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USE OF SOLAR ENERGY FOR PUMPING OUT GROUNDWATER FOR IRRIGATION IN RURAL AREAS

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ABSTRACT:- This project is basically built to provide a regular supply of clean water for the purpose of sanitation, drinking and most specifically for irrigation. The most important factor of this project is that no fuel or any other non-renewable source of energy is being used here to lift the ground water at the surface. Here, electrical energy required to run the pump is obtained from the solar panels installed at the roof of the unit. The capacity of the whole unit to store clean water is 8000 litres. The minimum depth of the boring of underground water is 120 – 150 ft. The lower tank is 2.5 ft deep with the storing capacity of 3000 liter which can be used by cattle and other animals for drinking purpose. The upper tank is basically a plastic syntax tank of capacity 5000 liter which is surrounded by the 4-inch brick walls. Such units have already been installed in five villages of Noorpur of Bijnor district of Uttar Pradesh and rest units are under construction of same district.

Key words: *Project, groundwater, renewable energy source, tank*

1. INTRODUCTION

In the country like India where the population is increasing in an alarming rate, there is an urgent need to switch over the non conventional energy to cater the need of our rural population. Keeping in mind of this aspect, this project work is done. This tank is not meant for irrigation purpose but also for regular supply of clean water for various purposes such as drinking and sanitation etc. This project is a CRS (Corporate Social Responsibility) FUND PROJECT for the welfare of the public allotted by the government for the completion of the work in Uttar Pradesh. INDO-CORN ASSOCIATES made a contract of block Noorpur under which total 113 units of this tank will be constructed in all the village of the block.

2. METHODOLOGY

The above unit is a combination of construction as well as electrical work. In this unit, the radiation coming from the sun is trapped by the solar cells present in the solar panels and further they convert the solar radiation into electricity. This electricity is then converted from an AC-DC converter and then used by the pump placed underground. This electrical energy then runs the pump and water is lifted out at the ground surface. The above statement is enough to explain the electrical touch and from here begins the construction work. Following are the construction stages:

2.1. BORING

The depth of the boring for the Noorpur block zone is 120-150 ft. At this depth, clean and drinkable water can be pumped out. The diameter of the boring is taken as 4 inches.

2.2. EXCAVATION OF SOIL

The soil is excavated in a square shape having dimensions of 9 x 9 ft. The depth of the excavation is taken 2 ft.

2.3. FOUNDATION

Raft foundation is used here as the soil is sandy in the area and it is found that raft foundation is economical and time saving in comparison with isolated footing for such a small structure.

2.4. RCC SLAB

In the whole structure, overall 3 slabs have been constructed of different dimensions. Grade of concrete that has been used is M20 having a ratio of 1:1.5:3. The foundation slab is of 9 x 9 ft and 6 inches thick. This slab consists of a steel cage of steel bars of diameter 12mm at spacing of 8 inches, hence number of bars used here is 24.The ground slab is of 10x10 ft and 4 inches thick. Here the bars used are of diameter 12 mm and spacing is of 8 inches. The slab at which the 5000 litre tank will rest is having dimensions of 8 x 8 ft and 6 inches thick. It also has steel bars of 12 mm and spacing of 8 inches.

2.5. COLUMN CASTING

The grade of concrete used for the casting of column is M20. The dimensions of the column is 9 x 9 inches and the height of the column above ground surface is 48 inches and below the ground is 16 inches. Basically, steel shuttering is used in this structure for the purpose of casting of the columns and slabs. The size of the frames of these columns was 9 x 9 inches and the height of these frames is 4 ft. Some advantages of steel shuttering includes better finishing, more durable and less time consuming in installation.

2.6. MASONARY WORK

In the whole structure, for the purpose of masonry work only 1700 traditional bricks of 1stclass are used. For the purpose of plaster, the ratio of cement and sand is taken as 1:4 for inner plaster of lower tank and 1:6 for outer plaster of lower tank.

2.7. ELECTRICAL EQUIPMENTS

4 Solar Panels, each having an output efficiency of 350 watts, an AC-DC converter, to convert the current from AC to DC, high power copper wire, 6-7 Meter were used. Water leveling sensors, to sense the decrease in water level and allow the pump to fill the tank automatically and stops at a particular level of height without any human effort. Solar charged LED lights with PRV sensors, which enables the light to charge from solar radiation and switch them, on and off according to the presence of any human and animal coming near or away from them.(range diameter of 7 meter). A DC water pump, this pump is of 1.5 horse power which requires a lot of electrical energy. This pump offers a lifting efficiency of 1000ltr of water from underground to the surface in just 7 minutes.

2.8. PIPELINE FITTINGS

A pipe of diameter 4" is required to lift the water from underground source. At the surface of the ground, the pipe connecting the pump and the main 5000 litre tank is of 1" in diameter. Total 2 taps of 0.15 inches are used in the unit to get the water from main tank.

3. RAW MATERIALS USED

3.1. CEMENT

The whole unit is constructed with in 25 bags of cement. The cement used in this unit is OPC of grade 43. The cost of 1 bag of cement is Rs 400 and the brand of cement used here is ULTRATECH CEMENT.

