

Chapter 9 Power

9.0 General

The Bedti - Varadalink project comprises two components.

Link I: Bedti (Pattanadahalla/ Shalamalahalla) - Varada

Link II: Bedti (Suremane) - Dharma - Varada

The entire link project lies in the state of Karnataka, requires power for lifting water and hence the power scenario of Karnataka state is discussed in the foregoing paragraphs.

9.1 Status of power development in Karnataka

9.1.1 Available generating capacity (MW) in Karnataka.

Karnataka is the leading power generating state in India with an installed generation capacity of 27,950 MW (as on 31.12.2020). It comprises 13,677 MW from conventional sources and 14,273 MW from Non-conventional sources. Power for Karnataka state is procured from the generating stations under KPCL, independent power producers (IPP's) (Conventional and Non-conventional), central generating stations (CGS) and from other states through bilateral trade, purchase and energy exchanges. KPCL is the major generation utility in the state with a total installed generation capacity of 8817 MW comprising of hydro generation capacity of 3797 MW and thermal generation capacity of 5020 MW. The category wise/ location wise break-up of installed capacity of Karnataka state is given in **Table 9.1**.

Table 9.1
Category wise/ location wise break-up of installed capacity
of Karnatakastate (As on 31.12.2020)

	Name of Power Station	Units and Size (MW)	Capacity in MW
I	Conventional		
A.	Hydro:		
1	Sharavathy Generating Station	10 x 103.5 MW	1035
2	Linganamakki Dam Power House	2 x 27.5 MW	55
3	Nagjhari Power House	6 x 150 MW	900
4	Supa Dam Power House	2 x 500 MW	100
5	Varahi Underground Power House	4 x 115 MW	460
6	Mani Dam Power House	2 x 4.5 MW	9
7	Kodasalli Power House	3 x 40 MW	120
8	Kadra Power House	3 x 50 MW	150
9	Gerusoppa Power House	4 x 60 MW	240
10	Almatti Dam Power House	(1x15 MW) + (5x55 MW)	290
11	Bhadra Generating Station	(1x7.2 MW) + (1x6 MW) + (1x2 MW) + (2x12 MW)	39.2
12	Munirabad Power House	(2x9 MW) + (2x10 MW)	38
13	Ghataprabha Dam Power House	(2 x 16 MW)	32
14	Mahatma Gandhi Hydro Electric Station	(4x13.2MW) + (4x21.6MW)	139.2
15	Shivasamudram Power House	(4 x 6 MW) + (6 x 3 MW)	42
16	Shimsha Power House	(2 x 8.6 MW)	17.2
17	Mallapur mini hydel scheme	(2 x 4.5 MW)	9
18	Sirwar mini hydel scheme	(1 x 1 MW)	1
19	Kalmala mini hydel scheme	(1 x 0.4 MW)	0.4

20	Ganekal mini hydel scheme	(1 x 0.35 MW)	0.35
21	Malaprabha mini hydel scheme	(2 x 1.2 MW)	2.4
22	Jurala share(50%)	(6 x 39.1 MW)	117.3
	Total hydro		3797.05
B	Thermal		
1	Raichur Thermal Power Station	(7x210 MW) + (1x250MW)	1720
2	Bellary Thermal Power Station	(2x500 MW) + (1x700MW)	1700
3	Yermarus Thermal Power Station	(2 x 800 MW)	1600
	Total thermal		5020
C	Gas		NIL
D	Interstate generating stations (share)		
1	Talcher STPS Stage-2		375
2	Ramagundam STPS Stage-1&2		445
3	Ramagundam STPS Stage-3		111
4	NLC TPS I - expansion		101
5	MAPS Kalpakkam		33
6	NLC TPS II- expansion		117
7	NLC TPS II - stage 1		133
8	NLC TPS II - stage 2		187
9	NTPL (NLC Tamilnadu power)		201
10	Simhadri STPS 2		213
11	Vallur (NTECL) STPS		150
12	Kudgi STPS		471
13	Kaiga 1 & 2		122

14	Kaiga 3 & 4		131
15	NPCIL, KKNPP		216
16	KKNPP Unit-2		204
17	Koderma (DVC)		250
18	Mejia TPS		200
	Total (ISG)		3660
E	Power purchases		
	Independent power plants (IPP)		
	UPCL	2 x 600	1200
	Total (PP)		1200
	Total installed capacity (I-Conventional) (A+B+C+D+E)		13677
II	Non - conventional		
1	Wind		4794.7
2	Solar		6972.7
3	Bio-mass		140
4	Co-generation		1520
5	Mini-hydel		846
	Total installed capacity (Non-conventional)		14273

Source: Chief Engineer, Karnataka Power Corporation Ltd, Bengaluru.

