Chapter 9
Power

9.1 General

The conveyance system of Godavari (Inchampalli) - Cauvery (Grand Anicut) link project is provided with 4 stages of lift in its reach from Inchampalli barrage to Nagarjunasagar along with the open channel to facilitate lifting of waters at various locations as the canal encounters a gradual rise while traversing its path from Godavari to Krishna. Thus, power becomes a vital input to this link project. Hence, an attempt is made to illustrate the availability of power in the region and the effect of link project on power scenario of the region in detail.

9.2 Present status of power development

9.2.1 Telangana

As per the statistics of the Central Electricity Authority (CEA), Govt. of India, Telangana has an installed capacity of 15,944 MW as on 31.12.18. It comprises 9510 MW of Thermal, 2480 MW of Hydro, 3806 MW of Renewable energy and 148 MW of Nuclear energy. The energy requirement of the state is supplied from the plants of the Telangana State Power Generation Corporation Ltd., (TSGENCO), Independent Power producers (IPPs), Central Sector allocations and renewable energy generators. TSGENCO is the major generation utility in the state with a total installed capacity of 5295 MW including thermal generation capacity of 2883 MW, hydro capacity of 2412 MW and solar capacity of 1.0 MW. The category wise break-up of installed capacity of TSGENCO is given in **Table 9.1.**

Table - 9.1 Installed capacity of TSGENCO

Sl.No	Power sector	Installed capacity (MW)
1	Thermal power plants	2882.50 MW
2	Hydel power plants	2411.76 MW
3	Solar power plants	1.00 MW
4	**Total installed capacity of TSGENCO**	**5295.26 MW**

A Thermal power plants

Sl.No.	Name & Address	Capacity (MW)	Unit size
1	RTS- B, Ramagundam, Peddapalli (Dt).	62.5	(1x62.5 MW)
2	KTPP I & II, Chelpur Jayashankar Bhupalpally (Dt)	1100	(1x500MW)+(1x600MW)
3	KTPS(O&M), Paloncha, Bhadradri Kothagudem (Dt).	720	(4x60MW+4x120 MW)
4	KTPS V & VI, Paloncha Bhadradri Kothagudam (Dt).	1000	(2x250MW +1x500MW)
	Total	**2882.50**	

B. Hydel power plants

Sl.No.	Name & Address	Capacity (MW)	Unit size
1	Pochampad, Nizamabad (Dist)	36.0	(4x9 MW)
2	Nizam Sagar HES, Hasan Palli, Nizamabad (Dist)	10.0	(2x5 MW)
3	Singur HES, Pulkal , Medak (Dist)	15.0	(2x7.5 MW)
4	PJHEP, Revulapallay Village, Jogulamba (Gadwal) (Dist)	234.0	(6x39 MW)
5	Srisailam Left bank HES, Srisailam dam west, Srisailam, Eagalapenta, Nagarkarnool (Dist).	900.0	(6x150 MW)
6	Nagarjunasagar left canal,	60.0	(2x30MW)

	,Pylon Nalgonda (Dist)		
7	NSHES, Pylon Colony, Nalgonda (Dist)	815.6	(1x110MW)+(7x100.8 MW)
8	Paleru	2 .0	(2x1MW)
9	Peddapalli MHS	9.16	-
10	LJHES,Lower Jurala, Jogulamba, Gadwal (Dist)	240.0	6x40 MW
11	Pulichintala HES, PCHES Pulichintala, Vazenepally village, Suryapet (Dist)	90.0	3x30 MW
	Total	**2411.76**	

C. Solar power plant

Sl.No	Name & Address	Capacity (MW)	Unit size
1	Solar plant at PJHEP, Revulapally, Jogulamba, Gadwal (Dist)	1.0	

Capacity addition

TSGENCO is also implementing capacity addition programmes of about 9320 MW. Project execution works of 3230 MW projects are in full swing and 6090 MW projects are in advanced stages of planning. Further, TSGENCO is aware of next green power scenario from non conventional energy resources and has a clear vision for Green Power development in Telangana.

