.44
0.46
84.10

EXHIBIT 6.14


OPERATING AVAILABILITY OF H E STATIONS DURING 2016-17
PM
FO
OPAV
PERCENTAGE
120.00
100.00
80.00
60.00
40.00
20.00
0.00
STATION
UPPER KOLAB HPS.
9.62
1.49
88.89
TEESTA-III HPS
0.00
0.00
100.00
JALDHAKA HPS ST-I
0.01
3.17
96.82
PURULIA PSS HPS.
18.04
0.21
81.75
RAMMAM HPS.
2.15
2.32
95.53
KARBI LANGPI HPS.
0.12
10.33
89.55
KYRDEMKULAI HPS.
0.00
35.27
64.73
MYNTDU(LESHKA) St-1 HPS
1.60
6.12
92.28
UMIAM HPS ST-I
8.99
0.11
90.90
UMIAM HPS ST-IV
5.08
3.81
91.11
DOYANG HPS.
5.10
0.90
94.00
KHONDONG HPS.
16.17
5.44
78.39
KOPILI HPS.
5.26
16.88
77.86
RANGANADI HPS.
2.58
1.84
95.58
LOKTAK HPS.
4.84
0.06
95.10

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	NORTHERN REGION					
	ADHPL					
1	ALLAIN DUHANGAN HPS	1	96	5.98	1.31	92.71
		2	96	6.99	1.86	91.15
	TOTAL :		**192**	**6.49**	**1.59**	**91.92**
	AHPC (GVK)					
2	SRINAGAR HPS	1	82.5	0.00	0.24	99.76
		2	82.5	0.31	0.00	99.69
		3	82.5	0.00	0.38	99.62
		4	82.5	0.19	0.11	99.70
	TOTAL :		**330**	**0.12**	**0.18**	**99.70**
	BBMB					
3	BHAKRA LEFT H P S	1	108	9.34	0.00	90.66
		2	108	2.92	0.05	97.03
		3	108	0.00	0.00	100.00
		4	108	0.00	0.03	99.97
		5	108	99.89	0.00	0.11
	TOTAL :		**540**	**22.43**	**0.02**	**77.55**
4	BHAKRA RIGHT H P S	1	157	39.63	0.02	60.35
		2	157	0.00	3.04	96.96
		3	157	0.64	0.00	99.36
		4	157	10.03	0.00	89.97
		5	157	5.03	0.04	94.93
	TOTAL :		**785**	**11.07**	**0.62**	**88.31**
5	DEHAR H P S	1	165	0.00	29.83	70.17
		2	165	3.01	25.19	71.80
		3	165	0.00	0.11	99.89
		4	165	6.40	0.52	93.08
		5	165	0.00	2.92	97.08
		6	165	100.00	0.00	0.00
	TOTAL :		**990**	**18.24**	**9.76**	**72.00**
6	GANGUWAL HPS	1	29.25	5.34	1.25	93.41
		2	24.2	100.00	0.00	0.00
		3	24.2	5.38	0.07	94.55
	TOTAL :		**77.65**	**34.85**	**0.49**	64.66
7	KOTLA HPS	1	29.25	3.91	0.66	95.43
		2	24.2	5.41	0.10	94.49
		3	24.2	100.00	0.00	0.00
	TOTAL :		**77.65**	**34.32**	**0.28**	**65.40**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
8	PONG H P S	1	66	4.44	0.01	95.55
		2	66	0.00	7.46	92.54
		3	66	3.20	0.45	96.35
		4	66	0.00	0.00	100.00
		5	66	4.21	1.64	94.15
		6	66	0.00	0.00	100.00
	TOTAL :		**396**	**1.97**	**1.59**	**96.44**
	E.P.P.L.					
9	MALANA-II HPS	1	50	7.93	0.73	91.34
		2	50	7.94	0.57	91.49
	TOTAL :		**100**	**7.94**	**0.65**	**91.41**
	GBHPPL					
10	BUDHIL HPS	1	35	28.70	4.23	67.07
		2	35	9.04	0.89	90.07
	TOTAL :		**70**	**18.87**	**2.56**	**78.57**
	HBPCL					
11	BASPA HPS	1	100	0.82	0.31	98.87
		2	100	0.82	0.31	98.87
		3	100	1.82	0.49	97.69
	TOTAL :		**300**	**1.16**	**0.37**	**98.47**
12	KARCHAM WANGTOO HPS	1	250	0.00	1.16	98.84
		2	250	0.00	0.93	99.07
		3	250	0.00	0.91	99.09
		4	250	0.00	0.90	99.10
	TOTAL :		**1000**	**0.00**	**0.98**	**99.02**
	HPPCL					
13	KASHANG -I HPS	1	65	0.00	0.00	100.00
	TOTAL :		**65**	**0.00**	**0.00**	**100.00**
14	KASHANG -I HPS	1	65	0.26	0.37	99.37
		2	65	0.00	0.00	100.00
	TOTAL :		**130**	**0.13**	**0.19**	**99.69**
	HPSEBL					
15	BASSI HPS	1	16.5	0.00	2.38	97.62
		2	16.5	0.00	1.03	98.97
		3	16.5	0.00	0.52	99.48
		4	16.5	0.00	1.10	98.90
	TOTAL :		**66**	**0.00**	**1.26**	**98.74**
16	GIRI BATA HPS	1	30	0.00	15.55	84.45
		2	30	0.10	17.30	82.60

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**60**	**0.05**	**16.43**	**83.52**
17	LARJI HPS	1	42	0.00	2.21	97.79
		2	42	0.00	5.88	94.12
		3	42	0.00	2.38	97.62
	TOTAL :		**126**	**0.00**	**3.49**	**96.51**
18	SANJAY HPS	1	40	0.48	27.65	71.87
		2	40	3.09	51.24	45.67
		3	40	3.09	67.19	29.72
	TOTAL :		**120**	**2.22**	**48.69**	**49.09**
	IAEPL					
19	CHANJU-I HPS	1	12	0.00	0.00	100.00
		2	12	0.00	0.00	100.00
	TOTAL :		**24**	**0.00**	**0.00**	**100.00**
	JKSPDC					
20	BAGLIHAR HPS	1	150	0.26	0.00	99.74
		2	150	0.66	1.56	97.78
		3	150	0.35	0.00	99.65
	TOTAL :		**450**	**0.43**	**0.52**	**99.05**
21	BAGLIHAR II HPS	1	150	0.18	0.00	99.82
		2	150	0.00	1.70	98.30
		3	150	0.35	0.00	99.65
	TOTAL :		**450**	**0.18**	**0.57**	**99.25**
22	LOWER JHELUM HPS	1	35	0.00	0.60	99.40
		2	35	0.00	0.41	99.59
		3	35	0.00	0.12	99.88
	TOTAL :		**105**	**0.00**	**0.38**	**99.62**
23	UPPER SINDH-II HPS	3	35	0.03	4.39	95.58
		4	35	0.00	2.21	97.79
		5	35	0.26	4.26	95.48
	TOTAL :		**105**	**0.10**	**3.62**	**96.28**
	JPPVL					
24	VISHNU PRAYAG HPS	1	100	0.11	0.30	99.59
		2	100	0.35	0.48	99.17
		3	100	1.17	0.44	98.39
		4	100	1.51	0.25	98.24
	TOTAL :		**400**	**0.79**	**0.37**	**98.84**
	MPCL					
25	MALANA HPS	1	43	0.00	0.01	99.99
		2	43	0.06	0.00	99.94

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**86**	**0.03**	**0.01**	**99.96**
	NHPC LTD					
26	BAIRA SIUL HPS	1	60	6.71	0.00	93.29
		2	60	7.92	0.45	91.63
		3	60	5.32	3.18	91.50
	TOTAL :		**180**	**6.65**	**1.21**	**92.14**
27	CHAMERA- I HPS	1	180	2.82	0.25	96.93
		2	180	2.98	0.63	96.39
		3	180	2.36	0.29	97.35
	TOTAL :		**540**	**2.72**	**0.39**	**96.89**
28	CHAMERA- II HPS	1	100	2.28	0.09	97.63
		2	100	7.03	0.08	92.89
		3	100	2.86	0.03	97.11
	TOTAL :		**300**	**4.06**	**0.07**	**95.87**
29	CHAMERA-III HPS	1	77	16.16	0.12	83.72
		2	77	16.16	0.00	83.84
		3	77	16.16	0.00	83.84
	TOTAL :		**231**	**16.16**	**0.04**	**83.80**
30	CHUTAK HPS	1	11	6.83	0.25	92.92
		2	11	14.34	0.00	85.66
		3	11	6.10	0.00	93.90
		4	11	14.70	0.00	85.30
	TOTAL :		**44**	**10.49**	**0.06**	**89.45**
31	DHAULI GANGA HPS	1	70	2.54	15.60	81.86
		2	70	0.00	22.96	77.04
		3	70	5.29	4.12	90.59
		4	70	5.43	0.16	94.41
	TOTAL :		**280**	**3.32**	**10.71**	**85.97**
32	DULHASTI HPS	1	130	3.40	0.16	96.44
		2	130	3.68	5.90	90.42
		3	130	5.09	0.17	94.74
	TOTAL :		**390**	**4.06**	**2.07**	**93.87**
33	NIMMO BAZGO HPS	1	15	4.21	0.00	95.79
		2	15	0.10	0.02	99.88
		3	15	5.50	0.02	94.48
	TOTAL :		**45**	**3.27**	**0.01**	**96.72**
34	PARBATI-III HPS	1	130	34.40	4.66	60.94
		2	130	8.33	0.44	91.23
		3	130	41.82	4.47	53.71

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		4	130	30.21	2.51	67.28
	TOTAL :		**520**	**28.69**	**3.02**	**68.29**
35	SALAL-I HPS	1	115	19.29	0.08	80.63
		2	115	31.75	0.01	68.24
		3	115	4.86	0.04	95.10
	TOTAL :		**345**	**18.63**	**0.04**	**81.32**
36	SALAL-II HPS	1	115	12.65	0.60	86.75
		2	115	13.56	0.43	86.01
		3	115	27.54	0.51	71.95
	TOTAL :		**345**	**17.92**	**0.51**	**81.57**
37	SEWA-II HPS	1	40	4.28	0.24	95.48
		2	40	4.25	0.47	95.28
		3	40	2.44	0.36	97.20
	TOTAL :		**120**	**3.66**	**0.36**	**95.98**
38	TANAKPUR HPS	1	31.4	20.63	0.52	78.85
		2	31.4	28.60	1.14	70.26
		3	31.4	9.87	2.12	88.01
	TOTAL :		**94.2**	**19.70**	**1.26**	**79.04**
39	URI-I HPS	1	120	4.46	0.19	95.35
		2	120	3.37	0.03	96.60
		3	120	7.67	0.47	91.86
		4	120	10.52	3.95	85.53
	TOTAL :		**480**	**6.50**	**1.16**	**92.34**
40	URI-II HPS	1	60	6.10	0.08	93.82
		2	60	0.00	39.79	60.21
		3	60	4.17	1.51	94.32
		4	60	6.01	0.08	93.91
	TOTAL :		**240**	**4.07**	**10.37**	**85.56**
	NTPC Ltd.					
41	KOLDAM HPS	1	200	0.00	0.00	100.00
		2	200	0.89	0.07	99.04
		3	200	1.63	0.00	98.37
		4	200	0.00	0.00	100.00
	TOTAL :		**800**	**0.63**	**0.02**	**99.35**
	PSPCL					
42	ANANDPUR SAHIB-I HPS	1	33.5	0.15	0.11	99.74
		2	33.5	0.05	0.31	99.64
	TOTAL :		**67**	**0.10**	**0.21**	**99.69**
43	ANANDPUR SAHIB-II HPS	1	33.5	0.00	2.86	97.14

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		2	33.5	0.09	2.76	97.15
	TOTAL :		**67**	**0.05**	**2.81**	**97.15**
44	MUKERIAN I HPS	1	15	7.40	0.20	92.40
		2	15	8.67	0.38	90.95
		3	15	5.37	0.30	94.33
	TOTAL :		**45.00**	**7.15**	**0.29**	**92.56**
45	MUKERIAN II HPS	1	15	6.99	0.50	92.51
		2	15	7.41	0.14	92.45
		3	15	6.69	0.24	93.07
	TOTAL :		**30.00**	**7.03**	**0.29**	**92.68**
46	MUKERIAN III HPS	1	19.5	9.16	0.25	90.59
		2	19.5	3.69	1.45	94.86
		3	19.5	10.28	1.97	87.75
	TOTAL :		**58.50**	**7.71**	**1.22**	**91.07**
47	MUKERIAN IV HPS	2	19.5	12.06	0.03	87.91
		1	19.5	8.90	0.01	91.09
		2	19.5	7.34	0.42	92.24
	TOTAL :		**58.50**	**9.43**	**0.15**	**90.42**
		2	19.5	7.34	0.42	92.24
	TOTAL :		**78.00**	**8.39**	**0.29**	**91.33**
48	RANJIT SAGAR HPS	1	150	25.75	0.00	74.25
		2	150	17.62	2.75	79.63
		3	150	26.15	0.58	73.27
		4	150	14.02	0.00	85.98
	TOTAL :		**600**	**20.88**	**0.83**	**78.29**
49	SHANAN HPS	1	15	3.09	0.02	96.89
		2	15	0.16	0.01	99.83
		3	15	0.40	0.02	99.58
		4	15	0.22	0.03	99.75
		5	50	3.97	13.99	82.04
	TOTAL :		**110**	**2.33**	**6.37**	**91.30**
	RRVUNL					
50	JAWAHAR SAGAR HPS	1	33	10.60	0.11	89.29
		2	33	4.54	0.00	95.46
		3	33	10.18	3.65	86.17
	TOTAL :		**99**	**8.44**	**1.25**	**90.31**
51	MAHI BAJAJ-I HPS	1	25	0.01	0.23	99.76
		2	25	0.00	1.39	98.61
	TOTAL :		**50.00**	**0.01**	**0.81**	**99.19**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
52	MAHI BAJAJ-II HPS	3	45	0.00	0.93	99.07
		4	45	0.00	2.86	97.14
	TOTAL :		**90.00**	**0.00**	**1.90**	**98.11**
53	R P SAGAR HPS	1	43	8.02	0.06	91.92
		2	43	6.90	0.52	92.58
		3	43	7.14	0.00	92.86
		4	43	6.94	0.00	93.06
	TOTAL :		**172**	**7.25**	**0.14**	**92.61**
	SJVNL					
54	NATHPA JHAKRI HPS	1	250	0.00	0.41	99.59
		2	250	0.00	0.00	100.00
		3	250	0.00	0.01	99.99
		4	250	0.00	0.00	100.00
		5	250	0.00	0.00	100.00
		6	250	0.00	0.04	99.96
	TOTAL :		**1500**	**0.00**	**0.08**	**99.92**
55	RAMPUR HPS	1	68.67	5.90	2.55	91.55
		2	68.67	3.90	0.44	95.66
		3	68.67	4.45	1.48	94.07
		4	68.67	3.11	2.22	94.67
		5	68.67	3.92	1.13	94.95
		6	68.67	3.04	10.13	86.83
	TOTAL :		**412.02**	**4.05**	**2.99**	**92.96**
	THDC LTD.					
56	KOTESHWAR HPS	1	100	3.73	0.00	96.27
		2	100	8.52	0.00	91.48
		3	100	7.76	0.02	92.22
		4	100	3.17	0.01	96.82
	TOTAL :		**400**	**5.79**	**0.01**	**94.20**
57	TEHRI ST-1 HPS	1	250	7.29	0.83	91.88
		2	250	1.27	0.39	98.34
		3	250	9.93	0.33	89.74
		4	250	10.23	0.00	89.77
	TOTAL :		**1000**	**7.18**	**0.39**	**92.43**
	UJVNL					
58	CHIBRO (YAMUNA) HPS	1	60	0.00	0.08	99.92
		2	60	23.29	0.18	76.53
		3	60	6.93	1.25	91.82
		4	60	21.34	1.38	77.28

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**240**	**12.89**	**0.72**	**86.39**
59	CHILLA HPS	1	36	5.17	0.15	94.68
		2	36	7.73	1.00	91.27
		3	36	15.92	0.64	83.44
		4	36	7.16	0.92	91.92
	TOTAL :		**144**	**8.99**	**0.68**	**90.33**
60	DHAKRANI HPS	1	11.25	19.49	0.33	80.18
		2	11.25	12.99	0.00	87.01
		3	11.25	11.72	0.00	88.28
	TOTAL :		**33.75**	**14.73**	**0.11**	**85.16**
61	DHALIPUR HPS	1	17	35.72	1.28	63.00
		2	17	7.01	1.90	91.09
		3	17	14.24	2.73	83.03
	TOTAL :		**51**	**18.99**	**1.97**	**79.04**
62	KHATIMA HPS	1	13.8	0.01	0.29	99.70
		2	13.8	7.53	0.84	91.63
		3	13.8	33.42	0.38	66.20
	TOTAL :		**41.4**	**13.66**	**0.50**	**85.84**
63	KHODRI HPS	1	30	4.02	0.00	95.98
		2	30	34.07	0.00	65.93
		3	30	10.60	3.67	85.73
		4	30	13.74	2.85	83.41
	TOTAL :		**120**	**15.61**	**1.63**	**82.76**
64	KULHAL HPS	1	10	24.48	0.00	75.52
		2	10	2.35	0.05	97.60
		3	10	2.35	0.00	97.65
	TOTAL :		**30**	**9.73**	**0.02**	**90.25**
65	MANERI BHALI - I HPS	1	30	7.19	0.21	92.60
		2	30	14.80	7.27	77.93
		3	30	39.37	1.34	59.29
	TOTAL :		**90**	**20.46**	**2.94**	**76.60**
66	MANERI BHALI - II HPS	1	76	10.18	1.02	88.80
		2	76	13.15	0.42	86.43
		3	76	1.38	4.29	94.33
		4	76	21.16	1.44	77.40
	TOTAL :		**304**	**11.47**	**1.79**	**86.74**
67	RAMGANGA HPS	1	66	15.07	0.00	84.93
		2	66	16.99	0.00	83.01
		3	66	0.00	0.00	100.00