9.1.2 Available generating capacity in the state (from different sources category wise)

Total electricity generated (including renewable energy sources) in the State was 75,129 million Units (MU) during 2019-20 which is 1.33% lesser than that during the previous year. The share of KPCL, Central share and Private in total electricity generation during 2019-20 was 34.0 per cent, 30.0 per cent and 36.0 per cent respectively. During 2019-20, the state

received 22665 MU electricity as share from the Central Sector. The category wise generation details of Karnataka during 2019-20 is given in **Table 9.2**.

Table 9.2
Category wise electricity generation in Karnataka during 2019-20

Sl.No.	Category	Generation in MU
1	Hydro	13622
2	Thermal	11845
3	Solar	40
4	Wind	7
	Sub – Total (KPCL Generation)	25514
5	Interstate Generating Stations (Share)	22665
6	Independent Power Plants (IPP)	3814
7	Non- Conventional Energy Sources (wind + solar)	17980
8	Other (CPP, Co-gen, Bio-mass)	5123
9	Open purchase (Generation, Traders and Exchange) including swap and wheeling	0
10	Tungabhadra Dam Share	33
	Sub-total (Purchase)	49615
	Grand Total	75129

Source: Chief Engineer, Karnataka Power Corporation Ltd, Bengaluru.

9.1.3 Present status of utilisation of power

Aggregate consumption of electricity in the State during 2019-20 was 57,971 MU as against 58,609 MU in 2018-19 which shows a decrease of

1.09per cent in consumption. During the year 2019-20, the consumption of electricity by the Agriculture (IP Sets) sector was the largest (36.76 per cent) followed by domestic sector (23.06 per cent) and Industries sector (13.48 per cent) in the state. These three sectors put together accounted for 73.30 per cent of the total electricity consumption. Sector wise electricity consumed during the years 2017-18, 2018-19 and 2019-20 are given in **Table 9.3**.

Table 9.3
Sector wise electricity consumption by different user groups

Unit: MU

SI.No.	Sector	Electricity consumption			Percentage change in	
		2017-18	2018-19	2019-20	2018-19 over 2017-18	2019-20 over 2018-19
1	Industries	7691	8231	7816	7.02	(-)5.04
2	Agriculture	20217	22843	21309	12.99	(-)6.72
3	Domestic	12538	12978	13369	3.51	3.013
4	LT Industries	1954	2029	2008	3.84	(-)1.03
5	Water Works & Sewage pumping	3252	3900	4179	19.93	7.15
6	Commercial Lighting	7090	7157	6615	0.94	(-)7.57
7	Public Lighting	1023	1092	1108	6.74	1.46
8	Others	369	379	1568	2.71	313.70
	Total	54134	58609	57971	8.27	(-)1.09

Source: Economic Survey of Karnataka, 2020-21, Department of Economics & Statistics, Planning Department, Govt. of Karnataka

9.1.4 Capacity addition

Thermal Power:The present installed capacity of thermal power in Karnataka is 5020 MW as on 09.06.2020. Some thermal power plants were

commissioned several years back and in order to keep these units operating healthy, R&M activities were carried out for certain units and need to be carried out for the remaining units, based on their ageing and operating hours. The state is considering phasing out thermal power plants in 3 to 5 years.

The economy of Raichur, which is likely to be the worst hit as two(2) of the three(3) major power stations with installed capacity 1720 MW are located in the district, will face a crisis. Oldest units are located in Raichur Thermal power station. All eight units are between 25 to 32 years old. The average lifespan of a thermal power unit is 30-40 years. Other thermal power stations are located at Bellary with installed capacity 1700MW and at Yeramarus with installed capacity of 1600MW.