Non-conventional Energy (NCE) sources in the state consist of Biomass, Bagasse, Solar, Wind, Mini Hydel and Waste based power projects. Telangana has large untapped non-conventional energy potential. Total installed capacity of NCE sources is a mere 2% of the total potential. Current energy mix of Telangana is coal-dominated. With coal sources depleting fast and uncertainty and

constraints on natural gas availability, there is an urgent need for Telangana to improve its energy mix with higher contribution from NCE sources. Currently share of NCE in Telangana is very low in comparison to other states such as Madhya Pradesh (7%), Rajasthan (24%) and Tamil Nadu (38%). The existing installed capacity of renewable energy sources is furnished in **Table 9.2.**

Table 9.2 Existing installed capacity of renewable energy sources

All fig in MW	Solar	Wind	Biomass	Bagasse	Others	Total
Existing Capacity	119	400	46	72	26	663

Capacity additions planned

Telangana has an advantage of high solar insolation at 5.0 w/m^2. The state has taken several key measures to attract solar companies. It has plans to increase the installed capacity of solar projects from 119 MW in FY 2014-15 to 6,135 MW in FY 2018-19. It has already concluded bid process for procurement of 515 MW of solar power through tariff-based competitive bidding and has received one of the lowest tariffs in the country with the least tariff being Rs 6.45/kwh.

To further promote solar power, the state has notified integrated and comprehensive solar policies, which includes; facilitation of expeditious approvals, deemed conversion to non-agricultural land status, exemption from land ceiling Act, exemption of wheeling and transmission charges for captive use within the state, banking of 100% of energy during all 12 months of the year, exemption of electricity duty, 100% exemption on cross subsidy surcharge as determined by Telangana State Electricity Regulatory Commission (TSERC) for five years, 100% refund of VAT/SGST for all the inputs required for solar power projects, incentive in terms of 100% refund of stamp duty for land, required clearances under pollution control laws as Solar Power Projects (SPPs) are part of green energy.

In addition to the above, the state is planning to set-up Gigawatt(GW) scale solar parks/ solar zones over the next five years. A dedicated Green Energy Corridor with evacuation capacity of over 3,500 MW (of which about 3,100 MW of solar capacity is expected to come up in the next five years) is being planned by Transmission Corporation of Telangana Limited (TSTRASNCO) to provide evacuation infrastructure for these solar parks. Other initiatives include implementation of solar pump sets, solar roof-top systems and solar off-grid systems through the decentralized distribution generation model

Power Consumption Pattern

The power consumption pattern among various uses shows that the industrial sector in the State is the largest consumer of electricity (about 37 per cent), followed by the domestic sector (23 per cent) and agri-sector (about 23 per cent). The three together account for about 83 per cent of the total consumption in the State.

Future plans of power development

Telangana State is expected to procure additional power of 4,733 MW from central generating stations (CGS) which are planned to be commissioned during next five years. The Telangana State also plans to procure power of 4,819 MW from other long-term sources which also includes power from upcoming Singareni - Stage 2. Power supply from long-term sources is furnished in **Table 9.3.**

Table 9.3 Power supply from long-term sources

Generating station	**Contracted capacity of Telangana State Distribution Companies (TSDISCOMS) (MW)**
Singareni Stage 1	1,200
Thermal Power Tech	269
Chhattisgarh Power Plant (Long Term	2,000

MoU)	
Long Term Bidding – Design, Build, Finance, Own and Operate model (DBFOO)	750
Singareni Stage-2	600
Total	4,819

Rise in agricultural demand is planned to be served using renewable sources, more specifically using the solar power generation. Total renewable capacity additions as planned by Telangana State is 6,016 MW by 2018-19 as mentioned in **Table 9.4.**

Table 9.4 Renewable capacity addition

Source	**Capacity (MW)**
NCE-Solar Competitive Bidding Upcoming in FY 15-16	550
NCE-Solar Competitive Bidding Upcoming in FY 16-17	2366
NCE-Solar Parks/ Solar Zones Upcoming in FY 17-18	1700
NCE-Solar Parks/ Solar Zones Upcoming in FY 18-19	1400
Total	**6016**

With the above mentioned capacity additions, Telangana State will have a cumulative 22,408 MW from all upcoming sources by FY 2018-19, comprising 35% from State generating stations, other generating stations (26%) and central generating stations (22%).

Demand supply position

Being a key component of the infrastructure needed to boost any economy, power shortage has been spreading ripples of concern in corporate and business

circles in the State. For, going by the present generation and distribution capacities, Telangana State has been facing a power shortage.