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**198**	**10.68**	**0.00**	**89.32**
	UPJVNL					
68	KHARA HPS	1	24	10.68	31.01	58.31
		2	24	2.69	3.05	94.26
		3	24	7.00	1.47	91.53
	TOTAL :		**72**	**6.79**	**11.84**	**81.37**
69	MATATILA HPS	1	10.2	0.01	0.12	99.87
		2	10.2	0.00	1.02	98.98
		3	10.2	0.28	1.05	98.67
	TOTAL :		**30.6**	**0.10**	**0.73**	**99.17**
70	OBRA HPS	1	33	29.26	0.00	70.74
		2	33	9.69	0.00	90.31
		3	33	0.00	51.18	48.82
	TOTAL :		**99**	**12.98**	**17.06**	**69.96**
71	RIHAND HPS	1	50	100.00	0.00	0.00
		2	50	100.00	0.00	0.00
		3	50	0.00	0.09	99.91
		4	50	31.51	0.11	68.38
		5	50	0.00	0.00	100.00
		6	50	100.00	0.00	0.00
	TOTAL :		**300**	**55.25**	**0.03**	**44.72**
	WESTERN REGION					
	CSPGCL					
1	HASDEOBANGO HPS	1	40	0.00	0.03	99.97
		2	40	0.00	0.12	99.88
		3	40	0.00	0.05	99.95
	TOTAL :		**120**	**0.00**	**0.07**	**99.93**
	DLHP					
2	BHANDARDHARA HPS ST-II	2	34	0.00	0.01	99.99
	TOTAL :		**34**	**0.00**	**0.01**	**99.99**
	GSECL					
3	KADANA HPS	1	60	0.00	0.00	100.00
		2	60	0.00	1.09	98.91
		3	60	0.00	2.92	97.08
		4	60	0.00	1.15	98.85
	TOTAL :		**240**	**0.00**	**1.29**	**98.71**
4	UKAI HPS	1	75	0.00	0.01	99.99
		2	75	0.00	0.10	99.90
		3	75	0.00	0.00	100.00

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		4	75	0.00	0.00	100.00
	TOTAL :		**300**	**0.00**	**0.03**	**99.97**
	MAHAGENCO					
5	BHIRA TAIL RACE HPS	1	40	0.00	4.68	95.32
		2	40	0.00	1.60	98.40
	TOTAL :		**80**	**0.00**	**3.14**	**96.86**
6	GHATGHAR PSS HPS	1	125	0.00	1.12	98.88
		2	125	0.00	0.30	99.70
	TOTAL :		**250**	**0.00**	**0.71**	**99.29**
7	KOYNA DPH HPS	1	18	0.00	0.00	100.00
		2	18	0.00	0.00	100.00
	TOTAL :		**36**	**0.00**	**0.00**	**100.00**
8	KOYNA-I&II HPS	1	70	0.47	0.22	99.31
		2	70	0.31	0.27	99.42
		3	70	0.42	0.01	99.57
		4	70	0.92	0.46	98.62
		1	80	0.67	1.98	97.35
		2	80	0.29	0.11	99.60
		3	80	0.47	10.84	88.69
		4	80	3.43	18.12	78.45
	TOTAL :		**600**	**0.90**	**4.25**	**94.85**
9	KOYNA-III HPS	1	80	3.30	2.32	94.38
		2	80	47.57	0.00	52.43
		3	80	0.00	21.83	78.17
		4	80	0.00	0.00	100.00
	TOTAL :		**320**	**12.72**	**6.04**	**81.24**
10	KOYNA-IV HPS	1	250	8.48	2.69	88.83
		2	250	0.11	0.00	99.89
		3	250	0.15	0.00	99.85
		4	250	0.20	2.33	97.47
	TOTAL :		**1000**	**2.23**	**1.26**	**96.51**
11	TILLARI HPS	1	60	6.23	7.62	86.15
	TOTAL :		**60**	**6.23**	**7.62**	**86.15**
12	VAITARNA HPS	1	60	0.18	0.56	99.26
	TOTAL :		**60**	**0.18**	**0.56**	**99.26**
	MPPGCL					
13	BANSAGAR TONS-1 HPS	1	105	11.67	2.21	86.12
		2	105	11.96	1.59	86.45
		3	105	0.05	0.85	99.10

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**315**	**7.89**	**1.55**	**90.56**
14	BANSAGAR TONS-II HPS	1	15	1.81	2.36	95.83
		2	15	6.13	3.92	89.95
	TOTAL :		**30**	**3.97**	**3.14**	**92.89**
15	BANSAGAR TONS-III HPS	1	20	5.35	0.31	94.34
		2	20	6.71	0.29	93.00
		3	20	5.35	0.12	94.53
	TOTAL :		**60**	**5.80**	**0.24**	**93.96**
16	BARGI HPS	1	45	5.62	1.74	92.64
		2	45	11.59	0.91	87.50
	TOTAL :		**90**	**8.60**	**1.33**	**90.07**
17	GANDHI SAGAR HPS	1	23	0.00	0.23	99.77
		2	23	0.00	0.07	99.93
		3	23	9.87	0.01	90.12
		4	23	0.00	0.03	99.97
		5	23	4.13	0.03	95.84
	TOTAL :		**115**	**2.80**	**0.07**	**97.13**
18	MADHIKHERA HPS	1	20	4.38	0.78	94.84
		2	20	5.00	0.29	94.71
		3	20	4.23	0.09	95.68
	TOTAL :		**60**	**4.54**	**0.39**	**95.07**
19	PENCH HPS	1	80	7.32	10.64	82.04
		2	80	0.09	1.69	98.22
	TOTAL :		**160**	**3.70**	**6.16**	**90.14**
20	RAJGHAT HPS	1	15	86.26	0.00	13.74
		2	15	25.97	0.10	73.93
		3	15	19.56	19.98	60.46
	TOTAL :		**45**	**43.93**	**6.69**	**49.38**
	NHDC					
21	INDIRA SAGAR HPS	1	125	2.95	0.22	96.83
		2	125	6.89	0.19	92.92
		3	125	4.83	0.13	95.04
		4	125	1.22	0.08	98.70
		5	125	3.22	0.14	96.64
		6	125	2.90	0.16	96.94
		7	125	4.85	0.64	94.51
		8	125	2.82	0.01	97.17
	TOTAL :		**1000**	**3.71**	**0.19**	**96.10**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
22	OMKARESHWAR HPS	1	65	4.26	0.00	95.74
		2	65	3.92	0.00	96.08
		3	65	4.13	0.00	95.87
		4	65	3.85	0.00	96.15
		5	65	3.45	0.00	96.55
		6	65	3.39	0.00	96.61
		7	65	2.56	0.00	97.44
		8	65	5.29	0.00	94.71
	TOTAL :		**520**	**3.86**	**0.00**	**96.14**
	SSNNL					
23	S SAROVAR CHPH HPS	1	50	5.41	0.00	94.59
		2	50	4.73	0.02	95.25
		3	50	4.45	0.00	95.55
		4	50	3.94	0.02	96.04
		5	50	4.72	0.03	95.25
	TOTAL :		**250**	**4.65**	**0.01**	**95.34**
24	S SAROVAR RBPH HPS	1	200	4.64	0.00	95.36
		2	200	0.09	0.00	99.91
		3	200	16.64	0.00	83.36
		4	200	7.66	0.00	92.34
		5	200	5.73	0.00	94.27
		6	200	6.11	0.00	93.89
	TOTAL :		**1200**	**6.81**	**0.00**	**93.19**
	TATA MAH.					
25	BHIRA HPS	1	25	0.00	0.00	100.00
		2	25	0.00	0.02	99.98
		3	25	0.00	0.00	100.00
		4	25	0.00	0.00	100.00
		5	25	2.38	1.70	95.92
		6	25	0.00	0.00	100.00
	TOTAL :		**150**	**0.40**	**0.29**	**99.31**
26	BHIRA PSS HPS	1	150	0.00	0.02	99.98
	TOTAL :		**150**	**0.00**	**0.02**	**99.98**
27	BHIVPURI HPS	1	24	0.00	0.00	100.00
		2	24	0.00	0.04	99.96
		3	24	13.88	0.00	86.12
		4	1.5	0.00	0.00	100.00
		5	1.5	0.00	0.00	100.00
	TOTAL :		**75**	**4.44**	**0.01**	**95.55**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
28	KHOPOLI HPS	1	24	0.15	0.04	99.81
		2	24	0.00	0.00	100.00
		3	24	0.00	0.00	100.00
	TOTAL :		**72**	**0.05**	**0.01**	**99.94**
	SOUTHERN REGION					
	APGENCO					
1	HAMPI HPS	1	9	10.63	1.42	87.95
		2	9	4.87	2.80	92.33
		3	9	5.67	0.55	93.78
		4	9	10.24	0.20	89.56
	TOTAL :		**36**	**7.85**	**1.24**	**90.91**
2	NAGARJUN SGR TPD HPS	1	25	0.00	0.00	100.00
		2	25	0.00	0.00	100.00
	TOTAL :		**50**	**0.00**	**0.00**	**100.00**
3	NAGARJUN SGR RBC HPS	1	30	6.17	0.00	93.83
		2	30	0.00	0.19	99.81
	TOTAL :		**90**	**3.09**	**0.10**	**96.81**
4	NAGARJUN SGR RBC EXT HPS	1	30	0.00	0.02	99.98
	TOTAL :		**30**	**0.00**	**0.02**	**99.98**
5	SRISAILAM HPS	1	110	1.67	0.00	98.33
		2	110	1.67	0.00	98.33
		3	110	0.00	0.05	99.95
		4	110	1.67	0.00	98.33
		5	110	1.67	0.00	98.33
		6	110	1.67	0.00	98.33
		7	110	1.67	0.00	98.33
	TOTAL :		**770**	**1.43**	**0.01**	**98.56**
5	T B DAM HPS	1	9	15.61	0.03	84.36
		2	9	27.35	0.35	72.30
		3	9	3.60	0.00	96.40
		4	9	1.15	0.03	98.82
	TOTAL :		**36**	**11.93**	**0.10**	**87.97**
6	UPPER SILERU-I HPS	1	60	0.00	2.50	97.50
		2	60	1.43	8.29	90.28
	TOTAL :		**120**	**0.72**	**5.40**	**93.89**
7	UPPER SILERU-II HPS	1	60	0.00	9.91	90.09
		2	60	0.00	6.48	93.52
	TOTAL :		**120**	**0.00**	**16.39**	**83.61**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	KPCL					
8	ALMATTI DPH HPS	1	15	2.61	0.10	97.29
		2	55	13.18	4.19	82.63
		3	55	14.96	1.02	84.02
		4	55	19.35	0.09	80.56
		5	55	21.12	6.15	72.73
		6	55	17.28	1.83	80.89
	TOTAL :		**290**	**16.42**	**2.52**	**81.06**
9	BHADRA HPS	1	2	0.00	2.92	97.08
		2	12	8.49	0.47	91.04
		3	12	0.00	0.00	100.00
		4	7.2	0.00	0.49	99.51
		5	6	0.00	0.00	100.00
	TOTAL :		**39.2**	**2.60**	**0.38**	**97.02**
10	GERUSUPPA HPS	1	60	3.73	0.93	95.34
		2	60	3.55	0.65	95.80
		3	60	3.72	0.08	96.20
		4	60	3.95	0.26	95.79
	TOTAL :		**240**	**3.74**	**0.48**	**95.78**
11	GHAT PRABHA HPS	1	16	32.29	1.88	65.83
		2	16	0.19	0.00	99.81
	TOTAL :		**32**	**16.24**	**0.94**	**82.82**
12	JOG HPS	1	13.2	2.24	0.05	97.71
		2	13.2	2.13	0.02	97.85
		3	13.2	15.64	0.03	84.33
		4	13.2	0.58	0.00	99.42
		5	21.6	5.81	0.04	94.15
		6	21.6	18.38	8.87	72.75
		7	21.6	12.17	0.02	87.81
		8	21.6	6.27	7.86	85.87
	TOTAL :		**139.2**	**8.57**	**2.61**	**88.82**
13	KADRA HPS	1	50	0.00	5.68	94.32
		2	50	0.00	5.47	94.53
		3	50	0.12	12.58	87.30
	TOTAL :		**150**	**0.04**	**7.91**	**92.05**
14	KALINADI HPS	1	135	0.00	0.01	99.99
		2	135	0.00	0.00	100.00
		3	135	0.00	18.26	81.74
		4	150	0.00	16.61	83.39

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		5	150	5.01	0.00	94.99
		6	150	6.70	0.00	93.30
	TOTAL :		**855**	**2.05**	**5.80**	**92.15**
15	KALINADI SUPA HPS	1	50	0.00	0.01	99.99
		2	50	0.00	0.02	99.98
	TOTAL :		**100**	**0.00**	**0.02**	99.98
16	KODASALI HPS	1	40	0.88	6.83	92.29
		2	40	0.03	12.87	87.10
		3	40	2.56	11.40	86.04
	TOTAL :		**120**	**1.16**	**10.36**	**88.48**
17	LIGANAMAKKI HPS	1	27.5	10.52	0.14	89.34
		2	27.5	1.86	0.38	97.76
	TOTAL :		**55**	**6.19**	**0.26**	**93.55**
18	MUNIRABAD HPS	1	9	0.00	0.33	99.67
		2	9	0.00	0.38	99.62
		3	10	0.00	3.63	96.37
	TOTAL :		**28**	**0.00**	**1.53**	**98.47**
19	SHARAVATHI HPS	1	103.5	1.44	35.60	62.96
		2	103.5	2.61	37.96	59.43
		3	103.5	1.42	30.45	68.13
		4	103.5	0.84	34.52	64.64
		5	103.5	2.17	32.11	65.72
		6	103.5	10.04	0.95	89.01
		7	103.5	7.96	1.88	90.16
		8	103.5	2.54	4.19	93.27
		9	103.5	3.09	25.55	71.36
		10	103.5	3.40	28.16	68.44
	TOTAL :		**1035**	**3.55**	**23.14**	**73.31**
20	SIVASAMUNDRUM HPS	1	3	0.00	0.00	100.00
		2	3	0.00	0.31	99.69
		3	3	0.00	0.18	99.82
		4	3	0.00	0.00	100.00
		5	3	0.00	0.00	100.00
		6	3	0.00	0.00	100.00
		7	6	0.00	0.00	100.00
		8	6	0.00	0.00	100.00
		9	6	0.25	0.00	99.75
		10	6	0.00	0.00	100.00
	TOTAL :		**42**	**0.04**	**0.03**	**99.93**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
21	VARAHI HPS	1	115	15.44	0.23	84.33
		2	115	0.15	0.80	99.05
		3	115	5.25	1.84	92.91
		4	115	0.00	10.22	89.78
	TOTAL :		**460**	**5.21**	**3.27**	**91.52**
	KSEB LTD.					
22	IDAMALAYAR HPS.	1	37.5	10.37	2.19	87.44
		2	37.5	9.53	1.21	89.26
	TOTAL :		**75**	**9.95**	**1.70**	**88.35**
23	IDUKKI HPS.	1	130	9.28	2.78	87.94
		2	130	10.19	2.17	87.64
		3	130	8.68	1.91	89.41
		4	130	8.04	0.20	91.76
		5	130	8.89	0.12	90.99
		6	130	8.65	0.09	91.26
	TOTAL :		**780**	**8.95**	**1.21**	**89.84**
24	KAKKAD HPS.	1	25	8.42	8.68	82.90
		2	25	0.75	0.43	98.82
	TOTAL :		**50**	**4.59**	**4.56**	**90.85**
25	KUTTIYADI HPS.	1	25	3.22	0.32	96.46
		2	25	0.79	0.28	98.93
		3	25	4.76	0.17	95.07
		4	50	3.32	13.14	83.54
	TOTAL :		**125**	**3.08**	**5.41**	**91.51**
26	KUTTIYADI ADDL. EXTN. HPS	5	50	10.30	0.46	89.24
		6	50	9.63	0.32	90.05
	TOTAL :		**100**	**9.97**	**0.39**	**89.64**
27	LOWER PERIYAR HPS.	1	60	5.80	14.36	79.84
		2	60	0.00	13.30	86.70
		3	60	0.00	14.65	85.35
	TOTAL :		**180**	**1.93**	**14.10**	**83.97**
28	NARIAMANGLAM HPS	1	15	0.00	0.00	100.00
		2	15	0.00	0.22	99.78
		3	15	0.00	6.23	93.77
		4	25	7.58	2.11	90.31
	TOTAL :		**70**	**2.71**	**2.13**	**95.16**
29	PALLIVASAL HPS.	1	5	4.64	0.02	95.34
		2	5	4.94	0.11	94.95
		3	5	0.00	8.96	91.04

