

## **Chapter -9**

### **Power**

#### **9.0 General**

As already discussed, the conveyance system of Wainganga (Gosikhurd) – Nalganga (Purna Tapi) (W-N) link project involves multistage lifts in 6 stages to facilitate pumping of waters to the identified enroute storage reservoirs/tanks. The total static head involved is about 155 m. The installed capacity required is about 723 MW. Thus, power is one of the basic inputs necessary for the success of the proposed link project. Hence, it is imperative to establish the availability of power in the region and the effect of the link project on power scenario of the region in detail. In this regard, in accordance with the policy initiative of the Ministry of New and Renewable Energy, Govt. of India, an attempt has been made to explore the possibility of installing Grid connected Solar PV Power plants on canal top/banks along the proposed Wainganga (Gosikhurd) - Nalganga (Purna Tapi) link canal. Accordingly, Solar Power Potential Studies have been carried out as a pilot study through the Gujarat Energy Research and Management Institute (GERMI), Gandhinagar, Govt. of Gujarat. All these aspects are discussed in the present chapter.

#### **9.1 Status of Power Development in Maharashtra**

##### **9.1.1 Available Generating Capacity (MW) in Maharashtra State**

As per the statistics of the Central Electricity Authority (CEA), Govt. of India, Maharashtra is the largest power generating State in India with an installed generation capacity of 42029 MW (As on 31.10.2017). It comprises 30598 MW of Thermal, 3061 MW of Hydro, 7680 MW of Renewable Energy and 690 MW of Nuclear Energy. The energy requirements of the State are supplied from the power plants of the Maharashtra State Power Generation Company Ltd., (MAHAGENCO), Independent Power Producers (IPPs), Central Sector allocation and Renewable Energy Generators. MAHAGENCO is the major generation utility in the State with a total installed capacity of 13602 MW comprising a hydro capacity of 2580 MW, thermal generation capacity of 10170 MW, a gas-based capacity of 672 MW and solar capacity of 180 MW. The category wise/location wise break-up of installed capacity of MAHAGENCO is given in **Table - 9.1**

**Table - 9.1**  
**Category wise/Location wise Break-up of Installed Capacity of**  
**MAHAGENCO(As on 31.10.2017)**

Sl. No.	Power Station	Units and Size (MW)	Installed Capacity (MW)
<b>A Hydro Power Stations</b>			
1	Koyna Hydro	St. I & II: 4x 70 + 4 x 80, St. III: 4x 80, St.IV:4x250 and Koyna Dam Foot:2x18	1956
2	Small Hydro		374
3	Ghatghar Pump storage	2x125	250
		<b>Total</b>	<b>2580</b>
<b>B Thermal Power Stations</b>			
1	Koradi 6 to 10	2x210+3x660	2400
2	Nasik 3 to 5	3x210	630
3	Bhusawal 3 to 5	1x210+2x500	1210
4	Paras 3 & 4	2x250	500
5	Parli 4 to 8	2x210+3x250	1170
6	K'kheda 1 to 5	4x210 + 1x500	1340
7	Chandrapur 3 to 9	2x210 +5x500	2920
		<b>Total</b>	<b>10170</b>
<b>C Gas Turbine Power Station</b>			
1	Uran G.T.	4x108	432
2	W.H.R. 1and 2	2x120	240
		<b>Total</b>	<b>672</b>
<b>D Solar Power</b>			
		<b>Grand Total (A+B+C+D)</b>	<b>13602</b>

Source: Data updated by MAHAGENCO on 17<sup>th</sup> Nov 2017

### 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 1,15,046 Million Units (MU) during 2016-17 which was 1.1 per cent higher than that during the previous year. The share of public, private and public-private partnership in total electricity generation during 2016-17 was 43.3 per cent, 52.7 per cent and four per cent respectively. During 2016-17, the State

has received 32582 MU electricity from the Central Sector. Status of electricity generation in Maharashtra State during the year 2016-17 is shown in **Table - 9.2**

**Table - 9.2**  
**Electricity Generation in Maharashtra State during 2016-17**

Sl. No.	Item	2016-17
<b>1.</b>	<b>Generation (MkWh)</b>	
	a) Thermal	89,084
	b) Hydro	5,978
	c) Natural Gas	9,481
	d) Renewable Energy including and Captive Power	10,502
	<b>Total</b>	<b>1,15,046</b>

*Source: Economic Survey of Maharashtra 2017-18, Department of Economics & Statistics, Planning Department, Govt. of Maharashtra*

During 2017-18 upto December, the total electricity generated in the State was 74,968MU, 9.06 per cent lesser than that for the corresponding period of 2016-17. During 2017-18 upto December, the State has received 18626 MU electricity from the Central Sector.