Solar power: A solar power potential of 24,700 MW is available in Karnataka whereas the installed capacity has been 5,967 MW as on 30th June 2019 against the total installed capacity of all non-conventional energy sources of 13,657 MW amounting to about 44 per cent. To provide a big push to exploitation of solar energy, the Government has published its Solar Policy for 2014-2021. India's first 2000 MW+ capacity Solar Park has been established in Pavagada, Tumkur District.

The state is likely to see three more ultra-mega solar power parks, each with a capacity of 2,500MW, in the districts of Bidar, Koppal and Gadag. This clearly shows that the expected contribution from solar energy to the energy sector of Karnataka will keep increasing in the coming years.

Renewable energy: Wind Energy, Solar (including solar rooftop), Biomass, Co-generation, Mini-Hydel etc. are the renewable, clean and eco-friendly energy sources. Karnataka stands no.1 in the country in renewable energy. Karnataka Renewable Energy Development Ltd (KREDL) is actively engaged in promotion of renewable energy and implementation of energy conservation programmes. Potential and installed capacity of renewable energy in the state is given in **Table 9.4**.

Table 9.4
Potential available and installed capacity of renewable energy
Unit: MW

Source	Potential available	Capacity addition			Installed capacity
		2017	2018	2019	
Wind Power	55857	875	87	60	4860
Small / Mini-Hydro	3100	9	2	50	903
Co-generation	2000	258	60	28	1731
Solar (including solar rooftop)	24700	3906	1106	1173	7354
Biomass	1000	0.00	0.00	0.00	139
Total	86657	5048	1255	1311	14987

Source: Economic Survey of Karnataka 2020-21.

9.2 Anticipated requirement of energy (MU) and peak load (MW)

The 19th Electric Power Survey of India conducted by Central Electricity Authority (CEA) has estimated anticipated electrical energy requirement and peak electricity load at power station bus bars for Karnataka state for the years 2022, 2027, 2032 and 2037. The details are furnished in **Table 9.5**.

Table 9.5
Anticipated electrical energy requirement and peak demand for Karnataka

State/ Year	Electrical energy (MU)				Peak electric load (MW)			
	2022	2027	2032	2037	2022	2027	2032	2037
Karnataka	83774	106909	136281	173405	12946	15860	19116	22868

Source: Central Electricity Authority.

9.3 Future plans of power development in the state

The Karnataka Government executes one gas based power project at Yalahanka with an installed capacity of 370 MW which is expected to be commissioned in 2021-22. In addition, one waste to energy project at Bidadi with an installed capacity of 11.5 MW under non-conventional energy source has also been taken up. Thus, the total installed capacity of ongoing projects works out to 381.5 MW. The category wise / location wise break-up of installed capacity of ongoing projects of Karnataka are furnished in **Table 9.6**.

Table 9.6
Category wise / location wise ongoing projects of Karnataka

SI. No.	Power Station	Installed capacity (MW)	Date of commissioning
A	Hydro projects		
	NIL		
B	Thermal		
	NIL		
C	Gas		
1	Yelahanka combined cycle plant	370	2021-22
D	Non-conventional		
1	Bidadi waste to energy	11.5	2022-23
	Total	381.5	

Source: Chief Engineer, Karnataka Power Corporation Ltd, Bengaluru.

New projects with an installed capacity of 5,151 MW are being contemplated by the KPCL in Karnataka. The category wise / location wise break-up of installed capacity of future power projects are given in **Table 9.7**.

Table 9.7
Category wise / location wise break - up of installed capacity of proposed projects in Karnataka.

Sl. No.	Power Station	Installed capacity (MW)
A	Hydro	
1	Pumped Storage Plant-Sharavathy basin	2000
2	Pumped Storage Plant- Varahi basin	1500
B	Thermal	
1	Godhna thermal power station	1600
C	Solar	
1	Floating Solar Power plant at YCCPP pond	1
2	Floating Solar power plant on KPCL reservoir	20
3	Solar roof top plant at YCCPP buildings	1
4	Solar roof top plant at YTPS plant buildings	3
5	5 MW Solar PV Plant at Shivanasamudram for improving CUF	1
6	Solar Plant at DuddaHobli, Hassan District	25
	Total	5151

Source: Chief Engineer, Karnataka Power Corporation Ltd, Bengaluru.