The energy requirement has been computed incorporating suitable growth rates and it includes demand from additional parameters like LI schemes, Water Grid Projects, 9 hour agricultural supply, 24 hours of rural supply, and Hyderabad Metro Rail loads. Based on these parameters the State of Telangana which has been facing power shortage is expected to emerge surplus by 8,604 MU by FY 2018-19. The demand supply scenario of Telangana State is furnished in **Table 9.5.**

Table 9.5 Demand supply scenario for Telangana State

Parameter	**FY 14-15**	**FY 15-16**	**FY 16-17**	**FY 17-18**	**FY 18-19**
Availability	48,788	56,236	70,599	88,546	114,593
Demand	50,916	60,313	74,081	92,475	105,974
Deficit(-)/Surplus(+) as % of demand	-4.2%	-6.8%	-4.7%	-4.2%	+8.1%
Deficit/ Surplus	-2,128	-4,077	-3,482	-3,929	8,619

Hence, the State of Telangana is expected to be energy surplus by year 2018-19 on the expectation that all the generation plants are operational as per their scheduled dates.

Lower Plant Load Factor (PLF)

TSGENCO stations are required to perform at 90% PLF (gross generation), to enable Telangana to achieve ‘Power for All’. But, the stations of TSGENCO are not able to generate to such optimum limit due to fuel constraints. The current PLF of TSGENCO plants is 74.5% which is far less to achieve the objective of 24x7 power for all. Low PLF can be majorly attributed to shortage in availability of domestic coal.

9.2.2 Andhra Pradesh

As per the statistics of CEA, Andhra Pradesh is one of the major power generating States in India with installed capacity of 23726 MW as on 31.12.2018. It comprises 14644 MW of Thermal, 1674 MW of Hydro, 7282 MW of Renewable energy and 127 MW of Nuclear energy. The energy requirement of the State are supplied from the plants of the Andhra Pradesh Power Generation Corporation (APGENCO) Ltd., independent power producers (IPPs), central sector allocation and renewable energy generators. APGENCO is the major generation utility in the State with a total installed capacity of 4613 MW including a thermal generation capacity of 2810 MW, hydro capacity of 1798 MW and solar capacity of 5 MW. The category wise break-up of installed capacity of APGENCO is given in **Table 9.6.**

Table - 9.6 Installed capacity of APGENCO

Sl.No	Name & Address	Capacity (MW)	Units
A.	**Thermal Power:**		
1	Dr Narla Tata Rao (Vijayawada) TPS Stage-I,II,III	1260	6 x 210 MW
	Ibrahimpatnam, Krishna ((Dist))		
2	Dr Narla Tata Rao (Vijayawada) TPS Stage-IV	500	1x500 MW
	Ibrahimpatnam, Krishna ((Dist))		
3	Rayalaseema TPP Stage-I,II,III	1050	5x210 MW
	V V Reddy Nagar, Kadapa (Dist)		
	Total thermal		**2810.0 MW**
B	**Hydel power**	**Capacity (MW)**	**Unit size**
1	Machkund PH *	84.0 (AP Share)	3x17 MW + 3 x 23MW
	Onukudelli - 764002, Koraput (Dist), Orissa		

2	Tungabhadra Dam PH *	28.8	4 x 9 MW
	TB Dam - 583225,Bellary (Dist), Karnataka		
3	Hampi PH, *	28.8	4 x 9 MW
	Hampi - 583215,Bellary (Dist), Karnataka		
4	Upper Sileru PH	240.0	4 x 60 MW
	Upper Sileru - 531105, Visakhapatnam (Dist)		
5	Donkarayi Canal PH	250.0	1 x 25 MW
	Donkarayi - 531110, East Godavari (Dist)		
6	Lower Sileru PH Mothugudem - 507113, Khammam (Dist)	460.0	4 x 115 MW
7	Srisailam Right Bank PH	770.0	7 x 110 MW
	Sunnipenta, Srisailam - 518102, Kurnool (Dist)		
8	Nagarjunasagar Right Canal PH	90.0	3 x 30 MW
	Vijayapuri South - 522439, Guntur (Dist)		
9	Penna Ahobilam HES	20.0	2 x 10 MW
	HLC Colony, Anantapur - 515004		
10	Chettipeta mini hydel	1.0	2 x 0.5 MW
	Chettipeta - 534357, West Godavari (Dist)		
11	Nagarjuna Sagar Tail Pond Power House	50.0	2 x 25MW
	Satrasala, Guntur (Dist)-522421		
	Total Hydro		**1797.6 MW**
C	**Non-Conventional Power:**		
1	Polavaram Right Canal Bund Solar	1x5 MW	5 MW

	PV Plant		
	Gollagudem, West Godavari (Dist)		
	Total Non-conventional power		**5MW**
	Grand Total (A+ B+ C)		**4612.6 MW**
*	InterState projects maintained by APGENCO		

Capacity addition

Existing generation capacity allocation for Andhra Pradesh from existing and under construction projects (Thermal & Hydel) has been considered in the proportion of 46.11% for APGENCO & IPPs and 47.88% for CGS stations and 100% for NCE projects. The total generation capacity of Andhra Pradesh as on 2nd June 2014 was 8,307 MW as per power allocation.