### 9.1.3 Present Status of Utilisation of Power

Aggregate consumption of electricity in the State during 2016-17 was 1,08,455 MU, as against 1,16,743 MU in 2015-16 (lesser by 7.1 per cent). It was 65,980 MU in the year 2017-18 upto October, which was 11.1 per cent higher than that for the corresponding period of 2016-17. During the year 2016-17, the consumption of electricity by the industrial sector was the largest (31.2 per cent), followed by agriculture (26.1 per cent) and domestic sector (24.8 per cent) in the State. These three sectors together accounted for 82.1 per cent of the total electricity consumption. Per capita ultimate consumption for industrial use was about 282 units while that for Agriculture use was about 236 units and domestic use was about 225 units. Sector wise electricity consumed during the years 2014-15, 2015-16, 2016-17& 2017-18(upto October) is given in **Table 9.3**

**Table 9.3**  
**Sector wise Electricity Consumption by Different User Groups Unit:**  
**MU**

Sl. No.	Sector	April-March			April-October		% change in 2017-18 over 2016-17
		2014-15	2015-16	2016-17	2016-17	2017-18	
1	Industrial	41,522	40,231	33,833	19,302	22,313	15.6
2	Agriculture	26,407	28,236	28,272	11,174	13,245	18.5
3	Domestic	25,428	27,001	26,874	17,240	18,009	4.5
4	Commercial	12,504	13,182	12,872	7,807	8,288	6.2
5	Public Services	4,183	4,287	4,504	2,608	2,731	4.7
6	Railways	2,443	1,795	113	72	91	26.4
7	Other	368	2,011	1,987	1,204	1,303	8.2
	<b>Total</b>	<b>1,12,855</b>	<b>1,16,743</b>	<b>1,08,455</b>	<b>59,407</b>	<b>65,980</b>	<b>11.1</b>

*Source: Economic Survey of Maharashtra 2017-18, Department of Economics & Statistics, Planning Department, Govt. of Maharashtra*

#### 9.1.4 Capacity Addition

**Thermal Power:** Out of the projects of 2,570 MW under execution & commissioning by MAHAGENCO, projects of 1,910 MW have been commissioned during the year 2015-16 and Koradi Unit 10 (660 MW) is commissioned in January 2017. MAHAGENCO has accorded approval for implementation of the action plan for installation and commissioning of Flue-gas desulfurization (FGD) project at various thermal power stations of MAHAGENCO. Capacity of addition projects at Chandrapur-2,500 MW, Bhusawal-1,000 MW, Paras-1,250 MW, Khaparkheda- 500 MW and Koradi 1,320 MW are in process.

**Solar Power:** Solar power projects of 383 MW have been commissioned in the State as on 31<sup>st</sup> March, 2017. Solar power projects of aggregate 1,704 MW capacity are proposed on various locations in the State including the Govt. barren land, land in possession of MEDA, dam, canal & land of Irrigation Department.

**Renewable Energy:** Wind, solar, biomass, biogas, sea wavers, geo-thermal, etc. are the renewable, clean and eco-friendly energy sources. GoM has notified Maharashtra Energy Development Agency (MEDA) as the designated

agency to co-ordinate, regulate and enforce the provisions of the Energy Conservation Act, 2001. MEDA is actively engaged in propagation & promotion of renewable energy and implementation of energy conservation programmes. Potential and installed capacity of renewable energy is given in **Table 9.4**

