

## Heat Stress to Clean Energy: Why Indian Agriculture Needs Solar Power Now

E. Karnika

Research Scholar, Department of Agricultural Extension and Rural Sociology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

### SUMMARY

The warming trend seen in India is causing problems within agriculture due to factors like water shortage, evapotranspiration, and high energy requirement for irrigation. Variability in climatic conditions, coupled with frequent heat waves, has made diesel and grid energy unreliable and expensive options for energy provision. As an alternative, solar power has emerged as a feasible option that addresses both climate and energy issues faced by agriculture. Irrigation, cold storage facilities, and dryers powered by solar energy increase production levels and reduce carbon emissions. Programs like PM-KUSUM have also supported farmers in utilizing this option. The purpose of this piece of writing is to convey the idea that warming in India is not just a danger but also a motivation to shift towards sustainable agriculture.

### INTRODUCTION

The agriculture sector in India is extremely sensitive to climate change, especially increased temperature and erratic weather conditions. Several studies have pointed out that increased temperature has an impact on crop yield, soil moisture, and availability of water (IPCC, 2023). This leads to increased consumption of energy, thereby posing two main issues: energy provision and sustainability. The use of traditional energy sources results in increased emission of greenhouse gases, thereby contributing to climate change. Hence, the need for renewable energy technologies like solar energy (Kumar & Singh, 2021).



(Source: IEA, 2022)

### Rising Temperature and Agricultural Stress

Rising temperatures result in increased evapotranspiration, thereby accelerating the drying of soil moisture content and more frequent need for irrigation. For areas that already experience limited supply of water, this results in immense strain on groundwater availability. Apart from reducing crop production, high temperatures affect physiological functions such as photosynthesis and nutrient absorption. Productivity of livestock is affected through low feed consumption, low fertility levels, and illnesses caused by heat (Food and Agriculture Organization, 2022). Moreover, rising temperatures result in faster spoilage, particularly of perishable products such as fruits, vegetables, milk, and fish. Lack of appropriate facilities for temperature control translates to greater losses for the farmers.

### Energy Crisis in Agriculture

The agricultural sector in India relies significantly on electricity and diesel power to irrigate crops, process them, and transport them. However, electricity distribution in rural areas is inconsistent, and farmers experience power failures and voltage variations, leading to disruptions in their irrigation planning. While diesel engines are popular among farmers, they have become costly because of escalating fuel prices. Besides, the utilization of fossil fuels in generating energy leads to massive greenhouse gases, which accelerate global warming, creating a vicious cycle of warming temperatures (World Bank, 2021). Small-scale and marginal farmers are disproportionately affected since they cannot afford to bear the increasing energy costs associated with climate risks.