Future Generation Plans

The capacity addition to the tune of 3850 MW is planned by Govt of Andhra Pradesh under State sector. The details are furnished in **Table 9.7**

Table 9.7 Capacity addition under State sector

Sl.No.	Scheme	Capacity (MW)
1	Krishnapatnam stage- I Unit 1 Krishnapatnam stage-I Unit II	800 800
2	RTPP – Stage IV	600
3	Nagarjunasagar tail pond (HEP)	50
4	Krishnapatnam Stage- II*	800
5	Vijayawada Thermal Power Station (VTPS) Stage V*	800

*****Not considered for energy availability / supply projections till FY 2018-19

Capacity addition from various sources is furnished in **Table 9.8 and 9.9**.

Table 9.8 Capacity addition from various sources

Particulars	**FY 14-15**	**FY 15-16**	**FY 16-17**	**FY 17-18**	**FY 18-19**	**Total**
State Thermal Total	1,600	600	600	0	0	2,800
State Hydel Total	170	150	90	0	0	410
Central Generating Stations Total	255	551	329	614	200	1,949
Others Total	520	1,020	1,050	0	0	2,590
Total Capacity Addition	**2,545**	**2,321**	**2,069**	**614**	**200**	**7,749**

Table 9.9 Capacity addition from upcoming RE projects (MW)

Particulars	**FY 14-15**	**FY 15-16**	**FY 16-17**	**FY 17-18**	**FY 18-19**	**Total**
NCE - Solar	30	800	1200	1500	1500	5,030
NCE-Wind Power	250	600	800	1000	1500	4,150
Total	280	1,400	2,000	2,500	3,000	9,180

Adequacy of generation capacity both existing & upcoming has been analyzed for meeting the projected peak demand and the same are given in the **Table 9.10.**

Table 9.10 Capacity available for meeting peak demand (MW)

Particulars	**FY 2014-15**	**FY 2015-16**	**FY 2016-17**	**FY 2017-18**	**FY 20 18-19**
Upcoming conventional capacity - Cumulative (A)	1,178	2,258	3,218	3,512	3,608
Load adjusted capacity (B=A*70%)	825	1,581	2,253	2,458	2,526

Contribution of NCE towards peak demand - Cumulative (C)	134	246	406	606	846
Power procurement through competitive bidding (D)	1,400	1,900	1,900	1,900	1,900
70% of existing capacity of 6910 MW (E)	4,837	4,837	4,837	4,837	4,837
Final projected capacity available for meeting peak demand (F)	7,196	8,564	9,396	9,801	10,109
Projected peak demand (G)	9,220	10,211	11,181	12,264	13,436
Additional capacity required to meet the projected demand	2,024	1,647	1,785	2,463	3327

The likely installed capacity from all sources (existing & upcoming) by FY 2018-19 is 13,264 MW, thus leaving a shortfall of 3,300 MW during peak hours in FY 2018-19. The NTPC has also proposed to set up a 4000 MW ultra mega power plant at Pudimadaka in Vishakhapatnam district, which is scheduled to be completed by FY 2019-20. Efforts are also being made to utilize the stranded gas based capacity in the State.The requirement of electricity both energy and peak demand in Andhra Pradesh are expected to increase significantly from the present level of 43,684 MU & 6,158 MW to 82,392 MU and 13,436 MW respectively by FY 2018-19. To meet this growing demand, robust & reliable transmission network is required both at InterState & Intra State level.

Renewable sources

The existing renewable capacity is about 1,397 MW (Wind-777MW, Solar-77MW, Others- 543MW) as on June 2014. It is envisaged to add about 9,150

MW renewable capacities by FY 2018-19 mainly through solar and wind generation. Out of this, 7,150 MW (Wind: 4150MW & Solar: 3000MW) would be developed as grid connected for which transmission system strengthening is required. Balance 2,000 MW capacity (majority solar) would be developed as distributed generation projects including roof-top solar, and therefore would be connected to the DISCOMs' network (33/11 kV substations). As part of the above mentioned 2000 MW distributed generation, AP will be shortly inviting tenders for 1000 MW (+/- 20%) of solar projects. Details of wind and solar capacity addition programme are given at **Table 9.11.**

