

A CASE STUDY ON CONVERSION OF CANAL BASED IRRIGATION NETWORK SYSTEM TO PRESSURIZED PIPE BASED NETWORK SYSTEM INTEGRATED WITH SOLAR PLANT IN THE STATE OF UTTAR PRADESH, INDIA

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PREAMBLE

- The project was designed many years back by the Government of Uttar Pradesh, India on Canal Based Irrigation Network.
- The project could not be completed in so many years except for the majority part of the Main Canal that too at substantially escalated project cost and after long **delays due to land acquisition** and many other associated problems, but none of the branch canals including the distributaries could be completed.
- At present, there is no facility available for irrigation. The irrigation here mainly depends on ground water and rain water. For the last several years, most of the Badaun district is being irrigated by tube wells. For this reason, the situation of ground water level is very poor in most, which often fails to provide most of the tube well irrigation facility due to bad ground water levels in summer.



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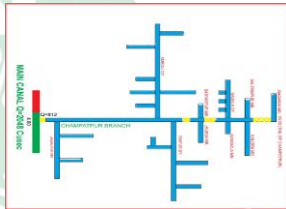


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PREAMBLE

➤ Under the Badaun Irrigation Project, the Champatpur branch emerges from the coastline of 4.800 km from the main canal. The length of the Champatpur branch is 34.00 km, GCA 21248 ha, and PPA 14874 ha.

➤ As per the instructions of the Government, adopting a modern irrigation system is proposed to be sprinkler irrigation under the pressure irrigation of the Champatpur branch system. By which irrigation can be done in more areas with less water. In compliance with the above instructions, project for sprinkler irrigation of Champatpur Branch system has been prepared.



SALIENT FEATURES OF THE PROJECT

Off take of Champatpur branch	4.800 Km from left bank
Length of Main Line	34.00 Km
Duty	7 ft ³ /sec per 1000 Acre
Capacity of Solar Power Plant	16.82 MW
Gross Command Area (GCA)	25841 ha
Culturable Command Area (CCA)	18001 ha
Total Cost of Project (Base Year: 2018-19)	INR 8578 million (With the Cost of Sprinkler System)
De-silting arrangement	Two step de-silting arrangement at the mouth of pressure pipe network and filtration arrangement at sub-chak level / diggies are incorporated in this estimate.
Cost/hectare	INR 0.47 million per Ha.
Benefit Cost Ratio	4.88 : 1



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ABSTRACT OF COST FOR THE PROJECT (WITH THE COST OF FIELD DISTRIBUTION NETWORK)

ITEM	COST (INR IN MILLION)
Preliminary	43.56
Land	103.59
Works	
1. Main	2965.05
2. Sub-Mains	1637.48
3. Cost of Solar power (SOLAR POWER PLANT capacity in 17.80 MW)	629.16
4. Cost of field distribution network	1118.63
Total Cost =	6437.49
Add SGST @ 6% =	389.85
Add CGST @ 6% =	389.85
Total Cost including GST =	7277.19
Add cervice charge @ 6.875% =	72.77
Add 5% Contingency =	363.86
Add 5% operation and maintenance =	363.86
Grant Total =	8578 million



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Operation and Maintenance

□ **De-silting arrangement:** Two step de-silting arrangement at the mouth of pressure pipe network and filtration arrangement at sub-chak level / diggies are incorporated in this estimate.

□ **Diggies & Pump Rooms:** Irrigation in the command will be provided through drip/ sprinkler (pressure). It is proposed to construct a Pump Room, Sump Well and Diggies at outlet point. Pumping unit along with control panel, valves, flow meter, hydro cyclone filter etc. will be installed in this pump room to supply water to cultivators with the help of HDPE pipe network laid about 1m below the ground level up to hydrant (Sub Chak OT) planned to be provided for 4.0-4.5 ha area.

□ **Design and Installation of PLC-SCADA system:** In this project it is envisaged to provide PLC-SCADA to attain automation of Pipe Network and get Full/partial Control on the functions of the Pump Rooms, in the Control Room proposed to be set up at head of Sub-Main Pumping Stations. It shall provide advanced visualization and system control for quality & reliability.



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SOLAR POWER GENERATION

As per estimates, the demand for power for this project in one year will be 25.36 Million Units. The annual expenditure on with conventional power is around 1.9 million but it could have been brought down to nil with the solar power station. Solar based power projects have attracted the attention of State and Central Governments and also have been given priority due to:

- Short gestation periods, photovoltaic systems are modular in nature.
 - Reduced transmission losses, decentralized and distributed generation systems.
 - Use of environment friendly solar resource for power generation.
- Badaun area has High Solar Power Generation Potential. So the option to generate power from solar power plant could be a good alternative and more remunerative in long period.

Revenue will also be generated from 6 months excess generation from 20MW Solar Plant @ INR 40,000 per MW for one year.