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		4	7.5	15.30	0.01	84.69
		5	7.5	2.13	5.76	92.11
		6	7.5	0.16	11.29	88.55
	TOTAL :		**37.5**	**4.80**	**4.62**	**90.58**
30	PANNIAR HPS.	1	15	19.13	0.70	80.17
		2	15	20.60	0.25	79.15
	TOTAL :		**30**	**19.86**	**0.48**	**79.66**
31	PORINGALKUTTU HPS.	1	8	8.91	23.48	67.61
		2	8	4.31	3.76	91.93
		3	8	7.24	37.77	54.99
		4	8	11.53	2.14	86.33
	TOTAL :		**32**	**8.00**	**16.79**	**75.21**
32	SABARIGIRI HPS.	1	50	9.64	3.17	87.19
		2	50	17.96	0.47	81.57
		3	50	16.00	1.37	82.63
		4	50	10.21	1.03	88.76
		5	50	10.58	4.61	84.81
		6	50	8.08	1.04	90.88
	TOTAL :		**300**	**12.08**	**1.95**	**85.97**
33	SENGULAM HPS.	1	12	5.03	1.14	93.83
		2	12	0.11	1.03	98.86
		3	12	20.28	0.43	79.29
		4	12	7.25	0.88	91.87
	TOTAL :		**48**	**8.17**	**0.87**	**90.96**
34	SHOLAYAR HPS.	1	18	0.12	0.18	99.70
		2	18	0.21	0.24	99.55
		3	18	22.72	10.64	66.64
	TOTAL :		**54**	**7.68**	**3.69**	**88.63**
	TNGDCL					
35	ALIYAR HPS.	1	60	0.20	0.53	99.27
	TOTAL :		**60**	**0.20**	**0.53**	99.27
36	BHAWANI BARRAGE III HPS	1	15	17.52	0.02	82.46
		2	15	16.88	0.00	83.12
	TOTAL :		**30**	**17.20**	**0.01**	**82.79**
37	BHAWANI BARRAGE-II HPS	1	15	0.07	0.88	99.05
		2	15	0.27	1.15	98.58
	TOTAL :		**30**	**0.17**	**1.01**	**98.82**
38	BHAWANI KATTAL HPS	1	15	20.20	0.00	79.80
		2	15	1.26	0.00	98.74

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**30**	**10.73**	**0.00**	**89.27**
39	KADAMPARI HPS.	1	100	0.00	32.17	67.83
		2	100	0.00	6.98	93.02
		3	100	0.00	60.12	39.88
		4	100	0.00	9.33	90.67
	TOTAL :		**400**	**0.00**	**27.15**	**72.85**
40	KODAYAR-I HPS.	1	60	6.66	18.72	74.62
	TOTAL :			**6.66**	**18.72**	**74.62**
41	KODAYAR-II HPS.	2	40	2.84	1.74	95.42
	TOTAL :		**100**	**2.84**	**1.74**	**95.42**
42	KUNDAH-I HPS.	1	20	4.42	0.00	95.58
		2	20	0.63	0.08	99.29
		3	20	0.49	2.17	97.34
	TOTAL :		**60**	**1.85**	**0.75**	**97.40**
43	KUNDAH-II HPS.	1	35	0.11	0.60	99.29
		2	35	0.00	2.61	97.39
		3	35	0.00	1.00	99.00
		4	35	5.15	0.39	94.46
		5	35	0.00	1.87	98.13
	TOTAL :		**175**	**1.05**	**1.29**	**97.65**
44	KUNDAH-III HPS.	1	60	6.13	0.37	93.50
		2	60	0.29	0.36	99.35
		3	60	0.31	0.37	99.32
	TOTAL :		**180**	**2.24**	**0.37**	**97.39**
45	KUNDAH-IV HPS.	1	50	0.61	0.00	99.39
		2	50	4.76	0.00	95.24
	TOTAL :		**100**	**2.69**	**0.00**	**97.32**
46	KUNDAH-V HPS.	1	20	0.00	0.00	100.00
		2	20	0.00	0.00	100.00
	TOTAL :		**40**	**0.00**	**0.00**	**100.00**
47	LOWER METTUR-I HPS.	1	15	2.91	0.00	97.09
		2	15	0.00	0.00	100.00
	TOTAL :		**30**	**1.46**	**0.00**	**98.55**
48	LOWER METTUR-II HPS.	1	15	5.39	0.00	94.61
		2	15	2.38	0.00	97.62
	TOTAL :		**30**	**3.89**	**0.00**	**96.12**
49	LOWER METTUR-III HPS.	1	15	0.00	0.00	100.00
		2	15	0.00	0.00	100.00
	TOTAL :		**30**	**0.00**	**0.00**	**100.00**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
50	LOWER METTUR-IV HPS.	1	15	2.81	0.00	97.19
		2	15	6.67	0.00	93.33
	TOTAL :		**30**	**4.74**	**0.00**	**95.26**
51	METTUR DAM HPS.	1	12.5	0.09	0.00	99.91
		2	12.5	7.57	0.00	92.43
		3	12.5	0.08	0.00	99.92
		4	12.5	7.38	0.00	92.62
	TOTAL :		**50**	**3.78**	**0.00**	**96.22**
52	METTUR TUNNEL HPS.	1	50	13.79	0.00	86.21
		2	50	5.32	0.00	94.68
		3	50	8.22	0.00	91.78
		4	50	8.22	0.00	91.78
	TOTAL :		**200**	**8.89**	**0.00**	**91.11**
53	MOYAR HPS	1	12	7.43	0.36	92.21
		2	12	0.00	1.64	98.36
		3	12	0.98	0.36	98.66
	TOTAL :		**36**	**2.80**	**0.79**	**96.41**
54	PAPANASAM HPS.	1	8	7.86	0.07	92.07
		2	8	0.14	41.93	57.93
		3	8	0.39	0.07	99.54
		4	8	0.25	0.15	99.60
	TOTAL :		**32**	**2.16**	**10.55**	**87.29**
55	PARSON`S VALLEY HPS.	1	30	0.17	0.07	99.76
	TOTAL :		**30**	**0.17**	**0.07**	99.76
56	PERIYAR HPS.	1	42	13.46	0.01	86.53
		2	42	11.19	0.00	88.81
		3	42	9.94	0.00	90.06
		4	35	91.78	0.00	8.22
	TOTAL :		**161**	**28.98**	**0.00**	**71.02**
57	PYKARA HPS.	1	7	0.09	0.95	98.96
		2	7	0.37	0.00	99.63
		3	7	0.48	1.07	98.45
		4	13.6	0.00	0.00	100.00
		5	13.6	0.09	1.36	98.55
		6	11	0.10	0.29	99.61
	TOTAL :		**59.2**	**0.15**	**0.61**	**99.24**
58	PYKARA ULTMATE HPS.	1	50	0.08	0.52	99.40
		2	50	9.74	0.00	90.26
		3	50	0.14	0.00	99.86

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
	TOTAL :		**150**	**3.32**	**0.17**	**96.51**
59	SARKARPATHY HPS.	1	30	14.99	0.04	84.97
	TOTAL :		**30**	**14.99**	**0.04**	**84.97**
60	SHOLAYAR HPS.	1	35	8.37	0.26	91.37
		2	35	6.54	1.22	92.24
		3	25	11.05	2.20	86.75
	TOTAL :		**95**	**8.40**	**1.12**	**90.48**
61	SURULIYAR HPS.	1	35	8.80	2.26	88.94
	TOTAL :		**35**	**8.80**	**2.26**	**88.94**
	TSGENCO					
62	LOWER JURALA HPS	1	40	0.00	0.00	100.00
		2	40	0.00	0.00	100.00
		3	40	0.00	0.00	100.00
		4	40	0.00	0.00	100.00
		5	40	0.00	0.00	100.00
		6	40	0.00	0.00	100.00
	TOTAL :		**240**	**0.00**	**0.00**	**100.00**
63	LOWER SILERU HPS	1	115	0.00	100.00	0.00
		2	115	0.65	0.48	98.87
		3	115	24.95	0.00	75.05
		4	115	6.88	0.00	93.12
	TOTAL :		**460**	**8.12**	**25.12**	**66.76**
64	NAGARJUN SGR HPS	1	110	0.00	0.00	100.00
		2	100.8	0.00	1.41	98.59
		3	100.8	7.92	12.74	79.34
		4	100.8	7.30	0.00	92.70
		5	100.8	0.00	7.77	92.23
		6	100.8	0.00	7.85	92.15
		7	100.8	0.00	10.03	89.97
		8	100.8	8.08	11.00	80.92
	TOTAL :		**815.6**	**2.88**	**6.28**	**90.84**
65	NAGARJUN SGR LBC HPS	1	30	0.00	0.00	100.00
		2	30	0.00	0.00	100.00
	TOTAL :		**60**	**0.00**	**0.00**	100.00
66	POCHAMPAD HPS	1	9	0.00	0.00	100.00
		2	9	0.00	0.00	100.00
		3	9	0.00	0.00	100.00
	TOTAL :		**27**	**0.00**	**0.00**	**100.00**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
67	PRIYADARSHNI JURALA HPS	1	39	0.00	0.14	99.86
		2	39	0.00	0.08	99.92
		3	39	0.00	0.15	99.85
		4	39	0.00	0.04	99.96
		5	39	0.00	0.06	99.94
		6	39	0.00	0.82	99.18
	TOTAL :		**234**	**0.00**	**0.21**	**99.79**
68	PULICHINTALA HPS	1	30	0.00	0.00	100.00
	TOTAL :		**30**	**0.00**	**0.00**	**100.00**
69	SRISAILAM LB HPS	1	150	0.00	0.00	100.00
		2	150	0.00	0.00	100.00
		3	150	0.00	0.00	100.00
		4	150	0.00	0.00	100.00
		5	150	0.00	0.00	100.00
		6	150	0.00	0.00	100.00
	TOTAL :		**900**	**0.00**	**0.00**	**100.00**
	EASTERN REGION					
	APGENCO					
1	MACHKUND HPS	1	17	0.01	2.96	97.03
		2	17	0.00	0.32	99.68
		3	17	0.00	55.01	44.99
		4	21.25	0.30	4.99	94.71
		5	21.25	0.00	0.89	99.11
		6	21.25	0.00	8.15	91.85
	TOTAL :		**114.75**	**0.06**	**11.23**	**88.71**
	DEPL					
2	JORETHANG LOOP	1	48	0.00	0.01	99.99
		2	48	0.00	0.00	100.00
	TOTAL :		**96**	**0.00**	**0.01**	**99.99**
	DVC					
3	MAITHON HPS.	1	23.2	14.04	7.56	78.40
		2	20	9.93	21.04	69.03
		3	20	25.32	0.46	74.22
	TOTAL :		**63.2**	**16.31**	**9.58**	**74.11**
4	PANCHET HPS.	1	40	0.00	53.60	46.40
		2	40	0.12	32.90	66.98
	TOTAL :		**80**	**0.06**	**43.25**	**56.69**
	GIPL					
5	CHUZACHEN HPS	1	49.5	8.02	0.47	91.51

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		2	49.5	5.90	0.41	93.69
	TOTAL :		**99**	**6.96**	**0.44**	**92.60**
	JUUVNL					
6	SUBERNREKHA-I HPS	1	65	0.00	43.90	56.10
	TOTAL :		**65**	**0.00**	**43.90**	**56.10**
7	SUBERNREKHA-II HPS	2	65	0.00	100.00	0.00
	TOTAL :		**65**	**0.00**	**100.00**	**0.00**
	NHPC LTD					
8	RANGIT HPS	1	20	7.27	2.24	90.49
		2	20	9.05	0.33	90.62
		3	20	7.69	0.51	91.80
	TOTAL :		**60**	**8.00**	**1.03**	**90.97**
9	TEESTA LOW DAM-III HPS	1	33	2.64	9.14	88.22
		2	33	10.92	1.13	87.95
		3	33	6.90	1.91	91.19
		4	33	4.34	1.30	94.36
	TOTAL :		**132**	**6.20**	**3.37**	**90.43**
10	TEESTA LOW DAM-IV HPS	1	40	6.13	1.20	92.67
		2	40	7.82	1.92	90.26
		3	40	0.04	0.40	99.56
		4	40	2.19	0.57	97.24
	TOTAL :		**160**	**4.05**	**1.02**	**94.93**
11	TEESTA V HPS	1	170	5.02	1.76	93.22
		2	170	4.88	0.00	95.12
		3	170	0.22	0.11	99.67
	TOTAL :		**510**	**3.38**	**0.62**	**96.00**
	OHPC					
12	BALIMELA HPS.	1	60	58.08	41.92	0.00
		2	60	0.74	0.66	98.60
		3	60	0.56	1.22	98.22
		4	60	5.51	0.27	94.22
		5	60	7.08	0.00	92.92
		6	60	0.56	0.00	99.44
		7	75	0.56	0.17	99.27
		8	75	0.29	15.77	83.94
	TOTAL :		**510**	**8.66**	**7.53**	**83.81**
13	HIRAKUD HPS	1	49.5	0.72	41.12	58.16
		2	49.5	69.31	17.16	13.53
		3	32	0.39	0.24	99.37

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
		4	32	0.50	0.91	98.59
		5	37.5	43.44	2.20	54.36
		6	37.5	100.00	0.00	0.00
		7	37.5	5.24	13.32	81.44
	TOTAL :		**275.5**	**32.98**	**12.79**	**54.23**
14	HIRAKUD HPS	1	24	8.83	0.13	91.04
		2	24	4.78	0.00	95.22
		3	24	100.00	0.00	0.00
	TOTAL :		**72**	**37.87**	**0.04**	**62.09**
15	RENGALI HPS.	1	50	6.74	1.12	92.14
		2	50	0.80	0.35	98.85
		3	50	1.09	0.00	98.91
		4	50	0.33	0.57	99.10
		5	50	1.25	0.45	98.30
	TOTAL :		**250**	**2.04**	**0.50**	**97.46**
16	UPPER INDRAVATI HPS.	1	150	9.06	0.16	90.78
		2	150	8.80	1.30	89.90
		3	150	33.87	0.00	66.13
		4	150	10.03	0.39	89.58
	TOTAL :		**600**	**15.44**	**0.46**	**84.10**
17	UPPER KOLAB HPS.	1	80	27.74	0.00	72.26
		2	80	0.37	0.00	99.63
		3	80	10.13	0.00	89.87
		4	80	0.25	5.94	93.81
	TOTAL :		**320**	**9.62**	**1.49**	**88.89**
	TUL					
18	TEESTA-III HPS	1	200	0.00	0.00	100.00
		2	200	0.00	0.00	100.00
		3	200	0.00	0.00	100.00
		4	200	0.00	0.00	100.00
		5	200	0.00	0.00	100.00
		6	200	0.00	0.00	100.00
	TOTAL :		**1200**	**0.00**	**0.00**	**100.00**
	WBSEDCL					
19	JALDHAKA HPS ST-I	1	9	0.01	1.33	**98.66**
		2	9	0.00	1.41	98.59
		3	9	0.03	3.19	96.78
		4	9	0.00	6.75	93.25
	TOTAL :		**36**	**0.01**	**3.17**	**96.82**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
20	PURULIA PSS HPS.	1	225	0.00	0.45	99.55
		2	225	0.05	0.19	99.76
		3	225	51.16	0.00	48.84
		4	225	20.96	0.20	78.84
	TOTAL :		**900**	**18.04**	**0.21**	**81.75**
21	RAMMAM HPS.	1	12.5	8.58	0.38	91.04
		2	12.5	0.00	0.33	99.67
		3	12.5	0.00	0.51	99.49
		4	12.5	0.00	8.07	91.93
	TOTAL :		**50**	**2.15**	**2.32**	**95.53**
	NORTH EASTERN REGION					
	APGPCL					
1	KARBI LANGPI HPS.	1	50	0.21	19.80	79.99
		2	50	0.02	0.86	99.12
	TOTAL :		**100**	**0.12**	**10.33**	**89.55**
	MePGCL					
2	KYRDEMKULAI HPS.	1	30	0.00	38.67	61.33
		2	30	0.00	31.87	68.13
	TOTAL :		**60**	**0.00**	**35.27**	**64.73**
3	MYNTDU(LESHKA) St-1 HPS	1	42	0.00	4.49	95.51
		2	42	4.81	2.26	92.93
		3	42	0.00	11.60	88.40
	TOTAL :		**126**	**1.60**	**6.12**	**92.28**
4	UMIAM HPS ST-I	1	9	11.97	0.01	88.02
		2	9	6.76	0.00	93.24
		3	9	0.25	0.02	99.73
		4	9	16.98	0.42	82.60
	TOTAL :		**36**	**8.99**	**0.11**	**90.90**
5	UMIAM HPS ST-IV	7	30	4.37	1.60	94.03
		8	30	5.78	6.01	88.21
	TOTAL :		**60**	**5.08**	**3.81**	**91.11**
	NEEPCO.					
6	DOYANG HPS.	1	25	14.21	1.84	83.95
		2	25	1.10	0.51	98.39
		3	25	0.00	0.35	99.65
	TOTAL :		**75**	**5.10**	**0.90**	**94.00**
7	KHONDONG HPS.	1	25	22.18	5.58	72.24
		2	25	10.15	5.30	84.55
	TOTAL :		**50**	**16.17**	**5.44**	**78.39**