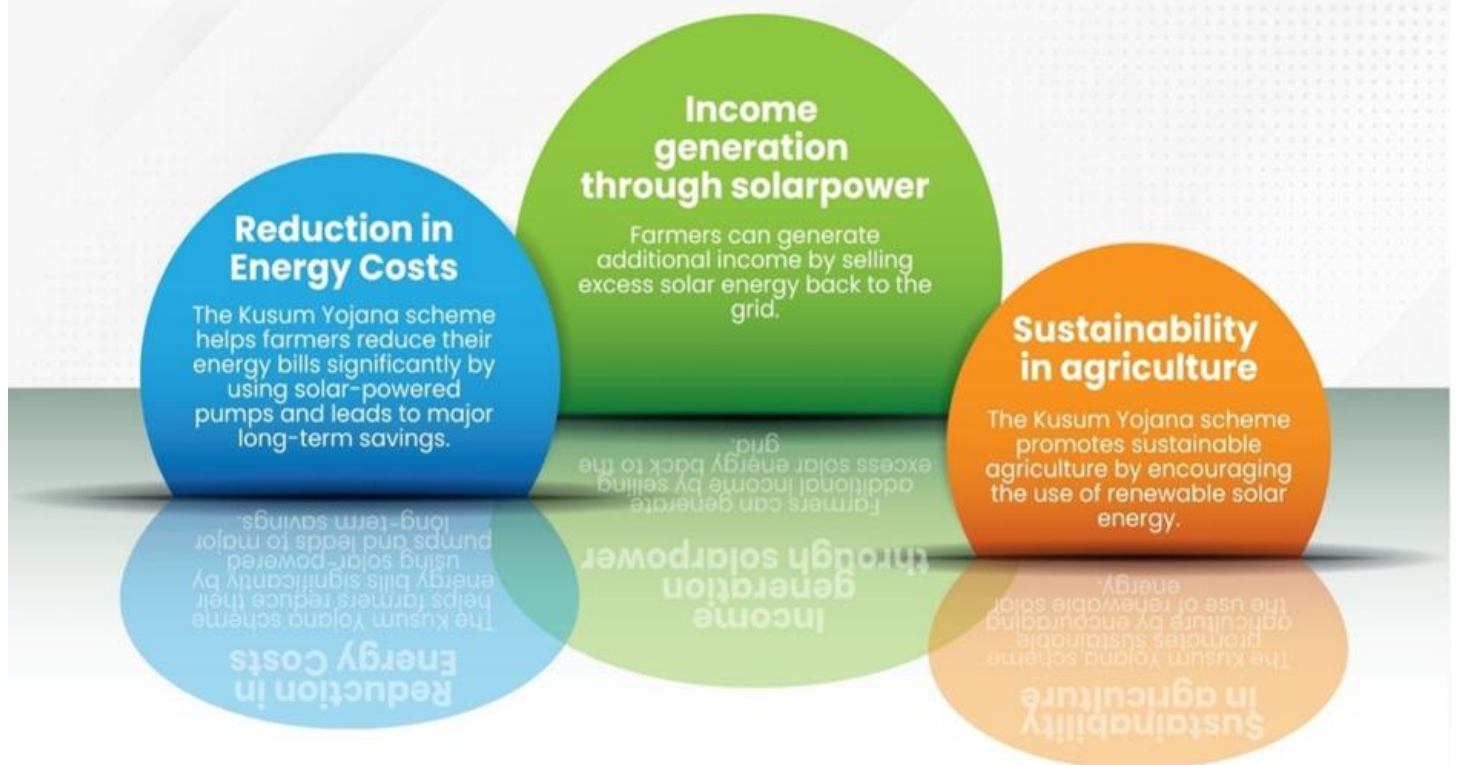
### Solar Power as a Sustainable Solution

The use of solar energy provides a sustainable and environmentally friendly source of energy. Through the application of solar energy, farmers can use solar power to draw water for irrigation purposes, as opposed to the use of diesel and electricity drawn from the grid. Solar energy will be highly helpful in places with limited access to electricity. In addition to irrigation, solar energy is used for several other activities that complement farming. For instance, solar refrigeration is useful in minimizing wastage of farm produce after harvest through preservation. The use of solar dryers improves the shelf life of the farm produce, while milk chilling units help the dairy industry. This helps in increasing value addition and income for farmers (Kumar & Singh, 2021). Furthermore, solar energy leads to minimal emissions to the environment.

### Government Initiatives and Adoption

PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evamUtthaanMahabhiyan), which is a policy framework proposed by the Ministry of New and Renewable Energy, encourages the use of solar-powered pumps and solar systems. This policy framework ensures that the implementation of such solar systems is supported by offering subsidies to farmers. With the help of this policy framework, farmers can make use of standalone solar pumps, grid connected solarization, and earn extra money by selling the generated power through the grid system.

## Benefits of PM Kusum Yojana



(Source: Novenergy solar, 2025)

**Benefits of Solar Adoption in Agriculture**

The use of solar energy in agriculture ensures several economic, environmental, and social advantages such as:

- Reduction in dependency on nonrenewable sources: Avoids exposure to changing oil prices
- Energy security: Guarantees continuous irrigation and production processes
- Economic gain: Saves money on energy expenses and boosts profits
- Environmentally friendly approach: Decreases greenhouse gas emissions and assists in climate change prevention
- Adaptation to climate change: Assists farmers in coping with increasing heat and shortage of water resources
- Self-sufficiency: Increases local energy production and stimulates rural areas development.

**Conceptual Framework to link rising temperature to solar adoption in agriculture**

**Stage 1: Climate Stimulus**

The rising temperatures, heatwaves, and irregular rainfall in India serve as major environmental triggers. The climatic conditions cause an increase in evapotranspiration rates, water shortage, and crop stress.