Table 9.11 Details of solar and wind capacity addition programme in Andhra Pradesh

Particulars	Unit	Wind	Solar	Others	Total
Existing capacity (June 2014)	MW	777	77	543	1397
Envisaged addition (2018-19)	MW	4150	3000	-	7150
Total	**MW**	**4927**	**3077**	**543**	**8547**

9.2.3 Tamil Nadu

As per the statistics of CEA, Tamil Nadu is one of the largest power generating States in India with installed electricity generation capacity of 30447 MW as on 31.12.2018. The energy requirements of the State are supplied from the plants of the Tamil Nadu Generation and Distribution Company Ltd., (TANGEDCO), Independent Power producers (IPPs), Central Sector allocation and renewable energy generators. TANGEDCO is the major generation utility in the State with a total installed capacity of 18733 MW including thermal generation capacity of 8220 MW, hydro capacity of 2585 MW, gas-based capacity of 672 MW and solar capacity of 180 MW. The category wise break-up of installed capacity of TANGEDCO is given in **Table - 9.12.**

Table 9.12 Installed capacity of TANGEDCO

Sl.No	Name & Address	Capacity	Programme of Commissioning
1	NCTPS-Stage-II Unit-1	1x600MW	Commercial Operation Declaration on 20.3.2014
2	NCTPS-Stage-II Unit-2	1x600MW	Commercial Operation Declaration on 08.05.2014
3	MTPS Stage-III	1x600MW	Commercial Operation Declaration on 12.10.2013
4	ENNORE SEZ Environmental Clearance	2x660MW	The project is expected to be commissioned in March 2018
5	ETPS Expansion project Environmental Clearance	1x660MW	The project is expected to be commissioned in January, 2018.
6	NCTPS Stage-III Environmental Clearance EC Compliance Report	1X800MW	The project is expected to be commissioned in July 2019
7	UPPUR Environmental Clearance	2X800MW	The project is expected to be commissioned in September,2019
8	UDANGUDI	2X660MW	The project is expected to be Commissioned in April 2021 / June 2021.
9	Periyar Vaigai 3 SHEP	2X2 MW	Unit I & II synchronised on 11-09-2013& 9-10-2013 respectively
10	Periyar Vaigai 4 SHEP	2x1.25MW	October 2014
11	Bhavani Barrage 1 HEP	2x5 MW	September 2014
12	Bhavani Barrage 2 HEP	2x5 MW	Unit I & II synchronised on 26-10-2013& 29-10-2012respectively
13	Kundah pumped storage hydro-electric project (4x125MW)	4x 125MW	The project is expected to be commissioned on 2021-22.

14	NTPC TNEB Energy Co. Ltd.(NTPC-TNEB joint venture)	3x500 MW	29/11/2012 - Unit-1 25/08/2013 - Unit-2 26/02/2015 - Unit-3
15	NLC Tamil Nadu Power Ltd (NLC- TNEB joint venture)	2x500MW	18/06/2015 - Unit-1 29/08/2015 - Unit-2

Capacity addition

The State draws power from its generating stations, private producers including renewable energy generators and has allocation from central generating stations. The total installed capacity in the State, (including own generating stations, IPPs and central allocation) is 24,433 MW. **Table 9.13** gives the break-up of the installed capacity.

Table 9.13 Installed capacity (MW) as on 31.03.2016

Sector	Thermal	Hydro	Hydro (RE)	Other RE	Total
State	5,176	2,185	123	17	7,501
Central	5,464	0	0	0	5,464
IPP+CPP	1,839	0	0	9629	11,468
Total	12479	2185	123	9646	24433

The share of thermal stations in the installed capacity stands at 51%. The State sources contribute to 31% of installed capacity (51% excluding RE Sources), whereas the private sector comprising of mostly RE sources contributes 39% of the installed capacity. The details of the projects are shown in **Table 9.14 to 9.17**.

