

Socio-Economic benefits of solar water pumps

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Abstract:

Majority of people in India are dependent on agriculture. Agriculture is the main source of sustenance of the people here. But they also face many challenges which create obstacles in their way. India is a tropical country where the high temperature provides most of the presence. India's hot state is not only a challenge. Rather, it is a blessing. But, increasing coal emissions and environmental pollution have disturbed the monsoon. India is a developing country, as well as for increasing industrial production and modernization in agriculture, electricity generation may be considered as the most necessary. But in India not only DG pumps are commonly used in agriculture and parkland irrigation. Though, efficiency and availability issues can occur where power source is inconsistent and costly, high maintenance costs and short-lived expectation in life. This and new environmental issues connected with DG engines advocate in lieu of a suitable alternative power source for irrigated agriculture pumping. A great deal has been learned from renewable energy sources. Consideration as a substitution for carbon energy or as a complement to alternative systems. Solar-energypumps are single of the feasible substitutes that have gained significant interest in this respect. They have been implemented in many inaccessible areas for a range of purposes, alternating from rural electrification and collective water sources to irrigation and cattle water supplies. It is renewable because it emits no carbon dioxide, causes no clutter and has low running and with conservation costs, it is accessible for sustainable economic development.

Key Words

Carbon emission, Conventional power, Agriculture, Solar water pump, Irrigation.

1. Introduction-

Majority of people in India are dependent on agriculture. Agriculture is the main source of sustenance of the people here. But they also face many challenges which create obstacles in their way. India is a tropical country where the high temperature provides most of the presence. India's hot state is not only a challenge. Rather, it is a blessing. But, increasing coal emissions and environmental pollution have disturbed the monsoon. India is a developing country, as well as for increasing industrial production and modernization in agriculture, electricity generation may be considered as the most necessary. But in India 66% of the electricity is produced with the help of coal (Guttikunda & Jawahar, 2014). Increasing fossil fuel production is causing the environmental situation to stagger and the earth's temperature to rise higher. As a result, many challenges can be faced by India. One challenge is uncertain warming of 1.5–2 °C in South Asia, which can harshly impact the stability of water resources due to increased monsoon changeability and glacial meltwater, thereby frightening the future farming productions (Vinke et al. 2017). On the other hand, falling below ground water level due to lack of rainfall is the challenge for the agriculturalists. Water is the first requirement for surviving on earth as well as for large scale of agricultural production (Gleick PH & IWRA, 2009). If we accept water scarcity as a challenge to agriculture, then on the other hand we see that **figure 1** in India, where the contribution of agricultural in GDP since 1970 it was 45%, it is now 17%. If we look at the data of pollution in **figure 2** the last 50 years, it is continuously increasing, but the contribution of agriculture in GDP is continuously decreasing. According to the data, if we look in detail, where pollution is 3 times increased by in the last 50 years, and the contribution of agriculture in GDP has decreased 3 times in the last 50 years (World bank data). Climate change adversely affected agricultural production and resources, along with decrease in food production and increase in their prices, this would further will affect the livelihood of the people, which poses the danger of increasing the poverty line (Wang et al. 2017). In recent years, India's economy has diversified, with agricultural importance dropping to around 10% as a share of GDP. Approximately 70 per cent of rural households in India still rely mainly on agriculture for their livelihoods, and 82 per cent of farms are considered "small and marginal."

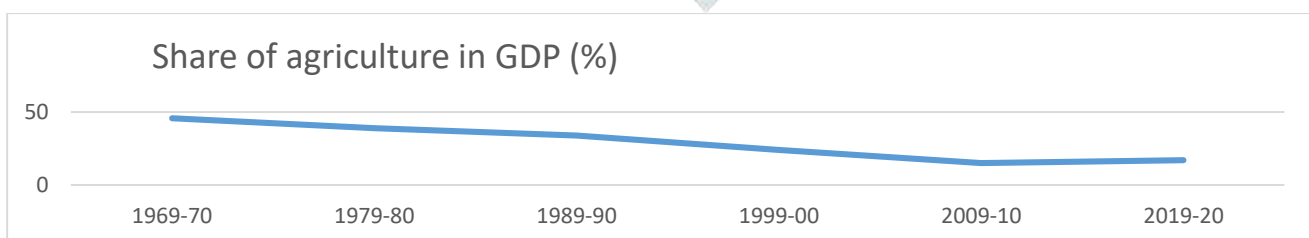
Methodology: To estimate the prospective impact of any developmental work, we need to understand the past behavior of individual and communities affected in the country. We seek to link the path of events in the public where change has occurred. Therefore, the best way to understand the public is to collect information through their literature study.