**Stage 2: Agricultural Response**

- Increase in irrigation requirements
- Reduction in crop production and livestock efficiency
- Post-harvest loss
- Energy dependence for water supply and storage

**Stage 3: Energy Response**

- Expensive and unstable
- Not environmentally friendly
- Causing greenhouse gas emission

**Stage 4: Technological Solution (Solar Energy)**

- Solar-powered irrigation pumps
- Solar refrigeration and drying machines
- Solar-powered allied agricultural operations

**Stage 5: Consequences (Reaction)**

- Solar technology application brings about:
- Decreased energy expenditure
- Uninterruptible energy supply
- Boost in farm income
- Low carbon footprint
- Climate resilience

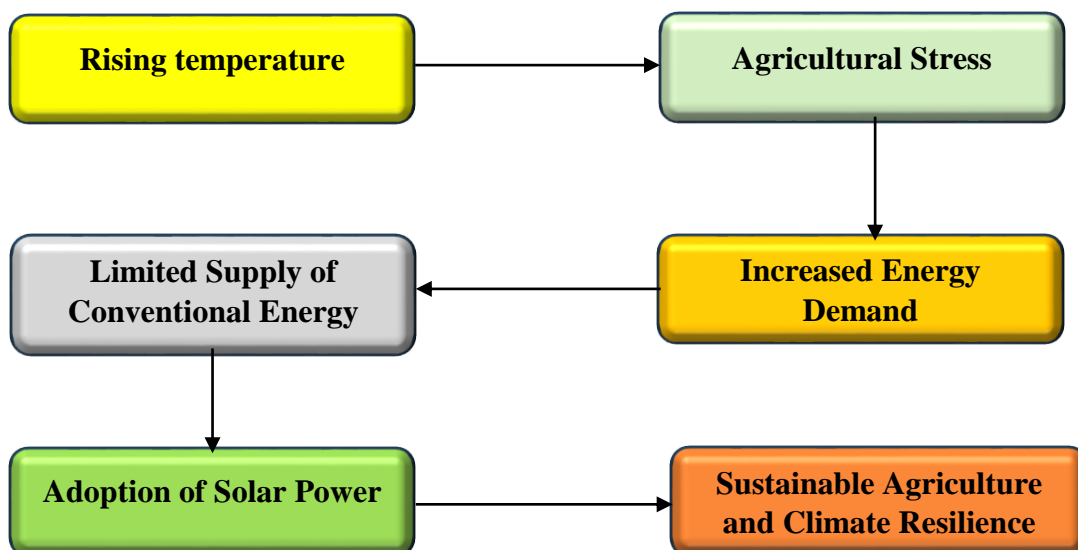


Figure 1: Conceptual framework to link increasing temperature to solar energy adoption

## CONCLUSION

The growing rise in temperatures in India can no longer be viewed as a distant threat but rather as a current phenomenon that impacts the sustainable development of the industry in question. Increasing temperatures contribute to greater water scarcity, the need for more irrigation, and greater pressure on the existing energy infrastructure. The reliance on traditional energy sources like electricity and diesel proves ineffective for small and marginal farmers. Under these conditions, the use of solar energy appears as a feasible way of addressing issues related to both energy insecurity and climate change. Solar technology proves effective in providing sustainable energy supply to perform various agricultural operations, including irrigation and harvest management. Despite the fact that the adoption of solar power is encouraged by the government, there is a need for wider dissemination of information and provision of technical support. Thus, the shift towards using solar power in agriculture becomes a critical step that needs further strengthening.

## REFERENCES

- Food and Agriculture Organization. (2022). *The state of food and agriculture 2022: Climate change adaptation in agriculture*. FAO. Retrieved from <https://openknowledge.fao.org/server/api/core/bitstreams/6fa56152-c232-4bc6-8eee-7d413261ad64/content>. Accessed on 19 April, 2026.
- Intergovernmental Panel on Climate Change. (2023). *Climate change 2023: Synthesis report*. IPCC. Retrieved from <https://www.ipcc.ch/report/ar6/syr/>. Accessed on 19 April, 2026.
- International Energy Agency. (2022). *Renewables 2022: Analysis and forecast to 2027*. IEA. Retrieved from <https://www.iea.org/reports/renewables-2022>. Accessed on 19 April, 2026.
- Kumar, A., & Singh, R. (2021). Solar irrigation systems in India: Status and challenges. *Renewable Energy*, 45(2), 120–130.
- Ministry of New and Renewable Energy. (2023). *PM-KUSUM scheme guidelines*. Government of India. <https://mnre.gov.in>. Accessed on 19 April, 2026.
- Novenergy Solar. (2025). Retrieved from <http://novergysolar.com/pm-kusum-yojna/>. Accessed on 19 April, 2026.
- World Bank. (2021). *Climate-smart agriculture and energy use in South Asia*. World Bank. Retrieved from <https://www.worldbank.org/en/topic/climate-smart-agriculture>. Accessed on 19 April, 2026.