OPERATING AVAILABILITY OF HYDRO ELECTRIC UNITS DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	PLANNED MAINTENANCE (P.M.) (%)	FORCED OUTAGE (F.O.) (%)	OPERATING AVAILABILITY (100-FO-PM) (%)
8	KOPILI HPS.	1	50	0.00	24.60	75.40
		2	50	17.53	18.48	63.99
		3	50	0.00	15.04	84.96
		4	50	0.00	16.79	83.21
		5	25	12.29	2.11	85.60
	TOTAL :		**225**	**5.26**	**16.88**	**77.86**
9	RANGANADI HPS.	1	135	2.45	0.19	97.36
		2	135	2.73	0.00	97.27
		3	135	2.57	5.33	92.10
	TOTAL :		**405**	**2.58**	**1.84**	**95.58**
	NHPC LDT.					
10	LOKTAK HPS.	1	35	4.76	0.06	95.18
		2	35	4.72	0.08	95.20
		3	35	5.05	0.06	94.89
	TOTAL :		**105**	**4.84**	**0.06**	**95.10**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
	NORTHERN REGION			
	ADHPL			
1	ALLAIN DUHANGAN HPS	1	96	0.03
		2	96	0.18
	TOTAL :		**192**	**0.11**
	AHPC (GVK)			
2	SRINAGAR HPS	1	82.5	0.00
		2	82.5	0.00
		3	82.5	0.00
		4	82.5	0.00
	TOTAL :		**330**	**0.00**
	BBMB			
3	BHAKRA LEFT H P S	1	108	0.00
		2	108	13.02
		3	108	4.98
		4	108	7.47
		5	108	0.00
	TOTAL :		**540**	**5.09**
4	BHAKRA RIGHT H P S	1	157	0.00
		2	157	6.73
		3	157	5.28
		4	157	3.73
		5	157	5.87
	TOTAL :		**785**	**4.32**
5	DEHAR H P S	1	165	17.68
		2	165	0.28
		3	165	24.76
		4	165	0.05
		5	165	5.33
		6	165	0.00
	TOTAL :		**990**	**8.02**
6	GANGUWAL HPS	1	29.25	0.02
		2	24.2	0.00
		3	24.2	0.01
	TOTAL :		**77.65**	**0.01**
7	KOTLA HPS	1	29.25	0.01
		2	24.2	0.01
		3	24.2	0.00
	TOTAL :		**77.65**	**0.01**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
8	PONG H P S	1	66	6.04
		2	66	19.21
		3	66	8.06
		4	66	13.07
		5	66	8.89
		6	66	4.23
	TOTAL :		**396**	**9.92**
	E.P.P.L.			
9	MALANA-II HPS	1	50	41.30
		2	50	42.31
	TOTAL :		**100**	**41.81**
	GBHPPL			
10	BUDHIL HPS	1	35	0.15
		2	35	0.12
	TOTAL :		**70**	**0.13**
	HBPCL			
11	BASPA HPS	1	100	0.29
		2	100	0.34
		3	100	0.29
	TOTAL :		**300**	**0.31**
12	KARCHAM WANGTOO HPS	1	250	0.00
		2	250	0.00
		3	250	0.00
		4	250	0.00
	TOTAL :		**1000**	**0.00**
	HPPCL			
13	KASHANG -I HPS	1	65	0.00
	TOTAL :		**65**	**0.00**
14	KASHANG -I HPS	1	65	0.00
		2	65	0.00
	TOTAL :		**130**	**0.00**
	HPSEBL			
15	BASSI HPS	1	16.5	1.77
		2	16.5	2.21
		3	16.5	1.75
		4	16.5	4.34
	TOTAL :		**66**	**2.52**
16	GIRI BATA HPS	1	30	6.91

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	30	5.79
	TOTAL :		**60**	**6.35**
17	LARJI HPS	1	42	0.42
		2	42	0.52
		3	42	0.39
	TOTAL :		**126**	**0.45**
18	SANJAY HPS	1	40	47.31
		2	40	15.97
		3	40	15.41
	TOTAL :		**120**	**26.23**
	IAEPL			
19	CHANJU-I HPS	1	12	0.00
		2	12	0.00
	TOTAL :		**24**	**0.00**
	JKSPDC			
20	BAGLIHAR HPS	1	150	0.00
		2	150	0.00
		3	150	0.00
	TOTAL :		**450**	**0.00**
21	BAGLIHAR II HPS	1	150	0.00
		2	150	0.00
		3	150	93.17
	TOTAL :		**450**	**31.06**
22	LOWER JHELUM HPS	1	35	0.19
		2	35	0.15
		3	35	0.04
	TOTAL :		**105**	**0.13**
23	UPPER SINDH-II HPS	3	35	0.00
		4	35	0.00
		5	35	0.00
	TOTAL :		**105**	**0.00**
	JPPVL			
24	VISHNU PRAYAG HPS	1	100	1.14
		2	100	1.14
		3	100	1.12
		4	100	1.30
	TOTAL :		**400**	**1.18**
	MPCL			
25	MALANA HPS	1	43	0.06

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	43	0.05
	TOTAL :		**86**	**0.05**
	NHPC LTD			
26	BAIRA SIUL HPS	1	60	50.60
		2	60	45.30
		3	60	49.31
	TOTAL :		**180**	**48.40**
27	CHAMERA- I HPS	1	180	40.89
		2	180	55.60
		3	180	45.24
	TOTAL :		**540**	**47.25**
28	CHAMERA- II HPS	1	100	46.30
		2	100	31.42
		3	100	43.01
	TOTAL :		**300**	**40.24**
29	CHAMERA-III HPS	1	77	36.11
		2	77	37.95
		3	77	36.80
	TOTAL :		**231**	**36.95**
30	CHUTAK HPS	1	11	18.63
		2	11	34.47
		3	11	30.88
		4	11	23.19
	TOTAL :		**44**	**26.79**
31	DHAULI GANGA HPS	1	70	41.30
		2	70	38.21
		3	70	48.88
		4	70	45.10
	TOTAL :		**280**	**43.37**
32	DULHASTI HPS	1	130	25.04
		2	130	24.53
		3	130	25.42
	TOTAL :		**390**	**24.99**
33	NIMMO BAZGO HPS	1	15	8.32
		2	15	6.53
		3	15	17.84
	TOTAL :		**45**	**10.90**
34	PARBATI-III HPS	1	130	55.19
		2	130	69.22

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		3	130	43.00
		4	130	38.33
	TOTAL :		**520**	**51.43**
35	SALAL-I HPS	1	115	3.84
		2	115	3.33
		3	115	4.64
	TOTAL :		**345**	**3.94**
36	SALAL-II HPS	1	115	3.47
		2	115	3.54
		3	115	3.99
	TOTAL :		**345**	**3.67**
37	SEWA-II HPS	1	40	45.74
		2	40	51.58
		3	40	48.82
	TOTAL :		**120**	**48.71**
38	TANAKPUR HPS	1	31.4	4.19
		2	31.4	7.10
		3	31.4	17.50
	TOTAL :		**94.2**	**9.59**
39	URI-I HPS	1	120	8.72
		2	120	7.64
		3	120	15.03
		4	120	13.44
	TOTAL :		**480**	**11.21**
40	URI-II HPS	1	60	0.94
		2	60	0.55
		3	60	0.77
		4	60	4.34
	TOTAL :		**240**	**1.65**
	NTPC Ltd.			
41	KOLDAM HPS	1	200	0.00
		2	200	0.00
		3	200	0.00
		4	200	0.00
	TOTAL :		**800**	**0.00**
	PSPCL			
42	ANANDPUR SAHIB-I HPS	1	33.5	0.00
		2	33.5	0.61
	TOTAL :		**67**	**0.31**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
43	ANANDPUR SAHIB-II HPS	1	33.5	0.72
		2	33.5	0.09
	TOTAL :		**67**	**0.41**
44	MUKERIAN I HPS	1	15	28.97
		2	15	26.89
		3	15	7.86
	TOTAL :		**45.00**	**21.24**
45	MUKERIAN II HPS	1	15	26.14
		2	15	27.26
		3	15	9.53
	TOTAL :		**30.00**	**20.98**
46	MUKERIAN III HPS	1	19.5	18.12
		2	19.5	25.62
		3	19.5	17.18
	TOTAL :		**58.50**	**20.31**
47	MUKERIAN IV HPS	2	19.5	12.95
		1	19.5	19.86
		2	19.5	20.91
	TOTAL :		**58.50**	**17.91**
		2	19.5	20.91
	TOTAL :		**78.00**	**19.41**
48	RANJIT SAGAR HPS	1	150	0.00
		2	150	0.35
		3	150	0.00
		4	150	0.00
	TOTAL :		**600**	**0.09**
49	SHANAN HPS	1	15	0.00
		2	15	0.00
		3	15	0.00
		4	15	0.00
		5	50	0.00
	TOTAL :		**110**	**0.00**
	RRVUNL			
50	JAWAHAR SAGAR HPS	1	33	0.00
		2	33	0.00
		3	33	0.00
	TOTAL :		**99**	**0.00**
51	MAHI BAJAJ-I HPS	1	25	65.94

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	25	56.64
	TOTAL :		**50.00**	**61.29**
52	MAHI BAJAJ-II HPS	3	45	5.68
		4	45	13.82
	TOTAL :		**90.00**	**9.75**
53	R P SAGAR HPS	1	43	0.00
		2	43	0.00
		3	43	0.00
		4	43	0.00
	TOTAL :		**172**	**0.00**
	SJVNL			
54	NATHPA JHAKRI HPS	1	250	48.70
		2	250	44.91
		3	250	50.81
		4	250	46.51
		5	250	48.08
		6	250	45.31
	TOTAL :		**1500**	**47.39**
55	RAMPUR HPS	1	68.67	35.71
		2	68.67	42.88
		3	68.67	44.50
		4	68.67	44.86
		5	68.67	45.31
		6	68.67	32.98
	TOTAL :		**412.02**	**41.04**
	THDC LTD.			
56	KOTESHWAR HPS	1	100	0.00
		2	100	0.00
		3	100	0.00
		4	100	0.00
	TOTAL :		**400**	**0.00**
57	TEHRI ST-1 HPS	1	250	0.00
		2	250	0.00
		3	250	0.00
		4	250	0.00
	TOTAL :		**1000**	**0.00**
	UJVNL			
58	CHIBRO (YAMUNA) HPS	1	60	10.00
		2	60	11.18

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		3	60	5.37
		4	60	0.00
	TOTAL :		**240**	**6.64**
59	CHILLA HPS	1	36	1.15
		2	36	0.93
		3	36	3.80
		4	36	1.78
	TOTAL :		**144**	**1.92**
60	DHAKRANI HPS	1	11.25	9.30
		2	11.25	0.42
		3	11.25	0.84
	TOTAL :		**33.75**	**3.52**
61	DHALIPUR HPS	1	17	9.86
		2	17	1.27
		3	17	2.09
	TOTAL :		**51**	**4.41**
62	KHATIMA HPS	1	13.8	0.00
		2	13.8	0.00
		3	13.8	0.00
	TOTAL :		**41.4**	**0.00**
63	KHODRI HPS	1	30	3.62
		2	30	0.00
		3	30	3.92
		4	30	8.37
	TOTAL :		**120**	**3.98**
64	KULHAL HPS	1	10	7.15
		2	10	8.79
		3	10	3.66
	TOTAL :		**30**	**6.53**
65	MANERI BHALI - I HPS	1	30	0.00
		2	30	0.00
		3	30	0.00
	TOTAL :		**90**	**0.00**
66	MANERI BHALI - II HPS	1	76	3.45
		2	76	1.58
		3	76	3.67
		4	76	1.95
	TOTAL :		**304**	**2.66**
67	RAMGANGA HPS	1	66	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	66	0.00
		3	66	0.00
	TOTAL :		**198**	**0.00**
	UPJVNL			
68	KHARA HPS	1	24	0.12
		2	24	0.68
		3	24	0.49
	TOTAL :		**72**	**0.43**
69	MATATILA HPS	1	10.2	0.00
		2	10.2	0.00
		3	10.2	0.00
	TOTAL :		**30.6**	**0.00**
70	OBRA HPS	1	33	0.00
		2	33	0.00
		3	33	0.00
	TOTAL :		**99**	**0.00**
71	RIHAND HPS	1	50	0.00
		2	50	0.00
		3	50	0.00
		4	50	0.00
		5	50	0.00
		6	50	0.00
	TOTAL :		**300**	**0.00**
	WESTERN REGION			
	CSPGCL			
1	HASDEOBANGO HPS	1	40	0.00
		2	40	0.00
		3	40	0.00
	TOTAL :		**120**	**0.00**
	DLHP			
2	BHANDARDHARA HPS ST-II	2	34	0.00
	TOTAL :		**34**	**0.00**
	GSECL			
3	KADANA HPS	1	60	0.00
		2	60	0.00
		3	60	0.00
		4	60	0.00
	TOTAL :		**240**	**0.00**
4	UKAI HPS	1	75	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	75	0.00
		3	75	0.00
		4	75	7.17
	TOTAL :		**300**	**1.79**
	MAHAGENCO			
5	BHIRA TAIL RACE HPS	1	40	0.00
		2	40	0.00
	TOTAL :		**80**	**0.00**
6	GHATGHAR PSS HPS	1	125	0.00
		2	125	0.00
	TOTAL :		**250**	**0.00**
7	KOYNA DPH HPS	1	18	0.00
		2	18	0.00
	TOTAL :		**36**	**0.00**
8	KOYNA-I&II HPS	1	70	0.00
		2	70	0.00
		3	70	0.00
		4	70	0.00
		1	80	0.00
		2	80	0.00
		3	80	0.00
		4	80	0.00
	TOTAL :		**600**	**0.00**
9	KOYNA-III HPS	1	80	0.00
		2	80	0.00
		3	80	0.00
		4	80	0.00
	TOTAL :		**320**	**0.00**
10	KOYNA-IV HPS	1	250	0.00
		2	250	0.00
		3	250	0.00
		4	250	0.00
	TOTAL :		**1000**	**0.00**
11	TILLARI HPS	1	60	5.00
	TOTAL :		**60**	**5.00**
12	VAITARNA HPS	1	60	0.16
	TOTAL :		**60**	**0.16**
	MPPGCL			
13	BANSAGAR TONS-1 HPS	1	105	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	105	3.29
		3	105	3.29
	TOTAL :		**315**	**2.19**
14	BANSAGAR TONS-II HPS	1	15	2.90
		2	15	0.01
	TOTAL :		**30**	**1.45**
15	BANSAGAR TONS-III HPS	1	20	0.00
		2	20	0.00
		3	20	0.00
	TOTAL :		**60**	**0.00**
16	BARGI HPS	1	45	0.00
		2	45	0.00
	TOTAL :		**90**	**0.00**
17	GANDHI SAGAR HPS	1	23	0.00
		2	23	0.00
		3	23	0.00
		4	23	0.00
		5	23	0.00
	TOTAL :		**115**	**0.00**
18	MADHIKHERA HPS	1	20	0.00
		2	20	0.00
		3	20	0.00
	TOTAL :		**60**	**0.00**
19	PENCH HPS	1	80	0.09
		2	80	1.73
	TOTAL :		**160**	**0.91**
20	RAJGHAT HPS	1	15	0.00
		2	15	0.00
		3	15	0.00
	TOTAL :		**45**	**0.00**
	NHDC			
21	INDIRA SAGAR HPS	1	125	0.05
		2	125	0.00
		3	125	0.00
		4	125	0.03
		5	125	0.00
		6	125	0.00
		7	125	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		8	125	0.00
	TOTAL :		**1000**	**0.01**
22	OMKARESHWAR HPS	1	65	0.00
		2	65	0.00
		3	65	0.00
		4	65	0.00
		5	65	0.00
		6	65	0.00
		7	65	0.00
		8	65	0.00
	TOTAL :		**520**	**0.00**
	SSNNL			
23	S SAROVAR CHPH HPS	1	50	0.04
		2	50	0.02
		3	50	0.02
		4	50	0.05
		5	50	0.04
	TOTAL :		**250**	**0.04**
24	S SAROVAR RBPH HPS	1	200	0.00
		2	200	0.00
		3	200	0.00
		4	200	0.00
		5	200	0.00
		6	200	0.00
	TOTAL :		**1200**	**0.00**
	TATA MAH.			
25	BHIRA HPS	1	25	0.00
		2	25	0.00
		3	25	0.00
		4	25	0.00
		5	25	0.00
		6	25	0.00
	TOTAL :		**150**	**0.00**
26	BHIRA PSS HPS	1	150	0.00
	TOTAL :		**150**	**0.00**
27	BHIVPURI HPS	1	24	0.00
		2	24	0.00
		3	24	0.00
		4	1.5	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		5	1.5	0.00
	TOTAL :		**75**	**0.00**
28	KHOPOLI HPS	1	24	0.00
		2	24	0.00
		3	24	0.00
	TOTAL :		**72**	**0.00**
	SOUTHERN REGION			
	APGENCO			
1	HAMPI HPS	1	9	0.00
		2	9	0.00
		3	9	0.00
		4	9	0.00
	TOTAL :		**36**	**0.00**
2	NAGARJUN SGR TPD HPS	1	25	0.00
		2	25	0.00
	TOTAL :		**50**	**0.00**
3	NAGARJUN SGR RBC HPS	1	30	0.00
		2	30	36.44
	TOTAL :		**90**	**18.22**
4	NAGARJUN SGR RBC EXT HPS	1	30	36.44
	TOTAL :		**30**	**36.44**
5	SRISAILAM HPS	1	110	0.00
		2	110	0.00
		3	110	0.00
		4	110	0.00
		5	110	0.00
		6	110	0.00
		7	110	0.00
	TOTAL :		**770**	**0.00**
5	T B DAM HPS	1	9	0.00
		2	9	0.00
		3	9	0.00
		4	9	0.00
	TOTAL :		**36**	**0.00**
6	UPPER SILERU-I HPS	1	60	0.00
		2	60	0.00
	TOTAL :		**120**	**0.00**
7	UPPER SILERU-II HPS	1	60	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	60	0.00
	TOTAL :		**120**	**0.00**
	KPCL			
8	ALMATTI DPH HPS	1	15	0.06
		2	55	0.07
		3	55	0.07
		4	55	0.06
		5	55	0.09
		6	55	0.12
	TOTAL :		**290**	**0.08**
9	BHADRA HPS	1	2	0.00
		2	12	0.00
		3	12	0.00
		4	7.2	0.00
		5	6	0.00
	TOTAL :		**39.2**	**0.00**
10	GERUSUPPA HPS	1	60	0.00
		2	60	0.00
		3	60	0.00
		4	60	0.00
	TOTAL :		**240**	**0.00**
11	GHAT PRABHA HPS	1	16	8.50
		2	16	40.58
	TOTAL :		**32**	**24.54**
12	JOG HPS	1	13.2	0.11
		2	13.2	0.07
		3	13.2	0.08
		4	13.2	0.01
		5	21.6	0.07
		6	21.6	0.25
		7	21.6	0.22
		8	21.6	0.13
	TOTAL :		**139.2**	**0.13**
13	KADRA HPS	1	50	8.43
		2	50	5.85
		3	50	8.43
	TOTAL :		**150**	**7.57**
14	KALINADI HPS	1	135	17.45
		2	135	16.96