Benefit Cost Ratio

S. No.	Particulars	Prop. Project (I in lakhs)	Cont. Project (I in lakhs)
A	1. Means Beneficial		
	2. Direct value of farm produce	862.25	183.87
	3. Indirect value of farm produce	265.00	55.54
	4. Increase in net worth of farmer (1+2+3)	1127.25	239.41
B	1. Capital cost	201.74	1200.50
	2. Provision for depreciation (1% of gross value of assets)	97.44	12.14
	3. Depreciation on investment (1% of gross value of asset)	66.14	264.57
	4. Interest on investment @ 10% (10% of gross value of asset)	130.64	260.54
	5. Labor Interest @ 10%	142.27	3010.00
	Total B (1+2+3+4+5)	538.23	3606.65
C	NET VALUE OF FINE PRODUCE (Contd A, Total B)	589.02	962.86
D	ADDITIONAL BENEFITS:		
	1. Net value of farm produce	1127.25	239.41
	2. Net value of farm produce	1127.25	239.41
	3. Net value of farm produce	1127.25	239.41
	4. Net value of farm produce	1127.25	239.41
	Total D	4491.00	8493.50
E	CAPITAL COST OF PROJECT (I in lakhs)	201.74	1200.50
F	ADDITIONAL COST:		
	1. Interest on capital (10% of capital cost)	20.17	120.05
	2. Annual operation & maintenance As per proposal cost	130.64	260.54
	Total F	151.81	580.59
G	NET ANNUAL COST TOTAL	353.55	1781.09
H	BENEFIT-COST RATIO	1.66	5.36

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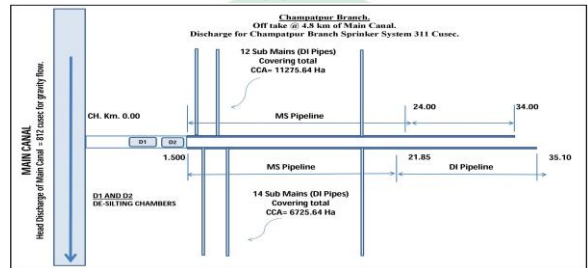
CROPPING PATTERN

- Selection of crops of cropping pattern totally depend on quantity and period of rainfall / water availability. In years of good well distributed rainfall large area is covered under Kharif crops while in years of late rainfall Rabi crops are taken. This is a project for Kharif Irrigation, and in the Kharif presently Maze, Paddy, Pulses, oil seeds are shown.

Sl. No.	Kharif Crop	Irrigation intensity in Percentage
1	Paddy	20.0%
2	Pulses	15.0%
3	Maize	10.0%
4	Oil seeds	15.0%
5	Sugarcane	20.0%
Total		80.0%

- Total CCA of the project - 18001.30 Ha.
- ICA of the project for Kharif Season is proposed - 14401.04 Ha.
- Water allowance for designing the complete water carrier system including all losses has been calculated for CCA 18001.30 Ha, based on peak monthly crop water requirement is 7 ft³/sec per 1000 Acre.

LAYOUT PLAN



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LAYOUT PLAN OF CHAKS



DETAILS OF PIPELINE

RD 0.00 M to 1500.0 M of Feeder		
Land already acquired in sufficient width, therefore it is economical to construct this reach as open gravity channel.		
RD 1500.00 M to Tail		
MS/DI pipelines has been proposed to carry the water up to the off take point of proposed sub- mains. Looking to the operation suitability two separate mains are proposed to be laid for feeding the command situated on left side and right side of the Main respectively.		
Left Side (RD 1500 M to 2400 M)	One pressurized MS pipe line Internal diameter of the pipes is varying from 1300 mm to 2100mm.	From the Left main twelve sub-mains (DI Pipe) of varying discharge capacity & Head as per design requirement off take at different RD.
Left Side (RD 1500 M to 2400 M)	One pressurized DI pipe line Nominal diameter of the pipes is varying from 700 mm to 1200mm.	
Right Side (RD 1500 M to 2185 M)	One pressurized MS pipe line Internal diameter of the pipes is varying from 1400 mm to 1700mm.	From the Right main fourteen sub-mains (DI Pipe) of varying discharge capacity & Head as per design requirement off take at different RD.
Right Side (RD 2185 M to 3510 M)	One pressurized DI pipe line Nominal diameter of the pipes is varying from 200 mm to 1200mm	

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DETAILS OF PIPELINE

Sl. No.	Description of activity	Open channel system (without sprinkler system)	Piped Irrigation system (without sprinkler system)	Piped Irrigation system (with sprinkler system)	Remarks
1	Head Discharge	812 ft ³ /sec	311 ft ³ /sec	311 ft ³ /sec	Savings of around 500 ft ³ /sec in Piped Irrigation for additional area to be irrigated.
2	Total area to be irrigated	14,874 Ha	18,001 Ha	18,001 Ha	(for pipeline system total design duty is calculated based on the CCA)
3	Cost comparison	INR 5787 million	INR 7101.2 million	INR 8578 million	Piped irrigation consists of Gravity / Pressure mains and sub-mains, field distribution in sprinkler, 20 MW Solar Power Plant, pump house and siltation chamber / sump wells, filters and valve arrangements, electro-mechanical works, cost of operation and maintenance.



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DETAILS OF PIPELINE

Sl. No.	Description of activity	Open channel system (without sprinkler system)	Piped Irrigation system (without sprinkler system)	Piped Irrigation system (with sprinkler system)	Remarks
4	Cost per Ha	INR 0.322 million	INR 0.395 million	INR 0.464 million	
5	Permanent Land required (in Ha)	433 Ha	7.88 Ha	7.88 Ha	In piped irrigation only RoU (Right of Use)/crop compensation and land is required, whereas in open channel system, land acquisition is required, resulting in enormous delays.
6	Cost of Land	INR 5412.5 million	INR 117.714 million	INR 117.714 million	Average rate of crop compensation and land taken 0.2 million/ha while average rate for Acquisition is 12.5 million/ha.
7	Revenue generation through solar plant	Nil	INR 4.8 million	INR 4.8 million	Considering 6 months excess generation of 20MW @ INR 40,000 per MW for one year.



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