**Table 9.4**  
**Potential and Installed Capacity of Renewable Energy Unit: MW**

Source	Potential Capacity	Installed Capacity As on 31 <sup>st</sup> March			As on 31 <sup>st</sup> October, 2017
		2015	2016	2017	
Wind	9,400	4,444	4,662	4,769	4,775
Biogas co-generation	2,500	1,415	1,415	1,849	1,849
Small Hydro Projects (SHP)	732	294	302	304	304
Biomass	831	200	200	215	215
Urban Solid Waste	287	3	3	3	3
Industrial Waste	200	32	34	9	9
Solar	7,500	329	362	383	624
<b>Total</b>	<b>21,450</b>	<b>6,717</b>	<b>6,978</b>	<b>7,532</b>	<b>7,779</b>

*Source: Economic Survey of Maharashtra 2017-18, Department of Economics & Statistics, Planning Department, Govt. of Maharashtra*

## 9.2 Power Requirement

Power is required for the proposed link project in order to lift the canal water in six stages at different RDs of the canal alignment to facilitate the link to serve uplands. Besides, at 5 locations pumping / lifting arrangements are planned to lift the water to the branch canals proposed in the project command area.

### 9.2.1. Power Requirement for Main Link Canal

The topography along the link canal necessitates the provision of lifting arrangements at certain places to irrigate the command area. Six lifting arrangements are proposed at RDs.2.40 km, 20.00 km, 39.90 km, 169.60 km, 176.90 km & 292.85 km 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 installed capacity required is about 723 MW and the annual energy requirement is worked out to be 839 MU. The details are furnished in **Table 9.5**.

**Table 9.5**  
**Lifting Arrangements on Link Canal and Annual Power Requirement**

<b>RD of link canal (km)</b>	<b>Static head (m)</b>	<b>Size and No. of pumps MW x No</b>	<b>Operating head (m)</b>	<b>Installed Capacity (MW)</b>	<b>Energy requirement (MU)</b>
2.40	23.25	3.9 x38	29.09	148.2	175.6
20.00	23.50	4.0 x38	29.94	152.0	180.7
39.90	29.25	5.2 x 36	36.56	187.2	207.6
169.60	28.00	4.6 x 20	32.43	92.0	108.5
176.90	30.00	5.0 x 20	35.04	100.0	117.2
292.85	21.25	3.6 x 12	24.82	43.2	49.2
	<b>155.25</b>			<b>722.6</b>	<b>838.8</b>

The detailed computations are furnished in **Annexure 9.1**. 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 house auxiliaries
- iii) Transformer and outdoor equipment etc.

### 9.2.2 Power Requirement for Branch Canals

Lifting arrangements are proposed at branch canal outlets across Borkhedi kalan branch (RD 115.45km), Sukhli branch (RD 147.55 km), Vai branch (RD 150.0km), Papal I branch (RD 246.3km) and Shelodi branch (RD 377.13 km) keeping in view the availability of command area, need for provision of irrigation and drinking water in the area and the topographical constraints for the flow irrigation. The energy requirement of these arrangements is 0.96 MU, 0.77 MU, 5.10 MU, 2.49 MU and 3.16 MU respectively, totaling to 12.5 MU. The details of computation are shown in **Annexure 9.2**. The details of the lifting arrangements on branch canals are furnished in **Table 9.6**.

**Table 9.6**  
**Lifting Arrangements on Branch Canals**

Name of branch	RD (km)	FRL (m)	FSL of link canal (m)	Operating head (m)	Size of pump (MWx No.)	Energy Reqt. (MU)
Borkhedi kalan	115.45	295	290.65	7.07	0.3x4	0.96
Sukhli	147.55	290	287.51	5.07	0.2x4	0.77
Vai	150.00	295	286.91	10.56	1.1x4	5.10
Papal I	246.30	340	332.88	10.25	0.6x4	2.49
Shelodi	377.13	330	324.26	8.26	0.8x4	3.16
<b>Total</b>					<b>12.0</b>	<b>12.5</b>

### 9.2.3 Anticipated Requirements of Energy (MU) and Peak Load (MW)

The 18<sup>th</sup> Electric Power Survey of India conducted by Central Electricity Authority (CEA), has estimated anticipated Electrical Energy Requirement and Peak Electric Load at Power Station Bus Bars for Maharashtra State for the years 2016-17, 2021-22, 2026-27 and 2031-32. The details are furnished in **Table - 9.7**