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		3	135	0.00
		4	150	0.00
		5	150	0.00
		6	150	0.00
	TOTAL :		**855**	**5.43**
15	KALINADI SUPA HPS	1	50	6.22
		2	50	7.10
	TOTAL :		**100**	**6.66**
16	KODASALI HPS	1	40	7.02
		2	40	6.48
		3	40	0.38
	TOTAL :		**120**	**4.63**
17	LIGANAMAKKI HPS	1	27.5	0.03
		2	27.5	0.00
	TOTAL :		**55**	**0.02**
18	MUNIRABAD HPS	1	9	0.00
		2	9	0.00
		3	10	0.00
	TOTAL :		**28**	**0.00**
19	SHARAVATHI HPS	1	103.5	0.00
		2	103.5	0.00
		3	103.5	0.00
		4	103.5	0.00
		5	103.5	0.00
		6	103.5	0.02
		7	103.5	0.13
		8	103.5	1.56
		9	103.5	0.49
		10	103.5	0.00
	TOTAL :		**1035**	**0.22**
20	SIVASAMUNDRUM HPS	1	3	0.00
		2	3	0.00
		3	3	0.00
		4	3	0.00
		5	3	0.00
		6	3	0.00
		7	6	0.00
		8	6	0.00
		9	6	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		10	6	0.00
	TOTAL :		**42**	**0.00**
21	VARAHI HPS	1	115	0.00
		2	115	1.26
		3	115	4.52
		4	115	5.39
	TOTAL :		**460**	**2.79**
	KSEB LTD.			
22	IDAMALAYAR HPS.	1	37.5	42.46
		2	37.5	45.31
	TOTAL :		**75**	**43.89**
23	IDUKKI HPS.	1	130	0.00
		2	130	0.00
		3	130	0.09
		4	130	0.00
		5	130	0.00
		6	130	0.01
	TOTAL :		**780**	**0.02**
24	KAKKAD HPS.	1	25	50.53
		2	25	32.31
	TOTAL :		**50**	**41.42**
25	KUTTIYADI HPS.	1	25	0.00
		2	25	0.01
		3	25	0.01
		4	50	0.22
	TOTAL :		**125**	**0.09**
26	KUTTIYADI ADDL. EXTN. HPS	5	50	0.16
		6	50	0.27
	TOTAL :		**100**	**0.22**
27	LOWER PERIYAR HPS.	1	60	6.43
		2	60	12.24
		3	60	8.39
	TOTAL :		**180**	**9.02**
28	NARIAMANGLAM HPS	1	15	43.70
		2	15	37.85
		3	15	46.31
		4	25	24.21
	TOTAL :		**70**	**36.05**
29	PALLIVASAL HPS.	1	5	9.50

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	5	6.62
		3	5	9.46
		4	7.5	4.61
		5	7.5	15.32
		6	7.5	3.05
	TOTAL :		**37.5**	**8.01**
30	PANNIAR HPS.	1	15	54.71
		2	15	53.30
	TOTAL :		**30**	**54.00**
31	PORINGALKUTTU HPS.	1	8	5.63
		2	8	6.53
		3	8	3.40
		4	8	6.62
	TOTAL :		**32**	**5.55**
32	SABARIGIRI HPS.	1	50	44.68
		2	50	52.53
		3	50	41.32
		4	50	58.80
		5	50	31.82
		6	50	41.96
	TOTAL :		**300**	**45.19**
33	SENGULAM HPS.	1	12	61.32
		2	12	65.22
		3	12	29.69
		4	12	57.95
	TOTAL :		**48**	**53.55**
34	SHOLAYAR HPS.	1	18	16.88
		2	18	13.00
		3	18	4.24
	TOTAL :		**54**	**11.37**
	TNGDCL			
35	ALIYAR HPS.	1	60	0.08
	TOTAL :		**60**	**0.08**
36	BHAWANI BARRAGE III HPS	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**
37	BHAWANI BARRAGE-II HPS	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
38	BHAWANI KATTAL HPS	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**
39	KADAMPARI HPS.	1	100	0.00
		2	100	0.00
		3	100	0.00
		4	100	0.00
	TOTAL :		**400**	**0.00**
40	KODAYAR-I HPS.	1	60	0.00
	TOTAL :			**0.00**
41	KODAYAR-II HPS.	2	40	0.00
	TOTAL :		**100**	**0.00**
42	KUNDAH-I HPS.	1	20	0.00
		2	20	0.00
		3	20	0.00
	TOTAL :		**60**	**0.00**
43	KUNDAH-II HPS.	1	35	0.00
		2	35	0.00
		3	35	0.00
		4	35	0.00
		5	35	0.00
	TOTAL :		**175**	**0.00**
44	KUNDAH-III HPS.	1	60	0.00
		2	60	0.00
		3	60	0.00
	TOTAL :		**180**	**0.00**
45	KUNDAH-IV HPS.	1	50	0.00
		2	50	0.00
	TOTAL :		**100**	**0.00**
46	KUNDAH-V HPS.	1	20	0.00
		2	20	0.00
	TOTAL :		**40**	**0.00**
47	LOWER METTUR-I HPS.	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**
48	LOWER METTUR-II HPS.	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**
49	LOWER METTUR-III HPS.	1	15	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	15	0.00
	TOTAL :		**30**	**0.00**
50	LOWER METTUR-IV HPS.	1	15	0.00
		2	15	0.00
	TOTAL :		**30**	**0.00**
51	METTUR DAM HPS.	1	12.5	0.00
		2	12.5	0.00
		3	12.5	0.00
		4	12.5	0.00
	TOTAL :		**50**	**0.00**
52	METTUR TUNNEL HPS.	1	50	0.00
		2	50	0.00
		3	50	0.00
		4	50	0.00
	TOTAL :		**200**	**0.00**
53	MOYAR HPS	1	12	0.00
		2	12	0.00
		3	12	0.00
	TOTAL :		**36**	**0.00**
54	PAPANASAM HPS.	1	8	0.04
		2	8	0.00
		3	8	0.04
		4	8	0.04
	TOTAL :		**32**	**0.03**
55	PARSON`S VALLEY HPS.	1	30	0.00
	TOTAL :		**30**	**0.00**
56	PERIYAR HPS.	1	42	0.00
		2	42	0.00
		3	42	0.00
		4	35	0.00
	TOTAL :		**161**	**0.00**
57	PYKARA HPS.	1	7	0.07
		2	7	0.00
		3	7	0.00
		4	13.6	0.00
		5	13.6	0.00
		6	11	0.00
	TOTAL :		**59.2**	**0.01**
58	PYKARA ULTMATE HPS.	1	50	0.00

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	50	0.00
		3	50	0.12
	TOTAL :		**150**	**0.04**
59	SARKARPATHY HPS.	1	30	0.00
	TOTAL :		**30**	**0.00**
60	SHOLAYAR HPS.	1	35	0.00
		2	35	0.00
		3	25	0.00
	TOTAL :		**95**	**0.00**
61	SURULIYAR HPS.	1	35	0.00
	TOTAL :		**35**	**0.00**
	TSGENCO			
62	LOWER JURALA HPS	1	40	0.00
		2	40	0.00
		3	40	0.00
		4	40	0.00
		5	40	0.00
		6	40	0.00
	TOTAL :		**240**	**0.00**
63	LOWER SILERU HPS	1	115	0.00
		2	115	0.00
		3	115	0.00
		4	115	0.00
	TOTAL :		**460**	**0.00**
64	NAGARJUN SGR HPS	1	110	0.00
		2	100.8	0.00
		3	100.8	0.00
		4	100.8	0.00
		5	100.8	0.00
		6	100.8	0.00
		7	100.8	0.00
		8	100.8	0.00
	TOTAL :		**815.6**	**0.00**
65	NAGARJUN SGR LBC HPS	1	30	100.00
		2	30	0.00
	TOTAL :		**60**	**50.00**
66	POCHAMPAD HPS	1	9	92.88
		2	9	84.66

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		3	9	84.66
	TOTAL :		**27**	**87.40**
67	PRIYADARSHNI JURALA HPS	1	39	88.40
		2	39	86.14
		3	39	87.61
		4	39	85.45
		5	39	86.47
		6	39	92.44
	TOTAL :		**234**	**87.75**
68	PULICHINTALA HPS	1	30	0.00
	TOTAL :		**30**	**0.00**
69	SRISAILAM LB HPS	1	150	0.00
		2	150	0.00
		3	150	0.00
		4	150	0.00
		5	150	0.00
		6	150	0.00
	TOTAL :		**900**	**0.00**
	EASTERN REGION			
	APGENCO			
1	MACHKUND HPS	1	17	0.00
		2	17	0.15
		3	17	0.00
		4	21.25	0.05
		5	21.25	0.06
		6	21.25	0.00
	TOTAL :		**114.75**	**0.04**
	DEPL			
2	JORETHANG LOOP	1	48	0.00
		2	48	0.00
	TOTAL :		**96**	**0.00**
	DVC			
3	MAITHON HPS.	1	23.2	0.02
		2	20	0.15
		3	20	0.04
	TOTAL :		**63.2**	**0.07**
4	PANCHET HPS.	1	40	0.00
		2	40	0.00
	TOTAL :		**80**	**0.00**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
	GIPL			
5	CHUZACHEN HPS	1	49.5	28.49
		2	49.5	30.75
	TOTAL :		**99**	**29.62**
	JUUVNL			
6	SUBERNREKHA-I HPS	1	65	0.00
	TOTAL :		**65**	**0.00**
7	SUBERNREKHA-II HPS	2	65	0.00
	TOTAL :		**65**	**0.00**
	NHPC LTD			
8	RANGIT HPS	1	20	21.92
		2	20	20.48
		3	20	35.87
	TOTAL :		**60**	**26.09**
9	TEESTA LOW DAM-III HPS	1	33	48.86
		2	33	34.52
		3	33	38.24
		4	33	37.34
	TOTAL :		**132**	**39.74**
10	TEESTA LOW DAM-IV HPS	1	40	30.97
		2	40	30.03
		3	40	30.18
		4	40	34.20
	TOTAL :		**160**	**31.34**
11	TEESTA V HPS	1	170	31.55
		2	170	27.98
		3	170	34.57
	TOTAL :		**510**	**31.36**
	OHPC			
12	BALIMELA HPS.	1	60	0.00
		2	60	0.00
		3	60	0.00
		4	60	0.00
		5	60	0.00
		6	60	0.00
		7	75	0.00
		8	75	0.00
	TOTAL :		**510**	**0.00**
13	HIRAKUD HPS	1	49.5	0.75

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		2	49.5	0.00
		3	32	0.31
		4	32	0.08
		5	37.5	0.12
		6	37.5	0.00
		7	37.5	0.17
	TOTAL :		**275.5**	**0.24**
14	HIRAKUD HPS	1	24	0.00
		2	24	0.00
		3	24	0.00
	TOTAL :		**72**	**0.00**
15	RENGALI HPS.	1	50	0.00
		2	50	0.00
		3	50	0.00
		4	50	0.00
		5	50	0.00
	TOTAL :		**250**	**0.00**
16	UPPER INDRAVATI HPS.	1	150	0.00
		2	150	0.00
		3	150	0.00
		4	150	0.00
	TOTAL :		**600**	**0.00**
17	UPPER KOLAB HPS.	1	80	0.00
		2	80	0.00
		3	80	0.00
		4	80	0.00
	TOTAL :		**320**	**0.00**
	TUL			
18	TEESTA-III HPS	1	200	0.00
		2	200	0.00
		3	200	0.00
		4	200	0.00
		5	200	0.00
		6	200	0.00
	TOTAL :		**1200**	**0.00**
	WBSEDCL			
19	JALDHAKA HPS ST-I	1	9	5.00
		2	9	11.71
		3	9	7.18

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
		4	9	0.01
	TOTAL :		**36**	**5.97**
20	PURULIA PSS HPS.	1	225	0.00
		2	225	0.00
		3	225	0.00
		4	225	0.00
	TOTAL :		**900**	**0.00**
21	RAMMAM HPS.	1	12.5	13.50
		2	12.5	21.94
		3	12.5	34.50
		4	12.5	28.52
	TOTAL :		**50**	**24.61**
	NORTH EASTERN REGION			
	APGPCL			
1	KARBI LANGPI HPS.	1	50	20.10
		2	50	21.51
	TOTAL :		**100**	**20.80**
	MePGCL			
2	KYRDEMKULAI HPS.	1	30	0.00
		2	30	0.00
	TOTAL :		**60**	**0.00**
3	MYNTDU(LESHKA) St-1 HPS	1	42	0.06
		2	42	0.00
		3	42	0.00
	TOTAL :		**126**	**0.02**
4	UMIAM HPS ST-I	1	9	0.00
		2	9	0.00
		3	9	0.00
		4	9	0.00
	TOTAL :		**36**	**0.00**
5	UMIAM HPS ST-IV	7	30	0.00
		8	30	0.00
	TOTAL :		**60**	**0.00**
	NEEPCO.			
6	DOYANG HPS.	1	25	7.56
		2	25	7.90
		3	25	7.32
	TOTAL :		**75**	**7.59**

NON AVAILABILITY OF HYDRO ELECTRIC UNITS DUE TO REASONS OTHER THAN PLANNED MAINTENANACE AND FORCED OUTAGE DURING 2016-17

SL. NO.	STATION/ CORPORATION	UNIT NO.	CAPACITY (MW)	MISC. NON AVAILABILITY (%)
7	KHONDONG HPS.	1	25	1.82
		2	25	2.22
	TOTAL :		**50**	**2.02**
8	KOPILI HPS.	1	50	0.00
		2	50	0.00
		3	50	0.74
		4	50	0.10
		5	25	0.31
	TOTAL :		**225**	**0.22**
9	RANGANADI HPS.	1	135	8.94
		2	135	9.37
		3	135	7.60
	TOTAL :		**405**	**8.64**
	NHPC LDT.			
10	LOKTAK HPS.	1	35	0.13
		2	35	0.06
		3	35	0.07
	TOTAL :		**105**	**0.09**

CHAPTER-7

GENERATION PROGRAMME FOR THE YEAR 2017-18

CHAPTER 7

GENERATION PROGRAMME FOR THE YEAR 2017-18

7.1 As on 31.03.2017, 200 HE Stations (of more than 25 MW capacity) having total installed capacity of 44478.42 MW are being monitored in the country. With the addition of new hydro units during 2017-18, the anticipated installed capacity of H.E. Stations in the country would be 45989.42 MW (above 25 MW capacity) by 31st March, 2018. Generation Programme for H.E. stations in the country for the year 2017-18 has been fixed at 146400 MU (including 5000 MU import from Bhutan), which is 18405.10 MU more than actual generation of 127994.90 MU (including 5617.34 MU import from Bhutan during 2016-17).

