

Detailed Project Report
Dugar Hydroelectric Project (500 MW)



CHAPTER - I

INTRODUCTION

1.0 GENERAL

The state of Himachal Pradesh has vast Hydro Power potential. The main rivers that flow through Himachal Pradesh are Satluj, Beas, Ravi and Chenab. The Chenab River also known as Chandra Bhaga River in its upper reaches is formed by the confluence of two rivers viz. Chandra and Bhaga at Tandi near Keylong in Lahaul & Spiti district of Himachal Pradesh. Chenab River enters Pangi valley of Chamba district in Himachal Pradesh near Bhujind and leaves the district at Sansari Nala to enter Paddar valley of Kashmir. Dugar Hydro Electric Project is in Pangi valley on Chenab River and is a run-of-river scheme.

The Dugar HE Project was allotted to M/s Dugar Hydro Power Limited (DHPL), a joint venture of M/s Tata Power Co. Ltd. & M/s SN Power Holding, Singapore Pte. Ltd. (Statkraft) by Government of Himachal Pradesh on Build, Own, Operate & Transfer (BOOT) basis. Accordingly, M/s DHPL had prepared the Detailed Project Report of Dugar HE Project and submitted to CEA for detailed examination vide their Letter No. Dugar/CEA/Consultation-Meeting/20160516-01 dated May 16, 2016. Subsequently, M/s DHPL surrendered the project back to the Government of Himachal Pradesh.

NHPC Limited has signed a Memorandum of Understanding(MOU) with the Government of Himachal Pradesh for execution of Dugar HE Project (449 MW) on Build, Own, Operate & Transfer (BOOT) basis for the period of 70 years on the River Chenab, in Chamba District of Himachal Pradesh on September 25, 2019.

The Project is now proposed for an enhancement of installed capacity from 449 MW to 500 MW after optimization of Power Potential study, which comprises 4 main units of 103 MW and 2 auxiliary units of 44 MW each. These

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auxiliary units are proposed to utilize the mandatory environmental flow as prescribed by MoEF & CC, GoI during lean season and non-lean non-monsoon season.

The project envisages construction of 128 m high concrete gravity dam across Chenab River. The reservoir storage is 61.58 MCM at Full Reservoir Level EL. 2114m and live storage capacity is 16.57 MCM. Power house will accommodate four units of 103 MW each for main plant and two units of 44 MW each for auxiliary plant (4 x 103 MW + 2 x 44 MW).

Salient features of the project have been given below: -

1.1 SALIENT FEATURES**Project location**

State	Himachal Pradesh
District	Chamba
River	Chenab
Vicinity	Luj village
Latitude	33° 07' 05" N
Longitude	76° 21' 20.7" E
Nearest rail head; Udhampur (J&K)	270 km

Hydrology

Catchment area	km ²	7,823
Snow fed catchment area	km ²	4,458
Total annual inflow in 90% dependable year	10 ⁶ m ³	8422
Average discharge in 90% dependable year	m ³ /s	267.1
Average annual rainfall	mm	859.5

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Flood discharge for river diversion	m ³ /s	2,700
Probable Maximum Flood (PMF)	m ³ /s	9,425

Reservoir

Full Reservoir Level (FRL)	m	2114.00
Maximum Water Level (corresponding to PMF)	m	2114.00
Minimum Draw Down Level (MDDL)	m	2102.35
Gross storage at FRL	10 ⁶ m ³	61.58
Gross storage at MDDL	10 ⁶ m ³	45.01
Live storage	10 ⁶ m ³	16.57

Dam & Spillway

Dam Type	-	Concrete Gravity
Design flood (PMF)	m ³ /s	9425
Top of the dam	m	2116.0
Full reservoir level (FRL)	m	2114.0
Average river bed elevation	m	2017.0
Deepest foundation elevation	m	1988.0
Length of dam at top	m	210.65
Maximum height	m	128.0
Total number of blocks	-	13
Number of overflow blocks	-	06
Number of non overflow blocks	-	07

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Type of spillway	-	Combination of free overflow spillway & sluice spillway
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Type of energy dissipator	-	Flip bucket
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Upper Level Spillway (Free Overflow Spillway)