9.4 Demand and supply of electricity

The capacity addition by various sources, improvement in the network infrastructure, reduction in transmission and distribution losses and energy conservation measures undertaken by the state have improved power supply position in the state. Karnataka's power sector has reduced its transmission & distribution losses from 21.30% in 2010-11 to 15.32% by 2019-20. The supply and shortfall of electricity at average peak demand for the period from 2015-16 to 2020-21 is furnished in **Table 9.8**.

Table 9.8
Supply and Shortfall of Electricity at Average Peak demand

Year	Average peak demand (MW)	Supply (MW)	Shortfall (MW)
2015-16	9508	8912	596
2016-17	10242	9519	723
2017-18	10802	10104	698
2018-19	12881	10798	2083
2019-20	13258	10800	2458
2020-21	14367	11470	2897

Source: Chief Engineer, Karnataka Power Corporation Ltd, Bengaluru.

9.5 Power requirement for the link canal

Power requirement for lifting of water from the weirs/barrage to the link canals is worked out as under:

Link - I

The combined surpluses of Pattanadahalla and Shalamalahalla are proposed to be diverted from Shalamalahalla to Tungabhadra sub-basin of Krishna basin through Varada, a tributary of Tungabhadra. Lifting arrangement is proposed at Shalamalahalla weir at RD. 0.0 km by 107.5 m for the link canal. The design of various components of lifting arrangements are discussed and furnished in **Chapter-6: Design aspects**. The efficiency of the pumping system is kept at 75%. The gist of the design details are furnished in **Table 9.9**.

Table 9.9: Lifting arrangements on link canal (Link-I)

RD of link canal (km)	Static head (m)	Size and No. of pumps MW x No.	Operating head (m)	Installed Capacity (MW)	Energy requirement (MU)
0.0 (At Shalamalahalla weir)	107.5	12.2x10 (including one standby)	134.15	122.0	137.90

The annual power requirement is worked out to be 137.90 MU for pumping. The details are furnished in **Annexure 9.1**.

Link - II

The surplus water at Suremane weir is proposed to be diverted to a stream leading to Dharma reservoir by lifting for 185.50 m (static) in 2 stages at RDs. 0.0 km(120.0m) and 10.90 km(65.5 m). The design of various components of lifting arrangements are discussed and furnished in **Chapter-6: Design aspects**. The efficiency of the pumping system is kept at 75%. The gist of the design details are furnished in **Table 9.10**.

Table 9.10
Lifting arrangements on link canal (Link-II)

RD of link canal (km)	Static head (m)	Size and No. of pumps MW x No.*	Operating head (m)	Installed Capacity (MW)	Power requirement (MU)
0.0 (Stage-I)	120.0	13 x 13	148.36	169.00	109.60
10.9 (Stage-II)	65.5	8.3 x 13	95.00	107.90	71.70
* Including one standby				Total	181.30

The annual power requirement is worked out to be 109.6 and 71.7 MU, for Stages-I & II of pumping respectively totaling to 181.30 MU. The details are furnished in **Annexures 9.2.1 & 9.2.2**.

9.6 Impact of link project on power scenario of the state

The total energy requirement of the link canal (Link - I & Link - II) is 319.20 MU. This requirement could easily be met, in the light of the following.

(i) Karnataka is the leading power generating state with a total installed capacity of 27,950MW (as on 31.12.2020). The State Government has taken various initiatives to implement projects in public as well as private sectors and has also introduced power sector reforms.

(ii) The Govt. of Karnataka has also drawn up plans to make the state power surplus, besides taking up remedial measures to control the high transmission and distribution losses and debilitating thefts.

(iii) Keeping in view the importance of meeting the irrigation needs of water short Tungabhadra sub basin, it is proposed that the requirement of power to the extent of 319.20MU needed by the Bedti-Varada link project can be met from the locally available sources of Govt. of Karnataka, which seems technically feasible.

(iv) Further, there may be number of pump sets already working to serve limited patches in the proposed command area of Tungabhadra. Providing irrigation through the link canal will help save that much power. This further reduces the losses considerably as the power outlets are minimized. Power theft also could be avoided to some extent.

(v) There is a tendency among farming community to have individual open wells with pump sets in isolation and to extract ground water to the alarming depths. The link canal will augment part of irrigation demands in the region and the ground water will be maintained at safer levels, in addition to saving energy.

Hence, diversion of water through 'Bedti - Varada link project' is not likely to have any adverse effects on the power scenario of Govt. of Karnataka.