7.2 Region-wise summary of likely installed capacity on 31.03.2017, Generation Programme for 2017-18 and actual generation during 2016-17 are given in **Table 7.1** below:

TABLE 7.1

REGION-WISE LIKELY INSTALLED CAPACITY OF HE STATIONS AND HYDRO GENERATION PROGRAMME DURING 2017-18

Sl. No.	Region	Likely Hydro Installed Capacity (as on 31.03.2018) (MW)	Hydro Generation Programme for 2017-18 (MU)	Hydro Generation during 2016-17 (MU)	
				Programme	Actual
1.	Northern	19062.27	71581	70932	71761.09
2.	Western	7392.00	17075	15719	17178
3.	Southern	11842.45	29163	29900	17041.68
4.	Eastern	5640.70	18180	13040	11746.21
5.	North-Eastern	2052.00	5401	4409	4650.58
Sub total		**45989.42**	**141400**	**134000**	**122377.56**
6.	Import – from Bhutan		5000	4800	5617.34
Total(Including Import from Bhutan)			**146400**	**139000**	**127994.90**

7.3 While finalizing the Generation Programme for 2017-18 during last quarter of 2016-17, it was anticipated that 33 nos. H.E. units having installed capacity of 2877 MW will be added during the year 2017-18 & last quarter of 2016-17. Unit-wise details of these units are given in **Annex-7.1**.

7.4 Actual generation from H.E. Stations during the year 2016-17 was 127994.90 MU against the Generation Programme of 139000 MU including import from Bhutan. Sector-wise and Utility-wise details of likely installed Capacity as on 31.03.2018, targets and actual generation during 2016-17, generation target for 2017-18 are given in **Annex-7.2**.

Annexure -7.1

HYDRO ELECTRIC GENERATING UNITS LIKELY TO BE ADDED DURING 2017-18 & LAST QAURTER OF 2016-17

Sl. No	Name of the Project	State/ Organization	Unit No.	Capacity (MW)	Programmed Date of Commissioning
	Central Sector				
1	Kishenganga	J&K / NHPC Ltd.	U-1 U-2 U-3	110 110 110	Aug. 2017 Sept. 2017 Sept. 2017
2	Kameng	Arunachal Pradesh / NEEPCO	U-1 U-2 U-3 U-4	150 150 150 150	Jul. 2017 Aug. 2017 Sept. 2017 Oct. 2017
3	Tuirial	Mizoram/ NEEPCO	U-1 U-2	30 30	Jul. 2017 Oct. 2017
4	Pare	Arunachal Pradesh/ NEEPCO	U-1 U-2	55 55	Nov 2016 Dec 2016
	State Sector				
5	Sainj	HP /HPPCL	U-1 U-2	50 50	Dec. 2016 Jan. 2017
6	Uhl-III	HP /HPSEBL	U-1 U-2 U-3	33.33 33.33 33.33	Jan. 2018 Feb. 2018 Mar. 2018
7	Pulichinthala	Telangana / TSGENCO	U-2 U-3 U-4	30 30 30	Dec. 2016 Oct. 2017 Nov. 2017
8	N J Sagar TPD	Andhra Pradesh/ APGENCO	U-1 U-2	25 25	Dec. 2016 Dec.2016
9	New Umtru	Meghalaya/ MePGCL	U-1 U-2	20 20	Mar. 2017 Jun. 2017
10	Teesta III	Sikkim/ Teesta Urja Ltd.	U-1 U-2 U-3 U-4 U-5 U-6	200 200 200 200 200 200	Dec 2016 Dec 2016 Dec 2016 Mar 2017 Mar 2017 Mar 2017
	Private Sector				
11	Tidong	Himachal Pradesh /NTPGPL	U-1 U-2	50 50	Jun. 2017 Jun. 2017
12	Tashiding	Sikkim/DEPL	U-1 U-2	48.50 48.50	Dec 2016 Jan 2017
		Total	**31**	**2877**	

Annexure-7.2

SECTOR-WISE PERFORMANCE OF HYDRO ELECTRIC STATIONS DURING 2016-17 & TARGETS FOR 2017-18

SECTOR/ UTILITY	Likely Hydro Installed Capacity as on 31.03.2018	Generation during 2016-17 (MU)		Generation Programmed for 2017-18 (MU)
		Targets	Actual	
A. CENTRAL SECTOR				
BBMB	2866.30	9536	10570.00	9360
NHPC Ltd	5451.20	22440	22929.80	23046
SJVN Ltd	1912.02	8595	9011.06	8625
NTPC Ltd	800.00	2800	3225.16	3055
THDC Ltd	1400.00	4100	4370.87	4115
NHDC	1520.00	3100	4748.49	3100
DVC	143.20	244	255.54	235
NEEPCO	1525.00	2585	2793.32	3492
Sub Total	**15617.72**	**53400**	**57904.24**	**55028**
B. STATE ELECTRICITY BOARDS/CORPORATIONS				
JKSPDCL	1110.00	5144	4789.60	4599
HPPCL	230.00	266.00	56.09	568
HPSEBL	466.00	1465	1237.42	1647
RRVUNL	411.00	710	965.99	720
PSPCL	1051.00	4069	3536.34	4021
UPJVNL	501.60	1161	1175.56	1170
UJVNL	1252.15	4700	4201.44	4688
SSNNL	1450.00	3263	3209.21	4460
GSECL	540.00	840	734.67	857
MAHAGENCO	2406.00	4358	4050.98	4296
MPPGCL	875.00	2383	2768.31	2625
CSPGCL	120.00	260	153.76	250
APGENCO	1796.75	3604	2605.99	3505
TSGENCO	2396.60	3132	1279.99	3335
KPCL	3585.40	11429	6691.09	11687
KSEBL	1881.50	6834	4067.49	6221
TANGEDCO	2182.20	4901	2397.12	4415
JUUNL	130.00	154	30.13	150
OHPC	2027.50	5621	4412.89	5672
TUL	1200.00	552	309.42	5214
WBSEDCL	986.00	1596	1560.85	1596
APGCL	100.00	390	396.59	390
MePGCL	322.00	919	719.60	919
Sub Total	**27020.70**	**67751**	**51350.53**	**73005**

SECTOR/ UTILITY	Likely Hydro Installed Capacity as on 31.03.2018	Generation during 2016-17 (MU)		Generation Programmed for 2017-18 (MU)
		Targets	Actual	
C. PRIVATE SECTOR				
MPCL(HP)	86.00	341	353.79	**344**
EPPL (HP)	100.00	370	366.54	**360**
ADHPL(HP)	192.00	686	679.12	**700**
GBHPPL(HP)	70.00	282	261.25	**282**
HBPCL (HP)	1300.00	5500	5715.04	**5500**
IAEPL (HP)	-	0.00	11.29	**-**
AHPC (UK)	330.00	1396	1280.75	**1340**
JPPVL (UK)	400.00	1776	2042.05	**1800**
DLHP(MAHA.)	34.0	65	47.12	**37**
GIPL(SIKKIM)	99.00	495	494.75	**495**
TPCL (MAHA.)	447.00	1450	1465.46	**1450**
DEPL (SIKKIM)	193.00	488	405.63	**859**
NTPGPL (HP)	100.00	-	-	**200**
Sub Total	**3351.00**	**12849**	**13122.79**	**13367**
Total All India	**45989.42**	**134000**	**122377.56**	**141400**
Import from Bhutan		**5000**	**5244.21**	**5000**
Total Hydro generation including import from Bhutan		**139000**	**127994.90**	**146400**

CHAPTER-8

RENOVATION & MODERNISATION OF HYDRO-ELECTRIC STATIONS

CHAPTER-8

RENOVATION & MODERNISATION OF HYDRO ELECTRIC PROJECTS

8.1 R&M Phase-I Programme

Recognising the benefits of the R&M programme, Govt. of India set up a National Committee in 1987 to formulate strategy on R&M of Hydro Power Projects. Based on the recommendations of the National Committee and subsequent reviews, a programme for renovation, modernization and uprating of Hydro Power Stations was formulated by Central Electricity Authority in which 55 schemes were identified with an aggregate generating capacity of 9653 MW in phase-1. The total cost of these R&M schemes was estimated as Rs.1493 Crores with expected benefit of 2531 MW.

8.2 R&M Phase-II Programme

The Hydro Policy issued by the Govt. of India, in 1998 called for priority to renovation & modernization of Hydro Power Plants to tide over the shortages in power in a cost effective and quicker manner. Accordingly, 67 hydro R&M schemes having an aggregate capacity of 10318 MW were identified to be undertaken under Phase-II programme till the end of X Plan to accrue a benefit of 3685 MW at an estimated cost of Rs. 2161 Crores. Subsequently, Hydro Policy 2008 has also called for continued focus on R & M activities.

8.3 National Perspective Plan

CEA formulated the National Perspective Plan for Hydro Power Stations in the year 2000 and incorporated R&M proposals under Phase-II programme alongwith the left out schemes as recommended in Phase-I programme of the National Committee. The left out schemes were those which were either under implementation or were yet to be taken up for implementation. This Perspective Plan was for R&M during IX, X and XI Plans with 117 schemes having an aggregate installed capacity of 19370 MW with benefits of 7755MW at an estimated cost of Rs.4654 crores.

8.4 VIII, IX, X XI and XII Plans Achievements

The R&M works at 104 H.E. Stations (21 in Central and 83 in State Sector) have been completed by the end of 31st March 2017(13 up to the VIII Plan, 20 in the IX Plan, 32 in the X Plan, 18 in the XI Plan & 21 in the XII Plan) with an aggregate installed capacity of 19481 MW. A benefit of 3635 MW through Life Extension, Uprating and Restoration has been accrued.

During the XII Plan, 21 schemes (2 in central sector & 19 in state sector) with an installed capacity of 4150 MW have been completed till March, 2017 and accrued a benefit of 549 MW through Life Extension, Uprating and Restoration.

8.5 Programmed for 2017-22 and beyond

During 2017-22, an aggregate capacity of 7654.60 MW at 44 Hydro Electric Power Station (7 in Central Sector and 37 in State Sector) is programmed for R&M which will accrue benefit of about 2994.15 MW through Life Extension, Uprating and Restoration.

Beyond 2022, an aggregate capacity of 1836 MW at 16 Hydro Electric Power Station (1 in Central Sector and 15 in State Sector) is programmed for R&M.

8.6 Plan-wise summary of R&M of H.E. Projects starting from VIII Plan is given below:

Summary of R&M of Hydro Electric Projects
(As on 31.03.2017)

I Hydro R&M schemes completed up to XII Plan

Sl. No.	Plan Period	No. of Projects			Installed Capacity (MW)	Actual Expenditure (Rs. in Crs)	Benefit (MW)
		Central Sector	State Sector	Total			
1.	VIII Plan Schemes completed **(Annex-8.1)**	**2**	**11**	**13**	**1282.00**	**127.37**	**429.00 [39.00(U) + 336.00 (Res.) +54.00(LE)]**
2.	IX Plan Schemes completed **(Annex-8.2)**	**8**	**12**	**20**	**4892.10**	**570.16**	**1093.03 [339.00(U) + 331.03(Res.) + 423.00(LE)]**
3.	X Plan Schemes completed **(Annex-8.3)**	**5**	**27**	**32**	**4336.60**	**1029.24**	**829.08 [123.40(U) + 701.25 (LE) + 4.43(Res.)]**
4.	XI Plan Schemes completed **(Annex-8.4)**	**4**	**14**	**18**	**4821.20**	**294.84**	**735 [12 (U) + 15 (Res.) + 708 (LE)]**
5.	XII Plan Schemes completed **(Annex-8.5)**	**2**	**19**	**21**	**4149.60**	**1116**	**549.40 [58 (U)+ 476.40 (LE)+15(Res.)]**

II Hydro R&M schemes Programmed for completion during 2017-22 (Annex-8.6)

Sl. No.	Category	No. of Projects			Capacity (MW) covered under R&M	Estimated Cost (Rs. in Crs.)	Benefit (MW)
		Central Sector	**State Sector**	**Total**			
1.	Programme	7	37	44	7654.60	5715.23	2994.15 [154.95(U) + 2839.20(LE)]
2.	Under Implementation	5	21	26	4904.55	3019.39	2159.90 [116.20 (U)+ 2043.70 (LE)]
3.	Under Tendering	1	11	12	2279.10	1678.80	525.75 [20 (U) + 505.75 (LE)]
4.	Under DPR Preparation/ Finalization/ Approval	1	5	6	470.95	1017.04	308.50 [18.75(U) + 289.75 (LE)]

III Hydro R&M schemes Programmed for completion beyond 2022 (Annex-8.7)

Sl. No.	Category	No. of Projects			Capacity (MW) covered under R&M	Estimated Cost (Rs. in Crs.)	Benefit (MW)
		Central Sector	State Sector	Total			
1.	**Programme**	**1**	**15**	**16**	**1836**	**770.51**	**623 [22(U) + 601(LE)]**
2.	**Under Tendering**	**0**	**1**	**1**	**36**	**67.05**	**42 [6 (U) + 36 (LE))**
3.	**Under DPR Preparation/Finalisation/Approval**	**1**	**4**	**5**	**565**	**703.46**	**581 [16(U) + 565 (LE)]**
4.	**Under RLA Studies**	**-**	**10**	**10**	**1235.00**	**-**	**-**

Abbreviations:
MW – Mega Watt;
Res. – Restoration;
U – Uprating;
LE – Life Extension

8.8 Achievements under R&M in Hydro during the year 2016-17

Four (4) Hydro R&M schemes namely Sharavathy (Ph B) (10x103.5 MW) of KPCL, Khatima (3x13.8 MW) of UJVNL, Sumbal Sindh (2x11.3 MW) of J&KSPDC and Jaldhaka St. I (3x9 MW) of WBSEDCL having an aggregate installed capacity of about 1126 MW have been completed during the year 2016-17 at a cost of about Rs.253 Crores and accrued benefit of about 68.4 MW through Uprating and Life Extension.

8.9 Programme for the year 2017-18

For the year 2017-18, it is programmed to complete following 7 schemes having capacity under R&M of about 600 MW. On completion of these schemes, there will be a benefit of about 396 MW through Uprating, Life Extension and Restoration at an estimated cost of about Rs. 338 Crores.

S. No.	Name of Scheme	Installed Capacity (No. x MW)	Capacity under R&M (in MW)	Cost (Rs. in Cr.)	Agency
1	Ganguwal U2 & Kotla U3	1x29.25 + 2x24.2 1x29.25 + 2x24.2	1x24.2 (U-2) + 1x24.2 (U-3)	14.19	BBMB
2	Dehar Power House	6x165	1x165 (U-6)	19.87	BBMB
3	Ganderbal	2x3 + 2x4.5	2x3 + 2x4.5	39.30	J&KSPDC
4	Chenani	5x4.66	5x4.66	39.14	J&KSPDC
5	Rihand	6x50	6x50	132.2	UPJVNL
6	Bhadra River Bed Units	2x12	2x12	28.01	KPCL
7	Hirakud-II	3x24	1x24 (U-3)	65.67	OHPC

Annex-8.1

State-wise List of Hydro RMU&LE schemes completed upto the VIII Plan

Sl. No.	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs. in Crs.)	Actual Exp. (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Himachal Pradesh								
1	Bairasiul, NHPC	CS	3x60	25.98	25.98	18 (U)	RM&**U**	1991-92
2	Giri, HPSEB	SS	2x30	9.85	7.90	6 (U)	RM&**U**	1995-96
Punjab								
3	UBDC-I, PSPCL	SS	3x15	11.00	8.00	11 (Res)	R&M+**Res.**	1990-92
Uttar Pradesh								
4	Rihand, UPJVNL	SS	6x50	1.43	1.43	100(Res.)	R&M+**Res.**	1995-96
Karnataka								
5	Nagjhari, U-2, KPCL	SS	1x135	11.97	11.32	15 (U)	RM&**U**	1995-96
6	Shivasamudram, VVNL	SS	6x3 + 4x6	8.00	8.00	18 (LE)	RM&**LE** (3MW)	N.A.
Kerala								
7	Sholayar, KSEB	SS	3x18	7.58	7.58	-	R&M	1996-97
Tamil Nadu								
8	Kadamparai (Units 3&4), TANGEDCO	SS	2x100	23.17	33.69	200(Res.)	R&M+**Res.**	1993-95
9	Kundah III (Units 1&2), TANGEDCO	SS	2x60	5.45	3.20	-	R&M	1991-92
10	Moyar, TANGEDCO	SS	3x12	1.62	1.30	36.00 (LE)	RM&**LE**	1990-91
11	Sholayar-I, TANGEDCO	SS	2x35	1.40	0.85	-	R&M	1994-95
Meghalaya								
12	Khandong, U-1, NEEPCO	CS	1x25	0.62	0.62	25 (Res)	R&M+**Res.**	1991-92
Tripura								
13	Gumti, TPGL	SS	3x5	17.50	17.50	-	R&M	1994-95
	Total		**1282**	**125.57**	**127.37**	**429 [39 (U) + 336 (Res) + 54(LE)]**		