Number of ULS	-	01 (Block No. 10)
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Size of opening	m	8.2 (W) x 11.7 (H)
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Type & No. of gates	-	Radial, One (01)
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Width of block	m	15.20
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Crest level of ULS	m	2102.30
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Lower Level Spillway (Sluice Spillway)

Number of LLS	-	05 (Block No. 5 to 9)
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Size of opening	m	8.2 (W) x 10.65 (H)
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Type & No. of gates	-	Radial, Five (05)
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Width of each block	m	15.2
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Total width of LLS blocks	m	76.0
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Crest level of LLS	m	2052.50
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River Diversion

River diversion flood	m ³ /s	2700
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Diversion scheme	-	Through diversion tunnels and coffer dams
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Location	-	Right bank
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No. of diversion tunnels	-	02
Diameter of each diversion tunnel	m	11.5 m, Horse-shoe shape
Length of diversion tunnel	m	463.0 (DT1), 577.0 (DT2)
Invert level of diversion tunnel inlet	m	2022.0
Invert level of diversion tunnel outlet	m	2016.0
Top of upstream coffer dam	m	2043.70
Height of upstream coffer dam	m	~23.7
Top of downstream coffer dam	m	2029.50
Height of downstream coffer dam	m	~ 13.5
Diversion tunnel inlet gate type and number for each diversion tunnel	-	Fixed wheel type, 02
Size of each diversion tunnel gate	m	4.7 (W) x 11.5 (H)

Power Intake**Main Power Plant**

Location	-	Left bank
No. and Size	-	02 Nos., 23.05m (W) x 34.35m (H)
Design discharge for each intake	m ³ /s	252

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Centre line elevation	m	2088.05
Type of intake gate	-	Fixed wheel,
Size of intake gate	m	6.40 (W) x 8.10 (H)

Auxiliary Power Plant

Location	-	Left bank
No. and Size	-	01 No., 13.5m (W) x 28.7m (H)
Design discharge	m ³ /s	113.66
Centre line elevation	m	2091.95
Type of intake gate	-	Fixed wheel
Size of intake gate	m	4.65 (W) x 5.90 (H)

Pressure Tunnel/Shaft

Main Plant

No. of pressure tunnel/shaft	-	02
Design discharge for each pressure tunnel/shaft	m ³ /s	252
Diameter of steel lined pressure tunnel/shaft	m	7.25
Length	m	314.3, 274.6
Internal diameter of steel lined pressure tunnel after bifurcation	m	4.85
Length of each steel lined pressure tunnel after bifurcation	m	37.2

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Auxiliary Plant

No. of pressure tunnel/shaft	-	01
Design discharge for pressure tunnel/shaft	m ³ /s	113.66
Internal diameter of steel lined pressure tunnel/shaft	m	5.1
Length of steel lined pressure tunnel/shaft	m	251.7
Internal diameter of steel lined pressure tunnel after bifurcation	m	3.7
Length of each steel lined pressure tunnel after bifurcation	m	29.9

Power House

Power house for main units

Type		Underground
Size (L x W x H) including auxiliary units	m	164.5 x 22 x 46.7
Gross head (Average)	m	94.8
Nos. & type of Turbine	--	4 Nos., Francis
Turbine c/l elevation	m	2002.50
Design discharge per unit	m ³ /s	126
Rated head	m	90.10
Installed capacity per Unit	MW	103
Nos. & type of Main Inlet valve	-	4 Nos., Butterfly type
Diameter	m	4.30

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Nominal speed	rpm	166.67
Voltage / Frequency	kV / Hz	13.8/50
Normal tail water level	m	2015.34
Probable maximum tail water level	m	2033.04

Power house for auxiliary units

Type		Underground
Gross head (Average)	m	92
Nos. and type of Turbine	--	2 Nos., Francis
Turbine c/l elevation	m	2006.50
Rated discharge per unit	m ³ /s	56.83
Rated head	m	87.69
Installed capacity per Unit	MW	44
Nos. & type of Main Inlet valve	-	2 Nos., Butterfly type
Diameter	m	2.60
Nominal speed	rpm	300
Voltage / Frequency	kV / Hz	13.8/50
Normal tail water level	m	2018.10
Probable maximum tail water level	m	2042.03

Transformer Cavern

Type	---	Underground
Cavern Size (L x W x H)	m	158.5 x 15 x 20.8
Transformer floor elevation	m	2014.50
GIS floor elevation	m	2022.50