Objectives of the study: The purpose of this study is to investigate the linkage effect between agriculture sector & economic development through usage of solar water pumps.

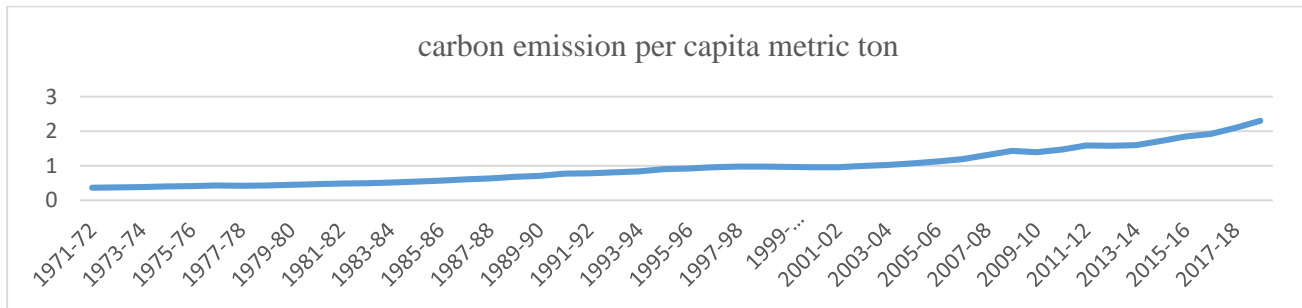
Literature review: India's population are growing from last decades, due to this reason fossil fuel energy is increasing drastically which is a threat to the country due to lack of coal storage and increasing environmental pollution, therefore non-permanent resolution to the energy crisis. So without affecting the growing economy, India need to switch from the nonrenewable to renewable energy (Kumar, Kumar, Kaushik, Sharma, & Mishra, 2010). Carbon dioxide and its carbon subsidy influences remain even more significant, as it is therefore the primary supplier of GHGs to climate change (Mardani, Streimikiene, Cavallaro, Loganathan, & Khoshnoudi, 2019). Agriculture remains to be the mainstay of the Indian economy. Farming is defined as the backbone of the Indian economy, accounting for about 15 percent of the GDP of India, and, above all, a shared Indian population relies exclusively or suggestively on agriculture and related livelihood activities. (Amutha, 2016). Irrigation is essential for good agriculture, in modern era energy needs can vary provisional on the vertical and horizontal distances the water travels. Solar water pumps are an excellent environment friendly option over outmoded and DG pumps (IRENA, 2016). Solar water pumping methods have become smart for livestock and agriculture uses in remote locations with limited access to traditional electricity (Profile, 2017). Although the substitution of traditional solar irrigation pumps has a direct benefit of minimizing costs, its rollout has been sluggish in India. (Garg, 2018). Solar water pumps are installed in more than 18 countries around the world and 1/3 of these countries in Africa (Aliyu et al., 2018). PV irrigation can increase the production output of crops (IRENA, 2016). 5.5 HP solar pumps, on the other hand, will enable the government to meet 70 % of its total renewable energy targets, exceeding the goal for solar energy of 100 GW of power and substitution of 3 HP traditional pumps by 3 HP solar pumps. This would require either an additional 25 million, 3-HP solar pumps or replacing the existing fleet with 5.5-HP solar pumps (Garg, 2018).

Economic and social analysis of the integrated solar pump system concentrates on all the studies mentioned. Here you can study a mechanical disturbance of the water pump. Water pumps have been used in the past to irrigate farmers. Therefore, it is difficult to offset solar water pumps. The new solar photovoltaic water pumps can also be analyzed effectively. The paper explores the performance analysis of existing conventional, DG and solar water pumps.