**Table - 9.7**  
**Anticipated Electrical Energy Requirement and Peak Demand**

State	Electrical Energy (MU)				Peak Electric Load (MW)			
	2016-17	2021-22	2026-27	2031-32	2016-17	2021-22	2026-27	2031-32
Maharashtra	169353	225606	310654	417826	28645	39622	54982	74528

### 9.3 Future Plans of Power Development in the State

Maharashtra State has plans for future power plants as furnished below:

#### **Future Power Projects (6090 MW)**

1. Uran Gas Based Combined Cycle Power Plant (1220 MW): (Block-I : 406 MW, Block-II: 814 MW)
2. Bhusawal TPS Unit 6 (1 x 660 MW )
3. Nasik TPS Unit 6 (1 x 660 MW)
4. Paras Thermal Power Project Unit 5 (1 x 250 MW)
5. Dondaicha TPS Unit – 1, 2, 3, 4 and 5 (5 x 660 MW)

#### **Solar Power Projects (450 MW)**

1. Sakri (Dhule) : 25 MW
2. Shirshuphal (Pune) : 50 MW
3. Kaudgaon (Osmanabad) Phase I,II : 50 MW each
4. Yadsi (Osmanabad) : 10 MW
5. Pokharni(Parbhani) : 50 MW
6. Anterveli (Parbhani) : 10 MW
7. Mangladevi (Yeotmal) : 80 MW
8. Malkhed (Yeotmal) : 125 MW

#### **Ongoing Thermal Power Projects (3230 MW)**

1. Chandrapur TPS Unit 8 and 9 (2 x 500 MW)
2. Parli TPS Unit 8 (1 x 250 MW)
3. Koradi TPS Unit 8, 9 and 10 (3 x 660 MW)

#### **9.3.1 Schemes under Construction/Expansion with Location**

##### **Ultra Mega Projects**

In addition to the State's power projects, the Government of India has proposed Ultra Mega Power Projects at coal put-heads and at coastal locations in



the country. In the tentative allocation from such projects, Maharashtra is expected to receive a total of 3800 MW, out of which 800 MW will be from the Mundra project in Gujarat, 2000 MW from Ratnagiri and 1000 MW from coastal Karnataka.

### **9.3.2 New Schemes Sanctioned Renewable Energy**

Wind, solar, biomass, biogas, wave, geo-thermal, etc. are the renewable, clean & eco-friendly energy sources. Wind power is planned to be developed over the 720 km long coastline of the State utilising the strong southwestern monsoon winds and the presence of the Sahyadri range alongside the coast. Maharashtra Energy Development Agency (MEDA), the State Govt. Institution, with the broad objective to promote, develop and diffuse knowledge in the various fields of renewable energy sources has been notified as the designated agency to co-ordinate, regulate and enforce the provisions of Energy Conservation Act, 2001 within the State.

### **9.3.3 Justification of the Scheme-Shortfall/Surplus and Proposals to meet the Shortfall/Disposal of Surplus Energy**

#### **9.3.3.1 Demand and Supply of Electricity**

The capacity addition by various sources, improvement in the network infrastructure, reduction of Transmission & Distribution (T & D) losses and energy conservation measures undertaken by the State have improved supply position and helped in gradual reduction in the supply-demand gap over the years. During the year 2016-17, the average peak demand of MAHADISCOM was 16,903 MW with load shedding of 37 MW, whereas it was 17,121 MW with load shedding of 82 MW during 2017-18 upto November . The supply & shortfall of electricity at average peak demand is given in **Table 9.8**.