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**Transformers for 103 MW machines**

Location	---	Indoor
Capacity	---	45 MVA
Voltage ratio	kV / kV	13.8/400

Transformers for 44 MW auxiliary machines

Location	---	Indoor
Capacity	---	45 MVA
Voltage ratio	kV / kV	13.8/400

Tailrace Surge Cavern/Draft Tube gate operation chamber

Type	-	Restricted orifice type
Size of tailrace surge chamber	m	81.8 (L) x 10.8 (B) x 47.85 (H)
Bottom elevation of chamber	m	2001.40
Maximum upsurge level	m	2028.70
Minimum down surge level	m	2005.20
Nos. and size of draft tube gates	-	04 Nos., 6.0m (W) x 7.7m (H)
Size of access tunnel	m	5.0 (Diameter), D-shape

Tailrace Tunnel**Main Plant**

Nos. & Dia. of draft tube tunnels	-	04 Nos., 7.7m
Length of each draft tube tunnel	m	58

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Diameter of tailrace tunnel (two draft tube tunnels combined to one TRT)	m	8.5
Length of tailrace tunnel (two draft tube tunnels combined to one TRT)	m	93, 82
Diameter of single tailrace tunnel (two TRTs of 8.5 m diameter combined to one TRT)	m	12.1
Length of single TRT	m	400
Design discharge for single TRT	m ³ /s	504
Length of Adit to TRT	m	155
Size of Adit to TRT	m	4.5 (D-shape)
Nos. and Size of TRT gates	-	02 Nos., 5.1m (W) x 12.1m (H)

Auxiliary Plant

Nos. & Dia of draft tube tunnels	-	02 Nos., 6.2m
Length of draft tube tunnel	m	29, 39
Diameter of tailrace tunnel (two draft tube tunnels combined to one TRT)	m	6.2
Length of tailrace tunnel	m	134
Design discharge for tailrace tunnel	m ³ /s	113.66
Nos. and Size of TRT gates	-	01No., 5.1m (W) x 6.2m (H)

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Estimated cost

Civil works (Including Pre-operative Works)	₹ 2604.12 (in crores)
E&M works	₹ 932.07 (in crores)
ATS COST	₹ 205.35 (in crores)
Cost of Miscellaneous Works(Including indirect Charges)	₹ 18.48 (in crores)
Total basic cost	₹ 3760.02 (in crores)
IDC and financing charges	₹ 666.18 (in crores)
Total Project cost	₹ 4426.20 (in crores)

Power benefits

Main plant (4 x 95 MW)

Annual energy (in 90% dependable year)	GWh	1420.78
Design energy (at 95% plant availability)	GWh	1397.66

Auxiliary plant (2 x 34.5 MW)

Annual energy (in 90% dependable year)	GWh	373.99
Design energy with 95% plant availability	GWh	361.32

Financial aspects

Tariff as per CERC

Cost of generation (1 st Year Tariff) per kWh at power house bus bars (including IDC) during 90% dependable year as per CERC Guidelines	₹4.65 /kWh
Cost of generation (Average for first ten year Tariff) per kWh at power house bus bars (including IDC) during 90% dependable year as per CERC Guidelines	₹3.2 /kWh
Cost of generation (Levellised Tariff) per	₹4.62/kWh

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kWh at power house bus bars (including IDC) during 90% dependable year as per CERC Guidelines

Construction period

Total construction period including preconstruction works 98 months

Construction period for preconstruction works 24 months

1.2 PROJECT LOCATION & ACCESS

Dugar HEP is located on Chenab River near Luj village in Chamba district of Himachal Pradesh which is about 10km from the nearest town Killar. The latitude and longitude of project site are N 33° 07' 05" and E 76° 21' 20.7" respectively. The Dugar project site lies between the Sachkhas HEP (267MW) at its upstream and the Kirthai-I HEP (390MW) at downstream.

The nearest rail heads are the railway stations Udampur and Pathankot. Udampur Railway Station is in Udampur city in the state of Jammu & Kashmir, while Pathankot Railway Station is in Pathankot city in the state of Punjab. The distance from Udampur to project site is about 270km. The location of the project is shown in Figure 1.1.

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