Figure 1- Share of agriculture in GDP (%)



Source- world bank data

Figure 2- Carbon emission of India in (per capita metric ton)

Source- world bank data

There can be several reasons for the backward contribution of agriculture to GDP. There is an increasing share of other sectors and a shortage of technology, irrigation and energy in rural areas that can be explained why the decline has led to decreasing growth in agriculture. This is the reason that poverty and starvation can be seen in an agricultural country like India. In fact, for each 10% growth in farm yield, there has been an estimated additional than 5% reduction in poverty in Asia (United Nations Environment Programme (UNEP, 2012)). India needs to improve its agricultural process keeping in mind the environment. Adequate irrigation is vital for civilizing agriculture, but increasing carbon emission has increased the problem of irrigation. Water is the important element of irrigation for this, due to the environmental reason, proper maintenance is needed. Agriculture advances and the use of green energies have enriched the livelihood (increased production, wages and food safety), increased social protection (reduced hunger, lowered emissions) and reduced fossil fuel subsidies expenses. (IRENA, 2016). Therefore, for the upliftment of agriculture, we have the duty to develop appropriate agricultural useful elements and take the reins of their development, irrigation is a priority in agricultural development.

1 Irrigation-

Water is the basic foundation of irrigation. Water is a very important component for all living organisms and flora in the world. Not only humans but every element present in the world is incomplete without water. Water supply basis can be stream, pond, well, deep drilled and river. Successful farming in India typically requires irrigation. 62% are watered by either comparatively deep wells or other, deeper types of wells as the overall net amount of irrigated land in the region. Most of these wells are electrically or diesel dependent. Just 48% of the country's "net area" is irrigated, but the remainder relies on natural vagaries.

Water management along with irrigation is very important for good agriculture. Climate change affects available natural resources such as water and land that are essential elements in crop production. Agricultural water consumption is estimated to increase by 20% to 30% in 2050 (UN-Water 2019). Indeed, the United Nations Climate Program reported that the poverty in Asia has dropped by over 5% with each 10% rise in farm yield (UNEP, 2012).

The growing modern era has also made irrigation modern, in the old times where irrigation was done from well and ponds, now the availability of Conventional and DG water pumps has worked hard with time saving but it has also given birth to many environmental, economic and social problems.

Table 1: Irrigation pumps of India

Water pumps in India	Million Units
Electricity grid connected pumps	21.00
Diesel pumps	08.80
Solar water pumps	00.13
Total	29.93

Source-CEEW

As shown Table: 1 India has some 28 million pumps for groundwater in farms that use diesel and conventional energy. Which seems to be a hindrance in development. Along with coal and diesel consumption, it also appears to be the major cause of pollution.

DG pumps which are technically helpful but not environment friendly as they cause noise and air pollution and diesel rates also increase day by day.

On the other hand, conventional electric water pumps also do not prove to be environment friendly as conventional electricity requires coal, which is a pioneer in spreading pollution and increase in prices every day.

Due to lack of 24-hour supply of conventional electricity, agricultural production has also come down.

Also, there is no visible benefit of conventional electricity to the farmers because there is no fixed time when and at what time the electricity will be replenished, as a result, women and people involved in this work are waiting for electricity supply. Like mortgage, many other things have to be denied. They are neither educated nor social, which does not seem to be a state of equilibrium for society and economy.

According to Table 1, solar water pumps are being used in India with little or no change. If we convert these data into conventional and DG pump figures, many changes are possible.

Why we choose off grid renewable water pump-

India is a subcontinent of the continent of Asia, which requires that it make a concerted effort for the people and development of their country. Along with India being a tropical state, it is possible to produce plenty of solar energy here. 4-7 kWh of solar radiation per square meter in several areas in India. This is parallel to 2300-3200 sunlight hours per year. State such as Rajasthan, Gujrat, Punjab, Madhya Pradesh, Maharashtra, has a huge potential for tapping solar energy. Despite India being so good productive, it seems to be backward in solar power generation. For this, India needs to make a few delineations for it. Despite being an agricultural country of India, the percentage of agriculture in GDP is also disconcerting.