**Table 9.8**  
**Supply & Shortfall of Electricity at Average Peak Demand Unit: MW**

<b>Year</b>	<b>Average peak demand</b>	<b>Supply</b>	<b>Shortfall</b>
2012-13	14,032	13,309	723
2013-14	14,406	13,830	576
2014-15	15,812	15,392	420
2015-16	15,948	15,850	98

2016-17	16,903	16,866	37
2017-18*	17,121	17,039	82

Source: *Economic Survey of Maharashtra 2017-18, Department of Economics & Statistics, Planning Department, Govt. of Maharashtra; \*upto November*

### 9.3.3.2 Energy Conservation

Various measures undertaken for energy conservation by Maharashtra Energy Development Agency (MEDA) are (i) Installation of Demo projects in Govt./Semi Govt./Local body institutions to facilitate the acceptance of the concept of energy conservation, (ii) Installation of Energy Conservation (EC) devices in Municipal Councils, (iii) Bright street light programme to install CFL units in replacement of the old units, (iv) Biomass briquetting scheme to convert all types of agriculture and forestry waste into solid cylindrical shaped logs which can be further used as non- conventional fuel, (v) Solar Home light in common places viz. school, gram panchayat office, mandir, etc., (vi) Solar Energy Applications in Ashramshalas, (vii) Wind Solar Hybrid Systems in Ashramshalas & Hostels, (viii) Walk through Energy Audit for Small & Medium Enterprises (SME) to provide financial assistance to eligible organizations/SME for Energy Audits and (ix) Waste Heat Recovery Plan to utilise the high temperature waste heat generated through process for power generation.

On the demand side management, schemes such as Akshay Prakash Yojana, voluntary load reduction scheme in small cities, single-phase supply in villages and introduction of capacitors on agricultural pumps are proposed.

### 9.3.4 Status of Present Proposal of Wainganga (Gosikhurd) - Nalganga (Purna Tapi) Link Project in Overall Planning

The present proposal envisages solar power generation on canal top/bank of the link canal, the details of which are discussed in para 9.4.

- a) The project would be developed on canal, so availability of land would not be a concern.
- b) Water is easily available from canal.
- c) Developer is responsible for construction of the transmission system till substation, after that DISCOM to construct it.

- d) Timely Completion of EPC Work probability is medium, sufficient time has been given for Project work to EPC Contractor. Prior market research has been done for deciding the same.
- e) The financial credibility of NWDA is very strong. Being a Government Organisation it would not be very difficult to arrange for the fund for this project.

## **9.4 Assessment of Power Benefits of the Proposed Project**

Solar Energy generation is a clean technology. There shall not be any environmental hazards. The Wainganga (Gosikhurd) – Nalganga (Purna Tapi) link project on implementation, would be creating power potential through the solar energy proposed to be tapped all along the link canal.

### **9.4.1 Canal Top Solar Power (PV) Plants along the Proposed Link Canal**

#### **9.4.1.1 Canal Top Solar Power**

Ministry of New and Renewable Energy, Govt. of India has proposed a scheme for providing some Central Financial Assistance for setting up of Grid - Connected Solar PV Power Plants of 1-10 MW Capacity on Canal Banks/ Canal Tops by State Power Generation Companies/ Utilities/any other Govt. Organisation/PSU operating in power or irrigation sector, either directly or through private developers. Accordingly, this component is included in the DPR of Wainganga (Gosikhurd) – Nalganga (Purna Tapi) link project.

Gujarat Energy, Research and Management Institute (GERMI), Gandhinagar has been assigned with the consultancy study for setting up of grid connected solar (PV) power plant on canal top/canal banks and to assess possible solar power potential along the link canal. The 426.54 km long link canal traversing through Nagpur, Wardha, Amravati, Washim, Akola and Buldhana districts is a major receiver of insolation, the incoming solar radiation and provides huge space for accommodating the canal top solar plants.

GERMI proposed three types of canal top solar power plant arrangements.

1. The first arrangement is E-W portal configuration i.e. the canal flows from East to West and the portal frames are arranged in South- North direction

at an angle of  $21^{\circ}$ . The portal frames are spaced at intervals of 8 m c/c. Different configurations such as portal frames without props, with one prop, two props and three props have been considered.

2. Second arrangement is Canal Bank Solar plant. Here, cantilever type structure having overhang on both sides is proposed. Two structural configurations, one with plate girders and other with truss are proposed. The cantilever arrangement is proposed for both East-West and North-South flow conditions of the canal.
3. Third arrangement is N-S truss configuration i.e. the canal flows from North to South and the trusses are arranged along East-West direction. Purlins are placed at an angle of  $21^{\circ}$ . The trusses are spaced at intervals of 7.45 m c/c. Different configurations such as trusses without props, with one prop and two props have been considered.