3.2. SAND

Around 50 quintals of course sand is used in the construction of whole unit and the cost of per quintal of course sand is Rs 105. For the purpose of the plaster work, fine sand is used with cement mixture with a ratio of 1:4.

3.3. AGGREGATE

Here, the course aggregate of diameter 12 mm is used in a quantity of 50 quintals. It has been high supervised that the shape of the aggregate is irregular or flaky. Rounded aggregate is highly prevented from being used in the construction as a raw material. Cost of course aggregate per quintal is Rs 95

3.4. STEEL

The whole structure consists of 3.5 quintal of steel in which bars for columns, raft foundation cage, hanging beam, rings are included. Steel used in this unit is Fe500D of diameter 12 mm. Steel bars used for the rings are of 8mm in diameter. Cost of steel bars per kilogram is Rs 48.

3.5. BRICK

Brick used in the construction of whole unit is traditional brick. Every batch of 5000 brick has been tested at the site for its Soundness, hardness, color and water absorbing capacity.

4. STRUCTURAL COMPONENTS

4.1 FOOTING

In this structure, the footing used for the purpose of the foundation is RAFT FOOTING.

This Raft is square in shape with dimensions 9 x 9 ft which consist of a cage of steel bars having a diameter of 12mm. The total number of steel bars used in the cage is 24 in which 12 bars are placed longitudinally and 12 bars are placed laterally. The basic need of Raft Footing for this structure was that the soil type of this region is Sandy and the size of foundation is also small hence it is proven very economic and time saving in construction.

4.2 RCC SLAB

Total 3 slabs of RCC have been constructed in the whole structure. Following are the slabs: The Footing slab, which is reinforced with 24 bars in it and is 6 inches thick and the grade of concrete used is M20.

The Ground slab, which is square in shape, is having dimensions of 10 x10 ft. This footing is also reinforced with 24 bars of 12mm diameter and the thickness of this slab is 4 inches. Slab resting on the columns and hanging beams, this slab is also square in shape having dimensions 8x8 ft and again it is reinforced with steel bars of 12mm diameter and this slab is 6 inches thick as it has to support a 5000 litre tank and the weight of the walls and the solar panels as well. All the 3 slabs have been constructed with the M20 grade of concrete.

4.3 COLUMN

Total 4 columns are used in the structure to support the slab having the 5000ltr tank resting on it. The grade of concrete used for the casting of column is M20.

The dimensions of the column are 9x 9 inches and the height of the column above ground surface is 48 inches and below the ground is 16 inches.

Total 6 bars of 12 mm diameter are used in each column and rings of 8mm with the spacing of 8 inches. The center to center distance of each column is 56 inches. At the connection of the column with cage, the bars are bent into L shape of 10 inches for better grip and stability.

4.4 HANGING BEAM

To support the top slab, hanging beams are also constructed having steel bars of 12mm diameter and 5.3fts in length. Rings of 8mm are used in these beams with a spacing of 10 inches from each other. These hanging beams are exactly installed at a height of 4fts from the ground in such a way that they connect all the 4 columns.

4.5 WALLS

All the 4 columns are jointed at the ground with traditional brick wall which is of 4 inches and consist 1st class brick. The wall at the lower portion is of 2.5fts in height and requires 300 bricks. Cost of 1 brick is Rs 4.7. The plaster work at the lower wall is done with the mixture of fine sand and cement with the ratio of 1:4 for the outer side and 1:6 for the inner side.

The upper wall which will be covering the 5000ltr tank has a height of 6.6fts and has the corners of 9 inches and the walls of 4 inches. The brick used in this wall is also 1st class brick. The ratio of sand and cement is same as of the lower wall.

Total 1500 bricks are required to build the upper walls including the corners of 9 inches.

5. ELECTRICAL COMPONENTS

5.1 SOLAR PANELS

Solar Panels are basically solar cells having the ability to convert the solar radiation into electrical energy. These cells are made up of silicon.

Total 4 solar panels have been used for this project and efficiency of each panel is to generate 350 watts of electrical energy. Four solar panels generate approx. 1300 watt of electricity. Cost of 1 panel is Rs 8000 and the whole assembly with the fitting structure of aluminum and 4 panels is Rs 40000.

5.2 LED LIGHTS

There are 2 LEDs of 1 watt each,these lights are solar charged and have their own solar cells hence they do not need the main solar panels to give them power. These LEDs are provided with a PRV sensor which enables the LED to increase their output by sensing the presence of any human or animal coming within the radius of 7mtr. The cost of 1 LED is Rs 10000 hence both the LEDs are of Rs 20000.

5.3 WATER LEVELLING SENSOR

This electrical sensor is dipped in the main water tank. This sensor works once the level of the water decreases in the tank, this sensor allows the pump to run and fill the main tank. No human assistance is required to switch on the pump, once the level of the water in the tank reaches the desired height the sensors automatically switch off the pump therefore not even a single drop of water will be wasted by over filling of the tank.

5.4 DC WATER PUMP

A heavy-duty water pump of 1.5 horse power is used to lift the water at the ground surface. The pump is enough strong to lift the water from a depth of 250fts below the earth surface. This water pump runs on a DC current generated by the solar panels. Cost of 1 pump is Rs 35000.

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BIOGRAPHIES

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