If the available solar energy in India is used more and more in place of coal and diesel, then we can reduce the consumption of growing coal and diesel which can be helpful in improving the environment and increasing the production in agriculture. This path can overcome many challenges and problems and go ahead and strengthen our economy from the root. For this, solar water pump is the latest discovery which can prove to be a sure measure of environmental protection along with increasing agricultural production using available solar energy. we have lots of alternative for transportation of irrigation water.

2.Scenario of Solar Water Pumps

A solar water pumping system is a system driven by solar energy. Water drawn from solar water pumps that can be used for many purposes other than community water supply, irrigation and livestock (Chandel, Naik, & Chandel, 2015). Fig 3 has been shown that the photovoltaic water pump consists of one or more panels of solar photovoltaic cell, also known as solar photovoltaic modules, engine pump collection, electronic controls, controllers for running pumps and critical hardware. The pumping of solar water decreases reliance on energy dependent on diesel, gas or coal. Not nur, it needs costly fuels but also noise and air emissions to use diesel or propane-based water pumping systems. Solar water pump systems are environmentally sustainable and have low fuel-free maintenance requirements. PV pumping is one of the most capable applications for solar energy, given the lack of grid energy in rural and remote regions in most parts of the world. The main exclusion is that it uses renewable energy as a replacement to fossil fuel or energy. This is much like the conventional electric pump. Solar water pump operates as any additional pump with solar energy used instead of non-renewable energy for its service as the only transition. The direct current (DC) generated when the sun lights fall on the solar panels supplying the power supply engine to pump the water out. However, if the engine needs an alternate current (AC), the DC provided by solar panels is transformed into AC with an inverter (Dharmesh, Kuldeepsinh, Parth, Ismail, & Bhagchand, 2018). This seems to be a very accessible method geographically and economically adopted. As shown table.1 If we convert the data of solar water pump into DG pump and on grid pump data, then the economic, social and environmental situation can be changed to a great extent.

Figure 3- Solar water pump



Source-Google

Just as water is needed for survival, similarly agricultural production is also necessary to move the country forward, for that water seems to work in a cycle. Fig.4 This flow chart shows that water is very important for economic development, as well as water is the first component in the production of agriculture.