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension; Res – Restoration; MW – Mega Watt; CS-Central Sector: SS- State Sector

State-wise List of Hydro RMU&LE schemes completed in the IX Plan

Sl. No.	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs. in Crs.)	Actual Exp. (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Himachal Pradesh								
1	Bhakra RB BBMB	CS	5x132	88.45	90.68	125.00 (U)	RM&U	2000-01
2	Dehra U-2 BBMB	CS	1x165	10.74	10.74	25.00 (Res.)	R&M+Res.	1998-99
3	Bairasiul, NHPC	CS	3x66	18.45	18.45	-	R&M	2000-01
4	Bassi, HPSEB	SS	4x15	5.35	4.34	-	R&M	2000-01
Jammu & Kashmir								
5	Salal St.I, NHPC	CS	3x115	51.50	51.50	-	R&M	2000-01
6	Chenani, J&KSPDC	SS	5x4.66	11.00	11.00	0.93 (Res)	R&M+Res.	2000-01
Punjab								
7	Ganguwal, U-2 BBMB	CS	1x24.2	18.90	15.00	22.00 (LE)+ 2.20 (Res)	RM&LE+Res	1997-98
8	Kotla, U-3, BBMB	CS	1x24.2	18.90	16.90	22.00 (LE)+ 2.20 (Res)	RM&LE+Res	1998-99
9	Ganguwal U-3, BBMB	CS	1x24.2	25.00	43.40	22.00 (LE)+ 2.20 (Res)	RM&LE+Res	2000-01
10	Kotla U-2, BBMB	CS	1x24.2	25.00		22.00 (LE)+ 2.20 (Res)	RM&LE+Res	2001-02
Uttarakhand								
11	Chilla U-1, 3& 4, UJVNL	SS	3x36	4.25	4.11	-	R&M	1998-99
12	Tiloth, UJVNL	SS	3x30	8.02	5.51	6.00 (U)	RM&U	1998-99
Andhra Pradesh								
13	Lower Sileru, APGENCO	SS	4x115	13.35	9.30	24.00 (Res)	R&M+Res.	2001-02
14	Srisailam RB, APGENCO	SS	7x110	16.32	11.40	-	R&M	2001-02
Karnataka								
15	Sharavathy, U-1 to 8, KPCL	SS	8x89.1	65.00	63.49	115.20 (U) +178.20 (Res)	RM&U+Res	1997-98
16	Sharavathy, U-9&10, KPCL	SS	2x89.1	17.96	14.68	28.80(U) +19.10 (Res)	RM&U+Res	1997-98

Annex-8.2
(Sheet 2/ 2)

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost	Actual Exp.	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
Orissa								
17	Hirakud-I, U1&2, OHPC	SS	2x37.5	95.10	95.10	24.00(U) +75.00(LE)	RMU&LE	1997-98
Gujarat								
18	Ukai,U-1&3, GSECL	SS	2x75	24.99	24.99	75.00 (Res.)	R&M+Res.	1997-98
Maharashtra								
19	Koyna I&II, MSPGCL	SS	4x65+ 4x75	74.91	74.91	40.00(U) + 260.00(LE)	RM&U of St-I & II & LE of St-I	1999-2000
20	Koyna III, U-10, 11 &12, MSPGCL	SS	3x80	4.65	4.65	-	R&M	1997-98
	Total		**4892.10**	**597.84**	**570.16**	**1093.03 [339.0(U) + 331.03(Res.) + 423.0(LE)**		

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension;
Res – Restoration; MW – Mega Watt; CS-Central Sector: SS- State Sector

Annex- 8.3

(Sheet 1/ 3)

State-wise List of Hydro RMU&LE schemes completed in the X Plan

Sl. No.	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs. in Crs.)	Actual Exp. (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Himachal Pradesh								
1	Pong, BBMB	CS	6x60	17.70	17.79	36.00(U)	RM&U	2003-04
Punjab								
2	Ganguwal,U-1, BBMB	CS	1x29.25	51.28	81.99	25.89 (LE) +2.10	RM&LE+Res.	2006-07
2	Kotla, U-1, BBMB	CS	1x29.25	51.28		2.33 (Res.)	RM&LE+Res.	2006-07
4	Shanan Ph.A, PSPCL	SS	4x15+ 1x50	11.35	10.93	-	R&M	2003-04
5	Shanan, Ph.B, PSPCL	SS	4x15+ 1x50 $	35.95	13.34	60.00(LE)	RM&LE(LE for 15 MW units+R&M for 50 MW unit	2006-07
6	Anandpur Sahib, PSPCL	SS	4x33.5	3.68	1.04	-	R&M	2006-07
7	UBDC I&II, PSPCL	SS	3x15+ 3x15.45	7.89	2.44	45.00 (LE)	RM&LE(LE for 3x15MW&R &M for 3x15.45 MW	2006-07
8	Mukerian St.I, PSPCL	SS	3x15	6.04	4.38	-	R&M	2006-07
Uttarakhand								
9	Chibro, UJVNL	SS	4x60	10.45	10.52	-	R&M	2006-07
Karnataka								
10	Nagjhari, U-1&3,KPCL	SS	2x135	26.12	21.62	30 (U)	RM&U	2002-03
11	Supa PH, KPCL	SS	2x50	2.64	2.47	-	R&M	2002-03
12	Mahatma Gandhi, VVNL	SS	4x12+ 4x18	44.66	43.13	19.20 (U) +120.00 (LE)	RMU&LE	2002-03
13	Munirabad, VVNL	SS	2x9+ 1x10.3	3.64	3.53	28.30 (LE)	RM&LE	2002-03

Annex- 8.3
(Sheet 2/3)

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost	Actual Exp	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
14	Mani Dam, KPCL	SS	2x4.5	1.00	1.00	-	R&M	2002-03
15	Shivasamudram, VVNL	SS	6x3+ 4x6	68.38	73.17	42.00 (LE)	RM&LE	2004-05
16	Bhadra, Ph.II, KPCL	SS	1x2	3.30	2.51	2.00 (LE)	RM&LE	2005-06
17	Varahi, KPCL	SS	2x115	2.57	2.66	-	R&M	2006-07
18	Sharavathy, Ph.A, KPCL	SS	10x103.5	5.22	3.52	-	R&M	2006-07
Kerala								
19	Neriamanga-lam KSEB	SS	3x15	58.00	53.05	9.00 (U) +45.00(LE)	RMU&LE	2006-07
20	Pallivasal, KSEB	SS	3x5+ 3x7.5	94.00	371.71	37.50 (LE)	RM&LE	2002-03
21	Sengulam, KSEB	SS	4x12	114.00		48.00 (LE)	RM&LE	2002-03
22	Panniar, KSEB	SS	2x15	62.00		30.00 (LE)	RM&LE	2002-03
Tamilnadu								
23	Pykara, TANGEDCO	SS	3x6.65+ 1x11+2x	26.06	20.147	58.95(LE)	RM&LE	2004-05
24	Papanasam, TANGEDCO	SS	4x7	27.05	22.61	4.00 (U) + 28.00 (LE)	RMU&LE	2005-06
Orissa								
25	Hirakud-I (Sw.yard), OHPC	SS		9.85	15.88	-	R&M	2006-07
26	Hirakud-I,U-3&4, OHPC	SS	2x24	126.14	108.86	16.00(U)+ 48.00(LE)	RMU&LE	2005-06
West Bengal								
27	Maithon, U-2, DVC	CS	1x20	42.08	36.94	3.20(U)+ 20.00(LE)	RMU&LE	2004-05
Maharastra								
28	Bhira Tail Race, MSPGCL	SS	2x40	1.60	0.70	-	R&M	2003-04
29	Tillari, MSPGCL	SS	1x60	4.50	4.24	6.0 (U)	RM&U	2004-05

Annex-8.3

(Sheet 3/3)

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost	Actual Exp	Benefits (MW)	Category	Year of Completion
				(Rs. in Crs.)				
30	Koyna Gen. Complex, MSPGCL	SS	4x70+4x80+4x80	12.00	11.50	-	R&M	2004-05
Meghalaya								
31	Umium St.I, MePGCL	SS	4x9	81.88	84.21	36(LE)	RM&LE	2002-03
32	Khandong, NEEPCO	CS	2x25	4.00	3.35	-	R&M	2003-04
	Total		**4446.60**	**1016.31**	**1029.24**	**829.08 [123.40(U) +701.25(LE) + 4.43(Res.)**		

$ - Installed Capacity of Shanan, Ph.B, at Sl. No. 5 not included in the total, as the same has been accounted for at Sl. No. 4.

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension; Res – Restoration; MW – Mega Watt; CS-Central Sector: SS- State Sector

Annex- 8.4
(Sheets 1 of 2)

State-wise List of Hydro RMU&LE schemes completed in the XI Plan

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs . in crs)	Actual Exp (Rs . in crs)	Benefits (MW)	Category	Year of Completion
Himachal Pradesh								
1	Dehar Ph. A BBMB	CS	6x165	11.00	6.94	-	R&M	2010-11
2	Dehar Ph. B BBMB	CS	6x165	49.00	24.45	330(LE)	RM&LE	2009-10
Uttarakhand								
3	Tanakpur, NHPC	CS	3x31.4	10.77	11.95	-	R&M	2007-08
4	Khodri Ph.A, UJVNL	SS	4x30	5.25	6.39	-	R&M	2008-09
5	Chilla Ph.A, UJVNL	SS	4x36	23.55	21.24	-	R&M	2008-09
Andhra Pradesh								
6	Upper Sileru, APGENCO	SS	4x60	4.20	3.34	-	R&M	2009-10
Karnataka								
7	Nagjhari, U1 to 6, KPCL	SS	5x150 + 1x135	14.75	15.31	-	RM&U	2009-10
8	Sharavathy Ph.B, KPCL	SS	10x103.5	20.50	11.14	-	R&M	2009-10
9	Supa, KPCL	SS	2x50	3.45	4.90	-	R&M	2009-10
10	Bhadra, KPCL	SS	2x12	1.44	0.85	-	R&M	2009-10
11	Lingnamakki, KPCL	SS	2x27.5	3.81	2.62	-	R&M	2010-11
Tamil Nadu								
12	Mettur Dam, TANGEDCO	SS	4x10	30.17	24.16	10 (U) + 40 (LE)	RMU&LE	2007-08
Maharashtra								
13	Koyna St.I&II, MSPGCL	SS	4x70 + 4x80	87.50	81.82	-	R&M	2008-09

Annex- 8.4

(Sheets 2 of 2)

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs . in crs)	Actual Exp (Rs . in crs)	Benefits (MW)	Category	Year of Completion
14	Vaitarna, MSPGCL	SS	1x60	16.00	0.14	-	R&M	2009-10
15	Koyna Dam PH, MSPGCL	SS	2x18	5.78	0.25	-	R&M	2009-10
16	Koyna St.III, MSPGCL	SS	4x80	16.65	5.79	320 (LE)	RM&LE	2011-12
Manipur								
17	Loktak, NHPC	CS	3x30 derated	18.55	17.88	15.00 (Res.)	R&M + Res.	2011-12
Meghalaya								
18	Umium St.II, MePGCL	SS	2x9	90.46	55.67	2(U)+18.00 (LE)	RMU&LE	2011-12
	Total		**5841.2**	**412.83**	**294.84**	**735 [12.00(U) +708.00 (LE)+15.00 (Res)**		

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension;
Res – Restoration; MW – Mega Watt; CS-Central Sector: SS- State Sector

Annex- 8.5
(Sheet 1 of 2)

State-wise List of Hydro RMU&LE schemes completed in the XII Plan

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs . in crs)	Actual Exp (Rs . in crs)	Benefits (MW)	Category	Year of Completion
Himachal Pradesh								
1	Bassi, HPSEB	SS	4x15	124.25	158.26	6.0(U)+ 60(LE)	RMU&LE	2013-14
Jammu & Kashmir								
2	Lower Jhelum, J&KSPDC	SS	3x35	101.3	96.10	15.00(Res)	R&M+ Res.	2014-15
3	Sumbal Sindh, J&KSPDC	SS	2x11.3	25.00	24.59	-	R&M	2016-17
Uttarakhand								
4	Pathri, UJVNL	SS	3x6.8	113.25	108.3	20.40(LE)	RM&LE	2014-15
5	Khatima, UJVNL	SS	3x13.8	256.77	118.83	41.40 (LE)	RM&LE	2016-17
Uttar Pradesh								
6	Matatila, UPJVNL	SS	3x10.2	10.29	7.21	30.6 (LE)	RM&LE	2015-16
Andhra Pradesh								
7	Lower Sileru, APGENCO	SS	4x115	8.75	6.77	-	R&M	2013-14
8	Srisailam RB, APGENCO	SS	7x110	16.70	17.60	-	R&M	2015-16
Telangana								
9	Nagarjuna Sagar Ph-I works, TSGENCO	SS	1x110+ 7x100.8	33.35	13.90	-	R&M	2012-13
Karnataka								
10	Supa, KPCL	SS	2x50	3.45	3.88	-	R&M	2014-15
11	Nagjhari,U-1 to 6, KPCL	SS	1x135 (U-6)	69.21	64.49	15 (U)	RM&U	2015-16
12	Sharavathy (Ph B), KPCL	SS	10x103.5	20.00	29.27	-	R&M	2016-17
Kerala								
13	Idamalayar, KSEB	SS	2x37.5	14.50	13.22	-	R&M	2012-13

Annex- 8.5
(Sheet 2 of 2)

Sl. No	Project, Agency	CS/ SS	Inst. Cap. (MW)	Est. Cost (Rs . in crs)	Actual Exp (Rs . in crs)	Benefits (MW)	Category	Year of Completion
14	Sabarigiri, U-4 KSEB	SS	1x55	52.20	50.41	5(U)	RM&U	2014-15
15	Poringalkuthu, KSEB	SS	4x8	88.63	51.90	4 (U)+ 32.00 (LE)	RMU&LE	2015-16
Tamil Nadu								
16	Periyar, TANGEDCO	SS	4x35	161.18	133.68	140(LE)+ 28.00(U)	RMU&LE	2015-16
Odisha								
17	Rengali Unit-1 OHPC	SS	1x50	47.50	36.76	50(LE)	RM&LE	2012-13
18	Rengali Unit-2 OHPC	SS	1x50	25.20	20.73	50(LE)	RM&LE	2013-14
West Bengal								
19	Jaldhaka St.I, WBSEDCL	SS	3x9	88.62	79.97	27 (LE)	RM&LE	2016-17
Assam								
20	Khandong, U-NEEPCO	CS	1x25	25.05	29.18	25(LE)	RM&LE	2014-15
21	Kopili, NEEPCO	CS	2x50	50.22	50.92	-	R&M	2014-15
	Total		**4149.6**	**1335.42**	**1115.97**	**549.40 [58(U)+ 476.40 (LE) + 15 (Res)]**		

State-wise List of Hydro RMU&LE schemes programmed for completion during 2017-22

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
A. Ongoing Schemes – Under Implementation								
Himachal Pradesh								
1	Bhakra LB, BBMB (5x108)	CS	5x108	489.77	340.53	540.00(LE)+ 90.00 (U)	RMU&LE	2019-20
2	Ganguwal (1x29.25+2x24.2) & Kotla (1x29.25+2x24.2), BBMB	CS	1x24.2 (U-2) 1x24.2 (U-3)	14.19	0.84	48.4 (LE)	RM&LE	2017-18
3	Dehar Power House, BBMB (6x165)	CS	1x165	19.87	15.00	-	R&M	2017-18
4	Baira Siul, NHPC (3x60)	CS	3x60	341.41	-	180 (LE)	RM&LE	2020-21
5	Bhaba Power House, HPSEB (3x40)	SS	3x40	153.10	60.78	120 (LE)	RM&LE	2021-22
Jammu & Kashmir								
6	Salal, NHPC (6x115)	CS	5x115	58.01	-	-	R&M	2019-20
7	Ganderbal, J&KSPDC (2x3+2x4.5)	SS	2x4.5	39.30	12.90	9.00 (LE)	RM&LE	2017-18
8	Chenani, J&KSPDC (5x4.66)	SS	5x4.66	39.14	14.66	23.30 (LE)	RM&LE	2017-18
Uttarakhand								
9	Tiloth, UJVNL (3x30)	SS	3x30	384.66	-	90 (LE)	RM&LE	2019-20
10	Dhalipur, UJVNL (3x17)	SS	3x17	152.65	-	51.00 (LE)	RM&LE	2020-21

Annex- 8.6
(Sheet 2 of 5)