Table 9.14 The State owned power plants in Tamil Nadu

Name of Plant	Fuel	Installed capacity (MW)	PLF (FY16)
Ennore Thermal Power Station	Thermal	340 (2x60+2X110)	14.81%
Mettur Thermal Power Station I	Thermal	840 (4X210)	81.01%
North Chennai Thermal Power Station – Station I	Thermal	630 (3X210)	80.39%
Tuticorin Thermal Power Station	Thermal	1,050 (5X210	76.80%
Mettur Thermal Power Station II	Thermal	600 (1X600)	74.49%
North Chennai TPS - Station II	Thermal	1,200 (2X600	61.65%
Hydro Plants Existing	Hydro	2,185.2	-
Hydro Plants Existing (RE)	Hydro	122.7	-
Basin Bridge Gas Turbine Power Station-BBGTPS	Naptha	120(4X30)	1.52%
Kuttalam Gas Turbine Power Station-KGTPS	Natural Gas	101	63.54%
Thirumakottai Gas Turbine Power Station-T(K)GTPS	Natural Gas	107.88	42.12%
Valuthur Phase-II Gas Turbine Power Station-VGTPS-II	Natural Gas	92.2	
Valuthur-Phase-I Gas Turbine Power Station-VGTPS-I	Natural Gas	95	86.42%
Total		**7,484**	

Table 9.15 Power plants under Construction (State) in Tamil Nadu

Sl.No	Name of Plant	Proposed capacity (MW)
1	ETPS Expansion Project	660
2	Ennore Sez Supercritical Thermal Power Project	1320

3	Kundah Pumped Storage Hydro Electric Project	500
4	Uppur Thermal power project	1,600
5	NCTPP Stage III	800

Table 9.16 Capacity addition MW (State and central Sources) in Tamil Nadu

Project	**Capacity Installation/Share**	**EXP COD**
Kudankulam APS (Unit 2 - 1000MW)	562	FY 17
Kudgi STPP Units-I (2x800MW)	100	FY17
Cogeneration Power Projects	165	FY17
PFBR Kalpakkam (1x500MW)	167	FY18
Neyveli New TPP at Neyveli (2x500 MW)	327	FY18
Kudgi STPP Unit II &III (2x800 MW)	201	FY18
ETPS Supercritical Expansion Project	660	FY19
New TPP at Neyveli Unit-II 2x500 MW)	327	FY19
Total	**2,509**	

Table 9.17 Planned capacity addition in renewable energy (2014-19)

Source	**Capacity (MW)**
Wind Power	2,000
Solar	3,000
Biomass/Biogas	100
Co-generation	165
Total	**5,265**

Existing sources

Presently the State has total RE based installed capacity of 9,687 MW which includes 1,155 MW of solar energy (including 54.97 MW of solar rooftop) based projects and 7,642 MW of wind based capacity. The details of total RE based installed capacity (as on 01 Sep 2016) are provided in **Table 9.18.**

Table 9.18 RE installed capacity

Plant name	**Capacity (MW)**
Solar	1,155.38
Wind	7,642
Bagassse based co-generation plant	659.40
Biomass	230.00
Total	**9,686.78**

It is observed that the entire solar and wind capacity in the various districts of the State is privately owned. The details are furnished in **Table 9.19 and 9.20.**

Table 9.19 Existing solar capacity

Sl.	Name of District	Installed Capacity (MW)	Private / State Owned
1	Sivagangai	11.55	Private
2	Nagapattinam	1.00	Private
3	Madurai	1.00	Private
4	Thoothukudi	28.00	Private
5	Coimbatore	7.00	Private
6	Tirupur	37.26	Private
7	Erode	1.00	Private
8	Virudhunagar	199.40	Private
9	Dindigul	59.60	Private

10	Tirunelveli	9.36	Private
11	Gobi	3.00	Private
12	Trichy	166.00	Private
13	Vellore	5.00	Private
14	Karur	151.49	Private
15	Krishnagiri	0.75	Private
16	Ramnad	348.00	Private
17	Perambalur	10.00	Private
18	Cuddalore	10.00	Private
19	Tiruvannamalai	30.00	Private
20	Pudukottai	20.00	Private
21	Kaniyakumari	1.00	Private
	Total	**1100.41**	
	In addition to the above of there is 55 MW of Roof Top Solar PV.		

Table 9.20 Existing wind capacity

Sl	Name of the Project	Capacity MW
1	Tirunelveli District	3,700
2	Tuticorin District	245.970
3	Kanyakumari District	118.815
4	Ramnad District	2.150
5	Coimbatore District	355.250
6	Tirupur District	2,264.980
7	Dindigul District	420.000
8	Theni District	534.700
9	Chennai	0.225
	Total	**7,642.09**

Capacity Additions -RE Plan in Tamil Nadu

The State has capacity addition plans in the renewable energy categories for the years FY17 to FY19 during which as per the projected figures, 5,265 MW is

expected to be added through RE Sources. The details are furnished in **Table 9.21**.