GERMI has identified the stretch of the canal which can hold 1 MW canal-top solar PV plant and carried out techno-commercial feasibility of the project (solar power component) including Capex and Opex which has been then extrapolated for entire stretch of 426.54 km. The study assessed the solar potential of the link project as 1884MW. The summary report of solar power potential study by GERMI is furnished in **Annexure 9.3**. The detailed report of the study by GERMI is appended at **Appendix 4.2**.

#### **9.4.1.2 Detailed Costing of the Canal Top Solar Project**

Based on the tentative arrangement for the canal section and dimensions so considered, there had been nine types of designs in order to calculate how much capacity that can be mounted. It is estimated that 3,333 photovoltaic modules of 300Wp capacity shall be utilized, which would be procured at Rs 37.2 to 40 per watt. Hence, the costing of photovoltaic modules themselves is expected around Rs. 37.3 to 40 cr. The cost of civil work and structure of most optimized type i.e. Type 9 would be around Rs. 3.49 cr. which is the lowest. On the DC side, the costing of the inverters from 1MVA, corresponding junction boxes, etc. is calculated at Rs.55 lakh. Hence, the total cost of 1 MW photovoltaic power plant is around Rs.9.73 crore. The detailed costing of 1 MW NWDA's Canal top photovoltaic power plant is given in Table 5-1 in GERMI report.

### 9.4.1.3 Financial Analysis

As per the financial analysis of GERMI, the cost for 1MW Canal top photovoltaic project is based on three categories of parameters: cost, financing and performance parameters. The capital cost of the 1 MW plant is estimated at Rs. 9.73 crore and the operation and maintenance cost is calculated at Rs. 9.73 lakh for the first year, which is approximately 1.0% of the capital cost. Thereafter, the O&M cost is considered to escalate @ 5.72% annually. The debt-equity ratio is taken at 70:30 based on common practice, while the interest on loan is taken at 12.50% per annum. The Capacity Utilization Factor (CUF) of the plant is calculated at 17.9% for the first year, thereafter degrading by 1% per year relative and compared to the previous year.

Without Accelerated Depreciation (A.D.), financial analysis yields project Internal Rate of Return (IRR) and equity Internal Rate of Return (Equity IRR) at 6.95% and 1.95% respectively and Debt Service Coverage Ratio (DSCR) of 0.87. Whereas in case of A.D., equity IRR increases slightly to 2.10% and DSCR increases upto 0.90. Hence it is advised to use A.D for accounting.

The sensitivity analysis of various technical and financial parameters is carried out and the risks are addressed. While there are many perceived risks in a photovoltaic project due to lack of experience and data in India, the limited experience in India indicates that tackling issues such as timely completion of work and thefts are the major risk factors. Technological risks are eliminated by utilizing the poly-crystalline silicon technology; while contractual risks may occur considering the type of power purchase agreement done for the installed solar projects.

## 9.5 Transmission System

Developer is responsible for construction of the transmission system till substation after that DISCOM to construct it.

## 9.6 Comparison of Total Cost of the Project with any Other Viable Category

The Wainganga (Gosikhurd) - Nalganga (Purna Tapi) link project is envisaged to divert 1772 Mm<sup>3</sup> of water to serve the districts of Nagpur, Wardha,

Yeotmal, Amravati, Akola and Buldhana in Vidarbha by providing irrigation, domestic and industrial water to the needy areas. The power benefits along the canal through canal top solar power plants are additional benefits that are likely to be available on completion of the project. Hence, comparison of its cost with any other viable alternative does not arise.

Further, the canal top solar PV plant got the following advantages over the other options of the solar power generation.

- a) Saving of huge land area (4.5 to 5 acres per MW).
- b) Helps reducing CO<sub>2</sub> Emission by 1,280,000 kg per Year.
- c) Helps reducing water loss due to Evaporation-approx. 90 lakh litres per MW annually.
- d) Increases Generation efficiency by 2.5% compared to similar ground mounted solar plant.
- e) Helps strengthening the grid.
- f) Helps reducing the transmission and distribution losses as generation is close to the consumption point.