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Uttar Pradesh								
11	Rihand, UPJVNL (6x50)	SS	6x50	132.20	95.52	300.00 (LE)	RM&LE	2017-18
12	Obra, UPJVNL (3x33)	SS	3x33	58.80	18.4	99.00 (LE)	RM&LE	2018-19
Gujarat								
13	Ukai, GSECL (4x75)	SS	3x75 (U-1,2,&4)	-	-	-	R&M	2021-22
14	Kadana PSS, GSECL (4x60)	SS	4x60	-	-	-	R&M	2021-22
Telangana								
15	Nagarjuna Sagar Ph-II works, TSGENCO (1x110+7x100.8)	SS	1x110+7x 100.8	22.17	14.34	-	R&M	2018-19
16	Nagarjuna Sagar Left Canal Power House, TSGENCO (2x30.6)	SS	2x30.6	30.99	2.00	-	R&M	2018-19
Karnataka								
17	Bhadra River Bed units, KPCL (2x12)	SS	2x12	28.015	21.81	-	R&M	2017-18
Kerala								
18	Sholayar, KSEB (3x18)	SS	3x18	199.55	1.833	54.00 (LE)	RM&LE	2018-19
19	Idukki 1st stage, KSEB (3x130)	SS	3x130	89.90	3.98	-	R&M	2019-20

Annex- 8.6
(Sheet 3 of 5)

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
Tamil Nadu								
20	Sholayar-I, TANGEDCO (2x35)	SS	2x35	120.00	1.388	70.00 (LE) + 14.00(U)	RMU&LE	2018-19
Madhya Pradesh								
21	Gandhi Sagar, MPPGCL (5x23)	SS	5x23	21.83	-	-	R&M	2018-19
22	Bargi, MPPGCL (2x45)	SS	2x45	3.12	0.36	-	R&M	2021-22
23	Pench, MPPGCL (2x80)	SS	2x80	13.36	-	-	R&M	2021-22
Odisha								
24	Hirakud-I U5&6, OHPC (2x37.5)	SS	2x37.5	158.77	14.75	75.00 (LE) + 12.2 (U)	RMU&LE	2018-19
25	Hirakud-II (Chilima), OHPC (3x24)	SS	1x24 (U-3)	65.67	12.21	24.00 (LE)	RM&LE	2017-18
26	Balimela, OHPC (6x60)	SS	6x60	382.91	1.70	360(LE)	RM&LE	2020-21
	Sub Total (A)		**4904.55**	**3019.39**	**633.00**	**2159.90 [2043.70(LE) + 116.20(U)**		
B. Ongoing Schemes – Under Tendering								
Himachal Pradesh								
27	Giri, HPSEB (2x30)	SS	2x30	139.8	-	60.00 (LE)	RM&LE	2020-21
Punjab								
28	Mukerin St.I, St.II, St.III & St.IV, PSPCL (3x15, 3x15, 3x19.5&3x19.5)	SS	3x15, 3x15, 3x19.5&3 x19.5	132.47	-	-	R&M	2019-20

Annex- 8.6

(Sheet 4 of 5)

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
29	Ranjit Sagar Dam, PSPCL (4x150)	SS	4x150	42.08	-	-	R&M	2019-20
30	Shanan HEP, PSPCL (1x50+4x15)	SS	1x50+ 4x15	40.20	-	-	R&M	2019-20
31	UBDC St.I & St.II, PSPCL (3x15+3x15.45)	SS	3x15+ 3x15.45	21.05	-	-	R&M	2019-20
Uttarakhand								
32	Chilla Ph B UJVNL (4x36)	SS	4x36	490.56	-	144(LE)+ 12(U)	RMU&LE	2021-22
33	Kulhal, UJVNL (3x10)	SS	3x10	115.24	-	30(LE)	RM&LE	2020-21
34	Ramganaga, UJVNL (3x66)	SS	3x66	455.2	-	198(LE)	RM&LE	2021-22
35	Dhakrani, UJVNL (3x11.25)	SS	3x11.25	137.31	-	33.75 (LE)	RM&LE	2020-21
Karnataka								
36	Nagjhari,U-1 to 3, KPCL (3x150)	SS	3x150	51	28.46	-	R&M	2021-22
Madhya Pradesh								
37	Bansagar Ton-I, MPPGCL (3x105)	SS	3x105	4.97	-	-	R&M	2021-22
Jharkhand								
38	Panchet, DVC (2x40)	CS	1x40 (U-1)	48.92	1.99	40(LE)+ 8(U)	RMU&LE	2021-22
	Sub Total (B)		**2279.10**	**1678.8**	**30.45**	**525.75 [505.75(LE) 20(U)]**		

Annex- 8.6
(Sheet 5 of 5)

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
C. Ongoing Schemes – Under DPR Preparation/ Finalisation/ Approval								
Andhra Pradesh								
39	Machkund St.I & St.II, APGENCO (3x17+3x21.25)	SS	3x17+3x21.25	124.45	-	114.75(LE)+5.25 (U)	RMU&LE	2021-22
Karnataka								
40	Shivasamudram, KPCL (6x3+4x6)	SS	6x3+4x6	41.05	-	-	R&M	2021-22
41	MGHE, KPCL (4x21.6+4x13.2)	SS	4x21.6+4x13.2	74.10	-	-	R&M	2021-22
Kerala								
42	Kuttiyadi, KSEB (3x25)	SS	3x25	377.41	-	75.00 (LE) + 7.5 (U)	RMU&LE	2021-22
West Bengal								
43	Maithon, DVC (2x20+1x23.2)	CS	2x20 (U-1&3)	56.03	5.75	40.00 (LE)	RM&LE	2021-22
Meghalaya								
44	Umium St.III, Kyrdemkulai, MePGCL (2x30)	SS	2x30	344.00	-	60(LE) + 6(U)	RMU&LE	2021-22
	Sub Total (C)		**470.95**	**1017.04**	**5.75**	**308.50 [289.75(LE)+18.75(U)]**		
	Total (A+B+C)		**7654.60**	**5715.23**	**669.20**	**2994.15 [2839.20(LE) +154.95(U)]**		

@ This cost includes Scheme I only i.e. Rehabilitation of damaged/burnt equipments.

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension; Res – Restoration; MW – Mega Watt; CS-Central Sector: SS- State Sector

Annex- 8.7

(Sheet 1 of 2)

State-wise List of Hydro RMU&LE schemes programmed for completion beyond 2022

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
A. Ongoing Schemes – Under Tendering								
1	Moyar PH, TANGEDCO (3x12)	SS	3x12	67.05		36(LE)+ 6(U)	RMU&LE	2022-27
	Sub Total(A)		**36**	**67.05**		**42.00 [36(LE)+ 6(U)]**		
B. Ongoing Schemes – Under DPR Preparation/ Finalisation/ Approval								
Uttarakhand								
2	Chibro, UJVNL (4x60)	SS	4x60	184.88	-	240(LE)	RM&LE	2023-24
3	Khodri PH-II UJVNL (4x30)	SS	4x30	169.63	-	120(LE)	RM&LE	2023-24
Tamil Nadu								
4	Kodayar Ph.I, TANGEDCO (1x60)	SS	1x60	88.48	-	60 (LE)+ 10 (U)	RMU&LE	2022-27
5	Kodayar Ph-II, TANGEDCO (1x40)	SS	1x40	-	-	40.0(LE)+ 6(U)	RMU&LE	2022-27
Manipur								
6	Loktak, NHPC (3x35)	CS	3x35	260.47	-	105 (LE)	RM&LE	2022-23
	Sub Total(B)		**565**	**703.46**		**581.00 [565(LE)+ 16(U)]**		
C. Ongoing Schemes – Under RLA Studies								
Tamil Nadu								
7	Kundah-I, TANGEDCO (3x20)	SS	3x20	-	-	-	RM&LE	2022-27

Annex- 8.7

(Sheet 2 of 2)

Sl. No	Project, Agency Inst. Cap. (No.x MW)	CS/ SS	Capacity Covered Under RMU&LE (MW)	Est. Cost (Rs. in Crs.)	Actual Exp (Rs. in Crs.)	Benefits (MW)	Category	Year of Completion
8	Kundah-II, TANGEDCO (5x35)	SS	5x35	-	-	-	RM&LE	2022-27
9	Kundah-III, TANGEDCO (3x60)	SS	3x60	-	-	-	RM&LE	2022-27
10	Kundah-IV, TANGEDCO (2x50)	SS	2x50	-	-	-	RM&LE	2022-27
11	Kundah-V, TANGEDCO (2x20)	SS	2x20	-	-	-	RM&LE	2022-27
12	Mettur Tunnel, TANGEDCO (4x50)	SS	4x50	-	-	-	RM&LE	2022-27
13	Sarkarpathy, TANGEDCO (1x30)	SS	1x30	-	-	-	RM&LE	2022-27
14	Sholayar-II, TANGEDCO (1x25)	SS	1x25	-	-	-	RM&LE	2022-27
15	Suruliyar, TANGEDCO (1x35)	SS	1x35	-	-	-	RM&LE	2022-27
Kerala								
16	Idukki 2nd stage,	SS	3x130	-	-	-	RM&LE	2022-27
	Sub Total(C)		**1235**	**0**	**0**	**-**		
	Total (A+B+C)		**1836**	**770.51**	**0**	**623.00 [601(LE)+ 22(U)]**		

Abbreviations: R&M – Renovation & Modernisation;. U – Uprating; LE – Life Extension; Res – Restoration;

MW – Mega Watt; CS-Central Sector: SS- State Sector

Annex- 8.8

State-wise List of Additional Hydro Projects Identified for Undertaking RMU&LE Works

Sl. No.	Project, Agency	CS/ SS	Inst. Cap. (MW)	Remarks
Himachal Pradesh				
1	Pong, BBMB	CS	6x66	CPRI Bangalore was hired to prepare scope of work for RLA & R&M studies of Pong machines. Therefore, RLA study will be conducted and on the basis of RLA study report, it will be desided whether work of RMU is required to be carried out or not.
2	Dehar, BBMB	CS	4x165	BBMB placed a Work Order upon M/s CPRI, Bangalore for firmimg up scope of RLA Study of various equipment to be under taken by an open tender basic RLA & R&M studies on Dehar Power House. The Report in this has been submitted by M/s CPRI and the detailed scope of RLA study to be undertaken is being perused by the field office. The tender document shall be finalised after receipt of detailed scope of RLA from field office.
Maharashtra				
3	Koyna Stage-III, MSPGCL	SS	4x80	
4	Vaitarana, MSPGCL	SS	1x60	
Andhra Pradesh				
5	Tungabhadra Dam, APGENCO	SS	4x9	
6	Hampi, APGENCO	SS	4x9	
Jharkhand				
7	Sikidiri, JSEB	SS	2x65	
Madhya Pradesh				
8	Rajghat, MPPGCL	SS	3x15	
Assam				
9	Khandong, NEEPCO	SS	2x25	Order has been placed with CPRI for carrying out the survey, investigation work and preparation of DPR after detail survey, investigation and testing of the equipment. The Survey & Investigation works has been carried out by CPRI. In the month of March` 2017. The Examination of Draft DPR submitted by CPRI is under process.
Uttar Pradesh				
10	Khara, UPJVNL	SS	3x24	
Rajasthan				
11	Rana Pratap Sagar (RPS), RRVUNL	SS	4x43	
12	Jawahar Sagar, RRVUNL	SS	3x33	
Total			**2076**	

Abbreviations		
1	AVR	Automatic Voltage Regulator
2	BOQ	Bill of Quantity
3	CERC	Central Electricity Regulatory Commission
4	CPRI	Central Power Research Institute
5	DPR	Detailed Project Report
6	DVR	Digital Voltage Regulator
7	JICA	Japan International Co-operation Agency
8	LOA	Letter of Award
9	RLA	Residual Life Assessment

CHAPTER-9

DEFINITIONS AND ABBREVIATIONS

CHAPTER-9

DEFINITIONS AND ABBREVIATIONS

9.1 DEFINITIONS

The definitions of different performance indices and other terms referred to in this review are as under:

a) Capacity: Capacity in MW is the installed or Uprated/Derated capacity of the unit.

b) Forced Outage Non-Availability (FO) (%)

$$= \frac{(Cf1 \times hf1 + Cf2 \times hf2 \ldots\ldots\ldots\ldots\ldots\ldots + Cfn \times hfn) \times 100}{C \times H}$$

Where Cf1, Cf2 …… Cfn are the capacities in MW of the generating units of the station on forced outage and hf1,hf2……hfn are the duration of each outage in hours during the year. C is the total installed capacity of the station in MW and H is the total period in hours during the year.

c) Planned Maintenance Non-Availability (PM) (%)

$$= \frac{(Cp1 \times hp1 + Cp2 \times hp2 + \ldots\ldots\ldots\ldots\ldots\ldots + Cpn \times hpn) \times 100}{C \times H}$$

Where Cp1, Cp2 …… Cfn are the capacities in MW of the generating units of the station on planned shutdown and hp1, hp2 …… are the duration of each shutdown in hours during the year. C is the total installed capacity of the station in MW and H is the total period in hours during the year.

d) Operating availability (OA) (%) = (100-FO-PM)

e) Miscellaneous Non-Availability: Non-Availability of generating units due to one or more of the following factors:

- Low reservoir level/poor inflow
- Transmission line faults/constraints
- Excess weeding/silting
- No/reduced system demand
- Low head/too high tail water level
- No irrigation demand
- Grid disturbance/failure
- Reserve shutdown/spinning reserve

f) Design Energy: The quantum of energy which could be generated in a 90% dependable year with 95% availability installed capacity of the generating station.

g) Targeted Energy: Estimated energy generation during the year based on the likely rainfall data, storage position of the reservoirs and past records of energy generation etc.

h) Full Reservoir Level (FRL): The maximum level up to which the water could normally be stored in the reservoir for conservation and regulation.

i) Minimum Draw Down Level (MDDL): The minimum level up to which the reservoir could be depleted under normal operating conditions.

j) Types of H.E. Scheme: The H.E. Schemes have been classified into following four categories:

- Run-of-river without pondage
- Run-of river with pondage
- Storage Schemes
  - Purely power
  - Multipurpose projects
- Pumped Storage Schemes

9.2 Abbreviations

MW	Mega Watt	(10^6 Watts)
KWH	Kilo Watt hour (I unit)	(10^3 Watts-hrs)
MU	Million Units	(10^6 Units**)**
MCM	Million Cubic Meters	(10^6 Cu.M.)
FRL	Full Reservoir Level	
MDDL	Minimum Draw Down Level	
HRT	Head Race Tunnel	
F.O.	Forced Outage	
P.M.	Planned Maintenance	

Abbreviations of Agencies

Northern Region			
1	Himachal Pradesh	ADHPL	Allain Duhangan Hydro Power Limited
		EPPL	Everest Power Private Limited
		GBHPPL	Greenko Budhil Hydro Power Pvt. Limited
		HBPCL	Himachal Baspa Power Company Limited
		HPSEB Limited	Himachal Pradesh State Electricity Board Limited
		HPPCL	Himachal
		MPCL	Malana Power Company Limited
		NHPC LIMITED	National Hydro Power Corporation Limited
		NTPC LIMITED	National Thermal Power Corporation Limited
		SJVN LIMITED	Satluj Jal Vidyut Nigam Limited
2	Jammu & Kashmir	JKSPDC	J&K State Power Development Corporation.
3	Punjab	BBMB	Bhakra Beas Management Board
		PSPCL	Punjab State Power Corporation Limited
4	Rajasthan	RRVUNL	Rajasthan Rajya Vidyut Utpadan Nigam Limited
5	Uttar Pradesh	UPVUNL	Uttar Pradesh Jal Vidyut Nigam Limited
6	Uttarakhand	THDC	Tehri Hydro Development Corporation
		UJVNL	Uttarakhand Jal Vidyut Nigam Limited
		JPPVL	Jaiprakash Power Pvt. Venture Limited
		AHPC	Alaknanda Hydro Power Company
Western Region			
1	Gujarat	GSECL	Gujarat State Electricity Corporation Limited
		SSNNL	Sardar Sarovar Narmada Nigam Limited
2	Madhya Pradesh	MPPGCL	Madhya Pradesh Power Generation Co. Limited
		NHDC	Narmada Hydroelectric Development Co. Limited
3	Chhatisgarh	CSPGCL	Chhatisgarh State Power Generation Co Limited
4	Maharashtra	DLHPPL	Dodson-Lindblom Hydro Power Private Limited
		MAHAGENCO	Maharashtra State Power Generation Co. Limited
		TPCL	Tata Power Company Limited
Southern Region			
1	Andhra Pradesh	APGENCO	Andhra Pradesh Power Generation Corporation Limited
2	Karnataka	KPCL	Karnataka Power Corporation Limited
3	Kerala	KSEBL	Kerala State Electricity Board Limited
4	Telangana	TSGENCO	Telangana State Power Generation Corporation Limited
5	Tamil Nadu	TANGEDCO	Tamil Nadu Generation & Distribution Co. Limited
Eastern Region			
1	Jharkhand	JUUNL	Jharkhand Urja Utpadan Nigam Limited
		DVC	Damodar Valley Corporation
2	Odisha	OHPC	Odisha Hydro Power Corporation
3	Sikkim	GIPL	Gati Infrastructure Pvt. Limited
		DEPL	Dans Energy Private Limited
4	West Bengal	WBSEDCL	West Bengal State Electricity Distribution Co. Limited
		TUL	Teesta Urja Limited
North Eastern Region			
1	Assam	APGCL	Assam Power Generation Co. Limited
2	Meghalaya	MePGCL	Meghalaya Power Generation Corporation Limited