Table 9.21 Renewable power addition plans

Year	Wind (MW)	Solar PV/Solar Thermal (MW)	Bio Mass (MW)	Bagasse based Co.Gen (MW)	Total (MW
FY 17	500	1,000	-	165	1,665
FY18	750	1,000	50	-	1,800
FY 19	750	1,000	50	-	1,800
Total	2,000	3,000	100	165	5,265

Demand supply position

The demand supply position in the State is better than the national average (2.1% energy deficit and 3.2% peak deficit). The FY16 power supply position is shown in the **Table 9.22.**

Table 9.22 Power supply position FY 2016

Demand Supply Position	Peak (MW)		Energy (MU)
Demand	14,533		1,00,319
Availability	14,533		99,691
Surplus/ Deficit	0%		(0.63)%

Per capita consumption including all losses in Kwh for last five years

Item	FY11	FY12	FY13	FY 14	FY 15	FY16
Per capita consumption (Kwh)	1040	1065	1111	1196	1228	1280

9.3 Power requirements

Power is required for the proposed link project in order to lift the canal water in four stages at different RDs in the reach from Inchampalli to Nagarjunasagar to facilitate the link to serve upland areas and deliver waters in Nagarjunasagar reservoir. Besides, at RD 105 km pumping is involved to lift waters from the link canal to NSLBC feeder canal.

9.3.1 Power requirement of main link canal

The link canal takes off from the proposed Inchampalli barrage on Godavari. The topography along the link canal necessitates the provision of lifting arrangements at certain places to irrigate the command area. Lifting arrangements are proposed in four stages at RDs. 0 km(57 m), 18 km(38m), 26.5 km(23m) and 60.5 km(11m) 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 89%. The gist of the design details are furnished in **Table 9.23.** The details are presented in **Annexure 9.1**.

Table 9.23: Lifting arrangements on link canal

Stage	Location RD in km	No. of units x cap. (MW)	Energy required (MU)
I (Main canal)	0.00	20 x 28.9 = 578	1296
II (Main canal)	18.00	20 x 21.6 = 432	970
III (Main canal)	26.50	20 x 14.4 = 288	647
IV (Main canal)	60.50	20 x 8.0 = 160	360

I (Lead canal)	0.00	2 x27.7 =	55	110
I (Gottimukkala feeder)	0.00	2 x 32.8 =	66	90
II (Gottimukkala feeder)	75.00	2 x 30.8 =	62	84
III(Gottimukkala feeder)	95.00	2 x 38.1 =	76	104
I Srisailam LBC (AMRLIS)		2 x 35.7 =	71	69
692.276*				115
Total			**1788**	**3845**

*Pumping for varying height of 1 to 2 m during May to October at the exit of the tunnel near Somasila off-take.

The following civil and electrical works would be required to be undertaken for each of the lifting arrangements.

Civil works

i) Unitised sump
ii) Suction pipes
iii) Pump house to accommodate pumps and motors
iv) Delivery pipes
v) Delivery mains
vi) Delivery cisterns

Electrical works

i) Pumps & control equipment
ii) Pump auxiliaries
iii) Transformer and outdoor equipment

9.4 Power potential of the link project

The link canal is proposed to be utilized for power generation through a) canal head powerhouse at Nagarjunasagar reservoir & proposed power house at Musi reservoir. b) Solar power all along the 1210.841 km long link canal.

9.4.1 Power generation from canal head power house at Nagarjunasagar

The link canal is proposed to be taken off from the existing Nagarjunasagar dam (FRL 179.83m), parallel to the Nagarjunasagar right bank canal (NSRBC) and at the same elevation of 155.45 m. Hence, it is proposed to construct a powerhouse on the link canal similar to the existing powerhouse on NSRBC utilizing the head available. The water to be drawn into the link canal would be guided through the powerhouse. It is proposed to install 4 units of 30 MW each, including one standby unit. Thus, the effective installed capacity of the powerhouse would be 90 MW. The head regulator of the link canal is proposed to be similar to that of the existing one on NSRBC but with 8 vents of size 3.05 m x 4.575 m with sill level of 149.05 m. A power block of length 70 m with 4 penstocks and dam toe powerhouse of size 67m x 39 m is proposed on the right side of the existing similar structures of NSRBC. The water after power generation using the available head would be guided to the link canal through a 130 m long tailrace channel. Suitable modifications to the right embankment of Nagarjunasagar dam are proposed to be carried out for accommodating the head regulator, power block along with penstocks, leading to the powerhouse on the link canal. The computation of power generation is shown in **Annexure 9.2**

The following civil and electrical works would be required to be undertaken for the proposed powerhouse.

