BUSINESS RECORDER

Valuing lost energy

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The energy crisis in Pakistan coupled with a hike in fuel prices has extended the need for investments and improvements in energy efficiency mechanisms. The agriculture sector is not an exception.

The agricultural sector is a significant consumer of energy resources in various ways, having major applications encompassing mechanization, irrigation, and transportation. This energy consumption predominantly

takes the form of electricity nearly 90% and High-Speed Diesel (HSD) approximately 10%.

Mechanization involves the use of tractors, harvesters, transplanters, and other seasonal machinery, spanning tasks from land management to harvesting and the subsequent transportation of agricultural produce to markets. Another critical area of energy consumption lies in irrigation, where a substantial amount of energy is required to operate tube-wells. Tube-wells are powered by both electricity and diesel to ensure efficient irrigation processes.

The energy consumption trends worldwide reveal that energy consumption in developing countries, including Pakistan, is increasing. However, in the case of Pakistan, this heightened energy demand has led to an energy crisis. This underscores the necessity for alternative energy sources, such as solar power, or to promote the more efficient use of energy to address and manage this crisis effectively. Pakistan being one of the economies with the lowest agricultural energy efficiency can achieve a competitive edge by reducing production costs, by adopting energy-efficient measures.

Over the last three and a half decades, there has been a gradual decline in oil consumption in the agricultural sector, with a corresponding shift towards increased electricity consumption. A significant uptick in electricity usage in the agriculture sector has been observed due to various government-sponsored initiatives, like providing subsidized electric motors, pumps, and other equipment to encourage farmers to adopt modern farming practices. Concurrently, the introduction of electricity-based agricultural machinery and rural electrification projects further contributed to this trend. As a result, electricity has gradually replaced a substantial portion of petroleum consumption within the

agriculture sector. This trend seems to persist during the current decade as well.

The energy demand for land management, particularly for soil preparation, can largely be attributed to the rising level of mechanization, leading to a greater number of tractors used in agriculture. Currently, there are approximately 692,626 operational tractors in the country, providing an availability of around 0.9 horsepower (HP) per acre. However, the recommended power requirement is 1.4 HP per acre.

This shortfall suggests that there is still a gap to be bridged, and the growing number of tractors will result in even greater energy consumption to meet the required power levels. Nevertheless, the key issue now is the inefficiency of nearly 60 percent of the total tractors, which are approximately 0.41 million, usually consume 4 liters per acre more than efficient tune-up tractors. This inefficiency significantly contributes to energy loss due to the increased consumption of HSD.

The total cultivated land area in the country sums to 59.65 million acres, whereas tractors are employed to cultivate 35.79 million acres, representing 60 percent of the total cultivated area. The estimated annual energy savings through utilization of well-maintained tractors amount to a substantial 1.43 billion liters of HSD. At the rate of 258.34 per liter, this is equivalent to PKR 36.98 billion. This is highlighting a sizeable potential for energy efficiency within the agriculture sector by using efficient tractors for land management practices.

Irrigation through diesel and electric-powered pumps is highly inefficient too. Inefficient irrigation techniques and practices, like flood irrigation, the excessive extraction of groundwater, and limited storage capacity have all played a role in the loss of both water quantity and quality along with a high level of energy consumption.

The running cost of electricity diesel pumps is lower, making them more cost-effective than diesel pumps. Many conventional tube-wells operate with an operational efficiency of 30 percent or even less in some cases. Inefficient use of energy in these pumps often stems from issues such as oversized pumps and improper selection, a lack of proper maintenance, and the use of high-friction piping networks.

Implementing effective energy efficiency measures like MEPS (Minimum Energy Performance Standards), for motors besides process optimization techniques can provide farmers several benefits, including energy savings and reduced production costs. According to NEECA (National Energy Efficiency and Conservation Authority), the saving potential in diesel and electric tube-wells is 0.5 percent and 15 percent respectively. The energy efficiency and conservation techniques in the agriculture sector can save up to almost PKR 6.69 billion.

Another prospect is that farmers may tend toward solar tube-wells to meet their future demands and to avoid bills and uninterrupted supply for smooth operation. However, this may lead to the over-extraction of groundwater in the country. However, enhancing energy efficiency in the agriculture sector accentuates a substantial opportunity to alleviate a significant cost, estimated at nearly PKR 43.67 billion.

The objective of energy efficiency can be achieved through properly planned awareness campaigns, especially during the cultivation and harvesting season by engaging key stakeholders such as the agricultural department's extension wing and NEECA.

It can be realized by restructuring the incentive framework within the agricultural sector. These incentives could specifically target the replacement of older tube-wells with more energy-efficient pumping systems.

Solarization presents a viable means to reduce energy consumption, but it must come with economic water pricing and metering mechanisms to prevent excessive depletion of already scarce resources like water. NEECA has undertaken a task to replace a maximum number of tube well pumps to enhance energy efficiency. However, there exists an opportunity to expand the scope of these programs further.

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