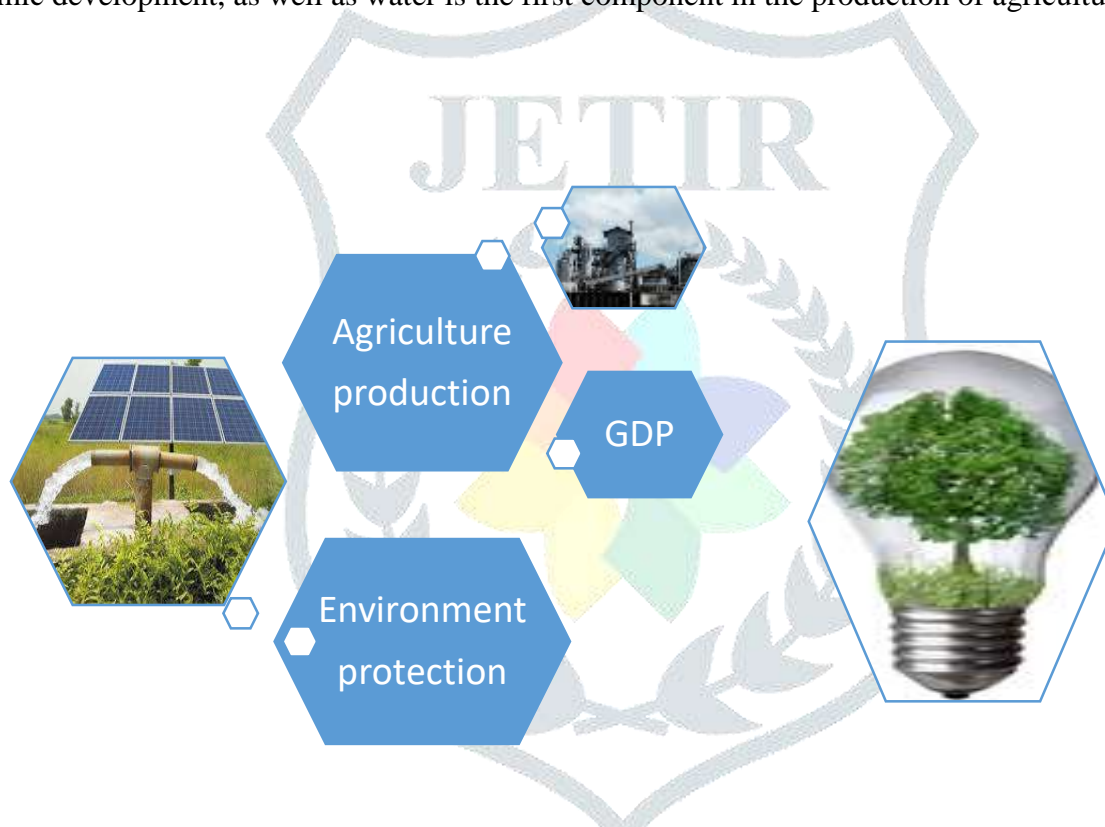


Figure 4. Flow chart of , Environment, Irrigation and Sustainable Economic Development

Water pumps required for agricultural irrigation, which are mostly run in India by the use of coal and diesel, if we use the available solar energy pumps in India instead of on grid and DG pumps, we will save coal and diesel as well You can also give an edge to economy by saving the environment and at the same time make a sustainable development.

3.Benefits of solar water pumps-

- The key benefit of a solar water pump is that we can store the generated power in the off-grid environment. We will access the electricity collected at night, because the energy is available 24 hours a day.
- If the weather is humid and there is no solar power available. Then, the batteries can be charged and the solar energy pumps operate.

- The use of solar energy pumps in rural areas is beneficial in alleviating villagers' socioeconomic upliftment and hunger.
- Fast time and less commitment, the introduction of solar water pumps is the only secure source of irrigation and drinking water in the villages. The time spent taking water from the solar water pump is much shorter compared to the traditional energy pump, as a result of which villagers and especially women and children are allowed more free time to participate in other activities or work in the fields that are the key livelihoods of the people.
- The solar water pump is very efficient where there is a lack of traditional 24-hour power supply in remote areas.
- In rural areas where there is no power available. The other choice for irrigation is the collection of DG pumps. Although the initial cost of the DG pump collection is much smaller than the initial cost of the solar pumping system, there are some drawbacks of the DG pump as they generate noise and air emissions, and the rate of diesel is often raised day by day. So the best irrigation method is a solar water pump.
- Supplementary solar power that can be produced by replacing 29.8 million solar pumps with a 3 HP 1 HP solar pump = 0.7457 kW GW of solar power to be installed = $29.8 * 3 * 0.7457$
- Decline in the usage of coal and diesel-22.4% of overall energy consumption by the agriculture sector in 2019-20. The same amount is believed to be supplied to the agriculture sector from domestic coal plants. And the other hand of the diesel pump sets account for 12% of India's overall fuel usage. In 2019-20, diesel consumption was 81.0 million tones. Through using solar water pumps, we will stop the import of coal and crude oil and encourage forex savings.
- Forex savings – By using solar water pumps, we can stop consuming coal and crude oil and encourage forex savings.
- Reduction in pollution – from a decline of coal and oil usage by 2.5 million tones and a reduction of CO₂ emissions of 25.3 million tones by combining 1 million electric and oil pumps with solar pumps.

The paper addresses the importance of solar energy water pumping systems to the eradication of carbonic acid emissions to the environment.

Conclusion-

As we know that in existing days, in agricultural area conventional electricity supply problems are major. Energy can be saved from agricultural loads and pumps using renewable energy.

Following are some of the important conclusions derived from the above study:

We would like to give suggestion to the policy makers, they create awareness to words solar water pumps. And to study the behavior or attitude the farmers.

Provide financial products such as bank loans to farmers for their needs.

Coal and diesel costs can be reduced as well as a sustainable development framework to prevent pollution from spreading in the environment.

Social and educational level will also be boosted in rural areas and sustainable development of rural livelihood will also be possible.

Increasing agricultural production will also increase GDP growth as well as economic growth. So we require that by increasing the agricultural production by using renewable energy pumps, the society and country should try to move towards development.

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