Maharashtra has huge land area deployed in irrigation and other industries. In contrast, use of canal for power generation seems to be an innovative option and is fruitful for the State. Further, this project contributes significantly to reach the Govt. of India target of 100 GW of solar PV by 2020 AD out of which 40 GW is rooftop mounted. The same achieved as on Sept 2016 was only 8.5 GW.

## **9.7 Power Requirement for Construction and Proposed Supply Arrangement**

The Wainganga (Gosikhurd) - Nalganga (Purna Tapi) link project is passing through well developed areas in Vidarbha and the settlements along the canal are sufficiently electrified. There are number of substations all along the alignment which can fulfill the construction power requirement.

### **9.7.1 Effect of Wainganga (Gosikhurd) – Nalganga (Purna Tapi) Link Project on Power Scenario of the State**

The total energy requirement of the link canal is 851MU. This requirement could easily be met, in the light of the following situation:

(i) Maharashtra is the largest power generating State in India. The State of Maharashtra forms a major constituent of the western grid of India, which now comes under North, East, West and North Eastern Grid (NEWNE) of India. The total installed capacity of Maharashtra has been increased to 42029 MW as on 31.10.2017 which was only 14954 MW during 2000-01. The State has initiated further measures to increase the power generation to cater the future demands and also for energy conservation.

(ii) The State Government is aware of shortcomings and has drawn up plans to make Maharashtra a power surplus State besides taking up remedial measures to control the high transmission and distribution losses and debilitating thefts. Also, Maharashtra is expected to receive more allocations from Govt. of India's Ultra Mega Projects such as from Mundra project in Gujarat, from Ratnagiri and from Coastal Karnataka.

(iii) The power utilized for agriculture is at 26.1 percent which is lower than that utilized for industries. As the Govt. of Maharashtra has already planned and initiated measures to increase the power generation to cater to the future demands, top priority would be given to the irrigation component keeping in view the demand for creation of more irrigation facilities, in addition to drinking and industrial water supply schemes.

(iv) Further, there may be number of pump sets already working to serve limited patches in the proposed command area of the link canal. Providing irrigation through the link canal will help save that much power resulting in the net power requirement for the link canal less than the estimated 851 MU. This further reduces the losses considerably as the power outlets are minimized. It would also help maintain ground water at safer levels as possible, in addition to saving energy. Power theft also could be avoided to some extent.

(v) The link canal itself will embody 1884 MW of solar power plant.

(vi) Keeping in view the importance of domestic and industrial and irrigation needs of water short districts of Vidarbha region, it is proposed that the requirement of power to the extent of 851MU needed by the project be met from the locally available sources of Govt. of

Maharashtra as well as from canal solar power, which is technically feasible.

In light of the above, it is expected that the diversion of water through ‘Wainganga (Gosikhurd) – Nalganga (Purna Tapi) link project’ will not have any adverse effect on the power scenario of Govt. of Maharashtra.

## **9.8 Economic Evaluation**

The Wainganga (Gosikhurd) – Nalganga (Purna Tapi) link project will fetch 3768 MU though solar power proposed on main canal, considering 6 hours of sunshine on average in a day. This will fetch Rs. 2637.6 crore per annum at the rate of Rs.7/Kwh over a period of 25 years, which is significant and this is besides the intended irrigation and water supply benefits. The capital cost of the solar power component will be Rs.18331 crore. Thus, the solar power component contributes significantly to the overall economics of the link project.

However, the benefits from the solar power plants are treated as additional benefits and these are not considered while evaluating the project for its economic viability.

## **9.9 Power Required for Lifting Arrangements**

Six lifting arrangements are proposed at RDs.2.40 km, 20.00 km, 39.90 km, 169.60 km, 176.90 km & 292.85 km for the link canal. The annual energy requirement is worked out to be 839 MU. Five Lifting arrangements are proposed at branch canal outlets across Borkhedi kalan branch (RD 115.45 km), Sukhli branch (RD 147.55 km), Vai branch (RD 150.0 km), Papal I branch (RD 246.3 km) and Shelodi branch (RD 377.13 km). The power requirement of lifting arrangements at branch canals is worked out to 12.5 MU. The total power requirement for the link canal is 851 MU.