Civil works

(i) 4 Nos. of trash rack structures
(ii) Power house civil works
(iii) 4 Nos. of penstocks of 6 m dia and 133 m long
(iv) Intake gate shafts

(v) Power house pit to accommodate 4 Nos. of turbines and generating units
(vi) Draft tube gate shaft to connect the runner to the tail race
(vii) Switch yard
(viii) Tail race pool and tailrace channel to join the link canal

Electrical works

(i) Power station, generating and control equipment
(ii) Power station auxiliaries
(iii) Power station transformer and outdoor equipment

The envisaged power generation from the link canal at Nagarjunasagar is shown in **Table 9.24.**

Table 9.24 Power generation from the canal power house at Nagarjunasagar

Sl.No.	RD (km)	Head available (m)	Capacity suggested	Annual energy generation MU
1.	340 km	20.4	4 x 30 MW	220

9.4.2 Proposed canal power house at Musi reservoir

A 299.256 km long Inchampalli - Nagarjunasagar link canal, on its way outfalls into the existing Musi balancing reservoir at RD 199.15 km with FSL 197.52 m . The FRL of Musi reservoir is 197.00 m. The link canal again takes-off from the Musi reservoir with FSL of 187.30 m. The head available at Musi reservoir is about 9.70 m which is adequate for generation of power in the form of mini hydel scheme (canal power house). Hence, a canal power-house has been proposed at the canal offtake from Musi reservoir for generation of power by utilising the head of about 9.70 m, available between the reservoir FRL and the canal FSL. The water to be drawn from the Musi reservoir for onward transmission to the link canal will be guided through this power house to generate power. It is proposed to install 7 units of 10 MW bulb turbines with one standby unit. The effective installed capacity of the powerhouse will be 70 MW. An

approach channel of 3 km long from the reservoir to the powerhouse is proposed to suit the topography at the Musi head works. The water after power generation will be released to the main canal through a tailrace channel. A bypass channel with regulatory arrangements has also been proposed to control the water supplies when the powerhouse is not in operation. The design of canal powerhouse at Musi reservoir is given in **Annexure 6.13.** The annual power generation shall be 146 MU as assessed in **Annexure 9.2**. The layout plan and sectional elevation of the canal power house are shown in **Plates-9.1 and 9.2** respectively. The following civil and electrical works will be required to be undertaken for the proposed canal power house at Musi reservoir.

9.4.3 Solar power

The solar power potential studies of the 426 km long Wainganga (Gosikhurd) - Nalganga (Purna Tapi) intra State link project were entrusted to Gujarat Energy Research and Management Institute (GERMI) Gandhinagar. The report assessed the solar potential of the link project at 1884 MW.This is expected to generate 3768 MU considering 6 hours of sunshine on average in a day. This corresponds to 4.4 MW/km of power potential and 8.8 MU/km of energy. The solar potential and energy of Godavari (Inchampalli) - Cauvery (Grand Anicut) link(1211 km) estimated on the similar lines, works out to 5328 MW and 10657 MU respectively. The details are given in **Table 9.25.**

Table 9.25 Solar power potential over the link canal

Sl.No.	Length of canal (km)	MW/km	Potential	MU/km	Energy (MU)
1	1211	4.4	5328	8.8	10657

9.5 Effect of Godavari (Inchampalli) - Cauvery (Grand Anicut) link project on power scenario of southern States.

The energy requirement of the link canal is 3845 MU. This requirement could easily be met, in the light of the following situation:

1. The States of Telangana, Andhra Pradesh and Tamil Nadu have initiated several measures to increase the power generation to cater to the future demands and also for energy conservation. There is increased focus on non-conventional energy sources like solar power and wind power.

2. The power utilized for agriculture is about 23 percent in Telangana, Andhra Pradesh and Tamil Nadu which is lower than that utilized for industries. This is in contrast with the scenario in other frontline States with predominantly agrarian culture where the power consumption for agriculture is more than 40%. Hence, increased share for agriculture is justified in States like Telangana, Andhra Pradesh and Tamil Nadu keeping in view the demand for creation of more irrigation facilities.

3. Further, there may be number of pump sets already working to serve limited patches in the proposed command area of 887022 ha under this link canal. 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.

4. The link canal itself will contribute 10657 MWh/year of solar power and 366 MU of hydro power from canal power house.

5. 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.